LUND UNIVERSITY
School of Economics and Management

Smart Cities in practice
A comparative case study between Warsaw, Gdynia, Copenhagen, and Malmö

A public actor's perspective with a secondary focus on collaboration and digitization

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1 Introduction

The purpose of this chapter is to outline the importance of the researched topic of Smart Cities in practice. The author introduces the context and background information about cities and urban development, specifically focusing on Smart City discourse that has gained much attention over recent years. Following, the author addresses the validity of this topic for the Masters in Management programme, to then go further to present the purpose and research questions this project concerns.

1.1 Background

Cities are possibly the most extensive social, economic and cultural structures that humans have ever created. They are the essence of societies condensed in a nutshell. It is no wonder then that the existing research about cities has been approached from many different angles, an example being: socio-economic, technological, historical, cultural or public administrative scope. Cities, in all of their variety, became a buzz topic, considering their importance for the global economy, technological development or implementing sustainability. Not once we hear about *cities of the future*, *sustainable cities*, *resilient cities*, *digital cities*, *ubiquitous cities* or just simply *intelligent* or *smart cities* [1]. Yet, what is the difference between these notions?

The lack of precision of these terms might create confusion for many since all the terminology of the concepts seems to be imprecise and overused by the media and public opinion. The researches so far could not come to an agreement on what a Smart City truly is, therefore the research on cities continues to expand (Albino, Berardi & Dangelico, 2015; Chourabi, Nam, Walker, Gil-Garcia, Mellouli, Nahon, Pardo & Scholl, 2012; Hollands, 2008; Vanolo, 2014).

What makes cities such an attractive topic for analysis, is the fact, that managing cities appears to be the biggest challenge for future world development and sustainability (Muggah, 2017; Smart City Expo World Congress, 2015). As for the year 2018, 55% of the world's population resides in urban areas, and it is estimated that by the year 2050, this number will rise to 68% (United Nations, 2018). Regardless of the prognosis for a much higher number of megacities by 2030 [2], rising from 33 to 43 megacities in the world, it is the mid-size and small cities that are fastest growing and where the change happens most rapidly (United Nations, 2018). A special attention should be given to low-income or middle-income economies, where the urbanization's pace is projected to be the fastest and the shift in the living standard for citizens the most explicit (OECD, 2015; United Nations Habitat, 2016).

[1] For the clarity of this research, the author decided to not go into detail to determine the differences and similarities of these notions. However, after researching the topic of Smart Cities for the purpose of this thesis, it seems clear that there is a potential for future research, examining why the research on the cities is so widely dispersed, simultaneously comparing what it means to be a *'resilient'*, *'sustainable'*, *'smart'* or *'intelligent'* city.

[2] According to UN World Urbanization Prospects: The 2018 Revision, megacity is a city that exceeds 10 million inhabitants. As for May 2018 there are 33 megacities in the world, including Tokyo, Jakarta, Seoul and New York (United Nations, 2018).

The problems the cities are facing nowadays, are complex and far-reaching, covering social issues, like: poverty, lack of housing, availability of education and immigration; geographical challenges, like: urban sprawl and depletion of resources; environmental challenges, like: CO2 emission, smog as well as water and soil pollution; and last but not least, the challenges for the city managers and municipalities, that is to handle these issues effectively, bearing in mind cost-efficiency, needs of the citizens and the best possible outcome for all the parties included, e.g. municipalities and citizens (Chourabi et al., 2012; Giffinger, Fertner, Kramar, Kalasek, Milanović & Meijers, 2007; Muggah, 2017; OECD, 2015; United Nations Habitat, 2016).

Considering the fact, that an immense amount of waste produced by cities does not decompose naturally and that cities occupy only around 2% of earth surface (International Organization for Standardization, 2017), while simultaneously giving a home to vast agglomerations of people, the cities face enormous complications trying to keep up with the accelerated pace of the demands the modern societies make (Pearson, Newton & Roberts, 2014).

Moreover, while approximately 70-75% of CO2 emissions in the world are produced by the cities (International Organization for Standardization, 2017; United Nations Environment Programme, n.d.) and the population growth is tremendously big, many cities in the world are becoming engaged in sustainability projects and smart strategies to tackle the uncertainty that arises with the urbanization process (Brorström, Argento, Grossi, Thomasson & Almqvist, 2018).

1.2 Smart cities in practice

It is not difficult to guess that the immense growth produced in the cities is not all good. The pace of change is so abrupt and often unexpected that cities need to adapt their aging infrastructure, increasing migration and respectively the limited capacity they have at their disposal to various unforeseen circumstances (Albino, Berardi & Dangelico, 2015; Dixon, 2012; Pearson, Newton & Roberts, 2014).

The conflicting challenges that the cities are facing require smart approaches based on sustainability, but not all smart approaches are suitable for every city environment. Thus, it is crucial for cities to learn what the true smart strategies look like (Bouton, Cis, Mendonca, Pohl, Remes, Ritchie, Woetzel, 2013). The notion of smart is an intriguing and relatively new concept which appeared at the end of the previous century, in the 1990s (Albino, Berardi & Dangelico, 2015). Since then the discourse on Smart City strategies has gained popularity, especially after widespread access to the Internet and the ever-present information and communications technologies [3] that are taking over the globe (Albino, Berardi & Dangelico, 2015; Lombardi et al., 2012; Meijer & Bolívar, 2016; Van den Bergh & Viaene, 2016).

Being smart is often described to be difficult to define not only by public officials and businessmen but many scholars too. This dissertation focuses on researching that notion from the empirical standpoint that aspires to bring new insights to the vast amount of literature that already exists.

[3] During the course of this thesis referred later as ICT.

In brief, the concept of Smart City is primarily the idea with a strong focus on ICT, in the forms of different tech appliances to make the cities work better and be more efficient. Nevertheless, it is important to underline that definitions on this concept vary and it is essential to look at them from a broader perspective. Taking into consideration that cities are platforms for inhabitants first and foremost, this definition is lacking socio-economical and governance perspective. Therefore the ambiguity of defining this phenomenon is discussed in a theoretical chapter of this dissertation.

Nowadays, smart solutions, like sensors, cameras, highly sophisticated energy or transportation system have been applied on the more frequent basis in many countries with different economies and are believed to bring cost-efficiency for the future, better service for the citizens and the concern for the environment, especially on a local scale (Muggah, 2017; Smart City Expo World Congress, 2016, 2017). Shedding light on how these projects are conducted in practice is therefore very important if we want to truly know the approach of the cities to the concept of smartness and its popularity as well as the real obstacles the cities are facing when it comes to sustainability.

There are, however, many critics of the notion of Smart City itself, claiming it to be an idealistic vision of a high-tech city (Townsend, 2013), lacking its conceptual core in the definition (Vanolo, 2014), causing digital marginalization in the societies (Hollands, 2008) or being used rather as a marketing tool for companies and cities themselves rather than be a beneficial for the citizens (Greenfield, 2013; Hollands, 2008).

A testimony of the growing reputation of this subject might be that major institutions over the globe as well as many big companies, see the importance of Smart Cities in their agenda. The United Nations (2018; United Nations Habitat, 2016), European Commission (n.d.), Organisation for Economic Co-operation and Development – OECD (2015), International Organization for Standardization – ISO (2017), and companies like Siemens (n.d.), McKinsey (Bouton et al., 2013), Microsoft (n.d.; Smart City Expo World Congress, 2016), IBM (2018) or Cisco Systems (n.d.) have all devoted special units that handle topics that revolve around cities' sustainability, digitalization or smartness in the broad sense.

One of the biggest inputs from an international non-governmental organization about these topics is the United Nations, 2030 Agenda for Sustainable Development established in 2015 (United Nations General Assembly, 2015), that has been widely accepted by many countries in their national and local strategies for sustainability for the future [4]. The agenda constitutes of 17 global goals, which are as follows: (1) no poverty, (2) zero hunger, (3) good health and well-being, (4) quality education, (5) gender equality, (6) clean water and sanitation, (7) affordable and clean energy, (8) decent work and economic growth, (9) industry, innovation and infrastructure, (10) reduced inequalities, (11) sustainable cities and communities, (12) responsible consumption and production, (13) climate action, (14) life below water, (15) life on land, (16) peace, justice and strong institutions, and (17) partnerships for the goals.

[4] Examples of such countries are Scandinavian countries, Switzerland, Germany, Netherlands, France or United Kingdom (Willinge, 2017).

1.3 Significance of the research for the MiM programme – managing cities seen as a challenge for the future

For the cities to prosper, it is fundamental to apply good management practices within municipalities and even on national levels, in countries. Since the city leaders and planners have a very crucial task of managing change in transition and cities that are continuously adapting to new conditions (Dixon, 2012), this research focuses on public actor's perspective, highlighting the intricateness of managing cities in the 21st century. The pace of urban growth and the ongoing Second Machine Age (Brynjolfsson & McAfee, 2014) that is fostering non-stop technological development, affecting people's everyday life tremendously, proves that the issues the city managers are facing are complex and ambiguous, requiring specific expertise.

Hence, the relevance for Master in Management programme of this research topic is substantial, covering aspects of managing change, big organizations, that is: city halls and cities as a whole, environmental challenges, and technological boost, where disruptive technologies are more and more prominent today.

There were multiple reasons why I felt the need to do research concerning cities, particularly Smart City phenomena. Cities, their architecture, planning and how they serve the citizens have always been fascinating topics to me. The differences I had noticed while living in different cities and especially different countries throughout my life, made me see that the processes happening within cities are very complex, interrelated and very often dependant on the country's prosperity. While conducting this research, I also found the importance of political, cultural and historical context in the city managing incredibly thought-provoking. Smart City concept, in particular, has been a very fashionable topic over the past years, by some considered even as a utopian vision of the future 'it' city (Townsend, 2013).

Moreover, I wanted to deepen my knowledge in topics like: innovation and managing change, having an empirical, rather than the theoretical focus of the study. I find innovation particularly interesting because of its relevance for technology-based societies, where a lot of the cities apply new solutions based on digitalization on a daily basis. This shift, from non-Internet -, non-cybernetic world that has happened throughout the past two decades, to very digitalized societies – having Interned and smartphones' apps as a foundation, is something that is truly captivating to me.

1.4 Purpose of the study

This case-based study seeks to examine how city managers and municipality authorities approach the Smart City projects in practice rather than a theory with a clear secondary focus on digitization and collaboration as the means to deliver successful Smart City projects.

The purpose of this thesis is, therefore, to outline what the notion of Smart City truly entails in practice from the public actor's perspective based on the collected empirically-driven material.

This dissertation also aims to unravel how different cities collaborate and create partnerships, especially with the private sector as well as handle and use digitization as tools to deliver the Smart City concept.
In this research, the author would try to find to what extent the collaborations that cities create are needed in order for a Smart City concept to flourish and consequently try to examine what is a desirable form of collaboration between public and the private sector in Smart City/sustainable projects.

Last but not least aim of this study, would be to compare the cities based on emerging patterns as well as to determine if Smart City practices or solutions for certain problems that are similar in different cities of different countries, can be compared to one another and applied on a bigger scale.

1.5 Research questions

With this research, the author aims to provide a dissertation that is beneficial not only for city officials but all the parties involved in Smart City projects, which could help to look at their cities with perspective and to allow them to locate the areas of handling city in transition that need special attention for the future prosperity. Therefore, to fulfill the above-outlined purpose of this study, four research questions were formulated:

1. What does the notion of Smart City entail in practice? Is the theory on this concept omitting some important elements?
2. How collaboration and digitization influence the Smart City development? Are they important tools for a Smart City to flourish?
3. What desirable form of collaboration should be applied while handling the process of innovation and change?
4. Can Smart City practices and solutions be multiplied in a different setting?

2 Methodology

The second chapter is concerned with the methodological reasoning, in particular, research approach and strategy, data collection and limitations of the project. Furthermore, it explains in detail how the cases were selected and elaborates thoroughly on the interview process and its participants. Finally, it discusses the change of focus in the study as well as various tools used to help in the writing process.

2.1 Research approach & research strategy

The research approach for this study was conducted in an inductive manner, where the author moved from data to theory, to explore a phenomenon and develop the theory after the collection of the data had taken place (Saunders, Lewis & Thornhill, 2009). Since Smart City concept is not a theory but rather an occurring phenomenon that has been rising in popularity in the past years, no specific theory could be applied and tested in this particular study, therefore theory followed data (Saunders, Lewis & Thornhill, 2009). Because this study is predominantly empirically-based, the data was collected first so that a more general focus could be established (Bryman & Bell, 2015).

According to Saunders, Lewis & Thornhill (2009) and Yin (2003), research that is characterized by an inductive approach is specifically associated with the context of the events or phenomena that is taking place. Hence, conducting an inductive study with a small number of subjects is often more suitable than with bigger number as in the deductive approach. This research project, in particular, is heavily dependent on context, considering that even though cities are located on the same continent, they are in different countries with different socio-economic situations, historical and cultural background.

The research strategy for this dissertation is based on a multiple-case study strategy, which was an essential step in order to gain in-depth knowledge from city managers in the context of the researched topic and approach. Eisenhardt (1989, p.534) in her work "Building Theories from the Case" emphasizes that: "The case study is a research strategy which focuses on understanding the dynamics present within single settings." The case study is, therefore, a specific contemporary phenomenon that is placed within its authentic context and uses various sources of information to explore the full scope of this phenomenon (Denscombe, 2017; Saunders, Lewis & Thornhill, 2009).

To achieve most accurate and true to the state of things data, applying the case study strategy requires to combine the data collection methods to some extent (Eisenhardt, 1989; Saunders, Lewis & Thornhill, 2009). This is referred to as the triangulation technique and is used to assure that the data gained, for instance during interviews with the experts, are correct and all the information gathered is true (Bryman & Bell, 2015; Saunders, Lewis & Thornhill, 2009). In this research project, the data gathered during the conducted interviews was double-checked and complemented by secondary sources, e.g., city projects' documentation, municipalities' or projects' web pages or various governmental and institutions' reports.

A cross-case comparative analysis was chosen to examine the emerging patterns as well as differences and similarities in city managing and approach to Smart City concept (Mills, Durepos & Wiebe, 2010), having in mind cities' location and socio-economical context.

2.2 Selection of the cases

As established in chapter one, cities play a pivotal role in the national and global development and are powerful platforms that shape the economies of the future. Therefore, they are claimed to be the biggest challenge of the 21st century. Cities problems need to be handled cautiously, with long-term sustainability agenda but simultaneously willing to take risks and implement novel solutions. Hence, the author's focus on the public actor's perspective in the Smart City discourse was an apparent choice, as being the most interesting and bringing the most valuable insights.

This research project is a multiple case comparative study, where four European cities from three different countries, have been chosen: Warsaw, Gdynia, Copenhagen, and Malmö. There were various reasons that formed this decision. Firstly, the author is Polish and was aiming to find some Polish cities to be willing to participate in the study. Also, comparing Scandinavian cities with cities located in a post-communist country like Poland, which has a very young democracy system is something that the author found strongly intriguing. Thirdly, the close vicinity of Copenhagen and Malmö from Lund was an important factor while deciding over what cities should be chosen for the study. What is more, Copenhagen is considered to be a cradle for Smart Cities not only in Europe but in the world. The city's approach to the smartness and sustainability has been proactive for many years now, and its recognition for implementing new smart solutions led to pursuing to include the city in the research. Moreover, it was important to choose cities of considerable sizes (having of a minimum 250 000 inhabitants), where the decision making and strategy processes are far more intricate than in the small-sized cities. All of these cities are also tech and IT hubs of the regions, where new companies invest or existing ones open their branches.
Lastly, the cities that are chosen for this research project can be compared size-wise, where two capitals Warsaw and Copenhagen are included and two other cities of similar size, Malmö, and Gdynia, that are considered to be very attractive areas for developing businesses. In chapter four, each of the case descriptions begins with an overview of facts about the city to support the study with a broad and detailed view of the cases.

2.3 The interviews

For this research project, it was essential to conduct interviews with public officials that were competent and knowledgeable about the topics of sustainability and smartness in the cities as well as collaborations and partnerships. Their expertise both in the topic of Smart Cities, sustainability and digitization as well as collaborations between municipalities, private partners, and other institutions, was expected to provide a holistic view on the city's whereabouts and its strategy for the coming years. Therefore it was crucial that the interviewees held vast knowledge on the processes taking place in a city hall as well as were informed and attentive of ongoing urban development trend.
Since this research is focusing on public actor's perspective in cities, taking into the consideration that public officials have a difficult task to manage the process of ongoing change and innovation implementation, it was important that the interviewees had a managerial viewpoint from the public sector, preferably being mayors, deputy mayors of

respective units or project leaders, and consequently would have managerial insight in public official's duty.

Given the fact that there was a limited amount of potential candidates that could be reached for such specific research, it had become a big constraint for this project, since people that could be interviewed were often one of a kind and very usually difficult to reach. That limited the number of potential candidates, sometimes even to one expert in the subject per city, meaning that if this one individual could not devote their time, the whole city could not provide an interview and therefore would not be taken into consideration by the author.

Since the division of labor in the city halls might be confusing for an outside person, it was not always clear who was the right person to reach. Hence in some cases, the individuals who were most knowledgeable about the researched topic were not always contacted in the first place. To be able to find an appropriate person, the snowball sampling technique was introduced quite naturally, where city hall's officials were redirecting the author to the desired person, although simultaneously not giving any assurance if this person would be willing to participate in the study. Snowball sampling was in many cases the only possibility for the author to locate the desired individual. Hence this technique is commonly applied when it is problematic to identify the specific members of a given group (Bryman & Bell, 2015; Saunders, Lewis & Thornhill, 2009).

Eventually, four people were willing to participate in the study, not only taking part in the interviews but also maintaining e-mail contact with the author, showing a willingness to answer the emergent questions throughout the progress of the project. All of them had the expertise and vast knowledge about the topics, and therefore the findings from the interviews helped to shape this dissertation in an empirical manner.

In addition to four interviews conducted either in person or via Skype call, two follow-up questionnaire interviews after one year for both Warsaw and Gdynia are included in the empirical material, to provide supplementary data and see the progress of the specific projects, e.g., Smart City or sustainable pilot projects in particular.

In the preparation stage for the interviews, identical e-mails were sent to the participants in order to support them with some information about the research. The questions that are included in Appendix 1 of this dissertation[5] were though not provided prior to the interviews since the author wanted to achieve an interactive dialog as well as authenticity and spontaneity in given answers. Even though the list of questions was meticulously prepared, the interviews themselves were conducted in semi-structured manner, where open questions are considered to be most effective tool where experiences and thoughts can be articulated more freely by the participant in comparison to structured interviews, allowing the interviewee to develop his ideas and be more receptive towards the interviewer (Denscombe, 2017; Yin, 2003).

The table below represents information about each of the interviewees in detail, distinguishing their name, function, areas of expertise, the city they serve and the duration and form of the interview.

[5] Appendix 1 can be found on page 58.

CITY	FUNCTION	NAME	AREAS OF EXPERTISE	DURATION AND THE FORM OF THE INTERVIEW
Warsaw	Deputy mayor of the city	Michał Olszewski	✓ city strategy ✓ EU funding ✓ revitalization ✓ infrastructure ✓ waste management ✓ regional development ✓ environmental protection and urban green areas ✓ leader of Warsaw Council for Innovation[6] ✓ city's representative of EUROCITIES	74 min (face-to-face meeting; a follow-up questionnaire in written form sent a year later)
Gdynia	Deputy mayor of the city	Bartosz Bartoszewicz	✓ public education ✓ healthcare ✓ experienced in collaborating with NGOs ✓ supervision and coordination of Smart City projects	42 min (face-to-face meeting; a follow-up questionnaire in written form sent a year later)
Copenhagen	Industrial Ph.D. fellow at Copenhagen Solutions Lab	Lasse Bundgaard	✓ Smart City ✓ Innovation & mission-oriented Innovation ✓ PPP ✓ Public-Private-Innovation Partnerships ✓ Ph.D. researcher at Copenhagen Business School ✓ experienced within different entities of City of Copenhagen	47 min (Skype meeting)

[6] pol. Rada do spraw Polityki Innowacji

Malmö	Director of city planning	Christer Larsson	✓ city strategy ✓ city administration ✓ urban planning ✓ city architecture ✓ responsible for the project Sustainable Malmö[7] ✓ chairman of Nordic City Network ✓ experienced with the public and private sector ✓ architect ✓ Lund University scholar	40 min (face-to-face meeting)

Table 1. Overview of the interviewees and their competencies

(Biuletyn Informacji Publicznej miasta stołecznego Warszawy, 2016, 2018; Biuletyn Informacji Publicznej Urzędu Miasta Gdyni, 2018a; Copenhagen Business School, n.d.; Copenhagen Solutions Lab, n.d.a; Hållbar Malmö, n.d.)

2.4 Data collection

Aside from conducted interviews, which were the main source of empirical material as well as two questionnaires sent to the deputy mayor of Warsaw and Gdynia, the supplementary data in the form of governmental documentation and numerous institutions' reports, city projects' documentation and municipalities' or projects' web pages were used in this research. Moreover, to gain a broad scope of Smart/Sustainable City discourse, the author watched many hours [8] of conference material online that handled the topics of urbanization, sustainability, IoT, ICT, Open Data, Sharing Economy, partnerships within cities and more. Subjects of many of these conferences and panel discussions were not strictly in line with the topic of this thesis, but have nevertheless deepened the understanding and the intricateness of the phenomenon.

The attendance in Sharing Cities Sweden launch event that handled the topic of Sharing Economy in Sweden as well as Lund Sustainability Week[9], where the author attended few conferences about urbanization and the sustainable urban future were also advantageous and supported this research project with some additional value.

[7] swe. Hållbar Malmö

[8] Approximate number of conference material that have been watched is around 30 hours.

[9] Sharing Cities Sweden launch event took place on 23rd April 2018 in Lund and was a part of Lund Sustainability Week. It covered the topic of Sharing Economy pilot project in Sege Park in Malmö, which brought some additional value for the Malmö case in this research.

2.5 Limitations

There are inevitably many limitations that come together with research of this extent.
Due to practical constraints, this paper cannot provide a more comprehensive review of the Smart City discourse, neither include more cities in the research nor even more aspects of the phenomenon. The topic of smartness is so complex, ambiguous and continuously evolving that there is much potential for it to be researched from different angles, an example being: environmental focus, smart grids, start-ups and new ways of entrepreneurship or citizen participation, which is discussed to some degree in this paper.

Secondly, the limited amount of interviews for this project gives no absolute assurance of providing a diversity of viewpoints on the topic. It is crucial in this case to critically asses the data, having in mind reliability, validity, and generalizability of the research.
It is then important to underline that by having multiple case analysis as a basis, generalizability might be the biggest problem to tackle. Keeping in mind that all the cities have different socio-economical, political and geographical predispositions, one should draw generalizable conclusions carefully.

Thirdly, one has to bear in mind the time limitations that arise from the process of qualitative study itself as well as difficulties in reaching the desired professionals and consequently, if reached long response waiting times which created extensive time constraints on this research project (Denscombe, 2017). Also, the time-consuming process of interviewing might have been the reason to withdraw from the project for certain individuals, implicating they would need to devote a considerable amount of their time for not only the interview but contact with the author as well (Bryman & Bell, 2015; Denscombe, 2017; Saunders, Lewis & Thornhill, 2009).
Moreover, considering the small amount of knowledgeable people within the frame of Smart Cities, collaboration, digitization and city management were suitable to fulfil the criteria of a desirable expert for this project, it resulted in putting even more limitations to the time distribution of tasks for this study, by being almost entirely dependent on the interviewees availability.

Hence there is only one person conducted this study; there is a considerable risk of bias of self that a researcher has. Choosing to conduct a qualitative study over quantitative implies that the researcher's background, own identity and opinions influence somehow the creation and analysis of the data (Denscombe, 2017; Saunders, Lewis & Thornhill, 2009). Therefore the author is self-aware and risks that his beliefs may cloud his judgment or place assumptions over the topic he researches (Denscombe, 2017). In this case, it is essential that the author has a more cautious view of the data and the conclusions he derives from it.

Last but not least fact that is important to mention is the fact that the language of the thesis, as well as interviews, are not a native language of both the author as well as participants of the study. Thus, it is almost a given that language will create barriers, miscommunication or some misinterpretations in the process.

2.6 Other

This thesis partially uses data that were analyzed in another study, titled 'Smart city: theory vs. practice. A comparative case study between Warsaw, Gdynia, and Malmö' written by Pim van den Oetelaar (2017) and published in Lund University Publications Student Papers in June 2017.

It is due to the fact that initially, the author took part in the same research in 2017, however, was forced to leave the project due to personal reasons. This study still uses only the same material from cities of Warsaw and Gdynia, and by the same time has much more in-depth secondary data that serves as a complementary tool to widen the empirical scope of the study. Additional information was gathered from both of these cities in the form of written questionnaires that were sent out to the participants of this project a year later. Both of the questionnaires had specially formulated questions that were applicable only to the respective cities, which can be found in Appendix 2 and 3.[10] This study also addresses the question of how Smart Cities are presented in literature in order to conclude what they are in practice. However, with given extensive material, the author decided to expand that question and discuss collaboration and digitization as the tools to achieve successful Smart City projects. The outcome of these two theses therefore differs.

During writing this dissertation, the primary focus on the topic changed. Initially, this thesis was supposed to analyze Public-Private Partnerships and how they correspond to Smart City phenomenon. Thus, this is visible in the lists of questions that are attached as appendixes to this paper. After gathering all the data, however, it seemed to be more clear that the primary focus in the majority of the cases, was handling more collaboration and digitization, rather than the PPP procedures in Smart Cities. The gathered data is nonetheless still valid, relevant and valuable for the Smart City discourse and can be used by applying different theoretical frameworks. Since it is a prevalent occurrence while conducting inductive research, to change the focus and the design of the project, the author believes that the outcome of this study is still bringing new insights to the Smart City discussion.

While writing this thesis, multiple tools were used to help in the writing process. Since the author is not a native speaker of English but Polish language, a tool that was used on a daily basis was a Polish-English online dictionary Diki.pl as well as an online thesaurus Thesaurus.com. For literature research, Lund University's library engine called LUBsearch was used.

In addition, a writing assistant programme called Grammarly Premium was used, providing the author with grammar and spelling corrections as well as plagiarism detector that reviews thoroughly Internet content and compares it to the written paper. Along with the writing assistant, the author occasionally used a referencing programme called Zotero, that helped to create bibliography and structure in the referencing system of the whole dissertation.

[10] Appendix 2 can be found on page 59 and Appendix 3 can be found on page 60.

3 Theoretical overview

Chapter three supports the reader with an overview of the theoretical dimensions of the subject necessary in order to fully comprehend the purpose of this research. This section begins with a brief outline on Smart City concepts, including the criticism and controversy it entails. The author then moves to two topics that are the secondary focus of this thesis, namely: collaboration and digitization. Focusing on cross-sector collaboration, digitization and technology development as well as the Smart City phenomenon, the aim of this chapter is to outline the theoretical underpinnings in brief.

3.1 Smart city theory – in search for a definition

As already established, over the past years the Smart City concept has gained wider currency in the urban development discourse both in academia and the business world as well as international and national policies (Albino, Berardi & Dangelico, 2015; Lombardi et al., 2012; Pereira, Cunha, Lampoltshammer, Parycek & Testa, 2017; Van den Bergh & Viaene, 2016; Vanolo, 2014). The lack of consistency in the understanding of the phenomena, its ambiguity, generic nature and the cacophony of existing definitions from researchers as well as private companies creates disarray (Chourabi et al., 2012) that often leads to using the term fitting to one's agendas (Hollands, 2008; Vanolo, 2014). The discourse is primarily focusing on using ICT as a means to create a Smart City, using as a basis the pervasive presence of developing tech advancements in forms of available data, sensors, appliances, cameras, social technologies, intricate energy technologies (smart grids) or complex transportation systems (Albino, Berardi & Dangelico, 2015; Meijer & Bolívar, 2016; Van den Bergh & Viaene, 2016). Moreover, the tech focus more recently involves Open Data facilities, where the city halls open their data resources to their inhabitants and external stakeholders to provide a platform for creating innovative solutions (Van den Bergh & Viaene, 2016). However, aside from focusing on smart technologies, there has been a considerable amount of research that also concentrates on the human resource capital (smart people) and governance (smart collaborations) (Meijer & Bolívar, 2016). Many articles with a human resource focus do not deny the importance of technology but rather shift their focus on smart people as the core of a future Smart City. In this sense, smart people are well-educated inhabitants of the city that are considered to bring innovative potential for urban growth (Thite, 2011). The focus on governance, on the other hand, emphasizes the importance of the interactions between different stakeholders in the city that are often rooted in different sectors. Meijer and Bolívar's (2016, p.392) definition of the concept of smartness consists of these three perspectives "(…) smart city governance is about crafting new forms of human collaboration through the use of ICTs to obtain better outcomes and more open governance processes".

Highlighting the fact that the discourse is widely inconsistent, Chourabi et al. (2012) underline that the notion of a Smart City is still developing and conceptualizing progressively. The authors provide a framework of the success factors for Smart City related projects that consist of eight factors that are affecting one another and are both external and internal to the respective city. These factors are: management and organization, technology, governance, policy context, people and communities, built infrastructure, and the natural environment

(Chourabi et al., 2012). This view is much more holistic than a single focus on a specific cluster. Giffinger et al. (2007) with their "Smart Cities. Ranking of European mid-sized cities" proposed a resembling framework a few years earlier, that is considered a classical and most reliable theoretical structure for discussing Smart Cities (Vanolo, 2014). This framework distinguishes six components of a city that is described as smart. These are smart economy (competitiveness), smart mobility (transportation and ICT), smart governance (participation), smart environment (natural resources), smart living (quality of life) and smart people (social and human capital) (Giffinger et al., 2007). It is important to highlight that many of these frameworks seem to misinterpret what Smart Cities truly are with what they aim to achieve. The extensive literature review conducted by Albino, Berardi and Dangelico (2015) summarizes the widely-dispersed research on the topic and provides the most common features of Smart Cities, that is:

> (1) a city's networked infrastructure that enables political efficiency and social and cultural development; (2) an emphasis on business-led urban development and creative activities for the promotion of urban growth; (3) social inclusion of various urban residents and social capital in urban development; (4) the natural environment as a strategic component for the future (Albino, Berardi & Dangelico, 2015, p.13).

As we see, the meaning of Smart City is multi-faceted. Alberto Vanolo (2014, p.884) criticizes this openly stating that " (…) the term smart city is basically an evocative slogan lacking a well defined conceptual core (…)". What adds to the vagueness of the definition is the fact that it is dependent on the sector it comes from, e.g., researchers' views on Smart Cities differ from companies', companies' from international organizations' [11] and international organizations' from city managers'. Nevertheless, one cannot omit to notice that the Smart City concept is firmly linked with innovation, particularly the disruptive nature of it. Smart City projects are above all about introducing novel solutions that would ultimately outperform the old ones. The examples of such solutions based on ICT are numerous, from electric cars, intelligent parking applications, air quality sensors, Open Data platforms to e-government services that are provided by national institutions and city offices.

Due to the elusive nature of the Smart City concept, there is naturally a considerable amount of criticism towards this notion. Robert G. Hollands (2008) argues in his article "Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?" that the idea behind Smart Cities caused an 'urban labeling' phenomenon, where suddenly many cities began claiming to be 'smart' for self-promotional purposes. This use of the label 'smart' as a marketing ploy is widely criticised among other scholars too (Greenfield, 2013). Hollands (2008) also emphasizes in his work that though Smart Cities indeed bring solutions that can

[11] As example, the European Commission (n.d.) has established its own definition of a Smart City, which according to them is "a place where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and business".

improve the life for many citizens, they can also widen inequality among citizens and lead to the digital marginalization of people who are not keeping up with the pace of changes.
Vanolo (2014) raises the opinion that the reasons why the concept of Smart Cities has been growing in popularity are accessibility to substantial resources from various institutions for smart-oriented projects as well as big interest of IT corporations to invest in such projects. Another very valid criticism point is the fact that the Smart Cities concept grew into this mystical, utopian vision of the future with perfectly functioning cities, fully digitized but to an almost inhuman degree. Examples of it already exist in the form of ubiquitous cities, like Songdo in South Korea (Townsend, 2013).
The last but not least critical remark focuses on the earlier mentioned interest in Smart City projects by large companies. Anthony Townsend (2013) believes that the Smart City concept is dominated by these companies to sell their solutions to the cities. Therefore they have had significant power over the Smart City discourse.

After in-depth research of journal articles, books and online material on the topic of Smart Cities, the author found it aimless to develop own definition of a Smart City for the purpose of this thesis. Taking into consideration the empirical nature of this study as well as the variety and wide span of theoretical material existing, it was important to outline the ongoing discourse on Smart Cities and its components for the reader in order to demonstrate the intricateness and vagueness of the praxis. There are however some characteristics that are apparent in most of the researched material, namely the importance of ICT, a strong emphasis on the natural environment (sustainability focus) and the emphasis on economy, where private companies are attracted to the Smart City concept and create more and more solutions.

Since this thesis researches a public actor's perspective, the issue that needs to be raised is what the executors or practitioners (i.e., the cities themselves) see in this concept and how they handle it with a long-term agenda. In comparison to researchers' and companies' view, the municipalities' take on Smart Cities is especially valid, since they are the ones managing cities as a whole, while the challenges for the cities become more compound with each day.
The author of this thesis undermines the fully techno-centric vision of Smart Cities that appears in a lot of the literature in order to focus on a more holistic approach, where the different Smart City aspects are interrelated with each other. Moreover, in line with the objectives of this research project, the author argues that aside from digitization, collaboration is a mean to achieve a successful Smart City.

3.2 Cross-sector collaboration in brief

While looking at the Smart City discourse in this broad extent, it seems to be evident that handling innovation processes in sustainable projects demand an ecosystem approach where municipalities do not tackle these complex challenges in isolation, but rather in collaboration with different parties from various sectors (Van den Bergh & Viaene, 2016). The magnitude of environmental, economic, societal as well as political challenges that we need to find an answer for stresses strongly the importance of creating partnerships where mutual strengths of various stakeholders have a possibility to bring the best outcomes for the common good (Smith & Thomasson, 2018). According to Bryson, Crosby and Stone (2006, p.44), cross-

sector collaboration is "the linking or sharing of information, resources, activities, and capabilities by organizations to achieve an outcome that could not be achieved by the organizations separately." In terms of this research, the author is particularly interested in cross-sector collaboration, where collaboration happens externally (outside the boundaries of the respective organization) and includes both governmental and non-governmental parties, like in this case the municipality (local government) as well as companies, civic sector in forms of non-governmental organizations[12] and different civic associations or individual citizens (Pereira et al., 2017). Successful collaborations are claimed to bring many benefits in the form of cost efficiency and improved quality of the services (Hilvert & Swindell, 2013). However, they also bring less measurable assets, like more expertise, the need to stimulate innovation, enhanced sense of trust between different sectors and more directly addressed needs of the citizens (Hilvert & Swindell, 2013). The key elements of a partnership discussed by many researchers are a culture based on mutual trust, mutual dependency and a fixed common goal for the collaboration (Selsky & Parker, 2005; Smith & Thomasson, 2018). It is important to underline that for many years, partnerships have been in reality based on contracting out or concession schemes based on rather principal-agent relations between the customer and the producer. A true and pure type of partnership, nevertheless, requires all parties to be actively participating and benefitting in some way from the collaboration (Hilvert & Swindell, 2013). Moreover, the parties should be aware and appreciative of differential features of respective parties, including their strengths and weaknesses and keep in mind the dynamic nature of establishing a collaboration together (Bryson, Crosby & Stone, 2006).

Bearing in mind that the emerging secondary focus in the gathered empirical material of this dissertation highlights collaboration and partnerships and the fact that a lot of Smart City literature discusses smart governance – in particular collaboration as means to establish successful Smart City projects (Meijer & Bolívar, 2016), the author believes that a brief theoretical overview on cross-sector collaboration needed to be included in this chapter.

3.3 Digitization

Another secondary focus of this thesis concentrates on the importance of digitization and ICT in a broad sense. Technologies that are usually linked with digitization are among others big data and advanced analytics, cloud computing, social software and Internet of Things – IoT (Schmidt, Zimmermann, Möhring, Nurcan, Keller & Bär, 2015). Aside from aforementioned ICT, the Internet of Things[13] and big data analytics seem to play the most crucial roles while establishing Smart City projects.

Two decades ago Shapiro and Varian (1999) defined digitized goods as encoding them as a stream of bits for information. Brynjolfsson and McAfee expand this basic definition and add more up-to-date dimension to the definition, stating:

[12] Later referred by the author as NGOs.

[13] The idea behind Internet of Things is that growing miniaturization enhances better functionality condensed in smaller spaces (Schmidt et al., 2015). IoT means that all the devices with some sort of computing, sensors and IP addresses become connected in order to exchange the data and bring optimized effects for organizations and the society (Lahtinen & Weaver, 2017).

> Digitization, in other words, is the work of turning all kinds of information and media—text, sounds, photos, video, data from instruments and sensors, and so on—into the ones and zeroes that are the native language of computers and their kin. (Brynjolfsson & McAfee, 2015, p.40)

The impact of digitization appears to be ubiquitous and is the main force shaping the Second Machine Age, we live in now (Brynjolfsson & McAfee, 2014). The reason behind it is that digital information can be replicated to close to zero cost, reproducing valuable ideas, innovations or whole processes (Brynjolfsson & McAfee, 2014, 2015). Therefore the more and more amount of data is accessible these days and the data, as Brynjolfsson and McAfee highlight, "are the lifeblood of science" (Brynjolfsson & McAfee, 2015, p.42). Moreover, it fosters new forms of innovation, which are so prominent in Smart City projects, and the new ways of attaining knowledge (Brynjolfsson & McAfee, 2014, 2015).

Smart City essential components are ICT, data, and information (Pereira et al., 2017). In short, everything that technology boost brings nowadays. The abrupt technological progress that is happening nowadays is the driver of human economic progress and societies as a whole (Lahtinen & Weaver, 2017). Therefore the author wants to point out that digitization alters the way cities are run, cooperate with different stakeholders and communicate. It also changes how they handle information and innovation. Thus, a brief theoretical background on digitization and ICT brings a more in-depth understanding of Smart City discourse and its strong technological focus.

4 Findings

The following chapter presents the findings of the research, distinguishing each case individually. The conducted interviews from Warsaw, Gdynia, Malmö and Copenhagen are used as core empirical material that the project is based on. The holistic view of the cases is provided with supplementary data from conference and panel discussions, municipalities' webpages, governmental documentation, various institutions' reports and municipal projects' information available online. Each city is shortly introduced, following by detailed summaries of the interview material, simultaneously distinguishing recurring themes, combined together with secondary source information to support the data gathered from the interviewees. Each case begins with a short description of the city, which is significant in order to understand the empirical data correctly.

4.1 Case of Warsaw

Warsaw is the capital and simultaneously the largest city of Poland with an estimated population of 1 764 615 as for the end of 2017 (Urząd Statystyczny w Warszawie, 2018). The city is located in the Masovian Voivodeship by the Vistula river and is characterised as the most significant cultural, economic and political hub with the biggest access to knowledge institutions and universities in Poland (Davies, Hutchinson Dawson & Durko, 2017; Encyklopedia PWN, n.d.a). Warsaw experienced many turbulent political events during its extensive history, gaining the title of a Phoenix City (Davies, Hutchinson Dawson & Durko, 2017). It is estimated that 85-90% of the capital was destroyed during and after World War II, which created an acute demand for reconstruction of the whole city. Industry in Warsaw constitutes of all branches, with a strong focus on services. Lately it is trending as a global business and IT hub, where outsourcing and shared service centres play a big role (ABSL, 2017). As indicated in chapter 1, the underlying reason for choosing Warsaw for this research study, was the capacity of the city and the relevance of its position in Poland. Warsaw is also ranked number one as city of the future for years 2017/2018 by Financial Times in their latest study (fDi Intelligence, 2017) and it has a very visible and innovative start-up sector that is continuously developing (Beauchamp, Kowalczyk, Skala & Ociepka 2017).

Smart City in practice

To the question if Warsaw considers itself a Smart City, the deputy mayor of Warsaw, Michał Olszewski, replies that being smart has been a very fashionable buzzword lately. Nowadays every city aspires to be smart, creative or accommodating to start-ups. Warsaw does not have an aspiration of being smart just for the emphasis of this notion. What is more important is the city's duty towards its citizens, that is if the city gives its residents the best available quality of service. The discussion of the Smart City concept is thus a complex matter, because this notion has been overused recently. The deputy mayor underlines that if smart solutions may help the city improve the quality of life, then Warsaw is more than keen to have them. Therefore Olszewski perceives Smart Cities as a means rather than an end. Warsaw applies smart solutions on a regular basis and sees it as something ordinary while handling innovation.

Smart solutions that are already implemented in the city help the government run the city in a more effective way, meaning always adapting them to the city's needs, so that they fulfil certain purposes.

Examples of Smart City projects

Many of the smart solutions that are applied these days are not traditional and require an innovative approach. More and more these projects are undertaken by the city hall.
It is essential though that all the technological advancements created under the city's brand should serve the citizens first and foremost. There are two reasons the city is using such solutions. They could either improve the quality of life or a service provided by the city or provide long-term cost efficiency.
An important example from the first group might be the application Warszawa 19115 which was created to complement the comprehensive service Warszawa 19115 that functions as a platform of communication between citizens and the city through phone, e-mail, chat and a webpage (Warszawa 19115, n.d.a)[14]. The application gathers the raised problems and requests from the citizens in one platform that is accessible to the people 24/7. What is more, the city has the same version of this application as the residents have. City officials can see in this application how many pressing issues there are and where they are located, taking into consideration the accumulation of requests from one district for instance. Such a system is facilitating the contact with the citizens and helps the city to maintain the desired quality level of its services. Furthermore, the application helps to engage the citizens in the city's life. For instance, one can indicate specifically where in the neighbourhood is a lack of greenery and a need for new trees or one can take an active part in the participatory budget (Warszawa 19115, n.d.b).

Another example that the deputy mayor distinguishes is their smart parking solutions that are implemented in order to decrease the maintenance cost of parking in the city.
SmartParking Warszawa, the Varsovian pilot public parking application, shows the availability of parking places in the city centre. Olszewski emphasises that such a solution will make it easier for citizens to park in the city centre during rush hours as well as decrease emission from the vehicles in the downtown area. However, an important feature to this application will be added in the near future. This application will have the possibility to check whether the car is paid or not which will help to decrease the operational costs for the city budget. Due to law regulations, there is an ongoing problem that occurs in Warsaw when it comes to maintaining carpools. Though there is a fixed parking fee rate in the centre, the city cannot increase the fee due to national laws, so the paradox occurs when the city has to pay more for parking officers and maintenance of the parking zone than the income that parking delivers. In this case, a smart solution is needed for the city to decrease the costs of this operation and reduce the unnecessary costs in the budget.

In Warsaw there are three kinds of smart solutions that Michał Olszewski defines:

[14] The Warszawa 19115 project was greatly financed by the European Regional Development Fund and realized between 2010 and 2015. The project was of great importance to eliminate technological exclusion in the city of Warsaw. The number 19115 functions as one number service to all city departments (Warszawa 19115, n.d.a).

1. Solutions that are only based on initiatives of the city, e.g. the above mentioned Warszawa 19115 application. These projects are fully driven by the city from the beginning. The city here is an actor that designs the solution, deploys it and later maintains the service.
2. Solutions based on Open Data provided by the city. In that case, the city is not paying for services, application or maintenance. It provides, nevertheless, the broad access to the data, which private companies have to use according to special regulations (terms of use).
3. Applications that are fully independent from the city and are not established with cooperation with the city, for instance the application 'Jakość powietrza w Polsce' (eng. Air quality in Poland) that was developed by the Chief Inspectorate of Environmental Protection supported by the national government [15] (Główny Inspektorat Ochrony Środowiska, 2015). Although, at the time of the interview, Warsaw was aiming to have its own air quality project called 'Warszawski Indeks Powietrza' (eng. Varsovian Index of Air Quality')[16] based on beacons starting in 2018 with much more detailed data than the national application has.

Importance of Open Data

The biggest proportion of smart solutions that are applied in Warsaw are based on geodetic cadastre and spatial data that the city updates regularly. This is the second type of smart solutions that Olszewski explains further in detail. Warsaw as a city believes that offering people not only applications and new services but also access to data, is crucial to becoming a smart society.

Every resident and company in the city has access to geodetic and spatial data through an Open Data platform fully open by the API to the coders and programmers, although this system is primarily aimed for the benefit of citizens.

Warsaw makes regular investments to have the most updated database of spatial data each year. The city even organizes hackathons, on the deputy mayor's initiative, which help the city to find innovative solutions to improve the quality of life in Warsaw, having as basis the data the city provides. As mentioned before, this platform is open to everyone and not restricted to some group of people. Accessible via internet (Urząd miasta stołecznego Warszawy, 2018a), the platform has a vast amount of different data, such as heritage monuments and their type of protection, master plans adapted by the city council, cemeteries,

[15] This application shows the air quality status in the whole country based on measuring stations located in all the voivodeships. Updated each hour, it has a much broader scope than just in the area of a particular city (Główny Inspektorat Ochrony Środowiska, 2015).
It is important to know that Warsaw is one of the most air-polluted and congested cities in Europe. The air quality issue in Poland is extremely important, since 33 out of 50 Europe's most polluted cities are located in this country (The Economist, 2018).

[16] The data gained from the questionnaire supported the author with additional information about this project, which in its first initial stage is finished and running. Currently, the city is executing tests for the measuring devices that will help to support indicators with more meticulous information. The index has a proactive approach to public health, where people with different conditions, like asthma, circulatory or respiratory system diseases, get direct guidelines what to do when the air is extremely polluted (Warszawski Indeks Powietrza, 2018).

property prices, biking infrastructure and access to city bikes, spatial maps for renewable energy including a map of solar intensity and geothermal maps.

Taking a closer look at environmental data for instance, one can check on this platform in which districts in the city it is profitable to invest in geothermal energy or how much savings residents may have after switching from a traditional, e.g. fossil fuel oriented heating system to renewable energy like solar panels [17]. Citizens will also find information about flooding and fire brigade interventions, heat islands and the soil temperature in every area of their neighbourhood. If a resident, after assessment of this data, decides to invest in renewable energy, they can not only calculate their profits but also check if they may use the city's subvention for implementing these solutions [18]. Besides data based on the geodetic cadastre, the city also provides among others data connected to education, healthcare, culture or city administration (Urząd miasta stołecznego Warszawy, 2018b).

The deputy mayor emphasizes that the open data platform is very valuable for the city having in mind the ongoing climate change. The problem of adapting the areas to be eco-friendly and sustainable is a strategy for 20 years, not a short-term goal. Solutions like planting greenery in problematic areas or introducing circulation of water in heated soils are plans that need to be continuously taken care of.

Warsaw's strategy is that the data is provided for free and may never be sold further in its raw form by a commercial party. Only when this data is processed to result in new information or service can payment be taken from the user. One example using this data is the public transport planner JakDojade, which uses timetables published by public transport operators. JakDojade uses raw data to provide timetables for the citizens, which is a service that has to be provided for free according to the terms of use of the Varsovian Open Data platform. If the company processes these timetables into travel advice, it is a service for which they can take payment. JakDojade is also an example of collaboration between cities and countries since the concept itself came from Berlin. To make it easier to incorporate the data into software, the data was adapted from the original Polish format into the format used by the German railways Deutsche Bahn. This application achieved huge success and recognition among Poles, since after introducing it in Warsaw it was deployed in other cities in Poland.

Collaboration and partnerships

If we look into regulations, and especially Polish national regulations, there are only several types of cooperation between partners described. These practices are not in practical use on city level usually and are more theoretical models of cooperation than what the city does in practice.

The deputy mayor of Warsaw defines three ways of collaborating with the private sector:

[17] The citizens of Warsaw can check for instance the sun exposition of their own building in the Open Data platform.

[18] At the time of the interview, the city of Warsaw had 600 motions for the city subvention for renewable energy solutions.

1. Tendering – if Warsaw decides to have something that a private company is offering, the city pays for it to own it for the future. Tendering is a very common procedure in Poland usually associated with a lot of trust between the parties included.
2. Traditional private-public partnership procedure – where the city is transferring the risk to the company. Warsaw has such a contract for instance for bus stops. In such cases it is very easy to transfer the risk to the company due to how little demanding the investment of constructing and maintaining the bus stops is. Therefore, there was no risk for the city and neither for the private partner.
3. Unregulated, Open Data based collaboration with a private partner, referred to as 'the third way' - where there is no contract and no strict regulations like with traditional PPP projects. It is a situation when a private company and the city come up with a novel idea and establish a project without any formal arrangement between the parties.

The deputy mayor favours the Open Data based collaborations, since there is no concession, no tendering procedure or no private-public partnership agreement. While the city is not transferring any risk towards the companies, it is also a much more innovative way of collaborating with fewer restrictions than traditional PPP projects. Therefore, according to Olszewski, partnerships that are based on Open Data to deploy smart solutions are considerably easy to manage, in comparison to different types of collaborations.

Although, one must not forget that especially in this 3rd type of partnership, the parties need to have the same mutual goal, which is to bring a service that will be beneficial to the citizens.

Another matter concerning Open Data based smart solutions that needs to be highlighted is that the smart offers from companies are not always demand-driven solutions. Sometimes these are offers by companies that want to sell solutions only claiming to be smart, but usually these services or products are not to be developed but are in a finished stage of service. This happens due to private companies' interest in the brand of the city which could bring them prestige and recognition. Altogether, Warsaw as a city has a certain reputation among citizens and in the market in general which gives the city a competitive advantage to reach the inhabitants. Thus, it is a challenge to decide which endeavours should be pursued with companies. The city, however, has to keep in mind that it is serving its citizens first and foremost. If the city and the company have the same goal, even if it is for different reasons, there is the possibility for cooperation.

The universities usually do not have extensive capabilities of generating practical solutions. However when it comes to cooperation with the city hall in Warsaw, they take an active part in creating strategies and different programmes. Apart from that, universities participate in creating solutions that are not yet available on the market. An example can be the aforementioned 'Varsovian Index of Air Quality'. These kinds of projects usually require bigger capital than replicable solutions and are more time-consuming, sometimes even take several years to reach completion. It is also important to underline that while establishing these collaborations, it is the public sector that takes all the risks associated with the potential failure of the project.

Citizen participation

Though citizen participation indicators are rather scarce, from the available quantitative data and surveys, Warsaw sees a growing interest in the city's issues among the citizens. Consultations, different local initiatives, the participatory budget or even community gardens have recently experienced a rise in popularity. Due to time restrictions while conducting the interview, the author had not sufficient time to examine the civic engagement in Warsaw. However, the short information provided in the questionnaire as well as the strong emphasis on smart solutions being developed to satisfy citizen's needs, such as the Warszawa 19115 project, show that Warsaw puts its people at the centre of attention when it comes to introducing new services to the market. The agenda for Warsaw 2030 (Urząd miasta stołecznego Warszawy, 2018c) signifies strong importance of citizens' involvement in co-creating the city. Creating diverse and open communities and enhancing civic engagement among the people are objectives ranked as number one in Warsaw's strategic agenda for 2030.

Other observations

The interview in Warsaw provided the author with a lot of information about the importance of socio-economic conditions and legal frameworks in the specific countries to bring Smart City projects to life.

Even though cities across Europe tackle the same or similar problems while managing cities, which according to the deputy mayor constitutes around 80% of their problems, 20% of them are different, depending on the city's status, legal framework, cultural and societal circumstances. Solutions for Amsterdam or Copenhagen cannot be applicable to Warsaw, since they would simply not meet the demands of the environment. Every city has to apply solutions that are suitable to their own needs.

There are multiple obstacles for Warsaw that author recognizes from the interview. The one that should be mentioned concerns handling partnerships involving big projects, namely access to financial capital for both public and private actors in such projects. Even though Poland is on a fast economic growth path since the fall of communism, the country is still treated as a secondary market, which entails it is not fully safe to invest money. Long-term contracts for big projects are the key issue here. Despite that the government can take a loan from the bank for up to 40 years, private companies can do it only for 15 years, sometimes even less. That of course creates restrictions for establishing long-term partnerships. Sometimes the project may appear very interesting to develop, but it is too risky and too expensive for the city to deploy it. In such cases the city usually withdraws the willingness from the cooperation. When the risks in a project are 'shared', at the end of the day it is the city who loses its reputation if something goes wrong. The deputy mayor underlines that: *"The city is always responsible for bringing the solutions, not the private partner"*.

Another problem that the city is facing is the difficulty in reaching companies with a specific demand for some services. An example is the Virtual Warsaw project, the biggest Smart City project based on beacons and an urban mobility tool for visually impaired people (OECD,

2017). When the city initially approached the market about this project, the feedback it received was from only four companies.

4.2 Case of Gdynia

Gdynia is a Polish harbour city with 246 306 inhabitants as for the end of 2017 (Biuletyn Informacji Publicznej Urzędu Miasta Gdyni, 2018b). Located in Gdańsk Bay on the southern coast of the Baltic Sea, it is one of the youngest cities in Poland, receiving its city rights in 1926 (Encyklopedia PWN, n.d.b). Gdynia, Gdańsk and the town of Sopot create a conurbation together, forming a well-connected metropolitan area called Tricity (pol. Trójmiasto) with around 750 000 inhabitants in total (Encyklopedia PWN, n.d.b). Industry in Gdynia is primarily focused on the shipyard and port that helped the city flourish after World War II (Encyklopedia PWN, n.d.b). As mentioned in the introduction, the primary reason for choosing Gdynia for this study was its size and the fact that the city is considered the happiest city to live in in Poland, winning the citizen satisfaction rankings for the past years in a row (Puls Biznesu, 2015; The Council for Social Monitoring, 2015). Furthermore, the city receives high positions in several other rankings, such as the most attractive mid-sized city for developing business in Poland by Forbes (2018) and the first ranked mid-sized Polish city of the future by Financial Times (fDi Intelligence, 2017).

Smart City in practice

The findings from Gdynia support this research with further insights into how the concept of a Smart City is actually perceived in practice. According to the deputy mayor of Gdynia, Bartosz Bartoszewicz, it is important to highlight what the notion of a Smart City really entails, considering that there are different explanations of this term from a theoretical standpoint.

In his perception, the key element here is the people and their participation in the city's development. Though Smart City is often associated with ICT solutions, software or technological advancements, the crucial feature is the climate the city creates for its citizens. Being '*smart*' is giving residents numerous opportunities and leaving them satisfied with the place where they live. To achieve that, a Smart City needs to offer their inhabitants a wide scope of entertainment, the best available education and a wide offer of culture, so that the citizens feel that their city is a place that constantly develops and adapts to their needs. For this, the deputy mayor gives examples of events organized in Gdynia, such as the Open'er Festival [19], Red Bull Air Race or the Ironman Triathlon.

A Smart City must also take into account minorities and unprivileged people, so that their everyday life in the city is not hindered. Citizens who are happy with their city are the best indicator for whether a city is *'smart'* or not. Being *'smart'* also means being open and accessible to everyone. Thus, it is crucial for the cities to use their budgets to their best capacities to offer the best available solutions.

[19] Open'er Festival is one of the biggest music festivals in Poland and takes place yearly in Gdynia.

The deputy mayor also points out that being *'smart'* is an interesting notion. He says:

"It is not about being smart because there is no smart and stupid. But if you want to have service on a high level, if you want to make people satisfied about living in the city, there is no other way than listening to them, about relations with them."

The key element here are the citizens and the relation that the city has with them, which is something that Gdynia holds in high regard. Therefore, citizen participation and awareness about the issues are decisive ingredients of the city's future. Bartoszewicz sees that with this interpretation of a Smart City, Gdynia is *"pretty smart"*.

Examples of Smart City projects

Since Smart City is an almost never-ending list of things to improve, the deputy mayor of Gdynia perceives that smart solutions can be attractive for the city for two reasons. These reasons are:

1. *Improving the standard of living in the city,*
2. *Decreasing long-term costs in the city budget.*

In spite of the fact that upgrading the living standard in the city can be initially costly, it is a wise and strategic move in the long run. The examples the deputy mayor gives are: the one number service [20], car sharing project and Open Data service, that are currently ongoing projects in progress. Particularly interesting here is the car sharing service, considering the fact that Gdynia has a well-developed network infrastructure for trolleybuses in the city, therefore implementation of electric cars would be a rather cheap smart solution for the future. Gdynia would be the first city in Poland to introduce car sharing based on electric cars and sees it as an opportunity to promote the city as well. With this innovation, Gdynia wants to reduce the amount of cars in the city centre and diminish pollution. Bartoszewicz sees a generation shift in Poland as a main reason why this solution could be successful nowadays and would not have been possible in the past [21]. At the time of interviewing the deputy mayor in May 2017, the car sharing service was not yet introduced in the city. However, the questionnaire sent a year later as well as additional sources supported the author with information how this project developed over the time span of a year. Today, car sharing is available in Gdynia and other cities in Tricity [22] and due to big popularity of the service, there

[20] One number service in Gdynia means that all government services can be reached via the same phone number. The city is currently working on this project and wants to reach out to inhabitants who are not using the online city platform to communicate with the city office.

[21] Note from the author: For many years people in Poland did not have many goods due to the political situation in the country. Therefore having a car was a very important sign of social status for older generations that experienced communism for instance. Nowadays however, young people are very keen on trying new things and less likely to own a car than older people.

[22] The car sharing service was introduced in Gdynia on the 27th October 2017 and Gdynia was the initiator of implementing this solution in the whole metropolitan area of Tricity (Oficjalny serwis internetowy miasta Gdynia, 2017b).

is growing interest from the citizens in using it in other areas. The service now has expanded into towns in the vicinity of Tricity, which proves that this smart solution is a great success on a bigger scale. Even though the plans to introduce electric car-sharing are still in progress with expected implementation in 2020 (Oficjalny serwis internetowy miasta Gdynia, 2017b), the vehicles that are used today are low-emission and therefore contribute to the concept of smart mobility.

The second reason to implement smart solutions in Gdynia is lowering the costs of current services, to either balance the budget, provide more service for the same amount of money or invest in the innovative solutions from the first group. The deputy mayor points out that citizens might not feel the results of these actions directly as users, but it definitely saves money into the city budget for future plans. One example can be smart lighting, where indicators in the city lamps adjust the light to whether it is needed in that moment or not. Another very accurate example is the Tricity's intelligent system of transportation within the agglomeration, called Tristar. Tristar is a system that allows navigating the traffic fluency within the metropolitan area of Gdańsk, Gdynia and Sopot with the help of Intelligent Transport Systems – ITS [23]. It was inaugurated in November 2015, being the signature sign of development in Tricity and their co-operation between local authorities (Oficjalny serwis internetowy miasta Gdynia, 2015).

Importance of Open Data

During the time of the interview, the city was planning to introduce an Open Data service in three different formats – CSV, JSON, API, which would make it even more accessible to a wide scope of companies (Otwarte Dane Gdynia, 2018). Owing to the answers provided in the questionnaire sent a year later, the information on the status of Open Data in Gdynia is up-to-date. As for this day, the platform is functioning and provides access to 127 data bases as well as displays some data to inhabitants by means of interesting presentations [24].
The deputy mayor believes that opening data has a huge potential for the future and is a new and easy-accessible solution for potential stakeholders. It also shows the information gathered by the city in a transparent and standardized way. Bartoszewicz emphasises that a city should not pay for any applications that are functioning, rather that they should be created by private sector companies, based on the Open Data provided by the city and paid for by a sponsor who wants to promote this solution. Nevertheless, one cannot forget that any application on a smartphone or computer is a tool to achieve something. The priority is that these digital smart solutions should be beneficiary for the citizens first and foremost.

Collaboration and partnerships

Moving onto collaborating with businesses, Gdynia's interview was focused strongly on the importance of cooperating between the public sector, the non-governmental sector and

[23] The biggest advantages of implementing the Tristar system in Tricity are its time saving qualities, more safety and comfort for the public transportation passengers as well as improvements in the traffic flow in the whole conurbation (Oficjalny serwis internetowy miasta Gdynia, 2015).
[24] The data bases are divided in 21 categories, including transportation, health, energy, finance, urban planning or maritime industry (Otwarte Dane Gdynia, 2018).

private companies. All of these three actors must work together, in order to have a city that functions well and can look ahead in the future. These three sectors of course, have different incentives and different policies to apply, however to run the city in an efficient way, all of these parties need to be included.

Private companies have their interest in pursuing involvement in city projectss as the deputy mayor claims. Businesses typically want to increase their revenues, make their company bigger or market themselves under the city's brand. Applications are mostly developed by businesses due to the fact that they hold expertise and experience within a certain field that the public sector does not have. It is important, therefore, to know what you, as a city are expecting from the private company and decide if you prefer to invest in something that will increase the standard of living or decrease the costs in the budget. The city always has to be cautious about where to locate their money for the future, because the results need to yield long-term benefits, whether it is financial or satisfaction among inhabitants. Hundreds of private companies approach city governments to offer their services or products, but the true question the public sector always must have in mind is whether it improves the quality of life, and if it is the best possible solution that will bring a long-term effect.

The hindrance that the deputy mayor encounters in building relations with businesses is a lack of trust, even among other public officials. Some people are convinced that NGOs, public sector and private sector should not interfere with each other because they have different incentives. Business, according to some public officials, is something wrong. This view is outdated and needs to change. The remedy for this issue could be true willingness to cooperate and openness to new things. Thus, the problems that the public sector faces while working with businesses should be resolved by continuous dialogue between the parties.

Bartoszewicz claims that Gdynia does not have reasons to complain besides perhaps situations when a private company is not able to deliver their service after winning a tendering competition. Such projects concern mainly infrastructure, for example road reparations.

The deputy mayor summarizes his thinking on the broad topic of collaboration in Smart City projects with one single sentence: *" I can't imagine a smart city without cooperation with business."* He adds that there is no other way for a city that can be smart or aspire to be named smart, than to work with businesses, work with NGOs, listen to the citizens and build relations with all of them.

On another side of the spectrum of deploying Smart City projects are universities and research institutions that the city collaborates with. Usually it happens when the city needs an expert opinion or to conduct an analysis by the University unit, while elaborating concepts for innovative solutions.

Citizen participation

In Gdynia, citizen involvement in the city's life and awareness among inhabitants about their influence over new solutions is considered of one of the highest in Poland. As mentioned before, Gdynia is one of the youngest cities in Poland, where citizens feel that they have impact on what is happening around them. Bartosz Bartoszewicz sees inhabitants of Gdynia

as proactive people who take charge if they face issues. They are often engaged in local initiatives, neighbourhoods or associations. In addition, in Gdynia there are around 700 NGOs or other non-formal groups that are taking a big part in cooperating with the city (Gdyńskie Centrum Organizacji Pozarządowych, n.d.). The deputy mayor sees their members as people who want to have influence in their city and make a change. Moreover, the share of the citizens that are involved in civil budgeting projects (Budżet Obywatelski i Przyjazna Dzielnica, 2018) is one of the highest in Poland as well. The civil budget for 2017 included over 160 projects, whereas in all editions of civil budgeting projects in Gdynia overall 717 motions were submitted (Oficjalny serwis internetowy miasta Gdynia, 2017a). Meetings with citizens are considered a very important part of the civil budget, where city officials listen to ideas and needs of inhabitants of Gdynia. The deputy mayor underlines that even small things are the ones that matter, for instance Gdynia's citizens' involvement to appear on the map of the Monopoly World Game. Many people wanted to participate in the voting procedure for the city, simultaneously contributing to the city promotion abroad as well.

Gdynia achieved, among others, recognition in the European Public Sector Award - EPSA (2011), in 2009 for their cooperation with NGOs and citizen involvement as one of the best practices in how to successfully work with citizens and promote their solutions further.

Other observations

During the interview there were various other questions raised, one of them being how the issues and understanding of the phenomenon of smart solutions and collaborations can be compared between Warsaw and Gdynia. The deputy mayor stressed that a city such as Gdynia cannot be compared to Warsaw by any means. Despite the fact that these cities are in the same country and surrounded by the same legal framework, the issues and capacities that Warsaw handles are much bigger than in Gdynia. One has to include financial capacities as well, since some departments of the city hall of Warsaw have bigger budgets than the whole city of Gdynia. The problem that Warsaw encounters, for instance, with reaching out to specific companies is non-existent in Gdynia. Bartoszewicz believes that the size of the city plays a crucial role in this case.

The author also found out that at the time of the interview Gdynia applied for the prestigious indicator ISO 37120, concerning Smart Cities: Sustainable development in communities - indicators for city services and quality of life (International Organization for Standardization, 2017) given by the World Council City Data. In June 2017, Gdynia officially received this certification as the first city in Poland and first in Eastern Europe.

4.3 Case of Copenhagen

Copenhagen is the largest city in Denmark, the country's capital and the centre of the Öresund region with its 777 816 inhabitants (Encyclopedia Britannica, 2017; Statistics Denmark, 2018). The city has experienced an significant transformation from an industrial city based on manufacturing to a knowledge, business and tech hub, where service (80% of the working population) and the commerce sector play a big role in the economy (Copenhagen, 2018).

Apart from that, Copenhagen is considered to be a heart of innovative, smart and sustainable projects, where research institutions and the city's 11 universities take an active part in bringing new solutions to life (Copenhagen, 2018; Københavns Kommune, n.d.). Winner of many rankings for the most liveable city in Europe and the world and according to OECD, the World Leader in Green Growth (Københavns Kommune, n.d.), Copenhagen is a multicultural city, where 25% of the population is of foreign background (CPH Post, 2017). The capital is also regarded as having significantly more people in creative business than on European average and as one of world's easiest places to do business, where corruption is scarce (Københavns Kommune, n.d.).

Smart City in practice

To some extent Copenhagen considers itself as a Smart City and strives in a way towards it. However, this is strongly interwoven with the definition one takes on Smart Cities. It is not surprising to say that Smart City definitions can differ from city to city. In some cities it is about technological development first and foremost, including collecting as much data as possible, in other cities it is about being able to grow local businesses. Copenhagen's smart goal for the future is to achieve CO2 neutrality by 2025 (Københavns Kommune, 2012). Since 2005, CO2 emissions have been already reduced by 50%, by applying different strategies such as implementing district heating and district cooling. Now, the aim to become CO2 neutral is a part of Copenhagen's Smart City agenda to tackle more complex issues of gas emissions. For that, it is crucial to involve the citizens and change their living habits, for instance encourage people to bike more or use public transportation instead of the car. Solutions that can help to change this situation are part of the goal. Even though it is a local strategy that Copenhagen has, it can inspire, motivate and educate people further in different regions, too.

It is also important to mention that as the only one of the four cities in this study, Copenhagen has its own Smart City incubator, called Copenhagen Solutions Lab, that works separately from the municipality [25]. Established in 2014, CSL is an organization that works cross-sectionally between three different city departments: technical and environmental, finance and culture and leisure department.

Examples of Smart City projects

There are numerous Smart City projects mentioned in the Copenhagen case but in different sections of this review in order to support the reader with more thorough descriptions.
Copenhagen has many ongoing Smart City projects connected with air and water pollution (e.g. transforming Copenhagen's harbour into an attractive public space by modernising the sewage system, implementing a cleaning programme and diverting rainwater) waste management (e.g. generating less waste and increasing direct reuse), green mobility (e.g. heavy focus on infrastructure for biking [26] and modern public transportation, where bus, train

[25] Note from the author: further discussion about CSL is provided in the 'Other observations' section of the Copenhagen case.
[26] Copenhagen is internationally renowned for being the 'capital for bikers' (aside with Amsterdam).

and metro services are highly integrated with each other) or renewable heat energy systems (e.g. Copenhagen has very carbon efficient way to generate energy locally based on biomass, where coverage of district heating is reaching 98%) (Københavns Kommune, 2014).
One of the projects that is ongoing and also tightly connected with improving the environment is cooperation with Leapcraft, a small start-up company that develops air-quality sensors, called CPH Sense (Leapcraft, n.d.). Since monitoring the air quality in the city had been based on data from only three measure stations, the city was looking for opportunities to test small, moveable and affordable sensors that could further complement the information gained from the existing stations and give a holistic view of the air quality in different city districts (Copenhagen Solutions Lab, n.d.b). With supplementary data from the new sensors, the city could take into account discrepancies in air quality that occur locally, while setting plans for, as an example, the construction of schools or kindergartens (Copenhagen Solutions Lab, n.d.b).
What is more, this company has a very innovative strategy and decided not to sell their technological solutions to bigger companies on the market, but rather develop everything by themselves. The city of Copenhagen supports projects of this kind and bought their air sensors for around 500 000 DKK to test them and give the company feedback on the technology they are producing. When standardization procedures are finished for such projects, the city creates a tender procedure specifying their demands for air-quality sensors in detail. This might lead to using Leapcraft's product or something even more suitable. The advantage of such an approach is that the city gains a wider scope of knowledge on what solutions and technologies are on the market from working collaboratively with Leapcraft, instead of creating a tender from the beginning without testing anything at all.

Importance of Open Data

For the city of Copenhagen, data is the foundation on which the city will build their smart innovations and technological advancements. The technology for using big data does not yet exist, however, the city strongly believes it is going to have a future. Most cities already have the majority of the data they need and therefore there is no need to put many new sensors and cameras in different locations of the city. Copenhagen has its own Open Data platform, which is the City Data Exchange established in partnership with Hitachi. Hitachi platform is a tool to combine existing private and public data, rather than creating new data. Since there were numerous complications while carrying out this project, the city of Copenhagen realized while managing the City Open Exchange platform that they had been ahead of the curve with their technological agenda. When the platform was introduced in April 2015 (Københavns Kommune, 2018), the world was not fully equipped to use this tool yet. The fully equipped Open Data platform is going to be a very valuable solution one day, but this day is still ahead.

Copenhagen was very proud of the applied innovation in this project and it was important to have people from the private sector build it, but the project did not go the way it should. Out of the multiple problems encountered a few were technical but above all, companies were not ready to understand how to monetize their data.
Hitachi wanted data on the platform, but with the focus on private data that they could sell in line with their business model. The city of Copenhagen, however, was aiming to collect as

much data as possible from the companies that the city co-owns to give away their data for free to Hitachi. The companies delivered, but Hitachi wanted to be charged for this service even a small fee because otherwise they could not sell or monetize any data that would be given to them for free. Therefore, the visible tensions in the incentives of the parties of this project appeared. Perhaps the project could be more successful if the city itself had procured some of the data from the platform, showing the companies that it is a good and safe idea to monetize or to buy the data.

The City Open Data Exchange platform is going to operate for the coming years but unfortunately it is kind of a failed project. Regardless of the fact that the project is a failure in practice, Lasse Bundgaard does not believe it is a right word to call it. A failure like that creates an immense amount of knowledge and experience for the future to move forward and understand what it is like to collaborate in partnerships based on innovation. Moreover, Copenhagen benefited greatly from this program for a very reasonable price. The size of expertise that was provided was notable, since at one point during the project around 40 people from the Hitachi company were hired by the city of Copenhagen. The City Data Exchange team itself had been in contact with around 1000 people while carrying out this project and was functioning as an open platform where companies and organizations could share their insights about data-sharing opportunities (Københavns Kommune, 2018).

Collaboration and partnerships

While handling innovation and technology-based projects, Copenhagen strives to create a pure type of collaboration. Usually this is a mixture between PPP, tendering procedure and concession.

The crucial component are the aligning objectives that all parties have to agree on instead of having a traditional principal-agent based relationship, where the objectives are not completely pure. The goal for such collaborations is to create a sustainable and scalable innovation, and later on in the process, to find a way to institutionalize this innovation, since this is not as straightforward as everyone wants it to be.

The city's strategy is to experiment with different types of partnerships, which creates a collaborative spirit. From Copenhagen's experience, it is apparent that the best collaboration happens if there is no hierarchy between the parties included, and simultaneously if it is essentially a trust-based partnership. The framework that the city applies to inventive projects is a completely new concept called Public-Private-Innovation Partnership, PPIP. This type of cooperation can be found for instance in an earlier mentioned pilot project about air sensors which is a pilot procurement project.

Copenhagen Street Lab [27] is another example of such pure partnership, where the city, Cisco Systems, Citelum and TDC create the common space where the technologies can be tested for both the private and public sector (Copenhagen Solutions Lab, n.d.c). Every party included devotes the same amount of hours into their project, which creates a collaborative

[27] Street Lab is a Smart City solutions test bed area, located in the centre of Copenhagen that tests the new solutions in a real urban setting. Located between Rådhuspladsen and Christians Brygge, the area is a testing site for prototypes and pilot projects in for instance smart parking, waste management or air and noise sensors (Copenhagen Solutions Lab, n.d.c).

spirit for the whole partnership. This is probably the most successful type of partnership so far. In such collaborations, networking and socialising are the keys to building mutual trust. As an example, the city of Copenhagen attends conferences together with Cisco and TDC, goes to dinners together and tells other cities of their fruitful collaboration, which is valuable for the companies of course.

One must know, however, that although PPIPs may not result in the most scalable technologies in the first place, they nevertheless contribute to anchoring the knowledge and experience in the city itself.

The traditional type of partnership, PPP, derived from PFI and Great Britain, has much more principal-agent patterns and is an utterly outdated procedure considering how innovation projects should be built. Moreover, traditional PPP is much easier to establish with bigger organizations, and the city of Copenhagen wants to collaborate with small actors as well.

It is also used mainly to support big infrastructure projects, whereas Smart City projects are a type of abstract infrastructure with many uncertainties. Therefore it is absolutely essential to outline that traditional PPPs are not meant for projects with uncertainty. The projects with elements of innovation and most importantly elements of unknown should be handled much more collaboratively and openly.

No wonder then, that the core of such collaborations should be trust. A strong emphasis should also be put on understanding the nature of technology in the cities and what this technology is all about. The industry seems to think that creating as much data as possible and putting up as many devices as possible is a way to go when it comes to smart or sustainable projects. For other cities, however, with a little bit more knowledge and experience with ICT, the technology is not an end goal itself, but rather a means to determine how to use the resources more efficiently.

To create the best type of partnership possible, collaboration, networks and knowledge are decisive components. Many employees in the Copenhagen Solutions Lab have a background in academia and are skilled at building consortiums. CSL also occasionally hires experts to get the most up-to-date knowledge about what the next technology is going to look like.

The city's approach is to balance gaining knowledge from both universities and businesses, to be able to come up with their own proposals. Examples are platforms like the earlier-mentioned Copenhagen Street Lab or EnergyBlock urban lab that works with blockchain technology [28]. By only hiring experts and consultants or contracting someone to do a project for CSL, the knowledge is likely to disappear and be only in the hands of the executers of these projects.

Copenhagen aims to build up their own capacity to be able to work with the technologies of the future, by anchoring the knowledge and experience taken from such projects. Therefore open collaboration between all parties is absolutely essential.

[28] The EnergyBlock project is a good example of cooperation between the city and university, where Copenhagen cooperates with the Technical University of Denmark (as well as a number of companies) in order to examine the potential of renewable energy resources in real urban conditions (Copenhagen Solutions Lab, n.d.d).

Citizen participation

Civic engagement is not very big in Copenhagen, but this question should be analysed more broadly. Demark has a very old tradition of citizen involvement. Thus, one could say that citizen participation in the processes of these projects is not very big, but also it is a fact that it is much bigger than in other countries. Copenhagen is not trying to explicitly involve citizens in these processes and is not using technology to do that. However, it is mostly local committees that pose challenges for the city administration, so it is an indirect process of involving the citizens.

Most importantly, the city uses inhabitants to gain knowledge that cannot be extracted from data and is extremely valuable. One has to remember that citizens know the city better than anybody and they are relevant assets. An example is that the city received 12 000 data points within ten days when asking citizens to report potholes in the bike lanes or dangerous crossroads. This lead to setting priorities in maintenance for biking infrastructure and is a clear example of using citizen engagement for something of huge value for which you cannot use technology to source this knowledge.

With instituting technology and implementing sensors however, engaging citizens is redundant. Copenhagen would prefer citizens not to use more technology than they already do and the city does not want them to have the city of Copenhagen app, which they need to monitor. The technology that should be used and be beneficial for citizens is ideally not noticed to a great extent. It should make their day better and smoother, without their realisation, for instance through bicycle sensors that measure their speed. The city is close to implementing a system that will automatize people's time on bikes by 15-20%. Perhaps the city will communicate this project to the public, since it is expected to be liked by citizens. However, the detail is that citizens do not need to be engaged in any way in this project, they just need to keep on biking on their bicycles.

Other observations

To the question why the separate incubator for Smart City projects only exists in Copenhagen, Bundgaard assures that to some extent, every city has an entity or organization that does what CSL does, performs similar procedures and handles topics of sustainability, big data and intelligent technologies, whether they are as autonomous as in Copenhagen is a different matter.

In the city itself, there is a lack of cross-departmental collaboration between the seven different departments of the city hall. Since the city of Copenhagen is the biggest public sector organisation in Denmark, it makes it difficult for companies and universities to know what entrance is available for them and what ways are there to contact. Therefore, CSL facilitates businesses and universities working with the city to find novel solutions.

CSL works together with the departments to identify problems and challenges that need to be taken care of. In addition, it tries to leverage all the capabilities of universities and private companies and simultaneously to better communicate between different sectors.

The initial focus of CSL was its digitization strategy for the city, which won a competition in Barcelona a few years ago. However, since then, CSL shifted its focus. The strategy then was

focused on leveraging technology and not so much on the true needs of the city. Technology surely is important, but it is not always the answer to the cities' needs.

4.4 Case of Malmö

Malmö is a Swedish city located in the southern part of the country, in the Öresund region (Encyclopedia Britannica, 2013). Its 333 633 inhabitants prove of its diverse background, where 33% of the city's population are foreign-born and come from around 180 countries (Malmö stad, 2018b). Malmö is the third biggest city in Sweden, the capital of the Scania region and a modern knowledge hub, which made a significant transition since the late 1990s from a shipyard industry city to a multicultural centre where service, retail, finance and IT play vital roles in the city's economy (Malmö stad, 2016b). Over the past decades, the city has had a strong focus on sustainability in all of its aspects, i.e. social, economic and environmental while implementing novel solutions to improve the quality of life for the citizens (Malmö stad, 2016b). The reason for choosing Malmö for this project was its size, vicinity and the fact that the city made a big transition over recent years, focusing on innovative approaches to city planning.

Smart city in practice

To the question if Malmö regards itself as a Smart City, the director of city planning, Christer Larsson, replies that Malmö is more likely a sustainable city. A Smart City works as a tool in means of smart energy, smart mobility, smart grids, different smart solutions and most importantly is to a great extent driven by technology. The focus that the Smart City discourse has on technology is of course valid, but it is not enough to drive a city that is aspiring to be forward-looking for the future. The municipality of Malmö is handling the sustainability aspects much broader than the Smart City concept does, therefore applying just ICT solutions is not enough. It is however very important for the city hall to include the social aspect in this discussion and the director of city planning does not think that the emphasis on the social in the Smart City concept is sufficient.
Malmö's agenda is to implement the UN's 17 global goals plan [29] in all sectors and into the budget system. Incorporating them in the economic process is a smart way to do it since they are included in the city development plan as other city issues are handled. This global goals agenda is very important for Malmö and treated with high priority.

Examples of Smart City projects

A flagship project that should be named as a Smart City project is without doubt the Western Harbour (swe. Västra hamnen) that was the first residential construction project applying smart solutions on a big scale. It can be perceived as a social innovation process as well as prototyping the shift of an old heavy-industrialized area to a modern, green district. Known

[29] The UN 17 global goals and its 2030 Agenda are discussed in chapter 1 of this thesis.

initially as the Bo01 project, the Western Harbour shows most visibly the undergone transition that Malmö has experienced since the end of the 20th century (Malmö stad, 2016a). This project has a strong focus on sustainability, where housing, working spaces, new industries, education facilities and recreation areas have been created to achieve a more eco-friendly environment (Malmö stad, 2013). The area is to this day considered the biggest accumulation of energy-effective buildings in all of Sweden, where the energy is renewable and locally produced, using solar, water or wind power (Malmö stad, 2013, 2016a).
Even though the Bo01 construction project was created 20 years ago, it is still placed among forerunners in Europe and Malmö is very proud of the result. The Western Harbour is constantly developing and is estimated to reach completion around 2031 (Malmö stad, 2013). At the same time, work will continue in the eastern part of the harbour (swe. Nyhamnen) so that the city can expand its sustainable approach to further parts of the area. The area of Nyhamnen with its central location and vicinity to both the main railway station as well as the sea is aspiring to become a new city centre of the future Malmö [30] (Stadsbygnnadskontoret Malmö Stad, 2018).

Other examples in Malmö are the other flagship projects Malmö Hyllie, parts of Sofielund and Sege Park with its sharing economy agenda. All of these projects are prototyping some important questions of sustainability. The project in Sege Park is a test bed for sharing economy, part of the Sharing Cities Sweden programme. The reason why Malmö decided to implement a pioneering project there was because Sege Park is the space where all three dimensions of sustainability could be combined together, that is social, economic and environmental. With this project, the city enhances that there is often a lack of affordability within sustainable cities' projects in general, which can create social exclusion. Therefore, the agenda is to not only offer novel, pioneering solutions but also that the solutions are available and affordable to the citizens. Malmö recognizes the educational value in these projects as well, that the first choice options should be sustainable options. That said, one of the goals is also to change the citizens' behaviour, showing them that the systems we live in are important for how we behave.

The next step for Malmö is to work with the city as a whole, not creating new prototype projects but rather connecting all the prototyping into one common process. According to Christer Larsson, the UN's global goal agenda will help to connect the city as a whole and that is how the city strategy should be handled in the future. In that sense, the director of city planning believes that Malmö is among forerunners with this approach, since many of the cities are still in the prototyping phase. Malmö is leaving prototyping, trying to focus on connecting the city and its different projects as a whole concept. By doing that, the social aspect will be included in more adequate way, since the city should be treated first and foremost as a social phenomenon, not a concrete system.

[30] The comprehensive plan for Nyhamnen is published on the city's website and to engage citizens in the process, they are welcome to leave their opinions and objections about the project till 1st September 2018 (Stadsbygnnadskontoret Malmö Stad, 2018).

Importance of Open Data

Open Data is very relevant topic in Malmö City Hall and currently being discussed. The city decided to give away the data in the near future, considering the fast-paced technological development and more companies being interested in accessing the city's data. Simultaneously Malmö has to find some sort of financing before this step will be undertaken. Nowadays, the data in Malmö is not for free and the city is selling it to interested parties. It is though essential to keep in mind that the city takes responsibility that the data is correct, accurate, revised and up-to-date. There have been cases in which companies were not willing to pay and instead looked online for the data they needed and accordingly based their work on outdated data, which indicates that they work on old knowledge. Such situations should not have taken place and in line with some incidents as well as growing demand, the city understands that the data has to be made available in the near future. Politicians, however, do not have models for compensating municipalities for handling these processes yet, and while waiting for the regulations and legal framework to be created, Malmö continues to sell its data.

Collaboration and partnerships

Malmö is keen on using partnerships as a basis of their strategy, which are used in many different forms, where very often the city experiments with the approaches to collaborating. Gaining a broad experience with different types of partnerships for the past decades gives the city a rather optimistic view about managing partnerships in general.
The transformation of the city, which started in the 1990s was done by applying a Triple Helix model into the agenda, in which the business sector, academy and municipality work together. Nowadays however, due to the fact that time has changed and the challenges are much more complex, Malmö is applying a broader perspective by using for instance a Penta Helix model in which NGOs are included as well.

One example of a broad partnership that the city has is in the Hyllie district. By collaborating with E.On and using their smart grid solutions which are focused mainly on energy, Malmö is signing climate contracts with all the developers in the area and when the contract is signed, all the stakeholders are a part of the partnership. This is an example of a very broad partnership, where the city is arranging and managing it as well as building a dialog between the parties.

Moreover, Malmö recently established a partnership called M21, which is Malmö in the 21st century. It is a broad collaboration with big companies, like E.On, IBM, Massive Entertainment, IKEA and Skanska to establish a test bed for urban innovation, having the UN 2030 agenda as a basis (E.ON, 2018; Westerberg, 2018).

Whereas for instance in Gdynia trust is a major obstacle when collaborating with interested parties, Malmö does not have problems with trust but certainly recognizes the importance of it. The city chooses its partners cautiously, firstly setting up the common goal and discussing the way forward in the project. If these issues are thought through in the beginning of the process with all partners, the city hall has no reason to not trust the partners.

Taking into account that one of the UN's 17 global goals for sustainability are partnerships, Larsson can only see possibilities with partnerships if the actors are striving towards the same goal. In addition to trust, other success factors are needed, such as willingness to cooperate and mutual understanding of the fact that public sector and private sector have different objectives.
A fruitful and true partnership should rely on understanding the different incentives and roles of all parties included but at the same time find a common ground and take action towards a shared purpose. In the past when the city worked with partnerships the roles were more divided. However nowadays there is much better understanding of the process, also gained from the experience of different types of collaboration. Also, something that has to be decided quite early in the process is an answer to the question *'Why are we creating this partnership?'* and if you define it and come to an agreement with all the stakeholders, everyone will be devoted to the cause. Many companies, but not all of them, understand the above-mentioned aspects and know that they are very important in order to achieve a successful cooperation.

Looking upon projects that Malmö has conducted throughout the years, there are undoubtedly knowledge, skills and experience that the municipality gained through these partnerships. This knowledge, skills and experience can be used or adapted in new collaborations, which entails that the city as an organization is quite adaptive. As Christer Larsson states: *"I think that cities that are successful, they have also good partnerships. They work together with the business sector. You can't work like an alliance. That is absolutely impossible for the future. And that's why one of the global goals is partnership. (...) That's a key to success, I think."* The emphasis on cooperation between different sectors in Malmö is substantial. Collaboration between industry, the city hall, academia, the civic sector with its informal groups and NGOs is absolutely necessary for the city to be able to bring the best solutions available.

Citizen participation

According to Christer Larsson, the city of Malmö treats the topic of citizen participation as one of their priorities. There are different means of building dialog with the inhabitants and different stages of that process. Malmö has a very broad perspective on communicating with its people, for example through exhibitions, discussion panels, consultations or meetings in the neighbourhoods. In addition, the city includes citizens in its overall perspective on comprehensive planning that takes place once per few years. During this project a few years ago, the city included around 40 000 people in the process, which estimates 10% of Malmö's population. Now the comprehensive plan is going to be revised in 2019 and the city has ambitious plans when it comes to including inhabitants in this project.

While the city and the ways it communicates with citizens are constantly changing, at the time of the interview Malmö City Hall was establishing a new team for dialog with the citizens in the city department. The goal of recruiting for that team was to facilitate communication between the city office and citizens and have a more open dialog, rather than just giving information.

The other important fact is to reach out to citizens and find expertise and knowledge about problems that are occurring in the areas that the city cannot gain from the data. This

perspective might not be new but in the time of ever-present technological advancements steering people's everyday life, it is much more relevant than before. As mentioned earlier, the social aspect of the Smart City discourse is what is extremely important for Malmö and the focus on the social inclusion is in that case crucial.

Malmö has also worked with a lot of NGOs and with people that are engaged in small communities, especially in Amiralsstaden [31]. Events like the Opportunity Space Festival, which takes place yearly in a public sphere and brings together not only residents of Malmö but also asylum seekers and refugees, is a very important tool in order to support social and economic inclusion in the city.

Other observations

As for the importance of context for replicating Smart City solutions or a variety of models of collaborating in different cities, Christer Larsson says that it is important to have different perspectives while thinking about this question. The geography and specific conditions of each city are of great relevance, therefore one cannot simply take the Malmö's Western Harbour project and build it somewhere in China. However, it is definitely possible to use the knowledge about energy solutions applied in such a project, which could be exported and implemented to some other location in the world, since it is a technical solution. Simultaneously, talking about architecture and city planning, the cities can take inspirations from one another and use it as part of their strategy, but it has to be well-adjusted to the geographical and socio-economic conditions of the place as well as the expectations of the citizens. Models for partnerships could be applied successfully, keeping in mind the legal framework and special limitations as well as the culture that exist in a given country. Then such a model can be adjusted further to the existing system in a given country and serve as a basis for their respective way of collaborating. Therefore we see, the question of context is very valid and shows us that it is a complex matter without one simple answer.

[31] Amiralsstaden is a city development project, located primarily in the Rosengård area that focuses on social aspects of sustainability (Malmö stad, 2018a).

5 Analysis & Discussion

The following chapter aims to analyze and discuss the gathered empirical material, in line with the research questions and the purpose of the study. The emerging themes defined in the previous chapter will serve as a canvas to evaluate and compare cases with each other in order to bring an original contribution from the author on the topic of Smart Cities. A detailed table with information from each of the cases is provided in order to conduct a cross-case analysis, finding similarities, differences, and emerging patterns. Thereafter, the answers to all four research questions raised in chapter one are provided.

5.1 Case comparison – differences, similarities and emergent motifs

Chapter four supported this study with rich material coming from each of the cases. While preparing the findings section, the author already noticed the emerging themes in all of the cities, these were:

1. focusing on Smart City as a concept, e.g., sections 'Smart city in practice,' 'Examples of Smart City projects,'
2. focusing on ICT solutions and digitization-related topics, like 'Examples of Smart City projects' and 'Importance of Open Data' sections
3. focusing on different collaboration forms and the importance of partnerships in section 'Collaboration and partnerships',
4. focusing on the citizens' interest in the city's development, like 'Citizen participation section,' and
5. focusing on other observations in the last section, e.g., the validity of comparing cities to each other, the importance of context in replicating Smart City solutions, financial restrictions for the cities.

In order to examine similarities and differences between the cases, the author constructed a table with six variables: Smart City definition, types and examples of Smart city projects, the importance of Open Data platforms, approach to cross-sector collaboration, citizen involvement and awareness, and last, the importance of context. It is important to mention that five of these variables [32] were necessary to distinguish in order to answer research questions of this study in an in-depth manner. Smart City definition, as well as its types and examples, are a foundation to answer what Smart City is in practice from the public actor's perspective, importance of Open Data and examples of different Smart City projects help to define how much digitization influences Smart City projects, approach to cross-sector collaboration shows to what degree collaboration is needed in order to bring successful smart projects to life, and the importance of context variable answers the question if smart practices and solutions can be multiplied in a different setting.

From *Table 2* attached in this chapter further below, we see clearly that cross-sector collaboration and Open Data services are the two themes that are the most prominent in the

[32] Section 'Citizen involvement and awareness' is not directly needed in order to fulfil the purpose of this study, nevertheless the author believes it brings valuable information on how cities perceive this topic.

empirical material. They are the things all the cities put a strong emphasis on, claiming that they are important tools to bring innovative solutions to life [33].

In all the cases, the most important features of cross-sector collaboration are a shared goal between the parties, relationship based on trust and putting the citizens' needs in focus. For many of these cities, collaboration with knowledge institutions and universities are essential in order to bring the best possible service. While two of the cities, Gdynia and Malmö put a strong emphasis on working with the civic sector in forms of NGOs and different organizations, one of the researched cities, Malmö indicates all of the sectors, that is the industry, local government, academia, civic sector, and NGOs are necessary in order to bring successful Smart City projects. There are of course differences in types of partnerships the cities create, like partnerships with private companies based on Open Data (Warsaw), PPIP (Copenhagen) or applying models like a Triple helix or Penta helix [34] (Malmö). It is nevertheless important to know that all of these types have relationships based much more on openness, aligning incentives and collaborative spirit than traditional principal-agent relationships. Thus, based on all cases, the author believes that cross-sector collaboration is an absolute necessity in order for a Smart City concept to flourish.

In all of the cases, Open Data platforms are treated as a tool that has and is going to have great importance for smart solutions in the future. Out of four cases, three of them have free and unlimited access to data for the external parties that are continuously being updated and improved. The city of Malmö however, recognizes the need to release their data in the very near future, however still waits for a proper jurisdiction to be introduced about the topic and therefore continues to sell the data to interested parties instead. Besides Malmö, Copenhagen is another city that sees the Open Data platforms more broadly and recognizes the issues arising while using them, where people, organizations, and institutions do not keep up with the pace of technological change. What is essential to mention is that many Smart City solutions already implemented in the cities are based precisely on the available data, an example being: smart parking applications, air quality sensors or intelligent transport systems. The potential and possibilities the data provides are immense, however, it is important to bear in mind the continuous and abrupt pace in which this tool develops. Consequently, the author sees the role of digitization and ICT as substantial while bringing successful Smart City projects to life.

There are, undoubtedly differences between these cities in the view of what type Smart City projects they conduct (applying smart, tech-based solutions in big-scale construction and environmental projects in Copenhagen and Malmö vs. rather small-scale projects in Poland), accessibility to financial resources (Copenhagen and Malmö located in rich economies whereas Poland is still considered a secondary market, and therefore experiences many limitations for big-scale projects) or the importance of sustainability and cities' impact for environment and inhabitants (Copenhagen and Malmö have a very strong environmental focus that in the end improves the quality for life for its citizens and their health).

The table below supports the reader with abridged information on each of the cases, allowing the author to compare the cities based on six previously-defined variables.

[33] The most apparent similarities between cases are marked in bold font in the table.

[34] Note from the author: A Triple helix model is a stakeholder model of innovation that involves industry, government and academia to foster economic and social development introduced by Henry Etzkowitz and Loet Leydesdorff in the 1990s.

CITY	SMART CITY DEFINITION	TYPES AND EXAMPLES OF SMART CITY PROJECTS	IMPORTANCE OF OPEN DATA PLATFORMS	APPROACH TO CROSS-SECTOR COLLABORATION	CITIZEN INVOLVEMENT AND AWARENESS	IMPORTANCE OF CONTEXT
Warsaw	1. Smart City is a rather popular and overused notion; every city aspires to be smart 2. **What is important is bringing the best service to the citizens and their needs**; if the smart solutions help to achieve that, the city is keen on having them 3. Smart solutions help the municipality to operate effectively 4. Smart Cities are means rather an end	1. Three types of smart solutions: (1) driven by the city; (2) based on Open Data with a private partner, and (3) fully independent from the city but working for the city's needs 2. The role of the solutions is to either (1) improve quality of life or (2) diminish the costs of services 3. Examples are: 24/7 service connecting city hall with inhabitants, smart parking app, app for visually impaired, air quality index	**1. Important tool for bringing innovative solutions** 2. To a big extent based on geodetic cadastre and spatial data 3. Free and accessible to everyone via the Internet	**1. Collaboration is important in order to bring new solutions to life** 2. Favorable type of collaboration for Smart City projects is based on the Open Data platform **3. The above-mentioned type needs to base on trust and establish mutual goals** 4. Universities do not work with the city hall to a big extent	1. Limited data 2. Engagement and awareness is not very big but growing 3. Enhancement of civic engagement is one of the goals in agenda for 2030	1. Even though core issues for many European cities are the same, they should not be compared 2. Every city should apply solutions suitable to their needs, based on the demands of the environment and legal framework
Gdynia	**1. Smart City's crucial features are the citizens and their needs** 2. Being smart is giving citizens many opportunities, so they	1. The role of the solutions is to either (1) improve the quality of living or (2) decreasing long-term costs for the city 2. Examples are: car	**1. Important tool for bringing innovative solutions** 2. Open Data platform recently	**1. Collaboration is important in order to bring new solutions to life** 2. It is significant to work not only with businesses but NGOs and different	1. Citizen involvement in Gdynia is considered one of the highest in the country 2. Many citizens take	1. Cities should not be compared to each other strongly 2. The issues that cities are facing are dependent on different factors, e.g., its

	are satisfied with the city 3. Smart City is a never-ending list of things to improve 4. 'Smart' is an interesting notion: there are no 'smart' or 'stupid' cities	sharing service, intelligent transport system, one number service to the city hall	created 3. Free and accessible to everyone via the Internet	organizations as well 3. **Trust is an important component while establishing collaborations**; lack of trust is an obstacle that Gdynia experiences 4. Universities expertise is important, and the city collaborates with them	an active part in the city's actions 3. NGOs are very present while establishing new projects	capacity, financial resources
Copenhagen	1. Smart City definitions can vary from city to city, e.g., from technological focus, to focus on small, local businesses 2. Copenhagen's smart goal is to be CO2 neutral by 2025 3. The city has its own incubator for Smart City and sustainability-related projects that work cross-sectionally between different city departments	1. The city applies a lot of smart solutions in big projects, for instance, environmental concerning for instance water sanitation and sewage system, heavy focus on green mobility, district heating based on biomass 2. Other examples: air quality and noise sensors, smart parking	**1. Important tool for bringing innovative solutions** 2. Both the city Open Data platform as well as Open Data platform basing on combining private-public data 3. The world is not yet fully equipped to use Open Data platform to its full potential	**1. Collaboration is important in order to bring new solutions to life** 2. **Pure type of partnership based on openness, trust, aligning incentives and collaborative spirit is essential** while handling innovation-based projects (PPIP) 3. Decisive components: collaboration, networks, and knowledge 4. Universities expertise is important, and the city collaborates with them, however, cities need to balance knowledge taken from universities and companies	1. Engagement and awareness is not very big however much bigger than in other countries 2. It is important to reach out to citizens to gain knowledge that cannot be taken out of data	1. Limited data

Malmö	1. Smart City works as a tool that has much more to do with technology and ICT in forms of smart grids, smart mobility, smart energy **2. Smart City concept does not include the social aspect sufficiently, where the citizens are in the center of focus** 3. Malmö considers itself a sustainable city and looks at smartness in a much broader way 4. Malmö's sustainable agenda is to implement UN 17 global goals in all sectors of city life	1. The city applies a lot of smart solutions in big projects, for instance, residential building projects or environmental, where locally renewable energy is used along smart grids applied in Hyllie or Western Harbour 2. Connecting the city into a whole common process, leaving prototyping for certain projects concerning sustainability	**1. Important tool for bringing innovative solutions** 2. Malmo treats this topic with high priority 3. The data in the city is not yet public, however, the city sells it to interested parties 4. The city waits for regulations and legal framework around the Open Data platforms	**1. Collaboration is important in order to bring new solutions to life** 2. Collaboration between industry, the city hall, academia, civic sector NGOs is necessary 3. Successful cities have good partnerships 4. It is good to experiment with different types of partnerships 5. Malmö used to apply Triple helix model while establishing their collaborations; now it uses Penta helix model more frequently 6. Trust is an important component while establishing collaborations, however, Malmö has no problems with trust **7. Pure type of partnership based on openness, trust, aligning incentives and shared goal is essential**	1. Malmö treats citizen participation as one of their priorities 2. Constantly changing the ways of communicating with citizens and having very broad perspective 3. It is important to reach out to citizens to gain knowledge that cannot be taken out of data 4. NGOs are very present in the city's life	1. The importance of context is a complex issue 2. Many smart solutions simply cannot be copied due to geography and specific conditions of each city 3. It is possible to use the knowledge about different smart solutions and apply it somewhere else since these are technical solutions 4. Models of different partnerships could also be applied in a different setting but only having in mind legal framework and specific condition of each country and city

Table 2. A summary of Warsaw, Gdynia, Copenhagen and Malmö cases based on six variables

Since the preliminary focus of this dissertation is to establish how the public sector, in the form of city governments, looks at the concept of Smart City in practice, and secondary focus lays on cross-sector collaboration and digitization, the author focused on these aspects while analysing the empirical material and therefore, due to limited scope of this study, will not research more combinations of similarities and differences between the cases. A detailed account of Smart Cities definition and its examples, cross-sector collaboration and digitization's influence on this phenomenon as well as the importance of context and environment for Smart City projects are provided while answering research questions in the next sections of the analysis & discussion part of this paper.

5.2 Smart city in practice

The short overview of Smart City discourse supported this study with an understanding of imprecision in definitions that exists in the literature. The strong emphasis on ICT in forms of various tech appliances to make the cities more efficient is, however, the most conspicuous characteristic that many researchers and especially companies base their definition on. For city managers, the concept is though more complex.

Based on Warsaw, Gdynia, Copenhagen and Malmö cases, a Smart City is a city that as a crucial feature holds its inhabitants and their needs. In all of the cases, bringing the best possible knowledge and service to them as well as focusing on the social aspect, seems to be the core of the concept of smartness. ICT and digitization, as well as cross-sector collaboration, are therefore tools to provide the best services. A Smart City, thus, according to the author, keeps up with the change of the environment and growing expectations of the citizens.

City managers do recognize the popularity of the notion itself, indicating that it is also a double-edged sword for cities to call themselves smart, where many cities nowadays overuse that word in 'urban labelling' phenomenon. Therefore, in that reasoning, we can find the linkage to the criticism and more cautious approach towards the concept from scholars like Hollands (2008), Vanolo (2014) or Townsend (2013).

The examples of Smart City projects between the cases vary, however, we can easily notice the same type of projects in forms of air quality apps and sensors (Warsaw and Copenhagen), one number comprehensive city service (Warsaw and Gdynia) or intelligent parking applications (Warsaw and Copenhagen). Moreover, in all of the cases Open Data platforms that function as a basis to establish collaborations with different stakeholders for smart or sustainable projects, are for a fact, a necessary tool for the cities to develop further and race together with the pace of technological development.

The author though believes it is important to indicate that cities located in Scandinavian countries, treat the topic of sustainability as one of their priorities of smartness goals, investing heavily to become a CO2 neutral capital, like in the case of Copenhagen or building sustainable residential areas with highly energy-effective buildings, in case of Malmö Western Harbour or Hyllie. Thus, it appears that Scandinavian undertakings on the concept of smartness are more grand and have humans' impact on environment strongly interwoven to their agendas for the future. This is prominent in many developed countries

with rich economies, where there is a strong focus on renewable sources of energy and humans' environmental impact not only on the city, while producing for instance exhaust fumes but globally, to treat this problem more broadly. The author believes this differentiation between European regions (Scandinavia vs. Poland) is based on the welfare of each country as well as cultural and historical context. Poland is still one of the countries with significantly low wages in European Union (along with another countries located in the former post-communist block), and its energy resources are in 80% based on coal (Mikulska & Kosinski, 2018), which has its revered tradition in the country's history.

This dissertation's main objective was to outline what the notion of Smart City entails in practice from the public actor's perspective based on the collected material. The following research question was formulated to support this purpose:

(1) *What does the notion of Smart City entail in practice? Is the theory on this concept omitting some important elements?*

To answer this question from the gathered material in all four cities, the author claims that Smart Cities in practice from municipalities' perspective are cities that treat their inhabitants and their needs as a number one concern. Keeping up with the current pace of change, collaborating with different non-governmental parties and applying ICT and novel solutions, which the Smart City literature focuses so much on, are things that cities must do in order to be able to bring the best possible service. However, this does not entail that Smart Cities are cities with the highest amount of tech appliances and should be by all means in the focus of the discussion over the phenomenon. ICT and digitization can help the city governors to implement projects, that either decrease the costs in the city budget or directly improve the quality of life for the people. The examples are numerous, e.g., smart lighting, intelligent transport systems, air quality sensors or application for visually impaired people. Nevertheless, it is all about making the cities work more efficiently and be more friendly towards the citizens. Thus, the author undermines the fully techno-centric vision of Smart City discourse, which is not fully just to the presence of the concept in practice, and favors theories that aside from ICT and digitization, have a more holistic approach and highlight the citizens and their needs.

5.3 Collaboration and digitization – the drivers behind Smart City projects

As mentioned before, the highest amount of similarities in the cases could be found in their approach to cross-sector collaboration and Open Data platforms. Collaboration between the cities and various non-governmental stakeholders is viewed as a basic fundament, and something desired while bringing novel solutions to life for the sake of common good (Smith & Thomasson, 2018; Van den Bergh & Viaene, 2016). Many cities gave their examples of successful smart or sustainable projects, that would not be possible, without the expertise of different parties. Cross-sector collaboration involving not only municipalities and businesses but also NGOs, universities and research institutions as well as different civic organizations,

appears to be the modern course of handling change and uncertainty when it comes to innovation-based projects. Aforementioned governing schemes in forms of PPP or PFI, hence, seem to be outdated and the need of establishing new partnerships by cities is explicitly visible in the cases. Warsaw has it's 'third way' of collaborating with private companies based on the city's Open Data platform, Malmö experiments with different types of partnerships, also taking inspiration from different stakeholder models like Triple helix or Penta helix, whereas Copenhagen applies PPIP, a 'pure' type of partnership, that is based on openness, trust, aligning incentives and collaborative spirit to help the ideas to grow. Innovation appears to function as a peculiar bond, that brings all the sectors together.

On the other hand, the importance of big data and digital technologies, like ICT, cloud computing, social software or sensors, emerges as very important challenge for the cities manage not in number of years, but now as we speak. City officials, however, need knowledge, experience, and expertise from either tech companies, or knowledge institutions, to be fully aware of the capacity and possibilities these tools can offer and the hazards they bring. Since the cases provide the reader with many examples of collaborations with the usage of ICT and tech appliances, the research question below seems legitimate.

(2) *How collaboration and digitization influence the Smart City development? Are they important tools for a Smart City to flourish?*

The author strongly believes that collaboration, in the form of external cross-sector collaboration and digitization, are the drivers behind Smarty City projects. They both influence Smart City concept development, making the projects more sustainable, better adjusted to citizens needs and better prepared for the future.

Furthermore, the author tried to examine what is a desirable form of collaboration in Smart City projects in the following research question:

(3) *What desirable form of collaboration should be applied while handling the process of innovation and change?*

The extensive information about the collaboration in all of the cases shows the different types of the partnerships the cities use while handling the process of innovation and change. Nonetheless, all of these partnerships share the main characteristics. The desirable form of collaboration between the city and various non-governmental actors in Smart City projects is based on trust, establishing mutual goals and openness. Despite differences in the types of partnerships the cities create, these similarities show how universal the approaches of city governors are. What is intriguing about the city practitioners perceptions, is the fact that they correspond almost fully to the theoretical core of cross-sector collaboration. The theoretical overview of collaboration namely indicates that a successful partnership bases on mutual trust, mutual dependency, active participation and a fixed common goal for all the parties included (Hilvert & Swindell, 2013; Selsky & Parker, 2005; Smith & Thomasson, 2018). It also indicates that such collaborations, like in all the researched cases, bring more expertise to organizations and provide innovation boost (Hilvert & Swindell, 2013).

5.3 The importance of context

With the fourth and last research question of this study, the author's incentive was to determine if Smart City practices or solutions for certain issues that are similar in different cities of different countries, can be compared to one another and applied on a bigger scale. Two out of four cities (Warsaw and Gdynia) replied to this question in a resembling manner, indicating that Smart City solutions cannot be replicated in another setting, because they would not meet the demands of the environment, socio-cultural predispositions and legal framework of the given city and country. However, looking upon provided examples by the author, about a comprehensive approach to sustainability in Scandinavian countries, compared to Poland as well as financial restrictions put on long-term projects in Poland, we can see that the context is vital when we talk about bringing Smart City solutions to life. What solutions the city will apply is entirely dependant on the specific needs of the given city, and Polish needs, as proved in this study, will not match the needs of Copenhagen or Malmö, located in richer countries. Hence, the author agrees with a more detailed opinion from Christer Larsson, from the city of Malmö in that regard.
To answer the following question:

(4) Can Smart City practices and solutions be multiplied in a different setting?

the author strongly believes that Smart City projects cannot be exactly multiplied in a different setting, however, the knowledge about technical solutions can be used. Models how to approach cross-sector collaboration when it comes to innovation-oriented projects can serve as an inspiration to other cities since they are dependent on common practices and legal framework in a given country. Therefore the question of context is complex, but as this research proved, certainly valid while talking about Smart Cities.

6 Conclusions

We live in the century of cities. The role of the cities was never more important for future world development and economic growth, as it is now. However, the immense growth produced in the cities is not all good. The problems the cities are facing nowadays are compound and far-reaching and cover issues like: poverty, lack of housing, aging infrastructure, depletion of resources, CO2 emissions, water pollution, increasing population, social inequality and lately, immigration. Simultaneously, the cities have to manage their ways in ongoing and fairly unexplored processes of technological development and digitization, which are the main components of the Second Machine Age the humanity goes through. All of these tensions as well as the abrupt and unexpected pace of change, require coping strategies that the city managers need to establish. The managerial challenges and the expectations put on the public sector in the form of municipalities, as a provider of services are tremendous and require specific expertise and long-term strategies. Thus, many cities in the world are becoming engaged in Smart City strategies to tackle the ambiguity of the challenges that arise with the urbanization process.

The purpose of this dissertation was to examine what Smart City concept entails in practice rather than a theory, with a clear secondary focus on digitization and collaboration as the means to deliver successful Smart City projects. The author also researched the importance of context for multiplying Smart City projects in different settings. The public actor's perspective was based on the collected empirically-driven material from four different cities, located in three European countries: Warsaw, Gdynia, Copenhagen, and Malmö.
The case study analysis with extensive empirical data, led the author to undermine the fully techno-centric vision of Smart Cities that is most apparent in the theoretical discourse, in order to focus on a more holistic approach, where the different Smart City aspects are complementary to each other and most importantly, the citizens and their needs are treated as a priority. Bringing the best possible service for inhabitants and being engaged in their growing expectations constitute a Smart City. To bring this best possible service and improve efficiency cities should be proactive about the current pace of technological change, collaborate with different non-governmental parties and apply ICT and novel solutions.

Moreover, in line with the secondary objectives of this thesis, based on the comparative case study it was established that cross-sector collaboration and digitization are the means to deliver successful Smart City projects. Thanks to cross-sector collaboration and digitization, Smart City solutions result as more sustainable and better adjusted to citizens' needs. The partnerships become most beneficial, when they involve not only municipalities and private companies but also NGOs, research institutions as well as different civic organizations, which appears to be the modernized approach of managing change and uncertainty when it comes to innovation-based projects, in comparison to tradition principal-agent based governing schemes. The innovation-based projects, like Smart City projects, require collaborations that are deeply based on trust, establishing mutual goals and openness between the municipalities and different sectors. The similarities between cases in this matter depict how universal the approaches of city governors are.

Simultaneously, digital technologies and ICT reshape the way cities work, cooperate with different stakeholders and communicate both internally and externally. Thus, cross-sector collaboration and digitization are the key factors to deliver successful Smart City projects.

The importance of context in the perception of establishing smart solutions or sustainable projects, should not be diminished. It is a complex, but valid factor that has an impact on Smart City development. Cities are determined by their financial capabilities, geographical environment, socio-cultural background and legal framework of the given city and country. Hence, Smart City projects cannot be exactly multiplied in a different setting, but they can serve as inspiration or be a source of technical knowledge.

This project sheds light on the public actor's perspective on many actual topics for the globalized urban world we live in. By interviewing deputy-mayors of the cities, strategists and project leaders, the author gives the opportunity to look at Smart City concept from a practical, rather than theoretical standpoint. The thesis can raise awareness among cities of how the projects handling innovation and change could be handled by others and the variety of types for cross-sector collaboration with external parties.

Thereby, this dissertation provides deep insight for private companies and other non-governmental organizations of how cities tackle Smart City projects, how they perceive collaboration and operate for their citizens, who are continuously affected by new technologies and demand improved services with each day. The contribution of this research project is, therefore, to serve as inspiration for other cities and to function as a tool for raising awareness for businesses and other sectors.

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List of appendices

Appendix 1
Interview questions

1. Does X consider itself a smart city? Does it aspire to be one?
2. What then is a smart city for you?
3. How big a role do the innovation and technology boost play in this smart city?
4. How are smart city/sustainable projects typically carried out in city X? What is the role of private companies in this process?
5. Is PPP a popular type of cooperation in city X ? Why/why not?
6. What are other types of cooperation that involve private actors in your city? (concession/ standard tendering e.g.)
7. What are the key prerequisites for success in collaborating with private businesses for city X? And what are the barriers?
8. Do national politics have a big impact on PPP governing in Smart City projects in city X? If so, does it cause any hindrances?
9. Does city X encounter situations when Smart City/sustainable projects with businesses are made but the projects do not reach completion? If so, what are the reasons for projects to fail?
10. How big is the interest from citizens in Smart City projects? How big is the awareness that they can contribute to the city's development?
11. In what ways does city X include citizens in the city's development?
12. How important is citizens' involvement to create a promising Smart City project but even in a broad sense, a sustainable city?
13. How important is the participation of universities, research institutions and other specialist knowledge to create a promising Smart City project but even in a broad sense, a sustainable city?
14. **Research question 1:** How does a smart city correlate with a PPP governing scheme? Is PPP a needed form of cooperation to foster smart cities or future competitive smart cities?

    Research question 2: What is fostering the Smart City development for city X? What are the essential components to bring the best Smart City solutions for city X?

Appendix 2
Follow-up questions for Gdynia

1. How do you see universities and research experts being a part of bringing Smart City projects to life? Is Gdynia collaborating with them while establishing Smart City projects? Where does the city get the most accurate and up-to-date expertise?

2. It has been a year since the launch of Gdynia's platform for Open Data. What did the platform bring to the city? How big is the interest from companies and citizens? What has been the learning experience of the Open Data project so far?

3. Last year, the interview gave insights into car-sharing in Gdynia and a soon implementation of this smart solution but with a focus on electric cars. Since the project is running since October 2017, what learning experience has Gdynia gained so far?

4. Why is the traditional, law-regulated PPP type of cooperation not so common in Gdynia?

5. What types of partnership are most popular in the city? Tendering/concession/some other type of cooperation? What type of partnership is the city creating when it comes to bringing a smart solution to life?

6. How do you see national politics affecting cooperating with businesses for a city like Gdynia?

7. Last but not least, do you recall any experiences with partnerships (that are handling innovation, sustainability etc.) throughout the period of last year that were informative and left the city managers with some new insights on the way of collaborating? Were there any examples of successful/unsuccessful projects?

Appendix 3
Follow-up questions for Warsaw

1. How do you see universities and research experts being a part of bringing Smart City/sustainable projects to life? Is Warsaw collaborating with them while establishing Smart City projects? Where does the city get the most accurate and up-to-date expertise?

2. Warsaw just raised a very far-reaching strategy for 2030. How big a role do sustainability, innovation and partnerships (not only with businesses) play in this strategy?

3. Would you say that citizen contribution in the city's life is big in Warsaw? What is the citizens' awareness of the process of changing the city and how big actually is their involvement in pointing out problems? Would you say that many people are aware that they can make a change?

4. How do you see national politics affecting partnerships with businesses for a city like Warsaw?

5. Last year the interview gave insights that in 2018 Warsaw was aiming to introduce its own project on air quality in the city based on beacons. What is the status of this project currently? (Warszawski Indeks Powietrza, introduced in early 2018)

6. Last but not least, do you recall any experiences with partnerships (that are handling innovation, sustainability etc.) throughout the period of last year that were informative and left the city managers with some new insights on the way of collaborating? Were there any examples of successful/unsuccessful projects?