Analysis of the Smart City Concept

How does the smart city concept change practices, and how do these new practices assist in further developing the concept?

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Executive Summary

The purpose of this thesis is to investigate how the smart city concept is received and enacted and how the concept is changing. The analysis is performed by using critical discourse analysis and is divided into two parts. The first part addresses the understanding of the smart city concept, whereas the second part addresses the enactment of the concept in Copenhagen and Oslo. There is no universal definition of what a smart city is, which is the motivation to investigate the subject.

For the process of investigating the concept, the analytical tool critical discourse analysis is applied. Four analyses are conducted. The first analysis looks into previously performed research and literature to look for common aspects of the smart city concept. The second analyzes the articulation of the concept in the two capital cities, followed by an analysis of social practice, to see what projects are being implemented. The last analysis reviews the projects highlighted in social practice and examines the presence of the three chosen Sustainable Development Goals. The results are then summarized in a matrix.

The outcome of the analyses revealed that the common denominator for smart cities is the focus towards improving the quality of life. Six smart city dimensions were revealed from the literature analysis, which then was affirmed to be present in the social practice in both Copenhagen and Oslo. Quality of life was found to be the most crucial aspect of a smart city. Both cities have citizens as part of the smart city strategy but include them differently. While Copenhagen revolves around the implemented projects around the citizens, Oslo is dedicated to involving the citizens in the decision-making process. The three chosen Sustainable Development Goals shows that Copenhagen focuses more on knowledge sharing and partnerships, while Oslo concentrates on sustainability.

The empirical results from this thesis suggest that the smart city concept is developing with quality of life as the main factor for change and adaptation. Our findings provide useful insights for managers in smart cities that seek to improve smart city collaboration and development.

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1. Introduction

Urbanization, globalization, and industrialization are recognized as three important elements that are leading the human civilization into the 21st century. Over 50% of the world's population resides in urban areas, which is expected to increase to approximately 70% in 2050 (Etezadzadeh, 2016, p. 3). More than 80% of the Global Domestic Product (GDP) today is generated in cities. Because of this, urbanization is a valuable and substantial factor for a country's financial situation (McKinsey, 2011, p. 1). In the context of urgent issues within a sustainable environment and climate change, governments and cities need to become greener and smarter (Lee, Hancock & Hu, 2014). Cities should, therefore, be designed in a way that is both livable and sustainable for future residents (Etezadzadeh, 2016).

Many leading cities have embraced green initiatives and Information and Communication Technologies (ICT) to strengthen their competitiveness and stimulate their economic opportunities (Lee et al., 2014). The initiatives range on a large scale of technological and non-technological solutions. The literature on the smart city concept has emerged during the last decade (Cavada, Hunt & Rogers, 2014). Smart city research belongs to a relatively new field and is at a preliminary stage (Deakin & Mora, 2019, p. 219). There are broad discussions of academic literature on the field. Even though the practice is fragmented, the implementation of projects exceeds the discussion from academic literature that is capable of generalization (Lee et al., 2014). Therefore, there are gaps in the practice and theory of smart city development.

This thesis will look into two Scandinavian capitals, Copenhagen and Oslo, and look for a common definition of the smart city term. The aim is to see if a gap exists between the definitions of the cities and the smart city practice. This is to enable a more organized investigation of smart city implementation and development. Copenhagen’s and Oslo’s enactment of the smart city concepts is analyzed by using critical discourse analysis. In addition, the thesis will investigate if the Sustainable Development Goals (SDG) are present in practice. The focus of the thesis is to see whether the smart city concept is enabled or constrained through social practices.

1.1 Problem Statement and Sub-Research Questions

By looking into how the smart city concept is currently being received and enacted by Copenhagen and Oslo, this thesis attempts to investigate if the smart city practice is evolving. The problem statement developed for this thesis is as follows:

"How does the smart city concept change practices, and how do these new practices assist in further developing the concept?"

The word "change" is used in the problem statement as it can be an ambiguous term. By looking into the potential change of the smart city concept, we aim to see whether the concept is enabled or constrained. Five sub-research questions were added to the problem statement to provide guidelines for this thesis. The sub-questions will assist in presenting separate objectives and provide a more accurate picture of what the research entails. The sub-research questions are:

- *How do researchers define the smart city concept?*
- *How do Copenhagen and Oslo articulate the smart city concept?*
- *Is there a gap between the definition of the smart city concept defined by researchers and the definition held by Copenhagen and Oslo?*
- *Is there a gap between the definitions presented by Copenhagen and Oslo versus the enactment of the social practice?*
- *Are the SDGs present in the enactment of social practice?*

To see how the smart city concept is changing, we need to see how the concept is received and enacted. This is done by investigating the first three sub-questions, in both previously performed research and literature, and by looking into the perception of the concept in the two capital cities. Further, to see how the smart city concept is developing, the last two sub-questions are investigated to present how the concept is enacted and adapted to the SDGs.

1.2 Delimitations and Assumptions

Copenhagen and Oslo ranked as two of the top ten European smart cities in 2019 (Chapman, 2019). Therefore, we refer to them as smart cities throughout this thesis. Further, due to the scope of the thesis, we have chosen to limit the project to contain only a handful of smart city projects from each of the respective capitals. As a result, some deviation might occur. This thesis uses the SDGs as a method for measuring and comparing Copenhagen and Oslo by their practice towards becoming a smart city.

The SDGs consists of 17 goals, which are relatively broad and addresses large areas. The goals were formed and adopted by all the members of the United Nations (UN) in 2015 (United Nations, n.d.-b). They address the world's global challenges, which include problems related to inequality, poverty, climate change, peace, environmental degradation, and justice.

In order to go more in-depth and conduct a focused investigation, only three of the SDGs were selected based on the topic of research, which is the smart city concept. Therefore, the chosen SDGs revolve around city development and growth. Each of the two capital cities was limited to the area of the municipality, and we chose not to include surrounding areas with close ties to the cities. A part of the analysis will revolve around which projects and initiatives that are chosen by the cities. Hence, the focus will lie on city development performed by both the private and public sectors.

The goals that this thesis will focus on are, in order of relevance:

- No. 11: Sustainable cities and communities
- No. 9: Industries, innovation, and infrastructure
- No. 17: Partnerships for the goals

1.3 Potential Contribution

Since there is no universal consensus on the definition of a smart city, this thesis intends to analyze the different perceptions of the concept. To see how the definitions held in Copenhagen and Oslo are conducted in social practice, some of the implemented projects are examined.

When pursuing this research, the goal is to uncover if there is a gap in the knowledge previously gathered from research on the topic. Hence, the purpose is to fill the identified knowledge gap with new knowledge gained from this investigation. This thesis contributes to providing valuable insights for managers in Nordic smart cities that seek to improve smart city collaboration and development.

1.4 Organization of the Thesis

The organization of the thesis is as follows. Chapter 2 presents the data, methods, and measures used in the thesis, while chapter 3 introduces the conceptual and theoretical frameworks utilized to structure and support the analysis process. Chapter 4 presents six related smart cities used to gain an understanding of how a smart city function and to investigate whether there are any similar components. Chapter 5 presents and analyzes the empirical results found in the collected data. The results from the analyses are discussed in chapter 6, whereas the discussed findings that emerged from the empirical results are concluded in chapter 7. Lastly, chapter 8 suggests further reflections and research by presenting alternative models and theories.

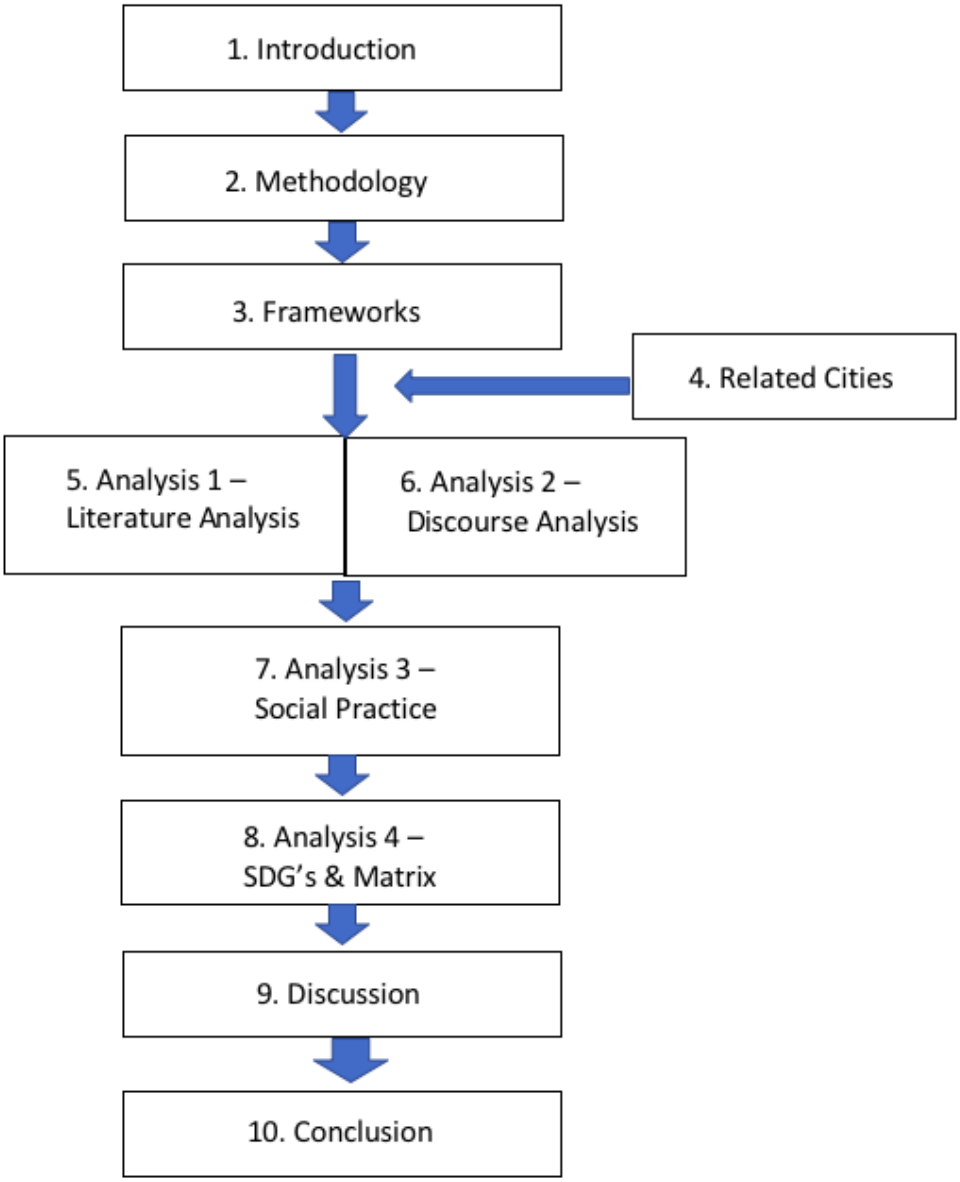

Figure 1 (Own illustration) - Visualization of thesis

2. Methodology

The following chapter will present the methodological processes chosen for this thesis. The methodology of a project is decided based on the objective of the study and the researched topic. The purpose of a project is based on the defined problem statement, thus making it important to utilize appropriate methods to obtain a credible result.

The use of a qualitative method is deemed most appropriate for performing this thesis. Whereas quantitative methods intend to identify patterns and correlations between a broad representative or large datasets, qualitative methods aim towards describing a concept or a phenomenon extensive and in-depth (Rhodes, 2014). This is done by performing in-depth interviews with several interviewees, as well as collecting documents, reports, and online articles.

In his book *InterViews: An Introduction to Qualitative Research Interviewing*, Steinar Kvale (1996, p. 81) states that there are seven stages of an interview investigation. The first step is *Thematizing*, where the purpose of the investigation is established, and the problem statement is formulated. The following step is *Designing*, where the investigation is planned. All of the seven stages are considered when this stage is performed. The next stage is *Interviewing*, where the interviews are held to collect data. An interview guide is established to assist during the interviews.

The fourth stage is *Transcribing*, where the interview materials are prepared for the analysis. This stage commonly includes the process of taking oral speech and turning it into written text. The next stage is *Analyzing*. The chosen method for analysis is based on the purpose of the investigation, along with the collected interview materials. Following is the *Verifying* stage, where it is established whether the results of the investigation can be generalized or not. The last stage is *Reporting*. At this stage, the findings of the study are presented in a way that is approved by scientific criteria. This thesis follows these stages as a way to structure the investigation.

2.1 Methodological Problem Statement

This section has the intention of explaining how the problem statement was developed and formed. Firstly, to outline the scope of the thesis and the direction of the research, a preliminary problem statement was defined. However, throughout the process of collecting data and performing the analyses, the problem statement has been subjected to change based on the direction the thesis has evolved. To be certain that the sub-research questions answer the problem statement, each question is presented, and we will define which aspect of the problem statement it is covering.

The first sub-research question is examining how researchers define the smart city concept and how it is presented in previously performed research. This covers the first section of the problem statement regarding the smart city concept. The second sub-question is about how the two cities that are being compared present and express their definition of the smart city concept. The third sub-question is looking to discover if there is a gap between the two first sub-questions.

The fourth sub-question aims to find a gap between the definitions found in the second sub-question compared to the actual enactment of the social practice in the cities. This covers the section of the problem statement regarding new practices. The last sub-research question will analyze whether the two cities use SDG in their enactment of social practice. The first, second, and third sub-research question is, therefore, covering the first part of the problem statement, while the two last sub-questions covers the second part.

2.2 Purpose of Research

The purpose of this thesis is to see how the smart city concept is received and enacted and how the concept is changing. This is done by investigating if there is a consensus between the definitions of a smart city in research literature and the perception of a smart city held by interviewees from Copenhagen and Oslo. This is conducted as a comparative study and is done by questioning interviewees from both capitals. Their perception of the smart city concept and what it entails will, therefore, be analyzed to see if the two capital cities work toward the same goal. Projects that are being implemented in the two capitals

towards further development as smart cities are analyzed. This approach intends to see how the enactment of the two capital cities definitions is implemented.

As mentioned in the introduction to chapter 2, the first stage of an interview investigation is thematizing. This stage is explained by Kvale (1996) as follows: "*Thematizing refers to a conceptual clarification and a theoretical analysis of the theme investigated, and the formulation of research questions*" (p. 89). The sections clarifying the content of the investigation are the section presenting the purpose of research, and the problem statement and sub-research questions. Hence, the theme of the thesis has been established and presented.

2.3 Philosophy of Science

The research philosophy considered to be best suited for the research depends on the aim of the study, the problem statement, and how the data is collected (Kvale, 1996). This thesis will investigate the definition of the smart city concept, if the perception differs between locations or individuals, and if the two capital cities are comparable as smart cities.

The section about choosing which philosophy of science to apply to the thesis is a part of the second stage of Kvale's guide for interview investigation, designing (Kvale, 1996). Given the nature of the thesis and its aim to perform a discursive analysis of the smart city concept, the philosophy of science best suited is hermeneutics. The hermeneutics approach is used to further develop our pre-understanding of the smart city concept. The term pre-understanding is explained in section 2.3.1. However, since the smart city concept is becoming a social construction, the research philosophy of social constructivism will also be used. The approach of social constructivism provides insights into how a social concept is formed and developed through discussion and enactment. Both these philosophies of science will contribute to answering the problem statement.

2.3.1 Hermeneutics

The hermeneutics is a type of interpretivism. It is considered the most suitable approach for research when the analysis is based on qualitative findings (Research Methodology, n.d.-b). This philosophy of science is relevant for understanding all forms of human activity and all sorts of cultural products, such as architecture, literature, archeology, economics, and marketing (Holm, 2016, p. 84). It does not intend to explain a phenomenon, but to understand.

One of the most prominent hermeneutic philosophers was Hans-Georg Gadamer, who stated that two fundamental conditions for human beings are interpretation and understanding (Tjønneland, 2018). Different social settings and relations can make humans act differently. Due to this kind of behavior, everything can be interpreted differently (Nilsson, 2007). In qualitative research, the emphasis is on interpretation and understanding, as opposed to other philosophies of science that solely search explanation and verification. Given the use of qualitative research as the base for collecting data in the thesis, the link between qualitative research and the hermeneutic approach is evident.

According to Gadamer, the hermeneutic approach is characterized by two elements. These are pre-understanding and pre-judgment, which are the epistemology of the hermeneutics (Nystrom & Dahlberg, 2001). Pre-understanding means that our basis for understanding something comes from a previously obtained understanding. The same principles go for pre-judgment, which can be considered the basis for our understanding (Nystrom & Dahlberg, 2001). Together, the pre-understanding and pre-judgment makes up a horizon of understanding for an individual. When the object and the interpreter meet, this is called the “fusion of horizons” (Vitkin, 1995). When the fusion of horizons happens, it does not necessarily mean an agreement is achieved, but rather that the ability to understand the communicated information has occurred (Vessey, 2009).

The hermeneutic circle is a central principle, which portraits the interplay between individuals as parts and the whole (Alnes, 2018). The individual parts and the whole are connected, and can thus only be understood in relation to each other. The principle of the hermeneutic circle denotes that all understanding is contextual, meaning we understand

the whole based on its parts, but also understand the parts from the whole (Alnes, 2018). For example, understanding a sentence based on the words, and the words based on the sentence (Oxford Reference, 2019).

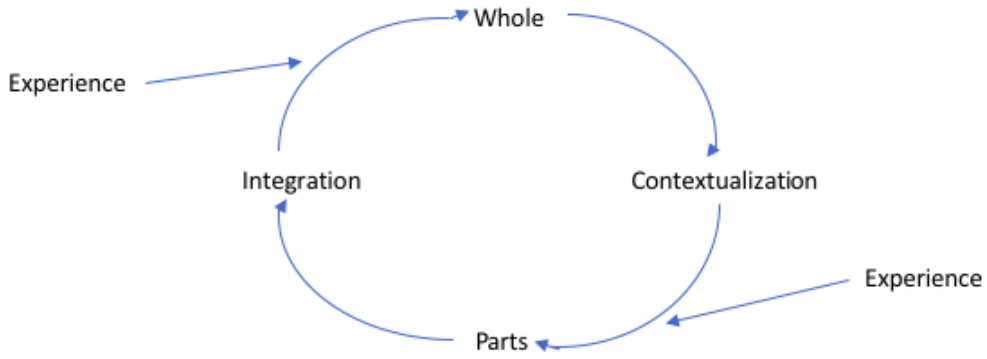

Figure 2 (Own illustration) - The hermeneutic circle

When applying the hermeneutic approach, it enables the researchers to make predictions and acquire an in-depth understanding of the phenomenon that is the topic of research (Jyväskylän yliopiston Koppa, 2010). When conducting research using this philosophy of science, the emphasis is on subjective interpretation of something that has a meaning, such as a text, a story, a picture, or an action (Alnes, 2018). From studying for our Master's degree in International Business, we have acquired a pre-understanding of the selected topic of research before starting the investigation. Also, our pre-understanding has evolved during the process of this thesis. Through collecting new information by conducting interviews and secondary data, our pre-understanding was influenced by the pre-understandings from the interviewees.

The new understanding is created through a merger of the understanding we have obtained through conducting interviews. Hence, we will experience the "fusion of horizons" (Vessey, 2009). This results in the hermeneutic circle becoming a spiral by obtaining a higher understanding. The analysis of different definitions of the smart city concept is performed to understand the whole concept. Through the use of critical discourse analysis, we gain the knowledge needed to answer the problem statement.

2.3.2 Social Constructivism

Constructivism is a philosophy of science that accepts reality as a construction made by the human mind. Therefore, making the perceived reality subjective (Research Methodology, n.d.-a). Equivalent to the hermeneutics approach, social constructivism utilizes qualitative findings as the preferred type of research. When conducting interviews, the questions asked are open-ended, which allows the interviewees to interpret the question and give their subjective opinion (Research Methodology, n.d.-a). The topic of the research will be on a specific phenomenon or concept.

Social constructivism denotes a perspective from sociology and other social sciences, where a person's understanding of reality is continuously shaped by their experiences, social situations, and who they communicate with (Thora, 2019). These factors contribute to form our perceptions of the world and certain situations. Hence, the meaning of words and sentences does not come from their references to reality, but from the way people use them in social contexts (Holm, 2016, p.122).

Kenneth J. Gergen is considered one of the originators of social constructionism (Johansen, 2018). He formulated four basic assumptions, which he says are the core of social constructivism (Holm, 2016):

1. There is no necessary connection between the world and our concepts of the world.
2. Our descriptions of reality derive from the social relationships we have.
3. We shape our future through our understanding of the world.
4. Reflections on our understanding of the world are essential to our future well-being.

With these four assumptions of social construction, Gergen takes a stand towards the traditional philosophy of science, positivism. Positivism assumes that one can achieve and form an objective understanding of the world. However, Gergen wanted to establish a concept of knowledge where the acquired knowledge is subjective and based on the relation between people (Johansen, 2018). Hence, knowledge and science are the results of communication between people, as opposed to objective methodological rules.

There are several advantages to this approach, but a prominent one is that it contributes to a close collaboration between the participants of the study and the researchers (Baxter & Jack, 2008). This approach enables the participants to characterize their view of reality and tell their stories. This gives the researchers the ability to gain a better understanding of the participants' actions (Baxter & Jack, 2008).

The smart city concept is a social construction. Therefore, it is relevant to perform the analysis with the approach of social constructivism to understand the perceptions held by the interviewees. A concept can become a social construct through the way it is spoken about, and in the way, it is enacted. For instance, through our speech, perceptions, and actions. This understanding is influenced by other actors' understanding, such as politicians, employers, or media, and is continuously evolving.

The hermeneutic approach is applied to find the opinions of the individuals. This is to discover the understandings of the concept from other people. Their understandings are the basis of the process of social construction, but individual contributions are investigated. As previously mentioned, the core of social constructivism is the notion that reality is something we create together through our interactions and through our way of talking about reality (Holm, 2016). Therefore, the subjective understandings of the interviewees on the smart city concept will assist in understanding the concept in its entirety.

2.4 Empirical Methods

This thesis is constructed based on a combination of approaches that includes both primary and secondary data. Primary data is defined as completely new data collected for the specific purpose of answering the defined research question for this particular study (Gripsrud, Olsson & Silkoset, 2004). Additionally, secondary data will be used to supplement the primary data when executing the analysis. Secondary data is defined as data that has previously been collected for another purpose and research (Gripsrud et al., 2004). In this thesis, the secondary data from previous research and reports are used to support our findings from the collected primary data.

2.5 Qualitative Research

Qualitative research represents a variety of research approaches that share some common elements. It can, therefore, be viewed as an umbrella term (Brink, 1993). Qualitative methods are used when collecting and analyzing qualitative data. This type of data is usually in the form of text, as opposed to quantitative data, which is usually expressed in the form of numbers or other types of quantity (Grønmo, 2020). Qualitative researchers focus on people's experiences, opinions, and beliefs, and this method is vastly more subjective compared to quantitative research (Brink, 1993). This section of the investigation, together with section 2.3, makes up the third stage of interview investigation, designing. According to Kvale (1996), the purpose of this stage "*(...) consists of overall planning and preparing the procedures for obtaining the intended knowledge"* (p. 98).

There are different methods for collecting qualitative data. In this thesis, both structured and unstructured interview methods have been applied. Qualitative studies often include a few units of collected data, for instance, a handful of depth interviews conducted, which is how the data was collected for this thesis. The purpose of performing a qualitative study is to gain in-depth knowledge and a comprehensive understanding of a specific topic, not to create an overview over an opinion or to generalize based on a sample population (Grønmo, 2020). The interviewees in this thesis were selected because of their expertise and insights on the topic of research.

There are several advantages and disadvantages to using qualitative research methods. The advantages are that the method reviews feelings, attitudes, and behaviors, and looks more in-depth than when analyzing quantitative data. Qualitative research is, therefore, filled with depth and detail (Kvale, 1996). This entails detailed descriptions of the feelings, experiences, and opinions of the participants, which makes it possible to interpret the meaning of their actions (Rahman, 2016). The design of the qualitative research has an interactive approach, and is flexible in that it can be constructed and reconstructed to a large extent (Rahman, 2016). This approach opens up for the possibility of thorough analyses, creating freedom for the participants to determine what is consistent for them. In this way, the complex issues can be understood more easily, and the dynamics outside the research situation can be captured (Rahman, 2016).

In qualitative research, the focus is on the details behind a personal choice. This means that the research process examines the purpose of the decisions made by an individual. When collecting information, the purpose is considered the primary information. However, the qualitative research process is not interested in the reasons why decisions were made in the first place (Regoli, 2019). The questions are open-ended, meaning there is room for researchers to ask questions wherever it is appropriate in the conversation. This opens up the opportunity for a broader data collection (Regoli, 2019). With qualitative research, it is also possible to use a smaller sample size, as questions can be answered immediately. Smaller sample sizes create information that is both usable and actionable, which can lead to new ideas. It is then possible to move forward with confidence, as certain predictability is provided to the results (Regoli, 2019).

The disadvantage to the research method is that the collection of data is more time-consuming in qualitative analysis, compared to quantitative analysis. Because of this, it is necessary to study fewer people and collect smaller sample sizes, which leads to the fact that generalization of the answers towards the population is difficult. Because of this, systematic comparisons are also challenging to make (Rahman, 2016). The quality of the research can be deemed questionable, as the researchers are responsible for connecting the data to find the answers to the questions they have (Regoli, 2019). The reading of non-verbal cues, to understand where and when it is suitable with follow-up questions, and to document the responses, are up to the researcher. The research method is, therefore, highly dependent on the skills of the researcher (Regoli, 2019). Since data can be interpreted in many ways, this might affect the conclusion.

Some potential solutions to the criticism can be applied to balance out the disadvantages. One of these solutions could, for example, by the use of transparency. Transparency can be done by explaining and documenting each step of the process thoroughly (Kvale, 1994). Regarding the issue of generalization, one possible way to avoid this is to review research previously conducted to see what other investigators have discovered. By looking at knowledge from similar cases and past research, it is possible to generalize the study based on these (Kvale, 1994).

Some of the factors that make generalizing based on qualitative research difficult are that the work is subjective and that the scope of the information collected is limited. These factors create doubt in the data (Regoli, 2019). Not all members of the demographic area that is researched are involved, meaning the qualitative research will always be incomplete. The inclusion of a margin of error can be the solution to this problem (Regoli, 2019). According to Kvale (1994): "*a hermeneutic mode of understanding allows for a legitimate plurality of interpretations.*" (p. 157). Based on this statement, even though the answers provided by the interviewees are subjective, they contribute to a collective understanding of the investigated concept.

2.5.1 Qualitative Case Studies

A qualitative case study is a type of research methodology that enables and facilitates the study of complex phenomenons and concepts (Baxter & Jack, 2008). This is done by identifying various factors that interact with each other (Debout, 2016). By using the case study approach to examine the concept or phenomenon, it ensures that the analysis is not carried out through only one perspective, but through several. This approach allows for multiple aspects of the phenomenon or concept to be revealed and understood (Baxter & Jack, 2008). Qualitative case studies are seen as the relevant approach for this thesis due to the problem statement being about investigating the smart city concept.

There are several approaches that present guides to case study methodology. One of the most acknowledged approaches is proposed by Robert Yin (2014). The basis of Yin's approach of performing a case study is on a constructivist paradigm. As mentioned in section 2.3.2, constructivism regards the truth as relative and subjective. Robert Yin (2014) proposes different situations where the use of a case study approach should be considered. One situation is when the study aims to answer questions such as "how" and "why", where the focus is on gaining understanding. Another is when the barrier between phenomenon and context are not clearly defined (Yin, 2014).

When the problem statement is determined, and the concept or phenomenon is selected for the study, the next step to consider is what type of case study to perform (Baxter &

Jack, 2008). According to Yin (2014), a case study is categorized as either explanatory, exploratory, or descriptive. In this thesis, the case study performed will be descriptive. This type of case study aims to describe a concept or phenomenon and the context when it occurs in reality (Yin, 2014). It can also be categorized as exploratory due to the purpose of the thesis, which is to understand the smart city concept better (Kvale, 1994).

Once the topic of research has been determined for the case study, the next step should be to figure out what knowledge has previously been gathered on the subject and in which areas there is a gap knowledge (Hancock & Algozzine, 2006). This step is done by reviewing the literature that has already been published to establish essential and viable research questions. Lastly, examining the literature on previously performed research can help establish if there is a gap in the knowledge available on the subject and determine if there is a need for further research on the topic (Hancock & Algozzine, 2006).

There are both advantages and disadvantages when using case studies. Firstly, the examination of the data is done within the situation where the activity takes place (Yin, 1984; Zainal, 2007). The researcher investigates a topic within the field of the case study. This makes it different from, for example, an experiment, as it would isolate a phenomenon from its context and focus on a limited number of variables. Secondly, variations in approaches to case studies allow for both a qualitative and quantitative analysis of the data (Zainal, 2007). By doing this, the case studies can rely on both interviews and numerical responses. However, it is important to know that case studies can be based solely on qualitative or quantitative data (Zainal, 2007). Thirdly, the qualitative material found helps to explore the data in real life and to explain the complexities of situations in real life. Other research methods may not capture these complexities (Zainal, 2007).

Some disadvantages comes with using case studies. According to Yin (1984), there are three arguments against case study research. Firstly, case studies have an accusation of lacking thoroughness. It is noted that the case study researcher has allowed ambiguous evidence or biased views to get the conclusion or findings in the wanted direction. This points to that case study work can be sloppy (Zainal, 2007). Secondly, scientific generalization is provided little for in case studies, due to the small number of subjects

used in case studies, some only using one subject (Zainal, 2007). This raises a question of how to generalize from one case only (Yin, 1984). A method that is more commonly used in case studies is called analytical generalization and will be further explained in section 2.7. Thirdly, case studies are often considered to be too long, difficult to conduct, and to have an amount of documentation that is massive (Yin, 1984). This is mostly the case when the data is not organized or managed systematically.

Once the disadvantages of the qualitative case study approach have been identified, it is important to figure out how to overcome them. In this thesis, the disadvantages are balanced out through analytic generalization. This is done by including secondary data and results from previously performed investigations (Kvale, 1994).

Further, the investigators must be aware that biases can occur, and behave critical when collecting data. "*Bias in research cannot be completely avoided, but counteracted by carefully checking for effects of bias in subjects and researchers.*" (Kvale, 1994, p. 155). When describing bias, Kvale (1994) stated the following about the phenomenon: "*Objectivity as free of bias refers to knowledge that is reliable, checked and controlled, undistorted by personal bias and prejudice, neutral, factual, and confirmable*." (p.152).

2.5.2 Depth Interviews

When performing a depth interview, the primary purpose is to gather the personal opinions and experiences of the interviewees (Kvale, 1996). The process of choosing who to interview for the investigation was performed through purposive sampling. This is a technique for choosing the participants for the study and is based on the researchers' judgment (Research Methodology, n.d.-c). The interviewees were chosen based on their relevance within the field of smart cities and their different backgrounds within the public or private sector.

A conscious choice not to involve the citizens was made because we wanted to speak to the people who perform the city development. Also, performing quantitative analysis and gathering data from citizens in both Copenhagen and Oslo would be too time-consuming (Kvale, 1996). To gain as much insight as possible and be able to draw comparisons

between Copenhagen and Oslo, the interviewees were diversified by each location. In addition, to be able to research Private-Public Partnerships, the interviewees are a mixture of employees from both private companies and public departments in the municipalities.

When conducting interviews as the chosen method to collect primary data, one question that is commonly asked is: How many interviewees is needed? The answer to that question is simple: "*Interview as many subjects as necessary to find out what you need to know.*" (Kvale, 1996, p.101). Before conducting the interviews, an interview guide was created. Kvale (1996) states that "*An interview guide indicates the topics and their sequence in the interview. The guide can contain just some rough topics to be covered, or it can be a detailed sequence of carefully worded questions.*" (p. 129).

In order to obtain in-depth insights, the interview guide needs to consist of open-ended questions that provide the opportunity to ask supplementary follow-ups (Orgeret, 2019). Therefore, the interviews in this thesis were semi-structured. The interview guide for this investigation consisted of roughly 15 questions, which were categorized into questions regarding the smart city concept, SDGs, and projects implemented in Copenhagen and Oslo.

The same questions were used for the interviewees from both Copenhagen and Oslo, with only a few exceptions. For example, the interviewees with a technology background were asked more into this area. During the conversation, supplementary questions were allowed for new input and to clarify anything that came across as ambiguous. By adopting this format of interviewing, bias responses were avoided, and it was allowed to ask relevant questions along the way, if necessary (Kvale, 1996).

The context of the interview was provided in advance, so the interviewees knew the topic of the questions. The interviewees could then create opinions and understand the purpose of the interview before it was held. Some of the interviewees requested to see a draft of the questions before agreeing to participate in the process, to be sure they could provide useful insight into the investigation.

The interviews were conducted consecutively when the interviewees had time and opportunity, regardless of where they were located. In order to keep the overview organized, the interviewees from Copenhagen are presented first, and the interviewees from Oslo after.

2.5.2.1 Interviewees from Copenhagen

The first conducted interview was with Pelle Lind Bournonville. He is a project manager at RealDania, which is a philanthropic organization with approximately 165.000 members. Their vision is to solve the challenges of a society in collaboration with their local communities and national partners (RealDania, n.d.) The motivation for interviewing Bournoville came from the projects where he was the project manager, which was listed on RealDania's website.

Kim Spiegelberg Stelzer is the smart city Senior Advisor at Copenhagen Solutions Lab. Copenhagen Solutions Lab is a part of the Technical and Environmental Administration (Teknik- og Miljøforvaltningen) in Copenhagen Municipality, where the focus is on utilizing intelligent and innovative technologies to create data-driven solutions for the city and its citizens (Copenhagen Solution Lab, n.d.-b). Stelzer has previously been responsible for the urban planning of the city center of Copenhagen and has worked with organization development and digitization. He also co-founded the Nordic Smart City Network, which is a smart city collaboration between the major cities in Scandinavia (Copenhagen Solution Lab, n.d.-a). His extensive knowledge about the city of Copenhagen and Smart Cities made him a valuable interviewee for gaining insights about the work done by the public sector towards becoming smarter.

Peter Bjørn Larsen is the director and owner of the company Smart City Insights ApS. He works with strategic city development, having clients like cities, regions, and governments regarding smart city and data ecosystem strategies (Appendix 4, p. 1). He has previously worked as a Smart City Manager in the organization CLEAN and as director of the City Data Exchange project at Hitachi Consulting. Larsen has worked with both public and private companies within the areas researched in this thesis and gave valuable insights.

Also, he was able to present us with real-life examples of city development and digitalization projects he has partaken in.

Frederik Tauber is the Chief Commercial Officer (CCO) of BLOXHUB, which is a Nordic hub for sustainable urbanization (BLOXHUB, 2019). As their website states, "*BLOXHUB is a Nordic launchpad for future urban solutions and a gateway to Danish & Nordic partners & markets for international companies*" (BLOXHUB, 2019). The company was founded in 2016 by RealDania, the City of Copenhagen, and the Ministry of Industry, Business and Financial Affairs (BLOXHUB, 2020). BLOXHUB focuses on areas within sustainable urbanization, such as livability, urban mobility, urban resilience, sustainable buildings, circular economy, digitalization, and governance (BLOXHUB, 2020). Tauber gave valuable perspectives on what kind of projects they take on, who their main partners and stakeholders are, and why organizations such as BLOXHUB are essential for city development and growth.

Marius Sylvester is the program director of Copenhagen Solution Lab. He has more than 15 years of experience working on smart city developments and green transitions by creating public-private partnerships, with a focus on societal challenges. Sylvester has extensive knowledge regarding subjects like digital transformation, city development, and IoT, making him an attractive interviewee for this thesis. Besides his work with Copenhagen Solution Lab, he has published articles and books on topics like smart city, public-private partnership, digitalization, and green economy.

The final interviewee from Copenhagen was Maja Ydhe, who is a senior project manager in Gate21. Gate21 is a non-profit partner organization, where they conduct projects in collaboration with the public sector, the private sector, and universities. Ydhe works with sustainable smart cities on a project basis. She provided knowledge about collaborations and partnerships between the private and the public sector. Ydhe provided valuable insights into how Gate21 performs private-public partnerships and how they identify their stakeholders.

2.5.2.2 Interviewees from Oslo

The first interview from Oslo was with Lasse Berntzen. He is a professor at the University of South-Eastern Norway (USN), where he works for the Department of Business, History, and Social Science. His research used to focus on the digital society, e-government, and smart cities. Berntzen currently researches the usage of IoT and big data in subdomains within smart cities, in areas like smart traffic, environmental monitoring, and smart energy (University of South-Eastern Norway, n.d.). The motivation for interviewing Berntzen was his extensive background regarding smart cities, both professionally and academically.

Anne Romsaas works for the Norwegian Association of Local and Regional Authorities (Kommunesektorens Organisasjon) as a senior advisor for innovation for the department of Research, Innovation, and Digitalization. Romsaas has previously worked in Oslo Municipality for eight years, where she learned about their routines and how they operate. Therefore, she has extensive knowledge about working for a public office, while cooperating with private companies on topics such as smart city, innovation, technology, and digitalization.

Frank Johnsen works as a researcher at the Norwegian Defence Research Establishment (Forsvarets Forskningsinstitutt, FFI). Johnsen has a background in informatics and a Ph.D. in programming and distributed systems and networks from the University of Oslo. His work at FFI revolves around solving problems related to interoperability and federation of systems. Johnsen's main area of work is with computer science and IoT, where he provided valuable insights into these fields. He has also accumulated knowledge about how the use of IoT can be implemented in smart cities and city development.

Haakon Hasli works as an App Development Specialist at Microsoft in Oslo. He previously worked with data and artificial intelligence (AI), which included IoT and other advanced analytic work. During his time at Microsoft, Hasli has worked as a solution advisor on projects revolving smart cities, smart buildings, and digital twins, amongst other things. The motivation for interviewing Hasli was because of his knowledge of data and technology, including his experience with AI and IoT from the private sector.

The final interviewee was Morten Fraas. He works as a senior advisor for the Department of Business Development and Public Ownership within Oslo Municipality. This department is divided into two parts. The first is Business Development, where they work with companies that build and develop on behalf of Oslo, such as sports facilities, schools, nursing homes, and housing (Appendix 11, p. 6). The second part is the section of Public Ownership, where Fraas works, which works with general business development. Here they also manage the company called Oslo Business Region, which is Oslo Municipality's business development service. Fraas provided direct information from the municipality of Oslo on how they operate and what projects that are in the process of development. Further, he gave insights into processes and protocols Oslo must follow, their perception of the smart city concept, and how Oslo is working towards this term.

2.5.2.3 Transcribing

Transcription is the action of taking spoken words and providing a written product from it (Kvale, 1996). In many types of qualitative research, audio or video data are collected. The method most commonly used is to record the interviews and perform transcription for extensive analysis afterward (Kvale, 1996). Transcribing is the fourth stage from Kvale's (1996) seven stages of an interview investigation, where he states: "*Every transcription from one context to another involves a series of judgements and decisions*." (p. 163).

One of the first decisions to make when transcribing is what method to use. This process is perceived as interpretative, which is why transcription is considered the first step in analyzing data (Bailey, 2008). When the content is transcribed into written form word-for-word, the method is called verbatim transcription (Bailey, 2008). In true verbatim transcription, every utterance made by the speaker is captured. It does not only transcribe the words being communicated, but it also includes how it was said and under what circumstances it was said (Corners, 2015).

Conducting transcriptions may appear to be a clear and unambiguous task. However, it involves decisions, such as the level of detail included, the interpretation of the spoken words and distinguishing its meaning, and how to represent the data (Kvale, 1996). These are decisions that will affect how the collected data is perceived and eventually affect the

outcome of the analysis. For this thesis, each interview was recorded after acquiring consent from the interviewees.

The transcription for this thesis was not a true verbatim transcription in the sense that the context of statements or other details, such as background noise, were not included (Corners, 2015). Instead, follow-up questions were asked to minimize ambiguity. However, there are different versions of verbatim transcriptions, and for this thesis, a clean transcription was chosen. This version allows detailed editing and minor paraphrasing, like correcting grammatical errors, as long as it does not change the meaning of the sentence. Also, this type does not include stutters, non-verbal communications, and surrounding sounds (Corners, 2015).

Most of the interviews were performed in English to avoid having to translate statements and quotes for further use in the analyses. However, the majority of the interviewees were either Danish or Norwegian natives, meaning English is not their first language. Therefore, grammatical errors were corrected during transcription, as this does not compromise the meaning of the statement. On occasions where the interviewees were more comfortable being interviewed in either Danish or Norwegian, the transcription was performed in that language (Bailey, 2008). Statements used were later translated into English for the analyses.

2.5.3 Documents

As previously mentioned, additional data besides the interviews were collected to supplement and support the primary data. In this thesis, the majority of the secondary data came from documents and articles on the smart city projects found on the municipalities' official websites. Information and data about each country and capital were collected from statistical websites, such as Danmarks Statistik and Statistisk Sentralbyrå. Similar information was collected for chapter 4, related smart cities. The information was mainly collected from the official websites of the cities.

Other forms of secondary data were gathered, like journal articles and reports, from sources that are considered renowned and trustworthy. Several books written by

acknowledged writers were also frequently used throughout this thesis. Some of the authors included were Steinar Kvale, Robert Yin, and Norman Fairclough.

2.6 Critical Discourse Analysis

Discourse analysis is a method of analyzing written or spoken language and relating it to a social context (Luo, 2019). For this thesis, an analyzing version of the analytical tool is implemented, which is called critical discourse analysis (CDA). This tool can also be considered a theoretical framework and is presented in section 3.7.

Norman Fairclough is one of the founders and developers of CDA, which is applied to sociolinguistics. It is an interdisciplinary approach to the study of discourse that views language as a form of social practice (Fairclough, 1995). It allows researchers to analyze the use of language within social contexts (Henderson, 2005). By utilizing CDA for analysis, researchers are allowed to examine the relationship between discourse and society, between text and context, and between language and power (Henderson, 2005).

For performing the analysis, Fairclough developed a model that consists of three dimensions (Fairclough, 1995). The first dimension is “text”, which can consist of speech, writing, images, or a mix of all three types of communication. The analysis performed at this dimension is called the “analysis-at-word” level and is descriptive (Janks, n.d.). The second dimension is “discursive practice”, which involves production or constitution of text. At this dimension, the analysis is performed at the text-level and requires interpretation (Janks, n.d.). The third dimension is “social practice”. This dimension is about the standards of society or the organization, and it requires an explanatory analysis at something called the norm level (Janks, n.d.). Fairclough’s analytical approach assumes that language helps create change and, therefore, can be used to change behavior (Fairclough, 1995).

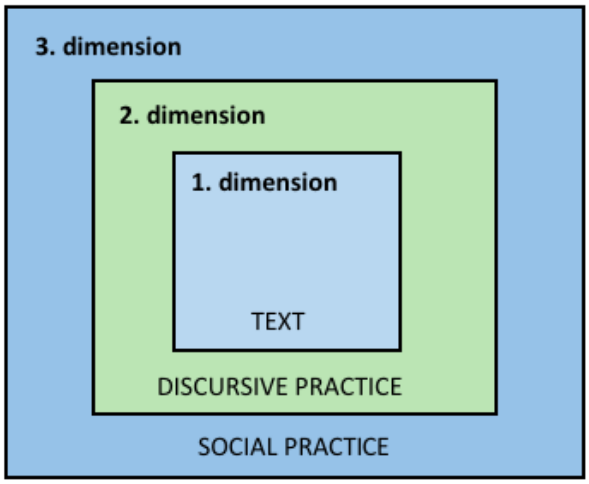

Figure 3 (Own illustration) - Critical Discourse Analysis

In order to utilize the CDA model for analysis, it is crucial to understand the different dimensions. The first dimension is text and revolves around analyzing the words used to form a sentence (Fairclough, 1995). By choosing certain words, we express an attitude towards the subject. For example, a person with a different origin may be a stranger for one group of people, a foreigner for second group, and a refugee for a third group (Fairclough, 1995). Discourse analysis is about text analysis and that any text contains interpretations.

The second dimension is the discursive practice. Through CDA, language is understood to be a bearer of change. The words we use and the way we compose our sentences are of importance, as it can change our view of the subject. Text is almost always subject to interpretation, and language is not neutral and innocent. It often contains values, attitudes, and assessments that the sender will convey to the recipient (Fairclough, 1995). The third dimension is a social practice. At this level, it is realized that language creates opinions, characterizes attitudes, and creates social relationships and practices (Fairclough, 1995). Language is a part of how we communicate. Hence, language is associated with power. Communication is a social event, and the language and the choice of words form the context of our community (Fairclough, 1995).

Even though CDA is one of the most acknowledged approaches of discourse analysis, the model has received some criticism. The model is depicted as being challenging to

understand and use, despite all the literature written about it (Breeze, 2011). Also, the model works differently depending on the culture, which means it can be difficult to transfer between cultures. However, there are certain advantages when using CDA to analyze language. For instance, this approach of analysis can reveal unspoken and unacknowledged attitudes and features of human behavior. CDA can also be useful when having to figure out what the sender wants to communicate to the recipients and what behavior the sender wants from the recipients (Mogashoa, 2014).

In this thesis, CDA will be used to analyze the concept of smart city and how different interviewees are articulating it. Besides investigating how the concept is being communicated, the third dimension will also analyze how the concept is realized in Copenhagen and Oslo.

2.7 Analytical Generalization

In the context of this thesis, it is interesting to discuss if case studies, interview findings, and frameworks can be generalized to relevant situations. Analytical generalization is about whether the findings from one study can be used as a guide to what will happen in another situation (Kvale, 2007). In other words, analytical generalization is a generalization of the investigated phenomenon.

This theory may have an applicability that is wider than the particular phenomenon being studied. It is assumed that the results of the study contribute to a general theory of the phenomenon (Yin, 2003). Analytical generalization separates from statistical generalization in that it compares the result of a case study to a theory that is previously developed, rather than concluding from data to a population (Yin, 2010).

According to Yin (2013), analytical generalization

> *"...can serve as an appropriate logic for generalizing the findings from a case study (...) By analytic generalization is meant the extraction of a more abstract level of ideas from a set of case study findings − ideas that nevertheless can pertain to newer situations other than the case(s) in the original case study.*" (p. 325).

The analytical generalization of Yin (2013) is based on case studies. It is here the aim that the analytical generalization in case studies should apply to other concrete situations, not just to theory building (Yin, 2013).

According to Yin (2010), if a finding supports the theory implemented, the researchers need to make a sound and logical argument to show how these findings can be generalized into similar situations. The claims of analytical generalization will also be more reliable if rival hypotheses are examined (Yin, 2010):

> "*Beyond making a claim, the generalizability of the findings from a single case study increases immeasurably if similar results have been found with other case studies — whether such studies already existed in the literature or were completed after the first case study."* (p. 22).

In other words, if similar findings are replicated in several case studies, it makes the generalization stronger. This is also mentioned in section 2.5.1 as a disadvantage of case studies. The continuation of this will make an ideal generalization, which applies to different cases (Yin, 2013). For this thesis, it is therefore interesting to see what type of content, general, or specific, from case studies, interviews, and other content, can be generalized and used to transfer insights into similar situations.

3. Conceptual and Theoretical Frameworks

The conceptual framework lays out the directions of the research, based on the purpose of the thesis and what is being investigated (Adom, Joe & Hussein, 2018). A conceptual framework is a process the researchers deem best suited for explaining the natural evolution of the phenomenon being researched. It shows how the researchers have planned to explore the research question to potentially reach an answer (Adom et al., 2018). In addition, by utilizing these conceptual frameworks, it makes it easier for the researchers to point out the concepts that can be found within the problem of the study (Camp, 2001).

It can be very beneficial for researchers to use conceptual and theoretical frameworks when conducting a study. This can assist with the identification of the specific phenomenon and construct the process of performing the research. Also, the researchers emphasize the reasoning for why the topic of research is worth investigating. Conceptual and theoretical frameworks further indicate which assumptions the researchers have made before performing the analysis and explains the chosen approach (Adom et al., 2018). Lastly, the analytical framework discourse analysis is used to perform the analyses.

3.1 Innovation Theory

According to the Organization for Economic Co-operation and Development (OECD), innovation is defined as "*the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" (OECD, 2005). Innovation can be described as a life cycle, starting from the creation of the concept to practice. The life cycle is divided into four sections: idea, invention, implementation, and impact (Oksanen & Hautamäki, 2015).

Several different theories exist about innovation, but perhaps the most known theory is the diffusion of innovation. The theory of diffusion of innovation was popularized by professor Everett Rogers in 1962 and is considered one of the oldest theories of social sciences.

The basis of the theory is that over time an idea or a product reaches momentum and then diffuses (LaMorte, 2019).

The theory analyzes at which stage a consumer partakes and adopts innovation. For instance, whether the consumer adapts new products and ideas as soon as it is released or waits until the majority adopts the product. The meaning of adoption is that a person changes the way they previously have done something. For adoption to be possible, the person must consider the idea, product, or behavior to be new or innovative, and it is from this perception diffusion is created.

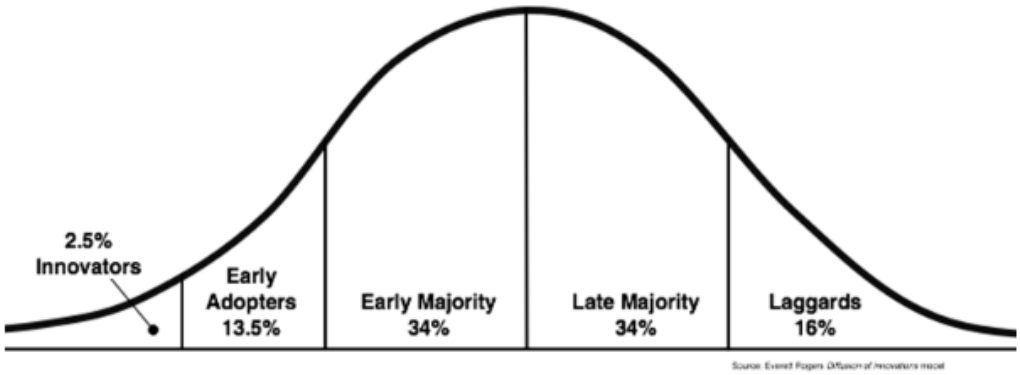

Figure 4 - five established adopter categories (LaMorte, 2019)

Five categories of adopters have been established for the diffusion of innovation (LaMorte, 2019). When promoting innovation to the chosen target group within a population, it is necessary to identify and understand the characteristics of that group. This is to know what might hinder or help the adoption of innovation (LaMorte, 2019). The first three categories of adopters from the figure above are considered the most relevant for this thesis and will be further explained.

The first category, Innovators, are the people who want to try the innovation first. These people are categorized as venturesome, intrigued by new ideas, and willing to take risks to be the first to develop new ideas or try new products (LaMorte, 2019). Secondly, Early Adopters consists of opinion leaders who recognize the need for change and embraces it without much hesitation. Last is Early Majority, which is rarely the frontiers for change but adopts new ideas before the average person. However, they require proof of success before they are willing to adopt new products (LaMorte, 2019).

When looking into innovation, one aspect to analyze is the consumers who are adopting the new products or ideas. Another aspect is what kind of innovation that is taking place. Innovation is generally divided into four types: product innovation, process innovation, organizational innovation, and marketing innovation (Ganzer, Chais & Olea, 2017). The two first types of innovation are assumed to be the most relevant regarding smart city development and will, therefore, be further explained in the following section.

Product innovation implies that a product is being changed by the creator, which can be done using either new or existing technologies (Ganzer et al., 2017). This type of innovation refers to the development and marketing of new products. The reason for changing the product could, for example, be to enhance customer satisfaction. Following is process innovation, where the processes of production and delivery for new or improved products are changed (Ganzer et al., 2017). Hence, innovation is occurring when different processes are developed and implemented.

In today's society, innovation is a driving power in every industry. New ideas and innovative thinking are crucial for businesses to maintain their competitiveness. If a company is not constantly innovating, they risk becoming outdated. Consequently, the business cannot continue to grow or win tenders (Open Innovation, n.d.). The traditional way of innovation is called Closed Innovation, where the process takes place within a company's department of Research & Development. Closed Innovation means that the company has complete control over the whole innovation process. The disadvantages of this method of innovation could be substantial investment costs, high patent costs, and slow innovation processes (Open Innovation, n.d.).

Opposite to Closed Innovation is Open Innovation, which is based on the free flow of internal knowledge, benefiting from external knowledge solutions (The Oxford Review, n.d.). Common misconceptions of open innovation are that it is free or open to anyone. However, Open Innovation is about exchanging knowledge and ideas between business partners, customers, public institutions, universities, and other entities (The Oxford Review, n.d.). Open Innovation provides businesses with opportunities such as reducing research costs, increasing market differentiation, and having new streams of revenue

(Chesbrough, 2011). It is the new approach for businesses to achieve greater success, as well as social advancement. For performing Open Innovation, there are three general models: Outside-in, Inside-out, and Coupled.

Outside-in Open Innovation draws external knowledge into the company to improve the internal innovation performance (Mazzola, Bruccoleri & Perrone, 2012). Inside-out Open Innovation does the opposite and looks at how internal knowledge can potentially be shared with the external environment and provide added value to the company. For example, through licensing, or becoming an open-source (Mazzola et al., 2012). Lastly, Coupled Open Innovation combines the first two models. It is often used to facilitate joint development of knowledge through collaborative partnerships, where partners share intellectual assets (Mazzola et al., 2012).

When it comes to innovation, there is a difference between private and public innovation. In the private sector, there is a lot more knowledge gathered about innovation than in the public sector. Innovation in the private sector is about something new in a market context where a company gains a competitive advantage by innovating the service, product, process, or new thinking applied to get a competitive position (van Acker, 2018). However, in the public sector, competitive advantage is not an issue because the government is usually the only player. Public innovation revolves around implementing ideas that provide benefits for the public (Digital Future Society, n.d.).

Certain aspects that complicate the progress and developments of public sector innovation are regulations and policies. With emerging technologies and rapid change in digitalization, it is becoming increasingly difficult for governments to construct relevant policies for the digital age at a high enough speed to keep up (Digital Future Society, n.d.). For public sector innovation, the aim is to create changes in public value. An example of this is innovation through digital advancement and technology, which can provide services to the public in a quicker fashion (van Acker, 2018). These innovations can be considered both positive and negative. This is because part of the population could be outside the service angle, due to not having access to digital tools, or not having the capability or

capacity to use them. Innovation aims to implement new things in a new context and provide added value to the population.

A phenomenon often incorporated in innovation is Internet of Things (IoT). *"IoT pursues to pervade our everyday environment and its objects, linking the physical to the digital world and allowing people and "things" to be connected anytime, anywhere, with anything and anyone ideally using any network and service"* (Lampropoulos, Siakas & Anastasiadis, 2019 p. 1). IoT is about connecting digital devices to the internet and each other, to share data about the environment around them (IBM, 2016). The IoT devices are connected to an application programming interface (API), which is the connector where all the applications communicate (Hill, 2016). According to a study of 2 300 executives, 48% are already using IoT solutions, and 58% said that IoT solutions are viewed as strategically necessary in their business strategy (Cisco, 2016). This phenomenon is, therefore, viewed as important for the smart city concept.

Sustainable innovation has become an important aspect of the current economic environment. This sort of innovation stems from sustainable development and is based on environmentally, economically, ethically, and socially sustainable principles (Oksanen & Hautamäki, 2015). Consumers are increasingly demanding sustainable products and are prepared to pay more. The market for sustainable innovation is, therefore, growing because more actors partake in the development of better products and ideas. This demand for sustainable products is not just limited to commercial goods. It is spread all over the market, in both private and public sectors, within construction, manufacturing, development, and other areas. The demand for more sustainable solutions is increasing, which, consequently, is forcing developers to think more innovative (Oksanen & Hautamäki, 2015).

3.2 Urban Development

Cities are commonly recognized as engines of growth and development for a country. As mentioned in the introduction for chapter 1, more than half of the world's population lives in cities today. While the expected world population in 2050 is about 9.3 billion people, the urban population is forecasted to consist of two-thirds of this amount, doubling in size from

the current number (The World Bank, 2019). With such an expected increase of people residing in cities, urban areas, and cities must be sustainable, focusing on urban development and growth (Pisano, Lepuschitz & Berger, 2014). According to the European Sustainable Development Network, a national strategy for sustainable development "*should build upon and harmonize the various sectoral economic, social, and environmental policies and plans that are operating in the country*" (ESDN, n.d.), and sustainable development should "*ensure socially responsible economic development while protecting the resource base and the environment for the benefit of future generations*" (ESDN, n.d.).

According to research conducted by the University of Oregon and the *Sustainable Cities Initiative,* livability is an important term in the field of planning. It is often used when describing long term goals. The planning is done in fields such as community development, transportation, resilience, and other disciples (Herman & Lewis, 2017). In a survey conducted by Rambøll, 3 200 Danish citizens were asked what makes a city attractive (Norn, 2017). The most important condition for livability was clean air. After this was safety, mobility, green areas and urban nature, and flood resiliency. All of these findings contained some dissatisfaction amongst the citizens, meaning these factors could be improved through well managed urban development (Norn, 2017).

A high concentration of people creates economic, social, and environmental challenges that must be solved. Sustainable solutions are, therefore, crucial and will require the cooperation of different sectors across society in combination with innovative solutions and research (NordForsk, n.d.). As previously mentioned, more than 80% of the global Gross Domestic Product (GDP) is currently generated in cities, making urbanization a valuable and substantial factor for the financial situation of a country (McKinsey, 2011). By managing urbanization well and focusing on its importance, it can contribute to sustainable growth through increasing productivity, as well as allowing innovation to take place and letting new ideas emerge (McKinsey, 2011).

3.3 Urban Governance

Urban governance refers to the collaboration and the decisions between governments (national, regional, and local) and stakeholders. Mainly, the decisions revolve around how urban areas should be planned, financed, and managed (GSDRC, 2016, p. 5). The process involves a lot of negotiation and contestation over how social and material resources and political power should be allocated. Urban governance is mainly political and is influenced by the operation and creation of political institutions and government capacity. Further, it is about the extent that these can recognize and react to the interests of the poor (GSDRC, 2016, p. 5).

Urban governance has a range of institutions and actors, and the collaboration and relationship of these is the deciding factor for what happens in the city (GSDRC, 2016, p. 5). The government must forge strategically important relationships with key stakeholders at all levels. Even though the city is the largest governance actor, much of the affections of the poor lie outside the control of the administrators. Here, the market and private businesses, agencies of the state, and voluntary actions determine the outcome (GSDRC, 2016, p. 5).

During the past two decades, two approaches to the traditional bureaucratic government have emerged. These are called the new public management (NPM) and the governance approach (Klijn, 2012). In the NPM approach, governments are attempting to administer the delivery of service and public policy by using private actors, as well as non-profit entities. The focus is on implementing organizational and institutional changes, as well as achieving adaptations within the public sector. The objective of NPM is to lead the public sector similar to the private sector by using rational management techniques and separating the acts of policy formulation and implementation (Klijn, 2012). The NPM aims towards improving the effectiveness and efficiency of service delivery and implementation of policies, similarly to processes being used in the private sector.

The approach called new public governance focuses on changing and adapting the relation between the government and actors in the market, also known as an inter-organizational focus. Whereas NPM prioritizes processes and increases efficiency, new

public governance holds the objectives of improving the quality of decision-making and enhancing inter-organizational coordination (Klijn, 2012). In order to achieve the objectives, new public governance utilizes network management in the approach. Some examples of management techniques being implemented are activating actors and organizing research as joint fact findings (Klijn, 2012).

The reason that urban governance is essential is that city management is one of the 21st centuries most defining challenges (GSDRC, n.d.). Also, cities are under constant pressure, as factors like urbanization, industrialization, urban sprawl, population growth, migration, and climate change lead to a shift in the existing urban governance structures (van Djik, Edelenbos, & van Rooijen, 2017). If this is managed well, cities can act as growth engines for inhabitants, creating better job opportunities, healthcare, social development, safety, and housing. This can result in growth on a national level through an increase in revenues and political stability. Opposite, cities that are badly planned concerning urban governance can become places of inequality, poverty, and conflict (GSDRC, n.d.). Therefore, urban governance is considered an essential aspect of developing as a smart city.

3.4 Private-Public Partnerships

According to the World Bank Group (2018), there is no widely accepted definition of the term Private-Public Partnerships (PPP). However, one definition of PPP is: *“a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance*" (World Bank Group, 2018). Another interpretation is that PPP is a collaboration between a private sector company and a government agency that is used to finance, operate and build projects, such as roads, parks, hospitals, or bridges (World Bank Group, 2018).

Financing a project through this type of collaboration can speed up the process of a project or create the opportunity of the project in the first place (Kenton, 2019). The partnership relies on the recognition that both sectors have certain advantages relative to each other when performing specific tasks. This could, for example, be that the private

sector is responsible for the finance, design, construction, management, maintenance, and operation of the project, while the public can focus on monitoring and defining compliance with the objectives (Deloitte, n.d.; Kenton, 2019). The risk is also shared between the partners and distributed according to the public and the private's ability to control, assess, and cope with these risks (Kenton, 2019). A typical overall assumption of the public and private sector is that the private sector is concerned with making money, whereas the public sector is concerned with providing a service for the citizens.

Many countries are enshrining a definition of PPPs in their respective country laws, and are tailoring their definition to their legal particularities and institutions (World Bank Group, 2018). A typical PPP has long contract periods of 25-30 years or longer and is financed partly by the private sector, but also requires payments from the public sector or users of the project during its lifetime (Kenton, 2019). The advantages of PPPs are that the technology and innovation from the private sector can help improve services in the public sector through an improvement in operational efficiency. At the same time, the public sector can provide an incentive to the private sector to deliver high-quality projects within budget, on time (Kenton, 2019).

The public sector can also promote social integration, create a sense of community, and endure productive environments for businesses and investments. This can create jobs and open up possibilities for innovation. The private sector is an essential partner for the municipalities. In collaboration with the public sector, the businesses can contribute with knowledge, investments, and creativity, and further tie this to challenges that are described by the SDGs (Deloitte, 2018). As stated by Laura Palmeiro, senior advisor at the United Nations Global Compact: "*The private sector plays an enormous role in the social and economic landscape. It would be impossible and unrealistic to reach the SDGs without them.*" (GRI, 2017).

The creation of economic diversification brings a great deal of competitiveness in the country on its infrastructure base. This boosts construction and supports services, equipment, and other businesses that are associated with the projects (Kenton, 2019). However, there are also risks to PPP projects. These are often in the form of construction

risks, risks of exceeding time frame or cost estimates, or the risk of technical defects (Kenton, 2019). In other words, PPPs allow large government projects to be completed with the help and support of private funding (Kenton, 2019). PPPs are, therefore, very important when discussing smart cities, as partnerships between public and private actors create many of the projects within the field.

3.5 Stakeholder Management

A crucial factor for being successful when doing a project is establishing the stakeholders involved. In project management, a stakeholder is someone who has an interest in the outcome of the project. It could be a person, a company, or an organization that is actively involved in the projects themselves, someone who will be affected by the decisions made or someone affected by the result (Rolstadås, 2018).

A stakeholder is considered anyone affected by the outcome of the project, regardless of whether they are affected negatively or positively (Wrike, n.d.). Primary stakeholders are those whose direct participation and collaboration with the project could cause it to be unsuccessful. It is also the stakeholder who is most affected by the choices and the outcome of a project (Wrike, n.d.). Some examples of primary stakeholders are owners, investors, customers, competitors, or employees. Nature is also considered a primary stakeholder due to the consumption of natural resources and the environmental footprint of the project.

The following are secondary stakeholders, which is defined as someone who is, or potentially will be, influenced by the outcome without being directly involved and engaged in the project (Madsen & Ulhøi, 2001). The secondary stakeholders are viewed as unessential for the success of the project. Some examples of secondary stakeholders are local communities, businesses, or the government (Forsvaret, n.d.).

Given the importance of stakeholder management for a project to be successful, this aspect becomes highly relevant to look into in regards to smart cities. Identifying the stakeholders involved in projects being implemented is important. This is to communicate with the actors involved and divide attention to the stakeholders with the most influence.

Therefore, stakeholder management is considered an essential aspect when developing as a smart city.

3.6 Environmental Sustainability

There are different definitions and approaches to environmental sustainability. Generally, there are three main definitions of the topic. The first definition is created by the UN's World Commission on Environment and Development: "*Sustainability is the ability to meet the needs of the present without compromising the ability of future generations to meet their own needs*." (Evans, 2019). This definition shows that the potential of a long term stay on this planet relies on the maintenance of the natural resources (Evans, 2019).

The second definition is: "*Sustainability is the capacity to improve the quality of human life while living within the carrying capacity of the Earth's supporting eco-systems*." (Evans, 2019). The definition is provided by the International Union for Conservation of Nature (IUCN). It is about humans having too high production and consumption patterns, which puts a strain on the earth. These factors can be seen in the decline of the earth's natural ecosystem and the number of inhabitants of the earth. This signifies a changed balance of nature, ultimately harming humans and other living systems (Evans, 2019).

The third definition comes from Paul Hawken. Hawken is an environmentalist who has written about the science and realization that people are using the resources of the earth faster than they can regenerate and replenish (Evans, 2019). He defines sustainability as: "*Sustainability is about stabilizing the currently disruptive relationship between earth's two most complex systems—human culture and the living world.*" (Evans, 2019).

The global population is growing, and it is estimated that the middle class will reach 5 billion people by 2030, meaning many of the emerging nations will need increased prosperity. This is one of many things that put stress on the environment and resources of the planet (World Economic Forum, 2014). According to the World Economic Forum (2014), our present economic model needs a new direction, a more circular one.

A circular economy will become a driver of economic growth, sustainability, jobs, and environmental quality, in addition to coping with the cities' high demand for global energy, greenhouse gas emissions, and global waste (OECD, n.d.). The cities and regions are the ones with a critical role as facilitators, promoters, and enablers of the circular economy, in which a circular economy has become a strategy for many cities and regions (C40, 2018). Nevertheless, sufficient economic and governance should already be present to get the most out of the potential (OECD, n.d.).

According to the Ellen MacArthur Foundation (n.d.), a circular economy has a philosophy that goes beyond the take, make, and dispose philosophy of a linear economy and aims to redefine growth to benefit the society. The system wants to switch to renewable energy sources and build natural, economic, and social capital. There are three principles in the circular economy, which are to design pollution and waste out of the system, keep materials and products in use, and to regenerate natural systems (Ellen MacArthur Foundation, n.d.). The overall difference between a linear and circular economy is, therefore, that the materials are reused in the circular, closing the cycle of raw materials (Upadhayay & Alqassimi, 2019).

Several policies can be implemented to promote environmental sustainability. These will most likely have a more substantial effect on the actions of humans than just encouragements. Examples of these are carbon taxes, government regulations to prevent harmful emissions, e.g., to ban diesel cars in a city, subsidizing of environmental practices, e.g., solar or wind power instead of non-renewable resources, and to create a shift in the behavior of consumer and firms (Pettinger, 2018).

The Sustainable Development Goals (SDG) are the blueprint of how to achieve a better and more sustainable world (United Nations, n.d.-a). The SDGs consists of 17 goals, which are all interconnected, and the aim is to achieve them all within 2030 (United Nations, n.d.-a). All of the countries and stakeholders that are involved in the SDGs are collaborating on these goals, to implement solutions to achieve them (United Nations, n.d.-c). The goals include three dimensions; social inclusion, economic growth, and environmental protection (CSR Hub, n.d.). The SDGs overall intention is to ensure

inclusiveness and equality for everyone (Together 2030, 2019). It can, therefore, be said that they have a corporate social responsibility (CSR), and that CSR is a tool to reach the SDGs.

CSR can also be used to build a competitive advantage and is used by many to create a positive ecological image of their business activities (Orzeł & Wolniak, 2019). The problem arises when enterprises create situations and data that appear to be green, but in reality, is not. This is called Greenwashing, and is defined as *"Disinformation disseminated by an organization so as to present an environmentally responsible public image"* (Orzeł & Wolniak, 2019, p. 212). Greenwashing is done in many large corporations and is unfair to the socially responsible companies (Orzeł & Wolniak, 2019). Hence, it is important to be critical concerning CSR, SDGs, and greenwashing.

Opposite of greenwashing is green trust, which is defined as *"a willingness to depend on a product or service based on the belief or expectation resulting from its credibility, benevolence, and ability about environmental performance*" (Chen, 2010). Many of the smart city initiatives are revolving around environmental sustainability and solutions. Hence, this conceptual framework will be applied further in this thesis.

3.7 Theory of Discourse Analysis

As previously mentioned in section 2.6, critical discourse analysis is considered both an analytical and a theoretical tool. According to Bayley, Cameron & Lucas (2013):

> *"In our day, discourse analysis is emancipating itself both from sociolinguistics and pragmatics. It is no longer just seen as method of language analysis, but conceived of as a multidimensional project incorporating theory, methods, methodology, and empirically based research practices that yield concrete social applications."* (p. 69)

This research method aims to understand how language is used in real-life situations and how opinions are created through communication in different social contexts (Luo, 2019). The majority of linguistic analytical approaches focus on the rules of language use. However, discourse analysis emphasizes the contextual meaning of language. Also, the

non-verbal form of communication, such as tone and gestures, are applicable to discourse analysis (Luo, 2019).

Theoretically seen, the term “discourse” is used in many ways, and within the field of discourse analysis, it is considered broad (Fairclough, 2001). Two ways are seen as most relevant. The first is “discourse” in an abstract sense, meaning the focus is on semiotic elements rather than non-semiotic elements in social life (language, body language, and similar) (Fairclough, 2001). The second is “discourse” as a count noun, meaning as a category for particular ways of representing distinct aspects of social life. An example of this is distinguishing between different political discourses like disadvantage, inequality, social exclusion, and poverty in different ways (Fairclough, 2001). For this thesis, theoretical discourse analysis will be applied using the CDA approach.

3.8 Summary of Frameworks

This section aims to give a summary of the frameworks used in this thesis and present how they relate to each other. Urban development and urban governance are considered the most important frameworks when investigating the smart city concept. This is because the way a city is governed and which measures are implemented for development is seen as crucial foundations for smart city development. Innovation is a substantial part of urban development as a smart city since the concept requires innovative thinking to develop as smart. The development may be done with innovative methods, new technology, or old technology being used in a new way.

Private-public partnerships are a way for municipalities to collaborate with the private sector on projects and gain access to their knowledge. By removing this aspect from urban development, it would result in slower progress and potential lack of insight. Stakeholder management is used to make sure that the projects being executed are successful and that unnecessary resources and time are not spent on stakeholders with little influence over the outcome of the projects. Similar to PPPs, if stakeholder management was discarded in the smart city process, the implementation of projects could be slowed down, and the possibility of successful ventures could be drastically reduced.

Environmental sustainability is also a method for carrying out projects in conjunction with achieving SDGs or other environmental goals. Because urban development has a focus on being sustainable, it is an essential factor for cities developing as smart cities. If this factor was removed, cities would not be able to develop as needed for the future. It is also important for economic, social, and environmental challenges.

Discourse analysis is an analytical framework that does not align with the other frameworks but is used when performing the analyses. If either PPP, stakeholder management, environmental sustainability, or innovation theory were removed, the projects could still be carried out. However, it will be much more challenging to achieve the goals that are needed. A visualization of how the frameworks are related to each other is added below.

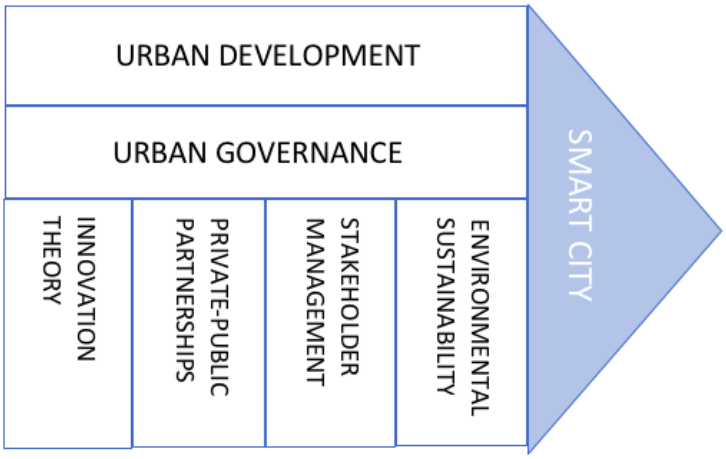

Figure 5 (Own illustration) - Visualization of framework relation

4. Related Smart Cities

This chapter will present related European smart cities. This is done to obtain a better understanding of the scientific field and to find which areas that can be further analyzed in chapter 5 to reach an answer to the problem statement. The selected cities stem from the Cities in Motion Index (CIMI) list of smartest cities in 2019 (Chapman, 2019). The list is a wide-ranging, objective, and holistic index that covers different key dimensions of metropolises (IESE, 2019-a). The main dimensions of this model are governance, human capital, the economy, social cohesion, public management, mobility and transportation, the environment, international outreach, and technology (IESE, 2019-b).

According to Chapman (2019), the top ten smart cities in Europe are:

1. London
2. Paris
3. Reykjavík
4. Amsterdam
5. Berlin
6. Copenhagen
7. Stockholm
8. Vienna
9. Helsinki
10. Oslo

London and Paris ranked as number 1 and 2, but due to their size in area and population, it would be difficult to compare these to Oslo and Copenhagen. The same applies to Berlin, Stockholm, and Vienna. Therefore, these cities are excluded. Instead, Reykjavík, Amsterdam, and Helsinki were chosen due to their size in area, population size, and location in the northern part of Europe. Amsterdam is relatively larger than the two capital cities being compared in this thesis but is considerably smaller than London and Paris. In addition, Dublin, Stavanger, and Aarhus were selected because several interviewees recommended these. Stavanger and Aarhus were chosen because they are cities from Norway and Denmark, which creates a basis for comparison in the rest of the thesis.

4.1 Reykjavík

Reykjavík was ranked the third smartest city in Europe in 2019 and is therefore considered one of the smartest cities in the world (Chapman, 2019). Iceland has several times been voted one of the most sustainable countries in the world and came in 11th at the Environmental Performance Index (EPI) in 2018 (EPI, 2018, p. 4). The country has only 330 000 citizens, where the capital Reykjavík holds more than a third of the country's population (NSCN, n.d.-a). Iceland has shown that a small population is an advantage, and they have become more resourceful in the use of technology (SCC, 2018). This is because of the Icelanders believe that a globalized world requires hard work, making them a nation of Innovators and Early Adopters. Also, they embrace the advantages of IT and communication (RFN, n.d.).

Reykjavík municipality's definition of a smart city is:

> *"Smart City is a city that uses information, communications and telecommunications technology to improve the quality of life in a sustainable way. Smart City gathers and combines data from different databases related to the infrastructure of the city and uses it to improve services, quality of life and environment."* (Reykjavik, n.d.).

According to the Smart Cities Council in Europe, there are three key factors in Reykjavík that make a difference within smart cities and sustainability. These are efficient transportation, government interaction, and connected homes (SCC, 2018). Other goals for Reykjavík is that innovation is beneficial to the citizens through the fields of education, culture, transportation, and welfare. The idea for a smart city is here that the experience of the measures should be more convenient, more environmentally friendly, and more accessible in tune with the policies of Reykjavík (NSCN, n.d.-a).

The key smart city projects of Reykjavík are called Straetó, Landupplýsingakerfi Reykjavíkur (LUKR), ON power, and Better Reykjavík (Reykjavik, n.d.). Straetó is an app for public transportation in Reykjavík, which was launched in 2014. The app has been downloaded 85 000 times, which shows that a large part of the population uses the app (Reykjavik, n.d.). LUKR translates to The Land Information System of the Reykjavík Area. It is a joint Geographic Information System (GIS) between the technical departments of the

municipality, the state-owned Telecommunications of Iceland, and the public utility systems in Reykjavík, which includes systems of hot and cold water, electricity, sewage, buildings and much more (Reykjavik, n.d.). The system covers 315 km^2, including both the municipality and urban areas, as well as six surrounding municipalities (Reykjavik, n.d.).

ON power is a power company that delivers energy to more than 50% of the population of Iceland (Reykjavik, n.d.). The energy is extracted by harnessing geothermal energy, which is further used for heating or electricity. In Iceland, more than 70% of the primal energy consumption comes from renewable power sources. ON power has the largest geometrical district heating utility in the world, and is a world leader in this field (Reykjavik, n.d.). Better Reykjavík is an online forum, where the citizens can propose ideas regarding the operation and services of the city of Reykjavík. The service is open for viewing for everyone, but registered users are the ones who can participate in it (Reykjavik, n.d.).

Strateó and ON power are both examples of the key factor efficient transportation, while Better Reykjavík is an example of government interaction and citizens' participation. The last key factor, connected homes, is also covered by one of the most advanced and True Open Access fiber network companies in the world, called Reykjavík Fibre Network (SCC, 2018). The network connects all of Reykjavík's homes to one-gigabit point to point fiber, and provides the connectivity and communications structure to make smart city solutions possible (RFN, 2020). It can, therefore, be said that Reykjavík is a smart city with sustainable solutions, and citizens that have adapted to the nature and the conditions of the country.

4.2 Amsterdam

Amsterdam is the capital of The Netherlands. The city has a population of about 1 100 000 inhabitants and is located in the Southeastern part of the country (Langvik-Johannessen, 2018). Amsterdam was ranked the 4th smartest city in Europe in 2019 (Chapman, 2019). Amsterdam Smart City is a platform that unites citizens, knowledge institutions, companies, and public authorities and allows them to work together to shape the future of Amsterdam (Amsterdam Smart City, n.d.-a).

Through the Amsterdam Smart City community, everyone can participate, share knowledge and be in contact with other innovators (Amsterdam Smart City, n.d.-a). The collaboration goes through a private-public partnership and a community of international actors. Knowledge sharing and collaboration are keywords in this initiative, which is the start of innovative solutions of economic, social, and ecological nature. The initiative is making sure that the Amsterdam metropolitan area continues to be livable both now and in the future (Amsterdam Smart City, n.d.-a).

According to Smart City Hub, Amsterdam is developing towards the direction of being categorized as a Smart City 3.0. The definition of this is: *"Smart city 3.0 promotes initiatives of citizens (individually, in a neighborhood or as part of a network), companies, and (knowledge) institutions. The municipality facilitates the use of ICT and creates the necessary infrastructure*." (van den Bosch, 2018). This is a change from Smart City 1.0 and 2.0, as these focused more on a strong technological infrastructure and urban problems (van den Bosch, 2018).

Amsterdam also has City Data, which can be viewed as a fuel for the smart city engine (Macpherson, 2017). City Data is open-sourced, and makes it possible for everyone to add or get access to data sets. This creates economic value for the citizens, as it is used to create new and innovative solutions for the problems of the city. Also, Amsterdam has a digital infrastructure that is considered robust, with an ICT ecosystem (Macpherson, 2017). Startups are also highly appreciated in Amsterdam and are supported by having access to startup exchanges, introduction to investors, and other factors. In 2016, 76% of the funding of startups in the Netherlands came from Amsterdam, consisting of 194 million Euro (Macpherson, 2017). This proves that the city is concerned with social entrepreneurship in combination with sustainability.

One smart city project in Amsterdam is the Great Bubble Barrier. The project is implemented in rivers and canals and uses air bubbles to move the plastic in the river towards the direction of the waste collectors (Bubble Barrier Amsterdam, n.d.). The collected plastic is further used as material for 3D printers, creating new objects (Macpherson, 2017). Amsterdam is known for its inward waterways and has more water in

the city than Venice, as well as more bridges than Paris. The collection of plastic from these rivers is therefore seen as highly necessary. The solution is adapted to the city, as well as it can be transferable to other cities.

The Great Bubble Barrier also contributes to Amsterdam's ambition of becoming the first city in a world with a circular economy. In this type of economy, materials are reused, and waste is minimized by redesigning production chains (Bubble Barrier Amsterdam, n.d.). This term is explained in the conceptual framework of environmental sustainability in section 3.6. One of the goals of Amsterdam is that the city is green and low waste by 2050 (City of Amsterdam, n.d.). Amsterdam Smart City has an innovation program that can be considered an innovation process framework. The projects within this program are supposed to increase knowledge of the circular economy and experience transitioning to a circular economy. The motive in these types of projects is learning by doing (Amsterdam Smart City, n.d.-b). The smart city initiatives of Amsterdam show that the city finds solutions based on the problems it has and that they include the citizens when doing so.

4.3 Helsinki

Helsinki is the capital of Finland, with about 630 000 inhabitants. The city was ranked the 9th smartest city in Europe in 2019 (Chapman, 2019). Over the past couple of years, Helsinki has consistently been topping the rankings over the world's most livable cities. In 2020 Finland was ranked the third country with the highest quality of life, after Denmark and Switzerland (Quality of Life Index, 2020). Because of the high ranking in livable cities, it could be interesting to look into their development as a smart city.

The municipality of Helsinki defines a smart city as:

> "*A smart city uses digital technology to improve its performance, liveability and the well-being of its citizens. New technology and data is used for solving the cities' economic, social and environmental challenges. Important smart city themes include energy, building, mobility, city planning and governance"* (Business Finland, n.d., p. 22).

According to the mayor of Helsinki, Jan Vapaavuori, there are three focus areas that make Helsinki noticeably smart. These are education, transparency, and removing bureaucracy (CGTN's Global Business, 2019).

Regarding education, Vapaavuori stated that:

> "*The most important element of a smart city is smart people. And as we know, we have been ranked as having the best schools in the world. And I think that that is the basis for an innovative society*" (CGTN's Global Business, 2019).

On the same occasion, he said it is crucial to not only invest in school, but also in teachers and in areas where the students are considered weaker. This policy is applied to other projects as well, such as area development. In these cases, if some districts or areas are lagging behind the rest of the city, they implement a principle called "positive discrimination" (CGTN's Global Business, 2019). This means that they increase the funding and resources to these areas, so that they can improve their schools and facilities in areas with less favorable conditions.

One notable project revolving area development is the development of Kalasatama, which is a district on the east side of Helsinki's city center. First, they extended the train tracks to this area for easy access and better mobility (My Helsinki, 2017). Second, they developed apartment buildings and office spaces, which created a new industrial area along with increased living spaces. However, it is citizen participation in the decision-making process that makes this development innovative. Veera Mustonen, project manager for the Smart Kalasatama project, stated the following about the citizens' involvement in the project: "*When the basic infrastructure works, people can build their own innovations on top of it. In Kalasatama the users have been involved from the beginning*" (Forum Virum Helsinki, 2018).

A major area of priority for Helsinki is testing, and the city has conducted several pilot projects over the past couple of years. Vapaavuori expressed that the reason for this is: "*We are big enough to enable tests, demonstrations and pilots in a systemic relevant way. But at the same time, we are small enough to make that happen and good enough to*

make it feasible." (CGTN's Global Business, 2019). A significant contributor to making this possible is the open data policy Helsinki has. This has, according to Vapaavuori, attracted various innovative smart city projects to the city (CGTN's Global Business, 2019).

The Global Innovation Index (GII) provides insights into a country's ability to produce innovation-driven growth (Global Innovation Index, 2019). It uses 80 metrics in its calculation of the ranking and is considered one of the leading measurements of an economy's innovation performance. On the list from 2019, Finland ranked 6th, placing them amongst the top countries in the world. The GII provides a benchmark for the innovation progress in Helsinki (Global Innovation Index, 2019).

Helsinki was ranked the best city in the world for services categorized as "Mobility-as-a-Service" (MaaS) (Juniper Research, n.d.). The city has become a global testing ground for MaaS ideas, which is working towards decreasing the number of private-owned modes of transportation and increasing the accessibility of mobility provided as a service. This is achieved by allowing commuters to plan their trips by using different transportation modes through a single access point (Zipper, 2018). With these initiatives, and a focus on citizens-involvement, Helsinki is emerging as a fast-growing smart city in Europe.

4.4 Dublin

Dublin is the capital of Ireland and has just over 1 200 000 inhabitants. The city is located on the eastern coast of the country (World Population Review, n.d.). In March 2016, the four local authorities in Dublin launched an initiative called "Smart Dublin" (Cudden & Rivera, n.d.). The purpose of the initiative is to engage with smart technology providers, researchers, and citizens to solve challenges and improve the quality of life in the city region (Dublin City Council, n.d.).

Before launching Smart Dublin, Dublin's four local authorities collaborated and developed an open data portal for the whole region called "Dublinked" (Cudden & Rivera, n.d.). After this project finished, there was no formal department for continuing the collaboration on projects. Thus, the Smart Dublin office was created, which had the desire to develop further collaborations, join resources, and share practices, to make the most out of the

technology advancement (Cudden & Rivera, n.d.). Smart Dublin's vision is: "*Developing smart solutions to make the Dublin region a better place to be, to live, to work, to visit and do business*" (Smart Dublin, 2019). In addition, Smart Dublin advertises themselves as being "open, engaged and connected". "Engaged" is here related to the involvement and participation of its citizens (Cardullo & Kitchin, 2018).

Smart Dublin aims to position the city as one of the world's leading developers of new urban solutions and to promote the use of open data (Smart Dublin, 2019). The four key objectives to reach the goal of the initiative are to provide better service, promote innovation solutions, improve economic activity, and increase collaboration and engagement (Dublin City Council, n.d.). One of the measures implemented to achieve this is to use the city region as a testing area for smart city solutions (Smart Dublin, 2019).

Several projects and collaborations are in progress due to the Smart Dublin initiative. For example, the Small Business Innovation Research competition. Together with Enterprise Ireland, Smart Dublin is looking for smart and cost-efficient innovative solutions in an attempt to solve various challenges in the community (Dublin City Council, n.d.). Such challenges could be illegal dumping of waste, finding a way to increase cycling, or how to monitor blocked gullies and make predictions for areas with a high risk of flooding (Smart Dublin, 2018).

As their vision states, the Smart Dublin initiative is created to improve the quality of life for all participants in the community (Smart Dublin, 2019). One of the benefits resulting from the initiative is that Dublin will act as a reference site to validate smart city technology (Smart Dublin, 2019). Another benefit is that the vision will assist in moving projects from research to reality. This will also contribute to enhancing the quality of life in Dublin and build a framework for future collaborations to solve the city's challenges (Smart Dublin, 2019). By having this initiative, Dublin has established concrete guidelines for further developing as a smart city.

4.5 Stavanger

Stavanger is the fourth largest city in Norway. The city is located on the Southwest coast of Norway and has a population of about 142 000 inhabitants (Thorsnæs, 2020). Stavanger is known as the “Oil City” since it is located on the coast where the oil production began in Norway in 1971 (Norsk Oljemuseum, n.d.). The discovery of oil contributed to Stavanger becoming a city with significant technological progress. This has had a significant impact on their development as a smart city.

Stavanger municipality’s definition of a smart city is:

> “*A smart city is based on the citizen's needs and applies new technology to make the city a better place to live, reside and work. The smart city work that's been done is based on a constructive collaboration between different players - from both the public and the private sector*.” (Stavanger Kommune, 2020).

The city believes that technology is a part of the solution in innovation and is the main driver when creating smart cities. This is because technology has the opportunity to reduce costs and create value and jobs. Other key drivers are cooperation and citizen involvement, which is reflected in their smart city vision: “*Smarter together”* (Stavanger Kommune, 2016).

There are five priority areas where Stavanger has the best opportunity to develop solutions that benefit the citizens, creates new jobs, and increases commercial development (Stavanger Kommune, 2020). These areas are education and knowledge, health and welfare, energy, climate and environment, governance and democracy, and urban art. The ones deemed relevant will be further elaborated.

Education and knowledge focus on technology and ICT solutions and is an essential factor when it comes to future competition. The municipality wants to assess education from kindergarten to the university level and see how technology can be implemented and make the citizens more skillful (Stavanger Kommune, 2020). Stavanger also wants to be active in solving the issues related to energy, climate, and environment. The municipality is

an energy capital in Europe and wants to use its position to solve these challenges (Stavanger Kommune, 2020).

Technological solutions are important to implement to reduce CO^2, create solutions that enhance environmental consciousness within the citizens, and develop more environmentally friendly transportation (Stavanger Kommune, 2020). In governance and democracy, Stavanger wants to simplify and improve public services, have greater cross-sectional interaction, and increase participation in the community through technology and digitalization. This will overall strengthen the democracy and improve the quality of life (Stavanger Kommune, 2020).

Stavanger participates in the Triangulum project, which is Europe's first and most significant innovation and demonstration project within smart cities. The project is a collaboration between Stavanger, Eindhoven, and Manchester, and revolves around integrating ICT, mobility, and energy into groundbreaking solutions (Stavanger Kommune, n.d.).

Stavanger contributes to the project with central energy, which has the purpose of heating and cooling buildings using climate-friendly energy sources. This is done through the sewage systems, which collects heat from the sewage and transfers it into buildings (Stavanger Kommune, n.d.). The goal is that this project is easily transferable to other cities, and since sewage is the energy source, this is deemed possible (Stavanger Kommune, n.d.).

In 2014, Triangulum was established as a lighthouse project. This is Norway's only lighthouse project when it comes to the EU’s commitment to smart cities and communities (Stavanger Kommune, 2016). The project has also won several other awards within areas such as water and heat pump industry, and one from China for forward-thinking solutions (Stavanger Kommune, n.d.). Other smart city projects in Stavanger revolve around parking, waste management, notifications of errors, open data, and much more (Stavanger Kommune, 2016). These projects prove that Stavanger is a city that continually strives for sustainable and forward-thinking solutions.

4.6 Aarhus

Aarhus is the second-largest city in Denmark, with about 340 000 inhabitants. The city is located in central Jutland (NSCN, n.d.-b). Aarhus is considered a university city, which could influence the environment of the city, making it more dynamic. According to research by the Ministry of Foreign Affairs of Denmark, Aarhus is categorized as a fast-growing, mid-sized city (Doody, Walt, Dimireva & Nørskov, 2016). The city is somewhat developed as a smart city and has an initiative called Smart Aarhus. The initiative was established to address societal challenges, strengthen the digital economy, and create jobs (Brynskov et al., 2015).

When it comes to smart cities, Aarhus believes that partnerships are essential. Smart Aarhus, therefore, offers a platform for everyone who wants to make use of digitalization through these partnerships. Hence, a collaboration between the private and public sector, the business community, knowledge institutions, and the citizens is present (Smart Aarhus, n.d.-b). In addition, national and international collaboration is important for Aarhus, as the city wants all efforts to be coordinated in a broad sense.

The secretariat for Smart Aarhus has a leading role when it comes to coordinating activities in organizations like Connected Smart Cities Network and the Danish Smart City Network. These entail international forums for smart city solutions, and Aarhus is said to have a large role in the community (Smart Aarhus, n.d.-b).

Smart Aarhus differentiates from the more commercial American and the centrally controlled Asian models of developing as a smart city, and is seen as the Scandinavian third way; The Scandinavian Smart City Model (Smart Aarhus, n.d.-b). This model is based on Scandinavian traditions, which revolves around involving stakeholders and citizens. Other traits of the Scandinavian model are that social, economic, and environmental sustainability plays a central role in the smart city strategy (Smart Aarhus, n.d.-b).

To test and implement smart city solutions, Aarhus has something called Aarhus City Lab. The lab is a test center for future solutions and has a showroom for smart initiatives (Smart Aarhus, n.d.-a). The experiments performed in the lab has the intention of connecting the

behavior of the citizens with potential digital measures and solutions. The aim is to make the city more citizen-friendly, and the focus areas are parking, waste, mobility, digital art and culture, events, incentives for exercise, and more (NSCN, n.d.-b).

In order to create smart city solutions, open data access is important. The data made available is from public and educational institutions and companies and is done through a platform called Open Data Aarhus (ODAA) (Brynskov et al., 2015). The platform promotes transparency, democracy, and economic growth by giving stakeholders access to data that can be used to create initiatives and services that meet the citizen's needs. Entrepreneurs and companies can also use the data as a base for new business or inspiration (Brynskov et al., 2015). ODAA integrates with the collaboration vision of Aarhus and is one of the core projects of Smart Aarhus. The platform was also the initiator for the Open Data Denmark network, which is a national open data platform (Brynskov et al., 2015).

Aarhus is among the first cities to have a publicly owned, city-wide LPWAN. This is short for Low Power Wide Area Network and is based on LoRaWan (Long Ranged Wide area network) (NSCN, n.d.-b). The system makes it possible for devices and sensors to connect on long distances at low costs. This enables new types of experiments and solutions. One example of sensors that are initiated using this method is sensors that monitor the citizens' flow of the city and reports to the test facilities. This is done through anonymized movement pattern data, which is used to improve the city and make it better for the citizens. An example of this is collecting traffic data to improve the mobility of Aarhus. Sensors for data on water temperature, PH levels, air temperature, and other measurements, are also implemented and analyzed for similar reasons (NSCN, n.d.-b). All these initiatives have contributed to making Aarhus a smarter city.

4.7 Key Components

When looking at the six related smart cities, many components of the cities are similar. One factor that all the cities all have in common is citizen involvement, where they wish to get input from the citizens for their smart city solutions. As mentioned in section 4.6, this is based on the Scandinavian Smart City model. It is, therefore, interesting to see whether this applies to Oslo and Copenhagen as well. Other than that, an Open Data Network is

prioritized in Reykjavík, Amsterdam, Dublin, and Aarhus. Other similarities were the test labs in Helsinki and Aarhus, and that Reykjavík and Amsterdam have chosen solutions that are adapted to the geography of the cities.

Even though certain aspects of the smart city strategy were similar between the related cities, this was not the case for all of them. For instance, Helsinki prioritized area development as one of its main focuses. Amsterdam is known for moving towards a circular economy. Stavanger has implemented a project using sewage systems for energy integration, which could be highly applicable to other cities, whereas Reykjavík utilizes its natural resources. Hence, the solution created by Stavanger is transferable, while Reykjavík's is relying on geological benefits. The key components identified from the related smart cities are aspects we will be looking for when analyzing the chosen cities for this thesis.

5. Analysis

In this thesis, we will analyze and compare the definitions held and the social practice of the concept in Copenhagen and Oslo. The characteristics of the cities and their respective countries are, therefore, presented. Critical discourse analysis is used as an analytical tool. The analysis section is divided into two parts, where the first part addresses the understanding of the smart city concept, and the second part addresses the enactment of the concept in Copenhagen and Oslo.

The first performed analysis is a literature analysis of previously discovered knowledge on the smart city concept. Following is a discursive analysis of the definitions held by the interviewees from the two capital cities. The subsequent analysis is of the social practice in the two capital cities. The last analysis measures the projects and initiatives discovered in the social practice towards the Sustainable Development Goals (SDG). The conclusion from each section, combined with chapter 6, is used to conclude the thesis.

Several aspects of Denmark and Norway are relatively similar. Despite this, there are certain areas where they are quite different. It is therefore interesting to investigate the two locations and compare them towards each other. Denmark and Norway are both placed in northern Europe, and their urban population is quite similar, consisting of 88,1% and 82,6% in Denmark and Norway, respectively (CIA, n.d. -a, -b). In Denmark, there are 5 827 463 inhabitants, where 795 510 of these live in Copenhagen (13,65%) (Danmarks Statistik, n.d.). Norway has a population of 5 356 789 people, where 690 335 of these reside in Oslo (12,89%) (Statistisk Sentralbyrå, n.d.-a, -b). Thus, more people are living in Copenhagen than in Oslo, with only a minor difference.

The geography in the countries is quite different. Denmark has a geography that is characterized as relatively flat, as its highest mountain is only 171 meters (World Atlas, 2017). Due to their flat geography, Denmark is associated with cycling, which has become a part of the Danish culture. Norway is famous for its fjords and mountains (National Geographic, 2019). Oslo is located at the heart of the Oslo fjord between mountains, which brings a vast difference in terrain throughout the city. Because of this, the same type of development does not work in Copenhagen and Oslo. The countries' respective

geographies can, therefore, influence their social practice of the smart city concept. An example of this is that the road structure in Oslo can be more challenging to develop than in Copenhagen due to the terrain.

In 2018, Denmark had a GDP of 298 276 million EUR, while Norway had a GDP of 368 546 million EUR. The countries had a purchasing power of 126 and 146, respectively (European Commission, 2019-a, p. 3; European Commission 2019-b, p. 2). The purchasing power standard of the EU is at 100, meaning both Denmark and Norway are far above. The unemployment rate of the two countries lie at 5,0% and 3,9% Denmark and Norway, respectively (European Commission, 2019-a, p. 3; European Commission 2019-b, p. 3). It can, therefore, be assessed that Denmark and Norway have quite similar economies and underlying conditions for the development of their cities.

In Denmark, 30% of all the energy used comes from renewable sources. The country is known for its wind power production, and the production of wind per capita exceeds all the OECD countries. They also produce almost twice as much as the country in second place (Ministry of Foreign Affairs of Denmark, n.d.-b). However, wind energy is only the second most used renewable energy source. The most used is bioenergy, followed by wind and geothermal energy. More than two-thirds of Denmark's renewable energy come from bioenergy. This is because of the large agricultural production, where manure, animal fat, and straw are used as the basis for liquid biofuels and biogas. In 2019, Denmark generated 50% of its electricity from wind and solar power (Ministry of Foreign Affairs of Denmark, n.d.-b). As a result of its commitment towards a green economy and renewable energy, Copenhagen was named European Green Capital in 2014 (European Commission, n.d.-b).

Norway is known for its access to renewable resources like hydropower, wind power, and bioenergy (Rosvold & Hofstad, 2018). Electricity production is prominent, and according to the Norwegian government, 98% of the electricity production in Norway comes from renewable energy sources (Ministry of Petroleum and Energy, 2016). Norway is therefore said to be an inspiring example of leadership on climate change, and Oslo was awarded

the title as European Green Capital in 2019, five years after Copenhagen (European Commission. n.d.-a).

Norway is also known for its non-renewable resources like natural gas and oil. The energy consumption is relatively high, due to the topographic and climatic conditions. The production of energy has its main focus on expanding the hydropower plants and in the extraction of oil (Rosvold & Hofstad, 2018). The paradox of Norway's energy resources is that Norway continues to sell and explore oil and gas, while the country's consumption mainly consists of renewable energy sources. This contradicts the Paris Agreement, which requires that the existing fossil fuel reserves no longer can be burned (Boyd, 2019).

A lot of the development of greater Copenhagen is based on a plan named *The Finger Plan*, which is the idea that to create an urban expansion, it starts with the railway expansion (Ministry of the Environment, 2015). The railways, or fingers, are the backbone of the urban expansion and endured a short commute within home and work. The place between the railways are called the green spaces and are used for agriculture and recreational purposes. This strategy helps to make sure that all of Copenhagen's population has access to recreational areas, as well as easy access to central Copenhagen (Ministry of the Environment, 2015). The initiative has decreased the traffic in Copenhagen. The finger plan is also backed up by the “close to station” principle from 1989, which is estimated to lead to savings of 100,000 million tonnes CO^2 per year 30 years from 2018, equaling 2 million driven km per day (Norman, 2018).

Because of the topographic and geographic limitations, Oslo has some issues within traffic development (Jean-Hansen, Hanssen & Aas, 2009). Therefore, they have to deal with bicycles and the development of traffic infrastructure and solutions differently than Copenhagen. In order to finance the road infrastructure in the country, Norway has a history of using toll rings. The country is considered a pioneer within user-based financing on urban transport infrastructure in major cities and within large toll collection projects. This is also the case for Oslo, which implemented its toll ring in 1990 (Wærsted, 2005, p. 1).

A recent initiative Oslo has been praised for is its car-free zones in the city center. According to Williams (2019), this initiative is to give the streets back to the people. Certain streets in the city center are therefore closed off entirely for cars. There is also an environmental reason for the initiative, as Oslo's geographical position causes problems with air pollution (Williams, 2019).

Oslo is one of the fastest-growing capital in Europe. The growing population density will be a challenge to deal with in a climate-resilient way (Oslo Kommune, 2015). However, when it comes to Oslo and its city development, several plans and programs are either initiated or planned to be implemented for making Oslo greener. Among these initiatives is one about making Oslo a green municipality, and a Climate change adaptation strategy for the city of Oslo, which is about making Oslo more climate-resilient (Oslo Kommune, n.d.-a).

In order to perform the analyses, the analytical framework Critical Discourse Analysis (CDA) is used, which was presented in section 2.6. The purpose of this model is to analyze the different levels of the language and text used in the thesis. The first section of the analysis will focus on how the smart city concept is presented in previously performed investigations and literature. The second and third analyses analyzes the answers received from the interviewees and uncover the reception and enactment of the smart city concept in Copenhagen and Oslo. As a way of comparing the two cities, the enactments performed to achieve the three chosen SDGs are reviewed and presented in a matrix.

5.1 Literature Analysis

Many cities have begun developing strategies and implementing policies and programs designed to transform them into a smart city (Cardullo & Kitchin, 2018). However, this evokes some important questions; What exactly is a smart city? What does the smart city concept entail? For the last few decades, researchers and investigators have looked into the emerging concept of smart cities, analyzing the future of cities (Arroub, Zahi & Sadik, 2016). The question of what can be considered a smart city is challenging to answer, as the concept can be viewed through several different perspectives.

Certain aspects and features have been highlighted as common denominators in the definitions of the smart city concept. However, there is currently no consensus amongst researchers on one universal definition. In order to answer the first sub-research question, an analysis of previous literature is performed. Here, definitions by different researchers are presented and analyzed to see how they characterize the concept and which attributes they consider necessary for a city to be recognized as smart.

To analyze the differences in reception and enactment of smart city concepts, an understanding of the term is necessary. When reviewing past literature and research conducted on the subject, various definitions arise. For instance, Albino et al. (2015) refer to the smart city concept as following:

> *"The concept of the smart city is far from being limited to the application of technologies to cities. In fact, the use of the term is proliferating in many sectors with no agreed upon definitions. This has led to confusion among urban policy makers, hoping to institute policies that will make their cities "smart"."* (p. 2)

This statement dismisses the common perception that the implementation of technological solutions is necessary for smart city development.

In his book, *Smart Cities - Big Data, Civic Hackers, and the Quest for a New Utopia* (2013), Anthony M. Townsend says the digital upgrade emerging in the society has given rise to a new type of city he calls a smart city. He concludes on a definition of the smart city concept, which is: "*Smart cities are places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems*." (Townsend, 2013, p. 3) This definition entails the general understanding that a smart city is a place where technology is used for handling potential obstacles and implementing projects. In addition, the definition suggests using technological solutions to resolve social, economic, and environmental problems. This can arguably be seen as saying the objective of a smart city is to improve the quality of life for the citizens, by making the city a better place to live.

A definition that is viewed as particularly vague and without much detail of what the concept entails is one presented by Joan E. Ricart. His definition of a smart city is as

follows: “*a truly smart city is one that has as its goal improving the quality of life of its residents, which means ensuring economic, social and environmental sustainability.*” (IESE, 2019-a, p. 39). The focus of the definition is on the aspect of quality of life for the citizens of the city. Unlike Townsend’s definition, it does not focus on technology or even mention it. Solely the wellbeing of the residents is the measurement of whether a city is considered smart or not. This does not exclude technology from being used in smart city projects, but suggests that if the same result can be achieved without technological solutions, these are favorable too.

Focus Group on Smart Sustainable Cities (FG-SSC) performed a study looking into the environmental efficiency and economic growth of urban areas. The group that conducted the research focused on the environment, climate change, and circular economy. Based on their study, the FG-SSC agreed on a definition of a Smart Sustainable City, which was:

> "*A smart sustainable city (SSC) is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects*" (ITU, 2015)

Unlike the two previous definitions presented, this definition references sustainability as a substantial aspect of a smart city. The definition shares the views of Townsend (2014) that technology is vital to utilize and implement in a city to develop as a smart city. Also, it agrees with Ricart (IESE, 2019-a) that the objective for a city to become smart is to improve the quality of life for its citizens.

Hafedh Chourabi and a team of researchers conducted a study where they were looking into the emerging strategy cities were implementing to become smart cities. The research identified eight crucial factors of smart city initiatives: management and organizations, technology, governance, policy context, people and communities, economy, built infrastructure, and natural resources (Chourabi et al., 2012). Based on their findings during the study, a definition of the concept was formed:

> “*Projects of smart cities have an impact on the quality of life of citizens and aim to foster more informed, educated, and participatory citizens. Additionally, smart cities*

initiatives allow members of the city to participate in the governance and management of the city and become active users." (Chourabi et al., 2012, p. 6).

This definition focuses on the types of projects being implemented and, similar to the previously mentioned definitions, emphasizes improving the quality of life within the city. This definition also names crucial features to nurture in a smart city, such as city management, education, and citizens' participation.

Washburn et al. (2010) have a perception of the smart city concept that seems like a compilation of all the definitions mentioned above. According to the report by Washburn et al. (2010), a smart city is defined as follows: "*The use of Smart Computing technologies to make the critical infrastructure components and services of a city - which include city administration, education, healthcare, public safety, real estate, transportation, and utilities - more intelligent, interconnected, and efficient."* (p. 2). This definition mentions technology as an essential factor for developing as a smart city. It also mentions vital areas that should be affected and improved during the process. The aspect of improving the quality of life for the residents of the city is not explicitly mentioned. However, by improving areas such as education, healthcare, and public safety, it would arguably make the life of the citizens better.

In a research paper by Caragliu, Del Bo & Nijkamp (2009), an examination of which factors urban performance depends on for development is presented. The result of this paper shows that urban performance not only depends on the infrastructure of a city ('physical capital') but increasingly rely on communicated knowledge and social infrastructure ('human and social capital') (Caragliu et al., 2009). Based on these findings, the researchers agreed on a definition of the smart city concept:

"*We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.*" (Caragliu et al., 2009, p. 6).

Compared to previously mentioned definitions, these researchers believe that there must be a combination of technology and citizen involvement to develop as a smart city. The social infrastructure of a city, referred to in the research as human and social capital, were

concluded as being crucial for urban competitiveness (Caragliu et al., 2009). This result portrays that it is not solely through using technological solutions that a city will become increasingly smart, but that citizens' involvement and the focus on the quality of life are necessary for the development.

In 2011, Leydesdorff and Deakin presented a research paper where they introduced the Triple-Helix model of smart cities (Leydesdorff & Deakin, 2011). The three dynamics that make up the Triple-Helix model are the intellectual capital of universities, the industry of wealth creation, and the participation of the democratic government in civil society (Leydesdorff & Deakin, 2011). The collaborations between the actors within the helix are making knowledge sharing more accessible. As stated in the research paper, the relationship between these three dynamics is described as reflexive.

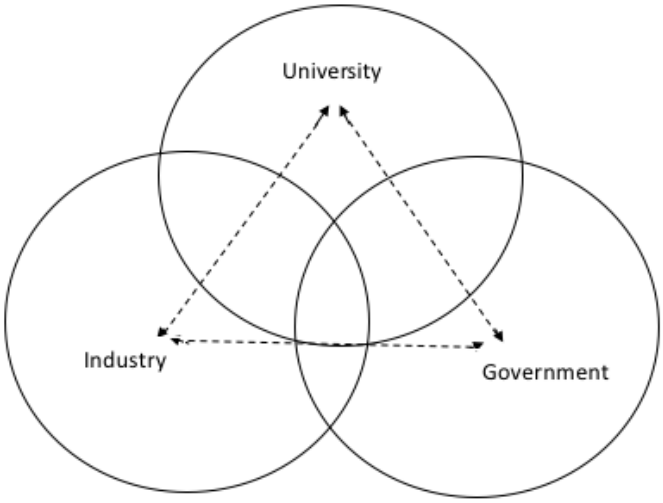

Figure 6 - Triple-Helix model (Leydesdorff & Deakin, 2011)

According to Leydesdorff & Deakin (2011), cities can be viewed as network densities among these three dynamics. Interactions between them create an effect that generates gaps in a city, which is making it possible to exploit the exploration of knowledge. Through the use of ICTs, cities could successfully generate intellectual capital and create wealth. Also, through knowledge production, it allows cities to "*become integral parts of emerging innovations systems by governing their emerging innovation systems*" (Leydesdorff & Deakin, 2011, p. 11). The takeout from the Triple-Helix model is that smart cities are

considered a process of reconstructing culture supported by implemented policies, corporate strategies, and academic leadership qualities.

Based on this analysis, there are certain recurring aspects throughout the definitions. Ricart, FG-SSC, Chourabi et al., and Caragliu explicitly mentions that a smart city aims to improve the quality of life for the citizens. The remaining three, Townsend, Washburn et al., and Leydesdorff & Deakin can be argued as indirectly stating this based on the other mentioned attributes. Further, several of the definitions stated that the advantages of a smart city should be social, economic, and environmental. These three aspects were in some way mentioned in every definition, either explicitly or indirectly. About half of the definitions mention the use of technology and ICT to achieve the status of a smart city. This does not necessarily mean that the ones not listing technology as a requirement will refrain from implementing technological solutions. It only shows that some researchers do not share the same focus on technology as others.

Another aspect frequently mentioned in the definitions is citizens' participation. The involvement of citizens in decision-making processes is viewed as highly valuable, as well as being active participants in the governance and city management. Hence, human capital is an important attribute to a smart city. Not only should the improvements made in the city be for the benefits of the citizens, but they also need to partake in the processes. This ensures that the solutions being implemented are ones the citizens want and need.

Despite a lack of consensus on a formal and widely accepted definition of a smart city by researchers, the majority have agreed upon six elements that encompass and characterize the concept. These elements are Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living (Winkowska, Szpilko & Pejić, 2019). Hence, if a city contains these characteristics, it can be defined as smart.

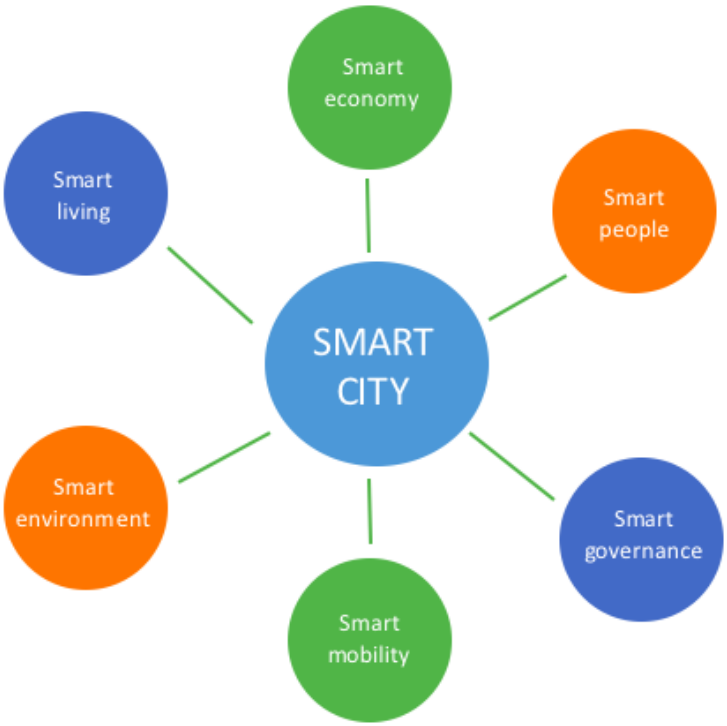

Figure 7 (Own illustration) - Six dimensions of smart cities (Winkowska et al., 2019)

Smart Economy is measured mainly by the productivity of a city (Berntzen, 2017). The productivity should be high based on a combination of market flexibility, innovation spirit, and utilizing knowledge as a means for production (Winkowska et al., 2019). Further, the economy should be characterized by its ability to transform and flexibly adapt to changing circumstances happening in society, as well by the use of innovative solutions (Sikora-Fernandez & Stawasz, 2016).

The next dimension is Smart People, which is characterized as a learning society. Some of the characteristics for the Smart People dimension are the level of qualifications, creativity, openness, and social and ethnic plurality (Winkowska et al., 2019). The citizens should initiate all the changes that are made in a city. When provided with technological support, the citizens can reduce pollution and energy consumption in the effort to improve their quality of life (Sikora-Fernandez & Stawasz, 2016).

The Smart Governance dimension is expressed by the transparency of governance and city management. It is measured through essential features such as social partnership,

implementation of strategies for development, and the level of public service provided (Winkowska et al., 2019). This dimension requires a proper governance system to be formed to carry out the development. It is also necessary to have established procedures for development with local authorities and other users of the city through the use of new technology (Sikora-Fernandez & Stawasz, 2016).

Smart Mobility is perceived by the convenience and accessibility of ICT-infrastructure. This is done through the development of innovative, safe, and sustainable transport (Winkowska et al., 2019). One primary objective for Smart Mobility is enabling the utilization of existing infrastructure when developing and improving the transportation options of the residents of a city. In order to do this, the development of traditional transport and the use of digital communication should be based on advanced technologies (Sikora-Fernandez & Stawasz, 2016).

The dimension Smart Environment is measured by the levels of pollutions, resource management methods, and attractiveness of the natural environment (Winkowska et al., 2019). A smart city should have implemented several environmental protection activities. This could include ways to encourage citizens to minimize their waste emissions or enforce the use of renewable energy sources to optimize the consumption of energy. It could involve creating and enforcing policies for waste management based on sustainable development principles (Sikora-Fernandez & Stawasz, 2016).

The Smart Living dimension is considered a friendly environment. It is measured by the living conditions in the city, which includes aspects like health conditions, individual safety, and housing quality (Sikora-Fernandez & Stawasz, 2016). Further, this dimension provides access to public services, cultural facilities, as well as social infrastructures, such as education, public facilities, and transportation (Winkowska et al., 2019). Additionally, the members of society should have social cohesion and work together towards improving their city.

The sub-research question that this section aimed to answer was: How is the concept of smart city defined by researchers? Through presenting a literature analysis, some

common attributes for the definitions were identified. The one aspect that all the definitions mentioned, either explicitly or indirectly, was that the objective of a smart city is to improve the quality of life for the citizens. The six smart city dimensions that most researchers agree that a smart city encompasses can be related to urban development and growth. Several different elements make up these six dimensions, and they can be seen as necessary areas to improve the quality of life. Some of these elements include the level of competitiveness of the city, new public management and governance, and social capital (Sikora-Fernandez & Stawasz, 2016).

5.2 Discourse Analysis

The discourse analysis is based solely on the statements from the interviewees. The reason for this is to investigate how the concept is articulated in the two capital cities. This section has the purpose of revealing their interpretations of the concept, and sometimes what it is not about, by using methodology and theory of critical discourse analysis explained in section 2.6 and 3.7.

When looking at the smart city concept, it is important to mention that a lot of the interview participants had very different views. Both their perception of the concept itself and the benefits of developing as a smart city will be discussed. Because the interviews were semi-structured, the interviewees were asked different questions. Some of the interviewees are, therefore, excluded or included in different sections of the analysis.

As mentioned in section 2.5.2.3, some of the interviews were conducted in Norwegian. The answers were later translated into English for this analysis. Through translating the answers from the interviewees, the original meaning of the answers may have been changed. The question regarding the smart city concept was in the direction of "*How do you perceive the term "Smart Cities" and what is your perception of what a Smart City is and what it should entail?".* During the interviews, the smart city concept was referred to as a term, which might influence the answers. It is also important to mention that not all of the interviewees came from Copenhagen or Oslo, but comes from or works in areas surrounding the cities. They are still considered relevant interviewees due to their

contribution to the field. The results will later be compared to the discursive perception of the smart city term revealed in section 5.1.

5.2.1 Copenhagen

When looking at the interviewees from Copenhagen and their perception of the smart city concept, a lot of interesting interpretations were revealed. Interviewee 1, Pelle Lind Bournonville from RealDania said the following about his interpretation of the concept:

> *"I tend to lean towards the old, the first [definition]. It's about technology driving (...) if we can pinpoint the need, that way we can build technology to satisfy that need. Then it's good. If we can't, it does not matter. But I don't subscribe to the other definition that it's about good governance and all of that. Because that's good governance and good fiscal management (...) Putting that under the header of "smart cities" is, in my opinion, not meaningful."* (Appendix 2, p. 10).

From this interpretation, it can be said that the keywords from Bournonville's definition of smart city are technology, to satisfy needs and that it is not about good governance.

Kim Spiegelberg Stelzer was the next interviewee. When asked about his smart city perception, he told a story about when he and two other guys started doing smart city work. He said that they first attempted to define what a smart city is and what it meant to Copenhagen. They were around this question for two years, but ended up agreeing that they did not care what the definition was, but said:

> *"Smart City is a tool that we use to help push the city in the right direction, of the main goals they have, like being CO^2 neutral and creating better living, and making the city more efficient. But, in reality it's about using technology and data to support the goals of Copenhagen."* (Appendix 3, p. 6).

From Stelzer's statement, it can be seen that he thinks the definition of smart cities is not important. He sees it as a tool and is more focused on the end goal. From this perception, the keywords can be discussed as being: a tool, better living, efficiency, technology, and data.

When Peter Bjørn Larsen was asked about his perception of a smart city, he said:

> *"So smart cities, for me, is how they understand your city to make better decisions, on all kinds of services. And you do that by using technology and also data. (...) So I'm trying to not say that it's all technology that's controlling the cities, because at the end of the day, most of the cities are asking, trying to find out "how does our city work?"."* (Appendix 4, p. 4).

He further mentions an example from Copenhagen about the city bike company *Bycycklen*. The company was sure that the bikes were mainly used by the tourists, resulting in that they placed their bike stations near the tourist's sites. He then said he asked them who their customers were because he had seen several students and companies signing up for their services.

It turned out to be 88% of the users of the bikes were locals. He said that this meant that they were planning the transport based on assumptions, not facts and that this applies in other areas as well. He ended by saying: "*If you don't understand it, you are going to make some wrong choices, and you are going to make a bad service for the citizens."* (Appendix 4, p. 4). We interpret this as Larsen saying that to make smart city solutions, you have to understand the citizens and the environment of the city. Our interpretation of Larsen's smart city definition is, therefore, that it is about understanding the citizens, which in combination with technology and data are the keywords.

Frederik Tauber, the CCO of Bloxhub, said the following about his smart city perception:

> *"Smart city for us is actually (...) very much in line with the way the city of Copenhagen views it. (...) There is no ambition on being the most connected or the most advanced in the world (...) They would rather not put up a sensor if you can do it with some other means. So, the approach is, whenever it can do something that helps do it smarter or cheaper, it's fine, we will do it. But, we would rather not have stuff in the city if we can prevent it, by using Big Data. (...) They test out some stuff, but they would rather use Big Data instead of installing gadgets."* (Appendix 6, p. 2-3).

Based on this statement, Tauber seems to indicate that the smart city concept sounds fancier than it is and that it is just to try to use big data rather than installing a bunch of

complicated gadgets. The keywords for his perception of smart cities could, therefore, be said to be ambivalent and big data.

Marius Sylvester defined the smart city concept as a “hype word”, and said there are differences in people's thoughts about the concept:

> *“Well, I guess the term is a bit difficult because it's everything and nothing. It's a hype word. Some people will react like "this is the best in the world" and some will say "what is this bullshit lingo?". For us, it's very much about working across sectors and across different departments. It's very much about thinking holistically about city development.”* (Appendix 7, p. 5).

Sylvester further talked about how organizations are built up and how this affects their way of thinking. He explained that there seems to be much sub-optimization in all types of organizations, but especially in larger ones. He stated that the organization would be divided into different sub-domains that further would be divided again, each having its manager who wishes to maximize their efforts (Appendix 7, p. 5). He further explains this, implying it is making a city smarter:

> *“(...) doing green transitions and stuff like that, it's about not thinking only vertical, but in horizontal lines. And that is difficult in national or public organizations, because they are built around silos, which are verticals. So much of the work that we do is actually trying to break down some of these silos and make teams, initiatives or projects that are encompassing different parts of the organization at the same time. Working across the silos using different types of technology or data in order to make the city better, function better, be more attractive be more stimulating for the citizens.”* (Appendix 7, p. 5-6).

When asked about the benefits of developing as a smart city, Sylvester said:

> *“I wouldn't be able to tell the difference between that and just developing as a well-functioning city, or livable city. So, it would be the same, like KPI [Key Performance Indicator], it would be the same end-goal. At the end of the day, why do we have cities and who should we design cities for? (...) So, I guess, in the center of the design process and the planning process, we should always have a human being*

and the needs and wants of individual citizens in the center, and smart cities are just a means to that end creating a livable city. (...) You want cities perhaps that are green or exciting or social or whatever. Smart is just like, it's cold, it's technology, it's not very interesting.“ (Appendix 7, p. 7).

This interpretation can be said to mean that Sylvester thinks that humans are in the center of the smart city strategy. In Sylvester's opinion, smart cities are about working across sectors and departments, holistic thinking, thinking horizontally, break down and work across silos, and using different types of technologies and data to make the city better for the citizens. The keywords can, therefore, be said to be livability, holistic thinking, technology, and citizens.

Maja Yhde was the last interviewee from Copenhagen. When asked about her perception of the smart city term, she said she did not think anybody knew the definition of a smart city exactly, and that everyone has their own definitions (Appendix 8, p. 4). She further stated:

“So, I actually asked all of the cities I have worked with all over the world and it depends on where they are located. In the Nordic countries, they think kind of the same and get the same answers. (...) You need a goal, a purpose, which is sustainability and livability, but the mean to get there might sometimes be data, technologies, digitalization and so on, and sometimes it might be analog and you need to be smart about choosing the best solution that is right for your need. And not just going tech-crazy.“ (Appendix 8, p. 4).

Yhde, therefore, hints that the Nordic countries, like Denmark and Norway, emphasize on livability and sustainability rather than technology. She also emphasizes that to obtain these, you need a goal. Technology, digitalization, and similar concepts can be used to reach the end goal, but is not essential (Appendix 8, p. 4). The keywords for her definition are, therefore, dependent on location, the end goal, sustainability, and livability.

From the interviews from Copenhagen, it is interesting to see the different opinions of the smart city concept. The overall keywords from the perceptions of a smart city from Copenhagen can be said to be technology, satisfy needs, used as a tool, efficiency, data,

understand the citizens, big data, livability, holistic thinking, citizens in the center, sustainability, and livability.

When analyzing the answers from the interviewees and their perception of the smart city concept, our opinion is that the main difference lies in whether the participants sees technology as a driver for smart cities or not. Bournonville and Stelzer imply that technology is the foundation of the smart city concept. Larsen partly states this, but emphasize that it is not the most important aspect. Tauber focuses more on big data, which is considered a form of technology. Yhde believes technology is not in the center, but is rather used as a tool to reach livability and sustainability. This shows a split opinion on whether technology should be a part of the definition of smart cities or not. However, the majority of the interviewees regard technology as an essential factor for the smart city concept.

Other keywords were also in common for several of the interviewees. Among these are to satisfy needs, to understand the citizens, and to have citizens in the center, which Bournoville, Larsen, and Sylvester mentioned, respectively. To simplify this category, we refer to it solely as citizens, and say that it is about having the citizens in the center of the smart city concept. Other than that, both Sylvester and Maja mentioned that the smart city term is about livability. When studying Copenhagen's interviewees and their thoughts of the term smart cities, three terms were in common for many of the interviewees and can be said to be their common smart city interpretation. These are technology, citizens, and livability.

5.2.2 Oslo

The first interviewee from Oslo for this thesis was Lasse Berntzen. When asked about his definition of what a smart city is and what it should entail, he started by saying that it was a good question, because there are several definitions out there. He continued saying that the problem is that there is no definition that everyone agrees upon (Appendix 1, p. 4). *“For me, Smart Cities is basically a way of marketing ways to handle the problems of the cities.”* (Appendix 1, p. 4). Berntzen has worked in electronic government since 2003, which changed to smart cities in 2015. This was because the funding was better when it

was smart cities, which became a continuation of eGovernment. He said that once you named the projects as smart city projects, it was easier to persuade the interests into giving funding "*because you don't want to be a "dumb city"."* (Appendix 1, p. 4). By saying this, he indicated that the term in itself is more of a marketing tool rather than an actual strategy to implement.

Later, Berntzen mentioned that: *"Smart cities are actually a very vague term (...) there is no agreed-upon definition today that everyone uses."* (Appendix 1, p. 4-5). He also stated:

> *"I think most of the definitions that have been proposed includes this "quality of life", it's in the center. And if you start with the "quality of life" then you will see that it's about the efficiency for the citizens, that they can do things in a better way (...) You will also see that reducing the environmental footprint is also important. And the last thing is the democratic dimension, making the city more democratic, making participation a part of the city. I think this is the three main things, if you look at all the definitions and you try to pick out the most important, you will get quality of life on top, then you will get reducing environmental footprint, efficiency and participation."* (Appendix 1, p. 5).

Based on this, Berntzen's keywords on the definition of the smart city term is; marketing tool and not agreed upon. However, he also stated that keywords are quality of life, efficiency, environmental footprint, and participation.

When we talked to Anne Romsaas about her perception of the smart city concept, she said it was very tied to digitalization and technology when she started in the field. However, she has always been concerned that it is an instrument to achieve something else (Appendix 5, p. 4). By saying this, she means that smart city is a tool, and is not the goal in itself. She elaborated this by saying she thinks people are missing out on the point of smart cities if they say digitalization is the goal of it. Romsaas continued to explain that the smart city definition her organization (KS) uses revolves around putting the citizens in the center. This by using technology in combination with innovative methods, collaboration and co-creation to become more sustainable, attractive, productive, and adaptable (Appendix 5, p. 4). She commented that the smart city strategies made by municipalities nowadays are focused on co-creating with citizens, businesses, and academics (Appendix

5, p. 4). From this, we can say that Romsaas' definition of a smart city involves the keywords tool, citizens in the center, technology, innovation, collaboration, co-creation, sustainability, and productivity.

Frank Johnsen, works with IoT and has a more technologic perspective on the smart city concept. In his perspective, smart cities are about making use of the new technology improvements and possibilities that have arisen during the last few years (Appendix 9, p. 2). He further said that he could see potential benefits within the areas of energy conservation, renovation, emission reduction, and much more. Johnsen said IoT would open up a lot of new opportunities in the health sector, and mentioned sensors and robots for the elderly as examples. He ended by saying he thinks there are many opportunities to improve the way of life with smart cities (Appendix 9, p. 2). We can, therefore, say that Johnsen's definition of a smart city is based on technology, using keywords such as innovation, IoT, emission reduction, and improving the way of life.

Haakon Hasli from Microsoft said that the smart city concept covers everything (Appendix 10, p. 3). He elaborated with examples like buildings, traffic control, pollution, sewage systems, people flow, security and operations of a city, and said that the smart city concept describes something, but that it is not concrete. He further mentioned that when he works on concrete projects within IoT, the smart city term is more of a marketing term than a concrete term to work around (Appendix 10, p. 3). He said that to create a smart city, both public and private companies have to be involved. He also stated that the benefits of developing as a smart city are that it creates value and costs savings for its citizens (Appendix 10, p. 4). We can, therefore, say that the keywords from Hasli in smart cities are that it is everything, not concrete, a marketing term, value creation, and costs saving.

The last interviewee, Morten Fraas, works in the municipality of Oslo. He said Oslo has four areas within the smart city concept. These are smart mobility, climate and energy, health and welfare, and education and competence (Appendix 11, p. 20). Based on our understanding of the interview, Oslo's definition of a smart city is that it is a concept that describes how cities and communities are developed to become economically, socially,

and environmentally sustainable communities. This is through the use of technology primarily, but also non-technological solutions (Appendix 11, p. 20). Further, we got the impression that the smart city concept has changed from being technology-driven to citizen-driven, and that technology is seen as a tool to reach political, economic and social goals (Appendix 11, p. 20-21). We interpret this as meaning technology is not crucial to Oslo's smart city strategy, and that sustainability and citizens are keywords in this context.

From the interviews from Oslo, several of the key terms have the same meaning. The most important terms in this section are technology, marketing tool, citizens, collaboration, co-creation, sustainability, IoT, emission, improving quality of life, value creation, and cost-saving. To be able to compare Oslo's results to Copenhagen's, we start by seeing if Oslo's definition is technology-based. It seems that Johnsen is the only participant that directly mentions technology as being a part of the smart city concept. Romsaas and Fraas seem to share an opinion that technology and digitalization can be used as an instrument to make a city smart, but it does not necessarily need to be used. Berntzen and Hasli do not mention technology as a keyword in their interpretations at all. Since Johnsen is the only one that implies that technology is in the center of the smart city concept, we can argue that technology is not a part of Oslo's overall smart city concept.

Further, both Berntzen and Hasli agree that the smart city term is hard to grasp as they use words as several definitions, vague term and not concrete term. They also agree that smart cities can be seen as a marketing tool to handle the problems of the cities. This aspect would be difficult to identify in social practice, and it is, therefore, excluded from further analysis. Berntzen, Romsaas, and Fraas agree that smart cities are about the citizens. Berntzen, Romsaas, Johnsen, and Fraas was indirectly saying that it is about sustainability. Further, both Romsaas and Hasli indicated that smart cities are about collaboration and co-creation. Lastly, Berntzen and Johnsen both talked about the quality of life and way of life. These can be seen as one common category, which we choose to name quality of life.

This section can, therefore, be concluded by saying that Oslo's smart city concept is not technologically driven, focusing on sustainability, the citizens, collaboration, and co-creation with the primary goal of improving the quality of life.

5.2.3 Comparing the Two Capitals

When comparing the interviewees' definitions of the smart city concept, there are not many similarities. The main difference is how they perceive the use of technology as the main driver for the smart city concept. The interviewees from Copenhagen believes technology is in the center and the ones from Oslo does not. Several of Oslo's interviewees said that the smart city concept is considered vague, not concrete, and that there are several definitions out there. This is not stated amongst the interviewees from Copenhagen.

In Copenhagen, the term livability is in focus, whereas Oslo focuses on the quality of life. According to Okulicz-Kozaryn (2011), *"Livability aims to capture objective quality of life..."* (p.1). We can, therefore, argue that these terms fall under the same category and that the smart city concepts of the two cities are equal in that area. This category will be named quality of life and will be used further throughout this thesis.

There is one term that is in common for both. This is citizens, which indicates that the citizen is in the center of their smart city concept perceptions. This term can be related to the citizen involvement that every related city from chapter 4 has in common in this thesis. Overall, the two cities are different in their thoughts on technology as the main driver, similar when it comes to citizens and quality of life, and that Oslo has expressed a focus on collaboration and co-creation that Copenhagen has not.

5.3 Social Practice

In this section, we will look at the projects and initiatives Copenhagen and Oslo have or aim to implement. The official smart city strategies presented by the two capital cities are viewed as part of the social practice. As mentioned in section 1.2, we had to limit the analysis to contain only a few projects. The projects that were chosen for this analysis are inspired by projects in the related smart cities in chapter 4.

The projects and initiatives can be seen as a form of innovation, which is explained in section 3.1. To perform this, we will use the third dimension of the CDA framework. The findings from this dimension will be compared to the strategies that were found in the previous section.

5.3.1 Copenhagen

On the list over the top ten smart cities in Europe in 2019, Copenhagen ranked as number six (Chapman, 2019). According to the smart city plan presented by the municipality of Copenhagen, the goal of its smart city strategy is to improve the quality of life of its citizens and increase the growth in a green city (Stelzer, n.d.). Five focus areas have been identified to achieve the goals: health, mobility, energy and climate, smart citizens, and smart learning. The initiatives that make up the foundation of the smart city strategy are data platform & privacy, smart city infrastructure, and co-creation & partnership (Stelzer, n.d.).

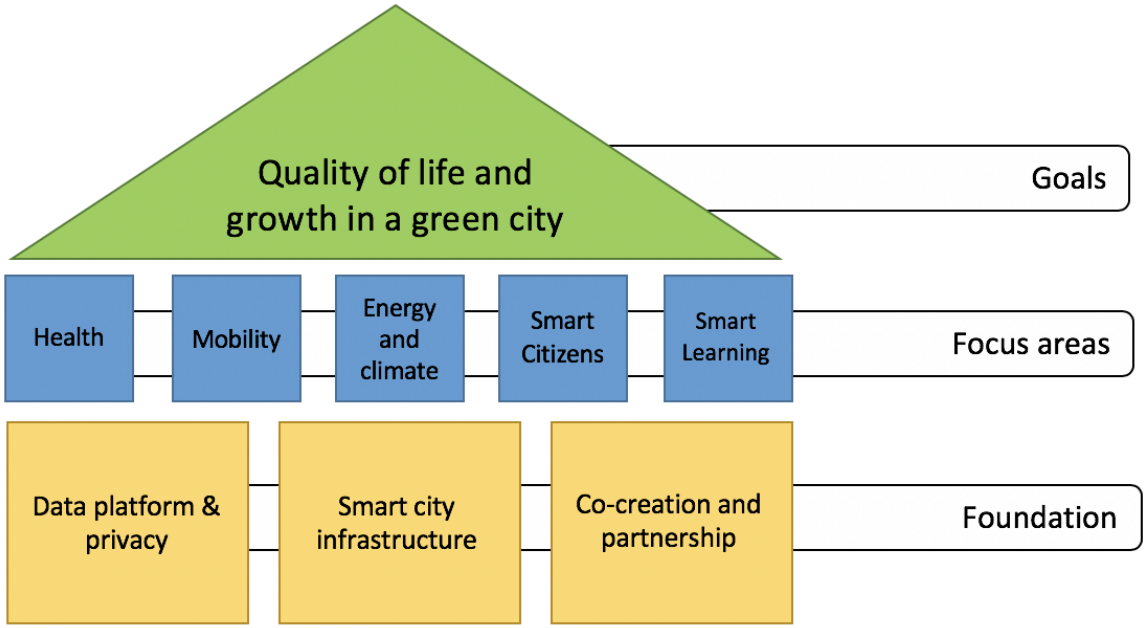

Figure 8 - Smart City Strategy Copenhagen (Stelzer, n.d.)

As earlier mentioned, Copenhagen was awarded the title of European Green Capital in 2014. "*The European Green Capital award is an annual prize that encourages cities to improve the quality of urban life by systematically taking the environment into account in urban planning and management*." (European Commission, 2012). When presenting the title to Copenhagen, the EU Environment Commissioner at the time, Janez Potočnik, said the following:

> "*I congratulate Copenhagen on the example they are setting. We have much to learn from the city's efforts to improve the environment and quality of life for citizens, whilst creating new business opportunities, and I look forward to their year as European Green Capital. They will have numerous occasions to showcase their expertise and their creative approach to urban planning and to developing a green economy*." (European Commission, 2012).

When receiving the title, several areas of achievement received special praise from the committee. For instance, Copenhagen was praised for acting as a role model for implementing a green economy, as well as having a promising communication strategy (Ministry of Foreign Affairs of Denmark, n.d.-a). Other notable areas that were highlighted were their involvement with sustainable mobility, eco-innovation, and the city's urban planning and design. The latter contributed to their strategy towards becoming the most practicable city for cyclists in the world (European Commission, 2012). By getting people to cycle instead of driving personal cars to their place of work or education, this will assist with reducing emissions and contribute to becoming carbon neutral (European Commission, 2012).

At the core of their approach to sustainability and eco-innovation, Copenhagen has focused on public-private partnerships (PPP). The framework for PPP is explained in section 3.4. Together with universities, organizations, and companies, the city is working towards further implementation and development of green growth (European Commission, 2012). This is the same approach as presented in the triple helix model introduced in section 5.1. The jury declared Copenhagen as an exceptionally successful role model in the fields of green economy, and urban planning and design. Prominent projects emphasized in the reason for the award were, for instance, the urbanization and area

development in North Harbor, from now on referred to as Nordhavn (European Commission, 2012).

In 2007, Copenhagen City Council implemented a plan called Eco Metropolis (European Commission, 2013). This plan had a vision, which presented some of the most important plans for the city, including the Climate Action Plan, the Strategy for Urban Life, and the Bicycle Strategy (European Commission, 2013). The initiatives were created to get Copenhagen on track towards becoming the first capital in the world to be carbon neutral by 2025. In the Eco Metropolis, the Copenhagen Model was presented: ""*The Copenhagen Model" refers to a unique vision of city life combining environmental initiatives, economic growth and quality of life.*" (European Commission, 2013, p. 6). The most acclaimed project to result from this smart institutional model is the development and transformation of the Nordhavn area. This area development project will be elaborated below.

Copenhagen aims to be the most practicable city in the world when it comes to cycling and holds a reputation as the world's best city for cyclists (Københavns kommune, 2015). The city developed its bike lanes at a time where all other cities were focusing on car roads to lead the way into the future (Municipality of Copenhagen, 2018). According to the Copenhagenize Index 2019, Copenhagen is the world's most bicycle-friendly city (Copenhagenize, n.d.-a). The city has a score of 90,2%, where 62% of the trips inhabitants make to work, or school are by bike (Copenhagenize, n.d.-a). The citizens cycle 1,44 million kilometers each day, and there are 167 kilometers of new cycle highways in the city (Copenhagenize, n.d.-a). The bicycle initiatives can, therefore, say to be helpful for Copenhagen to reach their goal of becoming carbon neutral by 2025. It is, therefore, seen as a fundamental smart city strategy for the city.

As mentioned above, Copenhagen has a goal of becoming carbon neutral by 2025 (Copenhagen Cleantech Cluster, 2017). This can be seen as the overall goal of the city and demands a lot of innovative solutions within fields such as waste, water, transport, alternative energy sources, and heating. To reach this, Copenhagen has implemented a dual strategy. Firstly, they want to become a world leader within the testing of smart and

sustainable solutions. Secondly, they wish to do so by having an imminent knowledge sharing. The first part of the strategy is done by turning the city of Copenhagen into a living lab for new green solutions, attracting several companies (Copenhagen Cleantech Cluster, 2017).

Many of the interviewees talked about their experience with testing labs in Copenhagen (Appendix 3, p. 2; Appendix 7, p. 1-2; Appendix 8, p. 2-3). Stelzer mentioned in his interview that Copenhagen Solutions Lab has a test lab in the city:

> *"We have an area from here [Bloxhub] going up to the city hall, that's our test lab, that's where we test out smart city solutions (...) We are testing them there together with private companies (...) four-five years ago we made a contract with Citylum, they're the biggest provider of lightening in the whole world, I think. At least also the provider of lights for Copenhagen. And TDC, the biggest Danish tele company, and CISCO, provider of networks. And we made this test area where we have all the digital infrastructure to test. And then we just started testing. But our policy is only to test things that will make a difference for the city, in the sense that it makes the city more sustainable, and it also has to be solutions that can be scaled for all of the city."* (Appendix 3, p. 2-3).

Stelzer elaborated by mentioning a project they have tested where they have put sensors in the garbage cans to know when they need to be emptied. This creates an opportunity of finding an optimal route for the garbage trucks, which saves both diesel and working hours. He ended by saying that if the project works, it can be scaled up for the entire city (Appendix 3, p. 3). In this project, the garbage can sensor is both changing the product, as well as the process of emptying it. As a result, it can be regarded as both product and process innovation, which are explained in section 3.1. Larsen mentioned in his interview that a similar solution within waste bin collection had the potential of saving 5 million Danish kroner in a town of just 180 000 people (Appendix 4, p. 9). Projects like these can have a significant impact on sustainability, making the whole process more effective, and more cost efficient.

An example of an urban sustainability lab this is the creation of a sustainable neighborhood in the area of Nordhavn, as mentioned above (Copenhagen Cleantech Cluster, 2017). The area is a new district, which is built from scratch and creates many opportunities to work with infrastructure, architecture, buildings, the needs of future residents and energy systems (Københavns kommune, n.d.). The area offers new possibilities within urban space design. For example, it is utilizing roof space as playgrounds. The area has the intention of housing 40 000 residents and to create an equal amount of jobs. Due to the high number of inhabitants, it functions well as a city laboratory (Københavns kommune, n.d.). This type of urbanization can contribute to sustainable growth in the city. Since this project contains so many aspects besides area development and different processes are being implemented, the Nordhavn project can be argued as using process innovation. This phenomenon is explained in section 3.1.

The Nordhavn project is done through a collaboration with private companies and public authorities. According to the head of Copenhagen's Sustainable Urban Development Division, it is necessary to break down the barriers between private and public sectors for a smart city to succeed (Copenhagen Cleantech Cluster, 2017). The Nordhavn area also has testing within energy in a project called Energy Lab Nordhavn, which is the first of its kind in Denmark (Københavns kommune, n.d.). The lab has 12 partners, and tests out and develops solutions within heat, electricity, electrical transport, and energy-efficient buildings on a 1:1 scale. The area explores options within the storing of renewable energy, electric vehicles, and many other things (Københavns kommune, n.d.). The lab will function as a green laboratory, focusing on eco-technologies that may be transferable to other cities (European Commission, 2012).

Yhde indicated in her interview that partnerships are essential for the labs and to find the best solutions:

> *"And I think Copenhagen also knows that the 17th [SDG] (...) partnership for action, (...) is the way forward for them. Also, for the municipality. They cannot do it by themselves. So, they also have test labs, they are involved in blocs, they do hacks and they do partnerships with universities and companies, and so on, to provide the best solutions for their citizens."* (Appendix 8, p. 5-6).

This statement coincides with the statement on Copenhagen's focus on PPPs mentioned earlier in this section and indicates that PPPs are highly important for Copenhagen as a smart city. PPPs can be seen as a form of Coupled Open Innovation due to collaborative partnerships. Coupled Open Innovation is explained in section 3.1.

Several of the interviewees also stated that PPPs were important for them in their work. Amongst these was Sylvester, who said that they mainly do PPPs (Appendix 7, p. 1). He further states that "*I can't see how you can avoid working in partnerships if you actually want to do these types of innovation.*", and that he believes global and national partnerships are highly important (Appendix 7, p. 5) Tauber also said that PPPs are the preferred way for them for working in the city, and that it is mainly through PPPs they do collaborations (Appendix 6, p. 2). Due to the statements from Yhde, Sylvester, and Tauber combined with the fact that PPP was deemed the core of Copenhagen's approach to sustainability and eco-innovation by the European Commission in 2014, PPPs are considered essential for Copenhagen's smart city strategy.

PPPs can also be considered as a form of knowledge sharing, which was mentioned earlier as the second aspect in Copenhagen's dual strategy to reach their carbon emission goals. It is, therefore, interesting to see if knowledge sharing is regarded as valuable in Copenhagen's social practice. Knowledge sharing is mentioned by several of the Copenhagen interviewees. Sylvester mentions that the company he works in, Copenhagen Solutions Lab, works as a bridge where the knowledge is shared back and forth to the private sector:

> "*(...) we try to be more like a mediator, bridge between the private and public sector divide, and getting the knowledge from the private sector to actually inspire us and get the data and technology into the city of Copenhagen. And vice versa, by opening up the city so it can be used as a test ground for many of these companies. (...) That dialog is also so fruitful for the private sector and the private companies.*" (Appendix 7, p. 1-2).

This indicates that knowledge sharing is an important part of Copenhagen Solutions Lab processes. As a result of this, we consider it essential for Copenhagen in their smart city work.

Yhde believes that there is a need for more knowledge sharing in Copenhagen. She states the following about the two cities:

> "(*...) I think they could learn a little bit about the openness from other cities. And that goes for Oslo and Copenhagen. They think of themselves as "big brothers", so they are kind of the biggest and the best and the capital, and they become maybe a little bit arrogant in their way of being open with others in collaboration. And that means that they actually lack a lot of partnerships and knowledge that they would have got if they had made partnerships instead for saying that they are big enough by themselves and we do it by ourselves."* (Appendix 8, p. 8-9).

This statement indicates that Copenhagen is not as good at knowledge sharing as the strategy might hope.

Larsen believes that knowledge sharing is one of the reasons why Copenhagen is a part of the C40 network:

> *"(...) Copenhagen is a member, and we saw that as an opportunity in strengthening the knowledge transfer. (...) By us going in and starting to actually transfer knowledge back and forth. First by tapping in, writing reports, gathering, sort of codifying the practices and knowledge of the C40 cities, and then disseminating that back to the Danish municipalities."* (Appendix 2, p. 4).

The C40 network is a network of megacities committed to addressing climate change. The goal is to lead towards a more sustainable future through supporting each other, sharing knowledge, and drive measurable and meaningful action against climate change (C40, n.d.). Larsen's statement coincides with our findings that knowledge sharing is an essential factor in Copenhagen's enactment of the smart city concept.

Stelzer is the co-founder of Nordic Smart City Network, which is an organization where Copenhagen is a member. He says that the main focus of the network is to work together and transfer knowledge back and forth (Appendix 3, p. 7). Even though Yhde states that Copenhagen is not good at knowledge sharing, it can still be seen as a strategy for the capital, and it can be stated that knowledge sharing is an essential aspect in Copenhagen's smart city concept. Due to Yhde's statement, however, it can be deemed as a strategy that needs some attention. Copenhagen's knowledge sharing on smart city

projects can additionally be seen as a form of open innovation or Coupled Open Innovation.

Since Copenhagen is doing a great deal of testing within smart city solutions and urban areas, they can be argued as being Innovators, as explained in section 3.1. However, it is not prominent that Copenhagen is a risk-taker in the field, because, as mentioned above, the city only seems to test solutions that will make a difference to it and make it more sustainable. It can, therefore, be argued that Copenhagen is categorized as Early Adopters, who recognize a change and embraces this when the opportunity presents itself.

An example of a project that is a climate-resilient city solution is one on Helenevej in Copenhagen (State of Green, 2017). This street is transformed into a climate street, where the asphalt is switched out with tiles, allowing rainwater to seep through the surface due to gaps between them. This is to avoid flooding from cloudbursts, and the tiles are designed to hold a large amount of water before losing the carrying capacity (State of Green, 2017). A benefit of integrating rainwater management in the overall urban planning is that synergies and cost benefits can be achieved. It can also improve the livability in the area.

Resilience is also an increasingly important topic due to the effects of climate change (State of Green, 2017). A similar project in Copenhagen is the first climate-adapted urban space on Tåsinge Plads (Klimakvarter, n.d.). The area aims to manage and withhold as much rainwater as possible and is designed with a sunken area that diverts the rainwater from the sewage. This is to make sure there is capacity in the sewer for future cloudbursts (Klimakvarter, n.d.).

In his interview, Larsen mentions a future project within resilience in Frederiksberg, where he says:

> *"(...) this is just a test, but they have like permeable where the water can run through the pavement (...) they have sensors, and as they start to fill up, they start to go on to water the trees and stuff like this. (...) So, this is again, how do you use design, technology, so basically is starting to change the different things. You don't*

want to keep watering (...) the trees, because they will die, so they need sensors for that as well. So, you can't see it. And that's the thing with smart cities, can you see it? No, that's not the point." (Appendix 4, p.11-12).

The resilient solutions are considered smart city solutions that are not visible to the citizens, but still makes a huge difference. Larsen states that the reason why the project is not implemented yet is that it is too expensive. It can, however, be assumed that these types of projects will be cheaper in the future. Because of these types of projects, Copenhagen is viewed as a city focusing on resilience as part of its smart city strategy.

The rankings by Chapman (2019) showed Copenhagen as the sixth smartest city in Europe. However, according to the International Institute of Management Development (IMD), Copenhagen is ranked the fifth smartest city in the world, only two places behind Oslo (IMD, 2019). The index rests upon its own definition, which is; *"'smart city' describes an urban setting that apply technology to enhance the benefits and diminish the shortcomings of urbanization"* (IMD, 2019, p. 1). The countries considered are put in a group based on their Human Development Index (HDI). The rating is based on several components, and is calculated from the city's performance relative to other cities in the same group (IMD, 2019). Copenhagen has an overall rating of AA, on a scale from AAA to D (IMD, 2019. p. 70). Only Singapore and Zurich have a AAA rating, meaning Copenhagen is amongst the cities with the highest ratings (IMD, 2019, p. 6).

Copenhagen		
Smart City Ranking	5th out of 102	
Rating	AA From AAA to D	
Factor Ratings	AA	A
	Structures	**Technologies**

Figure 9 (Own illustration) - Digital Smart City Index Copenhagen (IMD, 2019, p. 70)

The report also lays out data collected on two main areas: structure and technology, where each is divided into five key areas: health and safety, mobility, activities, opportunities (work and school), and governance (IMD, 2019). Copenhagen has a factor rating of AA on structures and A on technologies, which is high in comparison with other countries in the same category. In the Structure category, mobility is highlighted. The sub-categories in mobility are “traffic congestion is not a problem” and “Public transport is satisfactory” with a score of 36,2 and 57,65 out of 100, respectively (IMD, 2019, p. 70). Copenhagen is above mean in both categories, but is very close to the mean on the second. This means that Copenhagen does not have any significant issues with traffic congestion, but that there is room for improvement. Their public transport is about the same as the other cities in the same category, meaning improvements most likely are needed.

Under the main category of Technology, there is also a mobility section. The two relevant sub-categories for this thesis are “Bicycles have reduced congestion” and “Online scheduling and ticket sales make public transport easier to use”. In these categories, Copenhagen scores 57,24 and 71,99, respectively, which are above the means of the categories (IMD, 2019, p. 70). This means that these actions have contributed to making the city smarter. However, according to survey respondents from Copenhagen regarding the most urgent areas within the city, public transportation is listed as the fifth-highest priority (IMD, 2019, p. 71). It is interesting to see that even though Copenhagen scores high on factors such as that bicycles have reduced congestion and that public transport is easier to use, the public transport category in itself still needs improvement. This means that Copenhagen still has room for improvement to make the citizens happy with its public transport options and smart city solutions within this field.

When comparing Copenhagen's social practice with the related smart cities presented in chapter 4, some similarities arise. Amongst these are the test labs implemented in Helsinki and Aarhus. The bicycle strategy of Copenhagen can be argued as being implemented due to its geography. From this strategy, we see similarities found in Reykjavík and Amsterdam, who also have solutions adapted to the geography of the cities.

One of the unique initiatives that were discovered in chapter 4 was Amsterdam's circular economy. An initiative found in Copenhagen that is comparable to this initiative is its green economy. These initiatives can be tied to the framework of environmental sustainability, which was introduced in section 3.6. Another initiative is the area development in Helsinki, which can be viewed as similar to the area development conducted in Nordhavn. Based on these findings, we can see that Copenhagen has similar projects as other related European smart cities.

Copenhagen's social practice of the smart city concept is concluded to have many factors. The smart city concept focuses on areas such as having bicycles as a large part of their transport, using testing labs to find smart city solutions, urban sustainability and energy, and having climate-resilient neighborhoods and urban spaces. The smart city concept involves solving problems using PPPs and knowledge sharing, which are seen as important aspects of Copenhagen's smart city concept. These concepts can be tied to innovation theory and urban governance theory, which was introduced in section 3.1 and 3.3, respectively. The use of the triple helix model, introduced in section 5.1, can also be connected to Copenhagen's use of PPPs.

The strategy also revolves around factors such as improving quality of life, increasing and promoting growth, and having a green economy. When this is compared to the discourse analysis, it can be seen that technology and livability are visible in its social practice, as their test labs are testing solutions within technology and urban sustainability. Because Copenhagen is technology-oriented, it can be argued that the public sector innovation has the opportunity to operate faster. The test lab in Nordhavn can also arguably improve the quality of life of the citizens of the area. Nordhavn and the climate-resilient areas can also be argued as being initiatives that satisfy the needs of the citizens, putting them in the center. All the terms from the discourse analysis can, therefore, be seen in the social practice of the smart city concept.

5.3.2 Oslo

As mentioned in the introduction of chapter 4, Oslo was among the top ten smartest cities in Europe in 2019 (Chapman, 2019). According to Oslo municipality, its smart city strategy is: "*The vision for Oslo is to make it a smarter, greener, more inclusive and creative city for all citizens – a smart city that innovates with the citizens' interest and well-being at the core.*" (Oslo kommune, n.d.-b). Oslo's vision is to be one of the most sustainable, smart, and innovative regions in Norway (Akershus fylkeskommune, 2015). Their main goal is to take advantage of the growth in the region and to trigger potential within innovation that lies between the interaction between companies, research- and knowledge communities, talents, capital, and the public sector, to increase value creation and competitiveness (Akershus fylkeskommune, 2015).

As mentioned in section 5, Oslo became the European Green Capital in 2019 (European Commission, 2019-c). Because of this title, Norway will act as an ambassador for sustainable urban development. This will be done by promoting and sharing the practices that have worked best for Oslo, inspiring other cities to make environmental changes (European Commission, 2019-c).

The European commissioner for environment, maritime affairs, and fisheries, Karmenu Vella, stated this about Oslo:

> *"Any city can dream of being green, but it takes determination and political leadership to find solutions for the big environmental challenges we are facing today. That is what makes Oslo special. In a country known for its wealth of energy resources, Oslo is making great strides in transitioning to a society free of fossil fuel emissions. Its success in increasing public transport and prioritising people over cars is truly inspiring. Today's events show how Oslo is approaching its role as European Green Capital 2019. Actively seeking to inspire and motivate other cities to go green."* (European Commission, 2019-c).

There are several reasons why Oslo won this award, but eight main reasons are highlighted. The first one is Oslo's restoration of its waterways. The waterways have gone through a revolutionary strategy where the closed rivers and streams have been

reopened. This has increased the biodiversity of the rivers and helps to manage storm water in the city (European Commission, 2019-c). Second, Oslo has cut emissions by 26% since 1990, and the city claims it will be carbon neutral by 2050.

Third, Oslo has become the “Electric Vehicle Capital of the World”. In the first half of 2018, 60% of the new vehicles sold were electric vehicles (European Commission, 2019-c). Fourth, there have been improvements in the cycling, and public transport infrastructure, where 56% of all the public transport travels in Oslo are powered by energy from renewable resources. The amount of public transport journeys has also increased by 50% since 2007 (European Commission, 2019-c). Fifth, the city’s buses and waste trucks are fueled using biogas from bio-waste and city sewage (European Commission, 2019-c).

Sixth, Oslo also has a climate budget which goes across five sectors and consist of 15 separate measures. This budget aims to cut greenhouse gases by 26% by 2020 and uses a method where they count CO^2, the same way they count money in a financial budget (European Commission, 2019-c). Seventh, Oslo has been active and innovative when it comes to including its citizens in the plans of the city. Citizen participation is, therefore, an important part of the city’s planning processes. Lastly, Oslo has a network called Business for Climate, which addresses the impact business operations have on the climate by fostering cooperation between the city and the business community (European Commission, 2019-c).

The smart city projects in Oslo are quite varied, as there are projects within zero-emission construction sites, testing electrical busses, retrofitting existing buildings, and circle based green energy and waste systems, to mention some. It is also stated that any of the citizen-oriented services that can be digitalized will be (NSCN, n.d.-c). Therefore, there is a variety of interesting projects to discuss in this section. Two project areas that have been mentioned in the conducted interviews and earlier in this thesis are projects within smart and green transport solutions and projects within zero emission construction sites. These are also mentioned as core projects by Oslo Municipality (Oslo kommune, n.d.-c).

Oslo has sustainable transport and smart mobility as a strategic focus. In Smart and Green transport solutions, Oslo is considered a pioneer (Green visits, 2019). The goal is to get an infrastructure that is green, cost-effective, and accessible, and the reduction of emissions is the objective (Oslo kommune, n.d.-f). One of Oslo's approaches to smart mobility is to use electric vehicles and alternatives that are fossil-free in private and public transport. Another initiative is the areas in the city center that are car-free, which was mentioned in the introduction to chapter 5.

In his interview, Berntzen mentioned how these initiatives affect the environment: *"What they are now doing with the reduction of transport in the inner city (...) they have set a limit, so within 2022, everyone needs to change into zero-emission cars. I think they do a lot of good things in Oslo. They have managed to reduce the pollution (...) Oslo is really progressive in trying to achieve the sustainability goals."* (Appendix 1, p. 7).

Fraas also comments on this in his interview, where he says:

> *"Oslo have set extremely strict demands when it comes to climate and environment, and have banned cars [from the city center] and stuff like that. So one might expect that the election would show that people are displeased with that, but it turns out that people actually are quite satisfied with it."* (Appendix 11, p. 10)

From this, it can be said that Oslo's demands within the climate and environment does not necessarily have negative effects on the citizens. A reason for this might be the political parties that Oslo City Council is consisting of, which are the Labor Party, Socialist Left Party (SV), and The Green Party. These are elected by the people, which indicates a green shift among the citizens. This makes them more open towards environmentally friendly solutions.

By having these initiatives within green mobility, Oslo functions as a lab for innovative solutions on infrastructure (Oslo kommune, n.d.-f). This coincides with the third, fourth, and fifth reasons why Oslo was awarded European Green Capital in 2019, as mentioned above.

Oslo also has a smart and innovative procurement strategy that aims to reduce climate gas emissions at construction sites to make them emission-free (Oslo kommune, n.d.-e). Oslo's procurement strategy seems like an essential aspect of its overall smart city strategy. Fraas mentions the following when talking about the topic: *"We are very concerned with our purchasing power in relate to turning the market the way we do now (...)"* (Appendix 11, p. 4-5).

One of the procurements is a project within sustainable transport solutions through smart procurement named the BuyZET project. The city has been granted 225 000 euros from the European Commission for this project (Oslo kommune, n.d.-d). According to their website "*(...) the BuyZET project is a partnership of cities aiming to achieve zero emission urban delivery of goods and services."* (BuyZET, n.d.). This is done by understanding the transportation footprint on the different procurement activities and by developing innovative procurement plans for two key procurement areas. The latter has the intent of minimizing the number, disruptiveness, and distance of motorized vehicle trips within the city at the same time as maximizing the number of trips made by zero-emission vehicles (BuyZET, n.d.).

The reason for conducting the BuyZET project is that there currently are 200 000 people living within areas of Oslo that have a harmful level of air pollution (Oslo kommune, n.d.-d). It is also stated that 63% of emissions from sulfur dioxide, suspended particles, and nitrogen dioxide in Oslo stems from transport (Oslo kommune, n.d.-d). The partner cities are committed to sharing their gained knowledge on the topic, developing the policy, and identifying the critical areas for future collaboration and research initiatives with procurement agencies from all over Europe (Oslo kommune, n.d.-d). In addition to projects such as the BuyZET, Oslo has an initiative within emission-free construction. This will be done by replacing machines and equipment with fossil-free alternatives. Based on this initiative, Oslo is arguable using process innovation, mentioned in section 3.1.

Currently, construction machinery accounts for as much as 30% of the traffic emissions in Oslo. However, the city has a goal of reducing its climate gas emissions by 95% and reducing the use of fossil fuel to zero by 2030 (Oslo kommune, n.d.-e). To reach these

goals, the city council of Oslo has adopted emission-free construction sites in all public procurement procedures from 2017. This will contribute to the reduction of emissions from the cities, as the city is a major developer and owner of many buildings (Oslo kommune, n.d.-e). Currently, there are two sport arenas and four kindergartens in Oslo that are under construction using emission-free machines. The hope is that public developers can influence a change in the market and that the market will adapt to and develop new solutions within the area of fully electrical construction machinery (Oslo kommune, n.d.-e).

On the topic of emission-reducing construction, Fraas mentioned in his interview:

> *"(...) when you came in here, you saw a construction site. That is the first zero emission construction site in the world, there is no other in the world quite like that. Every machine and everything that goes in and out of there runs on electricity, and that is smart."* (Appendix 11, p. 4).

He also stated:

> "(...) *we have set requirements that the construction sites must be emission free, but Oslo is way too small to change the market like that, so the machines you see outside are demonstration machines which are re-constructed. What we want is that more and more demands this. Spreading and scaling is what we are talking about here."* (Appendix 11, p. 5).

Fraas further talked about that if Oslo is building all its new buildings using emission-free alternatives, it can turn the market. He means that this will respond to a lot of the environmental and climate challenges that Oslo sees and stated: *"So it's both building good products and services for the municipality, but also driving good business development, we have a lot of faith in that."* (Appendix 11, p. 5). It is interesting to see that Oslo has green and innovative solutions as a procurement strategy, which can be seen as an essential part of their smart city strategy. Romsaas states followingly about the topic:

> *"It is also exciting how they [Oslo] are using their purchasing power now, by demanding zero-emission solutions through demanding that all construction sites have to be electrified, having zero emissions. Stuff like that. (...) They [Oslo] have made a procurement strategy where they say they focus on green, innovative*

procurement, and they will satisfy the demands within the law in everything they do. And this is very brave." (Appendix 5, p. 6).

Fraas mentioned in his interview that Oslo wants what many other cities want and are good at, which is something he called *innovation districts* (Appendix 11, p. 5). He further states:

> *"What's interesting with that is that we are developing this as test and demonstration areas. We believe the best we can do, also in smart city development, is to facilitate for other actors to come in and test our infrastructure. For example, energy, energy production, energy consumptions, stuff like that, that you are allowed to test that type of stuff in real environments in different places in the city. Then you have to create a sort of sandbox where it is feasible. Also, we believe - and this is also the way you think business-wise - in order to disrupt, we can't do it internally within the organization. We believe that if we create these types of arenas, Oslo municipality will meet itself better on the outside. (...) We think that it is a good idea, that Oslo municipality meets with research institutions and the business world*" (Appendix 11, p. 5).

An example of a project like this is something called *Beta:By Hovinbyen*. The project is within sustainable urban development, and the intention is that it becomes a national laboratory for testing and demonstration of sustainable smart city solutions. The project happens in a geographically limited area in Økern in Oslo, where sustainable solutions are tested on everything from social solitude to energy systems. This creates a base for social, safe, and smart cities, and prioritizes social sustainability (Digital Norway, 2018). The aim is to inspire other cities, in addition to making Norwegian companies attractive, worldwide (Digital Norway, 2018).

To implement the Beta:By Hovinbyen project, 25 participants from different companies were chosen. These would find a plan for how the project would take form by going on a walking tour of the city and by finding international inspiration (Digital Norway, 2018). This approach can be argued as process innovation, mentioned in section 3.1. The project is a collaboration between Oslo municipality and several different companies and

stakeholders. It can, therefore, be argued that this project can be described as an Outside-In or Coupled Open Innovation. This is because Oslo is relying on outside knowledge and partnerships to realize the desired project.

The people worked in the fields of engineering, arts, psychology, public organizations, and other entities (Digital Norway, 2018). One of the project coordinators stated that only two of the 25 participants knew each other, which was an opportunity to break the regular silos (Digital Norway, 2018). This was stated as one of the benefits of developing as a smart city by Romsaas:

> *"I think one of the big benefits is that you break up these silos in what a public sector should do, what a private sector should do, and what the citizens should just accept as consumers. You move more towards utilizing all the resources and knowledge that are available to a more collective "we". I think you get better decisions and better solutions."* (Appendix 5, p. 5)

Oslo municipality financed a substantial part of the project and is seen as one of the main drivers behind it (Digital Norway, 2018). Oslo is considered one of the primary stakeholders, alongside investors and construction workers. Due to the importance of their involvement in this project, citizens are considered primary stakeholders in Beta:By Hovinbyen.

The smart city movement is often criticized for being too focused on technology. This project focuses on how good neighborhoods are created (Digital Norway, 2018). Beta:By Hovinbyen, therefore, stands out between other projects, as they have a sharper focus on the entirety of sustainability (Digital Norway, 2018). Fraas also mentioned Beta:By Hovinbyen in his interview, where he said:

> *"How can you get the citizens to involve more in the development in the areas they live in and are a part of? (...) an innovation aim that is being worked towards is for example Hovinbyen. Different models to involve the citizens more are being worked towards. Also, the business industry and other actors. We believe that that the more you can be involved in the development of your own area, the better it will become. (...) Hovinbyen is exciting. It is a giant area that is transforming (...) A lot of*

> *residential housing and industry is coming in, and it will be developed in a sustainable way and on the premises of the residents"* (Appendix 11, p. 12).

From this statement, it can be said that citizen involvement and participation, social sustainability, and working across the silos are a large part of Oslo municipality's agenda to make the city smart. Citizen involvement was something Romsaas found important. She stated that she works a lot with co-creation and citizen involvement and that the solutions created under this teamwork are more accurate, better, and more efficient (Appendix 5, p. 5). She further stated that:

> *"So, I believe that a smart city is one that works well on teams with the citizens and takes them seriously and uses their life experiences, engagement, and creativity to create something entirely new. Also, I believe the citizens that are involved more will better understand why you prioritize as you do and why you do the political choices you do. So, I believe it can contribute to building up the trust of the political system and for the elected and strengthen the democracy, in a longer perspective"* (Appendix 5, p. 5).

Beta:By Hovinbyen aims to inspire other cities to become smart, as mentioned above, which is also important for the municipality. The idea that the projects apply to other cities or projects is, therefore, central. However, Oslo is also highly interested in copying other smart city solutions, which Fraas believes is Oslo's strongest suit in the smart city agenda:

> *"We could think that the goal for Oslo is that they would be the best at copying [smart city solutions]. And by that, I mean we should be very good at, and the world's best at copying what others have done."* (Appendix 11, p. 4)

Romsaas also states that Oslo's bike strategy is almost a direct copy of Copenhagen's bicycle strategy created by Copenhagenize (Appendix 5, p. 9). It can be stated that due to copying Copenhagen's bicycle strategy, Oslo is currently the 7th most bicycle-friendly city in the world (Copenhagenize, n.d.-b).

Based on their overall strategy of copying solutions that have been proven successful by other cities, Oslo can be considered an Early Majority in innovation theory, which is explained in section 3.1. However, Fraas also states that Oslo will continue to develop new

solutions, methods, and tools that other cities will want to copy (Appendix 11, p. 4). It is, therefore, possible to argue that Oslo could be viewed as an Innovator. Nevertheless, the majority of the implemented projects in Oslo have been proven to work in other cities, and the conclusion falls on Oslo being an Early Majority. This differs from Copenhagen's strategy of being Early Adopters.

In the ranking presented in the introduction of chapter 4, Oslo was listed as the 10th smartest city in Europe (Chapman, 2019). According to IMD, Oslo ranked as the third smartest city in the world, two spots higher than Copenhagen (IMD, 2019). The explanation of the ranking is done in section 5.3.1. Oslo has an overall rating AA, on a scale from AAA to D, which means they are amongst the ones with the highest overall rating. On structure and technology, Oslo has a rating of AAA and AA, which both are higher than Copenhagen's rating and imply that they are very high in comparison with other countries in the same category.

Oslo		
Smart City Ranking	3rd out of 102	
Rating	AA From AAA to D	
Factor Ratings	AAA	AA
	Structures	**Technologies**

Figure 10 (Own illustration) - Digital Smart City Index Oslo - (IMD, 2019, p. 150)

In the structure category, mobility is seen as necessary in this section, as many of Oslo's smart city projects are in the main category of Mobility. In "Traffic congestion is not a problem" and "Public transport is satisfactory", Oslo has a score of 46,54 and 62,5 out of 100, respectively (IMD, 2019, p.150). These scores lay above the mean of the other cities in the same category, meaning Oslo is positioned well in the category of mobility. It is also

interesting to see that they score better than Copenhagen in both these categories. In “Bicycle hiring has reduced congestion” and “Online scheduling and ticket sales make public transport easier to use”, Oslo has a score of 66,39 and 73,33 out of 100, respectively (IMD, 2019, p. 151). Both lay above the group mean of the category (IMD, 2019), and both categories score better than Copenhagen, meaning Oslo is well-positioned in its mobility in technology. However, the score in itself shows that there is room for improvement.

In the five priority areas, Oslo respondents answered that the most urgent areas for the city were: affordable housing, public transport, security, fulfilling employment, and energy efficiency (IMD, 2019, p. 151). Two of these areas are seen as important in this context, which are public transport and energy efficiency. In public transport, it is interesting to see that even though Oslo scores relatively high on these categories in the structure and technology sections, it is still considered one of the most urgent areas for city improvement. This shows that the smart city development is essential for the citizens of Oslo. It is interesting to see that despite Oslo scoring high on factors such as “Bicycle hiring has reduced congestion” and “Online scheduling and ticket sales make public transport easier to use”, the priority area of public transport still needs improvement. This means that Oslo has some way to go to make the citizens happy with the public transport options and smart city solutions in this field.

Oslo’s social practice of the smart city concept can be compared to some of the related smart cities from chapter 4. The most prominent similarity is citizen participation, which was found in all related cities, meaning Oslo has a Scandinavian Smart City model approach, as explained in section 4.6. Oslo’s testing areas and innovation districts can draw similarities to the test areas in Helsinki and Aarhus. In addition, Oslo’s innovation districts are also highly similar to Helsinki’s area development.

It can, therefore, be concluded that Oslo’s social practice of the smart city concept focuses on elements like green energy, a green procurement strategy, innovation districts and testing areas, citizen involvement, social sustainability, and breaking the silos of traditional work. The analysis indicated a green shift among the citizens of Oslo. When analyzing the

enactment of the smart city concept in Oslo, some terms were recurring from the critical discourse analysis. These are sustainability, collaboration and co-creation, quality of life, and focus and involvement of the citizens. These terms are reflected in the projects and initiatives that are or will be implemented in Oslo. Many of these terms can be tied to environmental sustainability theory from section 3.6.

Some implemented initiatives in Oslo have become well-known aspects of the city, such as the climate budget requirement and zero-emission solutions. These can be viewed as a form of sustainable innovation, where Oslo is taking direct action towards improving the environment. It can further be connected as a form of NPM, due to the public and private companies having to present a climate budget and a plan on how to follow it. One of the terms that seem most important to both the interviewees and the social practice in Oslo is its citizen involvement. Therefore, this is concluded as the most important aspect of Oslo's smart city strategy.

5.4 Sustainable Development Goals

This section will compare Copenhagen and Oslo based on their performance with the SDGs. The impact the SDGs have on smart cities can be viewed as the final step of the innovation life cycle. The life cycle is explained in section 3.1. The projects and initiatives aim to ensure the sustainable development of the two cities. A short explanation of the goals is presented below, where the three main dimensions of the goals are social inclusion, economic growth, and environmental protection. The underlying objectives for each SDG will be utilized in the analysis to conduct the comparison between Copenhagen and Oslo and their development as smart cities.

The SDGs are seen as a global basis for comparison, which requires all of the UN member countries to develop a national plan for the action of implementation to secure progress (Deloitte, 2018). The plans of actions on a national level are mandatory, while the regions, municipalities, and cities decide whether they want to develop a plan for the SDGs. The latter plays a central role on the global agenda, just as much as the national one, as many of the crucial and long-term decisions concerning sustainable development happens locally. An example of this is that municipalities make decisions regarding

education, integration, city planning, transport systems, waste handling, and energy use (Deloitte, 2018).

As mentioned in section 1.2, three SDGs will be focused on in this section, sorted by relevance:

- No. 11: Sustainable cities and communities
- No. 9: Industries, innovation, and infrastructure
- No. 17: Partnerships for the goals

The 11th SDG is considered the most relevant goal to examine in this thesis, which focuses on making cities more sustainable. The goal entails "*making cities sustainable means creating career and business opportunities, safe and affordable housing, and building resilient societies and economies*." (UNDP, n.d.-b). The four underlying objectives of the goal are to make cities inclusive, safe, resilient, and sustainable (United Nations, 2020-b). Due to the rise of people migrating to cities and population growth, the number of megacities in the world has rapidly increased. This growth makes the execution of urban governance and development increasingly important. Some of the necessary actions include investing in public transportation, building green public spaces and parks, and increasing the effectiveness of urban development and governance through inclusiveness and participation (UNDP, n.d.-b).

Following is the 9th SDG, which focuses on innovation and infrastructure. The underlying objectives of this goal are to build resilient infrastructure, promote sustainable industrialization, and foster innovation (United Nations, 2020-a). The main concerns of the 9th SDG are infrastructure and innovation, which are critical factors in economic growth and development (UNDP, n.d.-a). Finding lasting solutions to economic and environmental challenges is a top priority in most cities. One way to promote sustainable development could be through investing in technological innovation and research (UNDP, n.d.-a).

Lastly, the 17th SDG is also deemed important to examine for this thesis. The underlying objective for this goal is to revitalize the global partnership for sustainable development (United Nations, 2019). A key component to increasing sustainable growth and

development is by working together, and the 17th SDG acknowledges how connected the world is and the importance of knowledge sharing and technology to promote innovation (UNDP, n.d.-c).

5.4.1 Copenhagen

Copenhagen has many initiatives within the SDGs. To see how good the city is at following the SDGs, the projects and initiatives in section 5.3.1, combined with statements from the interviewees on the topic, will form the basis of this analysis. The projects analyzed in section 5.3.1 will, therefore, be reviewed in this section.

The testing labs of Copenhagen function as places where new technology is formed, tested, and implemented, and therefore participates in fulfilling the 9th SDG goal. The specific testing of garbage sensors can also be placed under SDG 11, as it is considered a part of a resilient and sustainable society.

One of the most prominent projects in Copenhagen is the Nordhavn project. Because the project works with opportunities within infrastructure, architecture, buildings, the needs of the future residents, and energy systems, the area arguably contributes to achieving the 11th SDG. It is also considered a project that entails inclusiveness and participation because of the collaboration between public and private companies. This can be linked to the 17th SDG on working together. The energy lab Nordhavn tests out technological solutions within areas, such as electric transport, energy, and electricity. It can, therefore, be seen as an implementation of both the 11th and 9th SDG. The investment of a testing lab like the one in Nordhavn is seen as an investment in making the 9th SDG come true.

Other initiatives that were discussed in the social practice of Copenhagen were partnerships and PPPs. Yhde stated here that the 17th goal is the way forward for Copenhagen, indicating that the goal is not fully achieved. However, the goal can be considered one that needs constant work, and never will be fully completed. It is, however, stated that PPPs are significant for Copenhagen's strategy, and is explained as one of the reasons why the city was awarded the European Green Capital in 2014. Many of the

interviewees state that the 17th goal is important in their work, making it essential for the smart city strategy of Copenhagen.

Knowledge sharing is also a topic within the 17th goal, and is a part of Copenhagen's dual strategy to reach its carbon emission goals. Several of the interviewees says that knowledge sharing is an important part of their work process and that it is the reason why Copenhagen joined the C40 network. Even though Yhde states that Copenhagen can learn more from other cities regarding knowledge sharing, it is still considered a part of its smart city strategy. Based on these findings, it can be said that Copenhagen does influential work to achieve the 17th SDG.

The transport solutions in the city, with the bicycle strategy in the center, are highly unique for the city. The fact that 167 kilometers of new cycle highway is installed in the city indicates heavy investments in the field. The strategy also contributes to Copenhagen reaching its carbon emission goals. The combination of heavy investment within the field and its contribution to the carbon emission goal indicates a dedication in reaching the 11th SDG. The lastly mentioned projects in section 5.3.1 were the projects about climate-resilient streets and areas. The projects allow for water to be redirected from the sewer or otherwise used for different purposes. This fits well under the 11th SDG, in making resilient societies. The projects arguably ease the infrastructure in specific areas. Therefore, these projects can belong under the 9th SDG.

When it comes to the interviewees from Copenhagen, several of them had an opinion on the SDGs. Tauber mentioned, *“For us, at BLOXHUB, we focus mainly on goal 11 and goal 17, which is partnerships.”* (Appendix 6, p. 4). Yhde also mentions that the 11th and 17th goals are the ones Copenhagen looks at and goes forward with (Appendix 8, p. 5-6). Sylvester meant that Copenhagen focused on all of the 17 SDGs, and that the goals are too abstract to be used as actual goals or KPI’s (Appendix 7, p. 7). He ends by saying that since Copenhagen is a front runner in the green transition, it gives them an advantage on many of the goals (Appendix 7, p. 7).

Larsen said that Copenhagen focuses on all the SDGs: *"I think they focus on all seventeen. They have at least developed sort of their own strategy for all seventeen, which is a pretty cool move from their side."* (Appendix 1, p. 7). Stelzer also answered that Copenhagen focuses on SDG 11, adding *"But I think, when you look into them, they're all very connected, right?"* (Appendix 3, p. 9).

The three chosen SDGs are found in all the smart city projects implemented or planned to implement in Copenhagen. When looking at the specific projects and initiatives in section 5.3.1, one goal is most frequently discovered. This is the 11th SDG, which is found in the testing of garbage sensors, the Nordhavn project, the transport solutions, and the climate-resilient streets and areas. The second most used goal is the 17th SDG. This is found in the Nordhavn project, the PPPs, and the knowledge sharing. The 9th SDG is the one found the least times in the projects and initiatives. It is, however, found in the testing labs and Energy Lab Nordhavn.

It is interesting to see that the 9th goal is not widely represented in Copenhagen's social practice of the smart city concept, as technology is considered one of the three most important terms from the discourse analysis in section 5.2.1. This is further discussed in chapter 6, where the other two terms, citizens and livability, also are discussed. From this section, however, it can be concluded that the 11th goal is seen as the most important SDG in Copenhagen's smart city concept and strategy.

5.4.2 Oslo

Oslo also has several projects that can be linked to the SDGs and its work towards achieving these. As mentioned earlier, Oslo named public transport and energy efficiency as two of their most urgent areas. Since these areas were in focus in section 5.3.2, the projects within these areas will be reviewed in regard to their work towards achieving the SDGs.

The most prominent goal presented in section 5.3.2 is Oslo's desire to become emission-free by 2030. The majority of the initiated projects in the city revolve around achieving this goal. For instance, Oslo has decided that all construction sites carrying out a public

procurement and project are going to be emission-free. This initiative coincides with the 11th SDG, about making the city more sustainable and resilient. It can also be linked to the 9th SDG, about improving infrastructure and industries, and being more sustainable. Given that the construction on these sites is done by private companies, this initiative can also be seen as work towards the 17th SDG, which revolves around partnerships between both private and public actors in the market.

Oslo is considered a pioneer when it comes to smart mobility and green transportation. To become emission-free while improving the transportation infrastructure, Oslo started testing the use of electric buses and fossil-free alternatives. The objective is to make public transportation greener, more cost-effective, and ultimately reduce emissions. Because of this, the initiative can contribute to achieving the 11th SDG, by focusing and investing in public and private transportation, as well as the 9th SDG, working towards improving infrastructure.

Another initiative aimed towards making Oslo emission-free is making the city center car-free. The aim is to influence the citizens to prioritize public transportation over private by improving accessibility. Anne Romsaas stated:

> *"Rush hour fees and the use of the tools one has to both motivate but also somehow force the population to change behavior, so I think that they go ahead as a very good example that politics can give very specific impact on climate and the environment."* (Appendix 5, p. 6).

Romsaas meant that by enforcing certain restrictions would alter the enactment done by the citizens, which would influence them to make more environmentally friendly choices. This shows an effort from Oslo in committing to the 11th SDG. Further, Oslo is a part of the project BuyZET, which is a collaboration between several European cities. BuyZET revolves around knowledge sharing between the cities involved in the project and the procurement of innovative solutions, in an effort to provide delivery of goods and services with zero-emission. These projects are connected to SDG 11, because it makes the city more inclusive, sustainable, and resilient for its citizens. Further, it is arguably connected

to the 17th SDG regarding partnering to collectively come up with the most time- and cost-effective solutions.

Lastly, when it comes to public transport, improving the accessibility for bicycles has been a significant focus in Oslo over the past few years. By basically copying Copenhagen's strategy, Oslo has emerged as the 7th most bicycle-friendly city in the world. The project of developing Oslo and creating bicycle roads all across the city is also an effort to reduce the number of cars and further the objective of becoming emission-free.

Fraas mentioned in his interview that delegates from Oslo have gone to Copenhagen for inspiration regarding car-free city life (Appendix 11, p. 15). According to Copenhagenize (n.d.-b): *"Oslo has long been the world capital of electric vehicles but lacked until recently a serious commitment to bicycles. The last four years have seen the Norwegian capital make a leap, and show the world what can be done in only a few short years."*. This shows that Oslo is making an effort to achieve the 11th SDG, as it contributes to making the city more sustainable by focusing on green transport solutions.

The main project portrayed in the analysis was the sustainable area development of Beta:By Hovinbyen. Hovinbyen aims towards creating a base for social and safe smart cities. Thus, this project is working towards the 11th SDG, making the city more inclusive, sustainable, and resilient. Further, the 9th SDG is also connected here, as this project is aimed towards building resilient infrastructure and encourage inclusive, sustainable, and innovative industrialization. Beta:By Hovinbyen also focused on involving the citizens in the decision-making process.

Fraas said it could be challenging to get the citizens involved in the best possible way, but he emphasized the importance of including them (Appendix 11, p. 12). Romsaas praised Oslo for how it has done its processes: *"I would say that Oslo municipality has become a much more open municipality, much more concerned with involving the citizens, both in policy formulation and in concrete projects."* (Appendix 5, p. 4). The combination of citizen involvement and open communication in Oslo, Beta:By Hovinbyen can be linked to the 17th SDG.

When asked about the most significant SDGs for Oslo, Berntzen answered that it is reducing emissions (Appendix 1, p. 4). This is the 11th SDG. Romsaas shared a similar opinion and stated that Oslo is very ambitious within the climate field and that Oslo prioritizes the 11th and 9th SDG (Appendix 5, p. 6). She also said that she thinks the area lifts, closing down the streets for cars and how Oslo uses its procurement power is exciting (Appendix 5, p. 6), which relates to all of the three goals, 11, 9, and 17.

Concerning the SDGs, Fraas mentioned that Oslo is one of the first cities in the world to have a climate budget: "*All the businesses in the municipality of Oslo must set and implement a budget around climate. And climate reduction*. *So this contributes to some of the SDGs*" (Appendix 11, p. 13). Therefore, this will be placed under the 11th SDG. Oslo's climate budget can be viewed as an act of green trust, which strengthens their position as a climate-friendly city.

The SDGs that are mostly seen in the social practice and the interviewees' opinions of Oslo are the 11th and 9th. This coincides with the fact that public transport and energy efficiency is the most urgent areas for the city, and shows that Oslo is actively making an effort to reduce the urgency of these categories. Oslo also has initiatives within the 17th SDG, where they have shown improvements over the past few years. However, it can be argued that Oslo still has some way to go on the 17th goal and that Copenhagen lies before Oslo in this goal.

5.4.3 Matrix

The projects and initiatives mentioned in section 5.4 coincides with the six dimensions uncovered in section 5.1. The dimensions that were most prominent were smart governance, smart mobility, and smart environment. These can be identified as smart city initiatives, even though the majority were implemented to achieve the SDGs. The matrix presents the findings from sections 5.4.

SDG	Copenhagen	Oslo
Inclusive SDG 11	• Citizens participation • Nordhavn requires collaborations by public and private companies • Knowledge sharing	• Citizens participation • Make the community and city accessible and inclusive • Area development, like Beta:By Hovinbyen
Safe SDG 11	• Improve buildings, like in Nordhavn • Safety as a focus area	• Area lifts • Beta:By Hovinbyen
Resilient SDG 11	• Develop buildings and implements sustainable solutions, f.ex. Nordhavn • Resilient climate street and areas	• Area development • Beta:By HovinByen
Sustainable SDG 11	• Bicycle is central in their mobility • The goal of becoming carbon neutral capital within 2025 • Climate adapted street and areas	• Bicycle initiatives • Toll booths • Car-free city center • Zero-emission construction sites
Innovation SDG 9	• Testing labs in Copenhagen • Urban innovation test areas • The Energy Lab Nordhavn, testing innovation possibilities • Early Adopter	• Has the intention to be the best city at copying, and test solutions at the same time • Early Majority
Infrastructure SDG 9	• The Energy Lab Nordhavn, testing infrastructure solutions • Mobility and public transportation • Bicycles as a central strategy	• Mobility • Introducing electric vehicles in public transportation • Toll booths
Partnership SDG 17	• Nordhavn, a collaboration between public and private companies • PPP, crucial in Copenhagen's smart city strategy • Knowledge sharing is a part of their smart city strategy	• Collaboration and co-creation between the actors in the market • Public and private sector collaborates a lot in projects

Figure 11 (Own illustration) - Matrix

6. Discussion and Result

The discussion aims to answer the sub-research questions of this thesis. This will be performed by presenting the main findings from the analyses and comparing these. When performing the literature analysis, various definitions of the smart city concept were found. In order to establish a common definition, several attributes were compared and analyzed. The outcome of the literature review was that the smart city concept has the objective of improving the quality of life for the citizens. Six dimensions were identified as necessary elements that a smart city contains. These are; Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living.

In the discourse analysis, we discovered that the interviewees from Copenhagen and Oslo disagree on some aspects of the smart city concept. For instance, whether the use of technology is crucial or not. In the discourse analysis for Copenhagen, we found that the key aspects of a smart city concept were technology, citizens, and livability. In Oslo, we discovered that the majority of the interviewees agreed that technology is not a core factor in the smart city concept. For Oslo, the discourse analysis identified sustainability, citizens participation, collaboration, and co-creation as key aspects.

When it comes to Copenhagen's and Oslo's social practice of the smart city concept, there were several interesting aspects. Based on the findings from the interviews and the analysis, Oslo concentrates on working across the silos with the stakeholders. Oslo also focuses on collaboration and co-creation as a part of the smart city concept. This can also be seen in the implemented projects. Copenhagen concentrates on knowledge sharing through PPPs.

Copenhagen is more prominent in testing smart city solutions, where one of the main actors is Copenhagen Solution Lab, which is a division within the Technical and Environmental Administration in Copenhagen Municipality. The technological perspective and livability aspect from the discourse analysis can, therefore, be seen as a part of the social practice, as the city performs testing within these areas. In Oslo, however, the conducted testing is aimed more towards social sustainability. Both cities perform testing within urban sustainability, in projects such as Nordhavn and Beta:By Hovinbyen. These

projects put the citizen in the center, but as previously mentioned, Oslo has a more prominent focus on citizen participation.

One thing the two capital cities have in common is a bike strategy. Copenhagen is at the forefront of this area, while Oslo is trying to copy and implement a similar strategy. Bicycling has been a part of the culture in Copenhagen for decades, whereas it recently has become increasingly popular in Oslo. A reason for this might be that environmentally friendly means of transportation has gotten rapidly more important in Oslo, hence the desire to implement bike lanes. Because of the geographic nature in the capital cities, Copenhagen has a natural advantage in this area.

One difference in the two cities is that Copenhagen has climate-resilient neighborhoods and areas, whereas no such projects were discovered in the social practice analysis of Oslo. However, Oslo is at the forefront of climate-friendly solutions, because they have a climate budget and aim to use zero-emission construction sites on all building projects in the city. This is also seen in the green shift among the citizens. The last similarity between the cities is the implemented green initiatives. Copenhagen strives towards having a green economy, while Oslo has initiatives within green energy and a green procurement strategy. These can be linked to some of the keywords discovered in the discourse analysis. For Copenhagen and Oslo, the initiatives can arguably be categorized as livability and sustainability, respectively.

There were some differences regarding how and when the projects from the social practice analysis were implemented. Copenhagen was categorized as an Early Adopter. This is because Copenhagen is not viewed as a risk-taker and can identify the need for change and present solutions that will provide value to the citizens. Oslo was categorized as an Early Majority because of its strategy to copy other cities' initiatives, mainly choosing to implemented projects proven to be successful. Since the two capital cities belong to different innovation categories, this may have an impact on the types of projects they implement. Oslo is categorized as an Early Majority, which could impact the cost of the implemented projects. By mainly initiating projects that have been proven successful, Oslo is being risk-averse and is potentially saving money by not investing in high-risk projects.

However, Copenhagen is more open to take risks compared to Oslo, and will attempt to implement beneficial projects for their citizens.

Both cities share a common goal of improving the quality of life for its citizens, and implicitly share similarities with all of the related smart cities. The citizens are in the center of both concepts. However, citizen involvement in Oslo seems more prominent than Copenhagen's, based on the enactment of social practices. Citizen involvement is concluded as being the most important aspect of Oslo’s smart city concept.

The literature analysis performed on previously conducted investigations regarding smart cities found that one element was in common in all the definitions. This was the aspect of quality of life. It can, therefore, be discussed whether this element is present in the smart city definitions identified in the discourse analysis by the two capital cities. Both Copenhagen and Oslo had the quality of life incorporated into their definitions of the smart city concept. Also, the literature review discovered a consensus on the six dimensions of smart cities. Out of the six dimensions, there were four that were prominent in both Copenhagen and Oslo. These were smart mobility, smart environment, smart people, and smart living.

The last two dimensions, smart governance, and smart economy are also important elements, but are not as easily identified when reviewing a project. That does not mean they are not present. To implement a smart city project, the dimensions of smart governance and smart economy must be present. We, therefore, assume the existence of the last two dimensions. Hence, all six dimensions are present.

The smart city concept revealed in the discourse analysis matches the findings from the literature review. Hence, there is no gap between the definition of a smart city given by researchers and how the two cities perform in practice towards a smart city status. This is because both quality of life and the six dimensions of smart cities were found in Copenhagen and Oslo.

In order to see whether there is a gap between the definitions from the discourse analysis and the enactment of the social practice in the cities, the implemented projects are compared to the keywords from the discourse analysis. In Copenhagen, these were technology, citizens, and livability. The Nordhavn project does testing within infrastructure and technology solutions. The same goes for other testing labs in the city, that strives to find the best smart city solutions. These projects can, therefore, be aligned with the keyword technology from the discourse analysis.

Copenhagen's bicycle initiative, the urban sustainability of the Nordhavn project, Helenevej, and Tåsinge plads are projects that aim to improve the quality of life of the citizens. These can be aligned with the keyword quality of life from the discourse analysis. The climate-resilient areas and the Nordhavn project can be argued as initiatives that put the citizens in the center and focuses on their needs. Hence, the keyword citizens is present in the social practice of Copenhagen. Based on the analysis performed, there is no gap between the definition we discovered in the discourse analysis and the enactment of the social practice in Copenhagen.

In Oslo, the keywords from the discourse analysis were sustainability, citizen participation, collaboration and co-creation, and quality of life. Oslo has a lot of projects within sustainable transport and smart mobility, which has made the city a testing lab for infrastructure. They also have a green procurement strategy, with projects such as the BuyZET. Emission-free construction sites and the bicycle strategy of the city are also prominent. Beta:By Hovinbyen also belongs under this category, due to their testing within sustainable solutions. All of these projects belong under the keyword sustainability from the discourse analysis.

Beta:By Hovinbyen can be discussed as belonging under some of the other keywords as well. The project uses different models to involve the citizens and is a collaboration between Oslo municipality and several other companies and stakeholders. Therefore, Beta:By Hovinbyen belongs under the keywords citizen participation and collaboration and co-creation from the discourse analysis. Several of these projects aim to improve the quality of life, which is the last keyword from the discourse analysis. Similar to

Copenhagen, no gap was discovered between the discourse analysis and Oslo's enactment of social practice.

All of the chosen SDGs were found in the implemented projects in both Copenhagen and Oslo. When asked about the SDGs and their importance, Larsen mentioned that people used SDG pins on their chest to promote the goals (Appendix 4, p. 22-23). He referred to a conversation with smart city experts, where he asked how they work with SDGs and how it is different from the way they worked before. He then continued:

> "*So, for me it's 100% useless, unless this becomes the standard. So, the UN is working on trying to make this more standardized, but if this is not adapted by cities and governments around the world saying this is what we do, might as well just throw that pin in the bin, because then it won't be used. So, yeah, there's a lot of these things, but it's just too much talk.*" (Appendix 4, p. 22-23).

Larsen states that companies are using SDG pins to indicate that their company is doing something good, but that nothing has changed from what they did before (Appendix 4, p. 22-23). This can draw a line to greenwashing, which is explained in section 3.6. Greenwashing can arguably be performed on the SDGs both by companies and cities. This can be an argument that makes the SDG discussion weaker. Even though companies might present their SDGs action and results in a more positive light, the most important aspect is that actions are being taken. In this thesis, section 5.3 and 5.4 proves that Copenhagen and Oslo are dedicated to the cause. In addition, the SDGs are widely presented in everyday life in Scandinavia. Therefore, we consider the SDGs to be a valid set of guidelines.

When looking into the smart city concepts and projects, the 11th SDG is naturally more prominent, because this goal revolves around city development. The main difference between Copenhagen and Oslo in their smart city concept enactment of the SDGs was which goals were mainly in focus. Copenhagen focuses on the 17th SDG, with knowledge sharing and PPP as a large part of the smart city strategy and enactment.

According to our findings, the 17th goal is the least prominent SDG for Oslo, which is an intriguing contrast between the two cities. Although 17th SDG is less apparent in Oslo, it does not mean that it is not as important as in Copenhagen. How clear each goal is, depends on how the cities present and portray the goals in the implemented projects. Besides the 11th SDG, the 9th was the most prominent SDG in Oslo's smart city enactment, where mobility and their initiatives on reducing emissions are prominent. This is also the goal that is found the least in Copenhagen's smart city enactment.

To summarize, it can be said that both Copenhagen and Oslo contribute to increasing the quality of life by having these initiatives. When comparing the two capital cities, we discovered several similarities between them. For instance, various of the implemented projects are similar. However, there are two significant differences identified between Copenhagen and Oslo. The first is knowledge sharing, which was a prominent element in the smart city concept enacted in Copenhagen. The second is how the cities incorporate the citizens into projects. In Oslo, citizens' involvement is prioritized, as citizens who participate in the decision-making process are more understanding and committed to the project. However, in Copenhagen, the citizens are not as involved in the processes, but are in the center of the projects.

Overall, we can conclude that both Copenhagen and Oslo have initiatives that create value for the society and citizens. We looked at different rankings in the thesis, and both cities are at the top of the lists of smart cities in Europe and on a world basis. Depending on which measurements the rankings are based on, both Copenhagen and Oslo are listed above each other interchangeably. Hence, we argue that both capital cities are highly developed smart cities.

7. Conclusion

Throughout this thesis, we have conducted an analysis of Copenhagen and Oslo as smart cities through a critical discourse analysis. We found that there were no gaps between the discourse analysis of the two cities and their respective social practice enactment. The main area we discovered where the smart city concept had evolved was regarding citizens. Both Copenhagen and Oslo shared this focus on citizens. The difference is how the capital cities includes the citizens. Oslo prioritizes citizens' participation and strives to involve them in the decision-making process. In contrast, Copenhagen puts the citizens in the center of its projects, but they are not involved in the enactment.

In Oslo, the project that mainly presented this aspect was Beta:By Hovinbyen. The project focuses on the entirety of sustainability and stands out between other projects in the smart city movement, which has been criticized for being too focused on technology. Beta:Byen Hovinbyen revolves around the participation of the citizens and their involvement in decision-making processes. For Copenhagen, some aspect of the citizen focus is found in the Nordhavn project, which is a sustainable neighborhood that aims to create increased opportunities in housing and jobs.

A substantial part of Oslo's smart city strategy revolves around copying successful solutions previously implemented in other cities. Interviewees from Oslo stated that delegates have traveled to Copenhagen for inspiration on several projects. However, this is not something Copenhagen has done. We argue that Copenhagen focuses more on implementing new projects and initiatives, which corresponds with their innovation category as Early Adopters. Oslo mainly implements projects that have been proven successful by other cities, coinciding with it being categorized as an Early Majority. Since the two capital cities belong to different categories of innovation, this may impact the types of projects they implement and the cost of these.

Copenhagen is more concerned with knowledge sharing and PPPs, while Oslo has a strong focus on sustainability and citizens' involvement. It is concluded that both cities are highly and equally developed as smart cities.

The traditional view of the smart city concept is found to be revolving around the use and implementation of technology. The smart city concept change practices by implementing solutions that improve the quality of life of the citizens. These solutions do not have to be technological. The new practices enable further development of the concept by understanding the need for solutions adapted to the problem. As the concept is further developing, the practices being made will also change. This arguably enables the smart city concept by containing a variety of strategies for cities to implement and having a broad spectrum of potential solutions.

Through the discourse analysis, the social practice, and the measure of the SDGs, we discovered that quality of life is the key to smart city development. This opens up the possibility for smart city actors to adapt their strategies to be more compatible with the citizens' needs, ultimately improving the quality of life. The findings in this thesis can provide useful insights for managers in smart cities that seek to improve smart city development and collaboration.

8. Further Reflections and Research

Alternative approaches and methods could have been used in this thesis. A quantitative analysis could have been performed, in the form of a questionnaire, to supplement the qualitative data collected. This could have been done by taking sample sizes from Copenhagen and Oslo and asking them about their perspective on city development. This method could have broadened the data collection and strengthened the arguments, ultimately leading to more reliable answers.

After performing a couple of interviews and reviewing the provided answers, a second interview guide could have been created. The purpose of this would be to improve data collection. For instance, the questions that did not provide useful answers could have been removed or be angled differently to make them easier to understand.

As a result of the analyses, we concluded that the smart city concept revolves around the quality of life. This coincides with the perspectives held by the interviewees from the two capital cities. Thus, the generalization of the smart city concept might have been too broad. Quality of life can have different meanings and contains several aspects, which makes the term too broad. Therefore, the generalization that the smart city concept concentrates on the quality of life may be too vague and weak to conclude.

Other models and theories could also have been used in the thesis—for example, stakeholder mapping by using the salience model. The Salience Model utilizes three parameters for categorizing stakeholders: Power, Legitimacy, and Urgency (Sharma, 2018). The Power parameter measures the ability the stakeholders have to influence the project outcome. Legitimacy revolves around authority and reviews the level of involvement the stakeholders have on a project (Sharma, 2018). Finally, Urgency measures the degree to which the requirements made by stakeholders demands immediate attention (Usmani, 2020). These three parameters are used by project managers to narrow down the critical stakeholders.

The mapping of stakeholders is crucial for the performance of a project, as the stakeholders hold power over the outcome of the project (Madsen & Ulhøi, 2001). For

instance, by identifying whose involved, it gets easier to establish the interests and needs of the stakeholders and, at the same time, minimize potential risks and misunderstandings. External stakeholders can be considered to have an equal impact on the implementation of a project as internal stakeholders. Hence, equal impact on the smart city concept. This could make the results of the thesis more reliable, as stakeholders have to be considered in the implementation of successful projects.

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10. Appendix

Appendix 1	Interview Lasse Berntzen
Appendix 2	Interview Pelle Lind Bournonville
Appendix 3	Interview Kim Spiegelberg Stelzer
Appendix 4	Interview Peter Bjørn Larsen
Appendix 5	Interview Anne Romsaas
Appendix 6	Interview Frederik Tauber
Appendix 7	Interview Marius Sylvester
Appendix 8	Interview Maja Yhde
Appendix 9	Interview Frank Johnsen
Appendix 10	Interview Haakon Hasli
Appendix 11	Interview Morten Fraas