

**Smart cities: theory vs. practice**  
**A comparative case study between Warsaw, Gdynia and Malmö.**

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# 1. Introduction

This study is concerned with the phenomenon of Smart city and the comparison between theoretical viewpoint and practical on that matter.

## 1.1 Background

Approximately 55% of the world's population, i.e. more than 3.5 billion people, live in cities (United Nations, 2016). This is expected to rise to 60% by 2030. Cities are increasing in number and in size: from 83 cities with over 1 million inhabitants in the 1950s to 512 such cities in 2016 (PRB, 2009; United Nations, 2016). This continuous process of urban growth happens mostly through migration from rural areas or even foreign countries to cities that offer a vast variety of lifestyles and a higher average income (Dixon, 2012, Public Reference Bureau, ref add). City governors and municipal planners are facing substantial challenges: an ongoing course of change as well as a long-term impact of their decisions (Dixon, 2012).

The unprecedented urban growth is not only visible in the population figures mentioned above, but also in rising energy consumption, pollution, congestion and urban sprawl, as well as healthcare and transportation requirements (add references, Smart City Expo World Conference, Governance - PPPP and strategic partnerships to foster smart cities, 2015). Urban areas house 55% of the world's population on 3% of the world's land surface, whereas they consume between 60-80% of energy and produce 75% of carbon emissions (United Nations, 2014). The rising demand is to tackle the cities' issues efficiently and at the same time with sustainability in mind. Therefore, bringing the best available knowledge and solutions to action is essential. One of the most important questions about city development is how to make the desired changes happen (Smart City Expo World Congress, 2015), considering that many cities are facing similar problems, such as aging infrastructure, vulnerability to climate change, shrinking per capita budgets, increasing congestion and shortage of housing (Dixon, 2012). When expanding, these problems become worse since facilities have to be in place before the new citizens (and their tax payments) come in. Simultaneously, each city is different and requires approaches that are suitable to their environment as well as their unique cultural and historical heritage.

The innovation processes happening currently in urban areas are started both by and for cities themselves, as they are hubs for knowledge and new solutions and as such willing and suitable testing places for these new solutions. Cities are the drivers of human development, considered

to be the biggest hope and future for profitable growth. Cities make up the heart where all of the advancements, digitalization processes, networking technology and novelty are first implemented and then multiplied on a bigger scale (Dixon 2012). Wide access to a variety of jobs, the best available healthcare, a far-reaching offer of culture and entertainment, commerce, the newest technology from companies and universities, and innovation hubs are simultaneously the drivers of economic development and reasons why cities become more and more densely populated (Giffinger et al., 2007).

“Managing urban areas has become one of the most important development challenges of the 21st century.” says John Wilmoth in United Nations, (2014). Both this statement as well as the prognosis that the *urban* population across the globe is expected to outreach six billion by year 2045 (United Nations, 2014), and that the ongoing Second Machine Age leads to continuous technology development that affects and redesigns people’s everyday life (Brynjolfsson & McAfee, 2014), cities must be managed well i.e., prepared for the future. They should be offering opportunities for all of their residents, whilst simultaneously decreasing existing inequality, thriving to grow, using the available resources wisely.

Cities have to simply become smarter in their approach to resources and handling existing capacity (Dixon, 2012). The notion of *smart city* is often mentioned as the term for this phenomenon, especially in the last two decades (Van den Bergh and Viaene, 2016). Inventive and spot-on use of technology and maximizing the use of the city’s resources in an efficient and sustainable way are examples of features cities that aspire to be called smart can have (Giffinger et al., 2007; Lombardi et al., 2012; Albino, Berardi and Dangelico, 2015; Van den Berghe & Viaene, 2016; Harrison et al., 2010). Unfortunately, there is no clear definition what a smart city actually is (Van den Berghe & Viaene, 2015; Albino, Berardi and Dangelico, 2015; Giffinger, 2007; Lombardi et al., 2012) The need is recognised to contrast literature perception of what a smart city entails with daily empirical practice, which apart from a few cases studies (e.g. Snow, Håkonsson and Obel, 2016; Van den Berghe and Viaene, 2016) to be the lacking component in journal articles.

## **1.2 Context**

### *Public actor’s perspective*

As established above, cities are in the process of ongoing change that needs to be handled carefully with a long-term sustainability mindset. It is considered crucial that our research on cities has a public official's perspective since the mayors, deputy mayors, city councillors and

civic servants in the municipalities are the ones who make decisions and form the shape of the city, any city for that matter, for the future. The public actor's focus is essential here, having in mind that it helps us see the process of managing change and innovation in practice, as well as managing unknown future development. Interviewing people in managerial positions (deputy mayors, project leaders in the cities) sheds light on the current challenges the cities are facing as well as strategies of local governments on how to solve them.

### *Researched cities*

For this research, three cities were chosen: Warsaw and Gdynia, located in Poland, and Malmö, located in Sweden, for this comparative case study. These cities were chosen due to numerous reasons: firstly, all of them are considered big cities (+200 000 inhabitants), with Warsaw, the Polish capital, the biggest with nearly two million inhabitants<sup>1</sup>. The large population in these cities entails much more complex decision-making and strategy processes for the city governors that need to create sustainable and resilient cities for the future growth. Additionally, 40% of all European urban cities live in mid-sized cities between 100 000 and 500 000 inhabitants, including Gdynia<sup>2</sup> and Malmö<sup>3</sup>. Thirdly, all of these cities are somewhat different sizes, which will help us to explore how different the issues encountered and solutions implemented are. Moreover, Warsaw, Gdynia and Malmö are considered being technological hubs with flourishing IT-oriented businesses. And last but not least, Malmö is a city in transition from a working-class industry-heavy city, to a knowledge-based economy (Carlström, 2016).

## **1.3 Research Purpose and Questions**

With Smart City projects being a new phenomenon that has not yet been fully researched and thoroughly explained by scholars, a great potential is observed in looking at these projects from an empirical rather than a theoretical point of view. Therefore, the purpose of this study is to explore the knowledge of how Smart City theory corresponds to practice and if there are any aspects of this phenomenon that researchers are omitting or need to pay special attention to in the future.

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<sup>1</sup> Warsaw had 1 753 977 inhabitants on 31/12/2016 (Urząd statystyczny w Warszawie, 2017)

<sup>2</sup> Gdynia had 246 911 inhabitants on 31/12/2016 (Główny Urząd Statystyczny. Baza Demografia, 2017)

<sup>3</sup> Malmö had 328 494 inhabitants on 31/12/2016 (Malmö stad, 2017b)

Ultimately, the ambition with this study is to serve as a beneficial contribution for city authorities across Europe on how their agenda for sustainability and technological development should be handled in the long-term perspective as well as identify Smart City research gap areas for academics that need to be further researched in the future studies.

In line with the outlined purpose of this dissertation, the main research question that will be attempted to provide an answer for is: *How does smart city theory compare to practice?*

To achieve a broad account of the topic, the two following questions are defined, that need to be answered:

1. *What does the notion of smart city entail?*
2. *What are the key characteristics of smart cities?*

Both these questions will be initially answered from a theoretical perspective, and then analysed through comparison with the case studies.

## **2. Literature review**

The goal of this chapter is to establish a framework that repeats throughout the thesis. To do this, existing literature is used to 1) explore what a smart city entails and 2) to assess the extent and form of the current research. The research goals include comparing smart city theory to practice, which means that the theory from the literature will be expanded on in the empirical case studies. The idea is to find a theoretical framework based on quantitative studies, and assess this framework through qualitative data. The end result, after analysis, should yield a more practical version of the framework, which can subsequently be used in further research.

### **2.1 Smart city as a phenomenon - definition**

‘Smart city’ is currently not more than a notion. It is not an established concept or theory, there is no clear definition that is universally accepted. It is not a protected term and there are no repercussions for calling a city ‘smart’ that arguably is not or does rather little to deserve the title. Regardless, it is used for city marketing or by companies such as IBM (Harrison et al., 2010). The term has become fashionable in the mid-90s (Albino, Berardi and Dangelico, 2015) and has grown in popularity ever since (Lombardi, 2012).

Even in academic literature, a definition is not necessarily a given. A third of the papers on smart cities researched by Meijer and Bolívar (2016) lacked one. However, the articles that do supply definitions tend to use their own, as surveyed by Albino, Berardi and Dangelico (2015) and Meijer and Bolívar (2016). Rather than adding yet another definition to the list, we choose to instead look at patterns and observations from these aggregated papers.

According to the overview by Meijer and Bolívar (2016), there are generally three types of smart cities identified: those using smart technology (technology focus), smart people (human resources focus), smart collaboration (governance focus), or some combination of the three. Of the defined papers in Meijer and Bolívar (2016) that have a definition, and can be classified as one of the three individual types rather than a combination, the technology focus is more prevalent than the other two types together.

There are a number of arguments for using each focus, starting here with technology. Streitz (2011) for instance, poses the following question: “How can the realization of a Smart City contribute to reducing and potentially even avoiding some of the problems that are faced by today’s cities and in the future?”, which is then rephrased into “How can ambient and ubiquitous ICT help to contribute to Urban Life Management?” For Streitz, a smart city is synonym to ambient and ubiquitous urban ICT. O’Grady and O’Hare (2012) describe the use of technology in cities as “a way to make the human environment more responsive to individual

needs”. Other definition attempts go further than merely ICT, even if it remains the primary point in some papers. “The concept of Smart City is concerned primarily with integration of ICT with processes performed in the city [...] with the aim to obtain optimal efficiency of these processes [...]” (Gontar, Gontar and Pamuła, 2013). Similar definitions can be found from the ICT industry, such as from IBM, who denote that a smart city is “an instrumented, interconnected and intelligent city” (Harrison et al., 2010; Gontar, Gontar and Pamuła, 2013), i.e. a city that uses sensors in the broadest sense of the word, connects them to a shared platform across governmental services, and which uses the data from these sensors for analysis and modelling to make better decisions (Albino, Berardi and Dangelico 2015). This notion of technology is also what logically has become in practice known as ‘smart’ by the citizen - who is increasingly buying smartphones, smartwatches, smart kitchen appliances and smart energy meters - where the smartness is expressed as the digital and connected nature of these appliances. This as opposed to landline or simple mobile phones, mechanical watches, display-lacking fridges and coffee machines, and wall-mounted manual thermostats (Lazaroiu and Roscia, 2016). Speakers at smart city conferences (Smart City World Expo Congress, 2015) are also often focused on the technological solutions that were provided to the problems in the city. Because of this ubiquity of technological definitions, examples of the technology focus are not difficult to find: the newest generation of buses in Edinburgh (Eurocities, 2015), electric car charging points in Amsterdam (Eurocities, 2016a).

There are definitions in the literature too that omit the explicit mentioning of technology, and thus might fit into the smart people and/or the smart governance categories from Meijer and Bolivar (2016). An example that fits in both of categories is from ICLEI in Guan (2012): A smart city is “a city that is prepared to provide conditions for a healthy and happy community under the challenging conditions that global, environmental, economic and social trends may bring”. Thite (2011) interprets the term ‘smart city’ as a creative city, “aimed at nurturing a creative economy through investment in quality of life which in turn attracts knowledge workers to live and work in smart cities”, and fits as such in the ‘smart people’ category in Meijer and Bolivar (2016). An example of using smart people is given in the municipality of Utrecht, where City Talks were initiated on the environmental strategy to be taken by the city (Eurocities, 2016b).

The question can be raised if being a smart city is the end, or merely a means to an end. With this dissertation, the aim is to uncover if this focus on technical solutions in the literature is justified. After finding that there are two more categories of smart city, the focus in finding a definition should maybe not lie on using technology to the extent it is done in much of the

literature. Merely regarding smart cities as technologically innovative would make the notion about digital rather than smart cities (Lombardi et al., 2012).

Whichever definition is chosen, it is evident that smart cities are inherently connected to innovation. Smart cities are about introducing new thought, and new technology into city government and city life.

## **2.2 Features of a smart city**

The second question to consider, is establishing what a smart city consists of. This has various uses, one of which is the ability to directly compare cities to each other to learn from each others' problems and solutions (ISO, 2014), if these so happen to be similar. A next step in comparing cities is to construct rankings. These are valuable for companies to investigate what the most attractive places are for their expatriates (Giffinger et al., 2007) or local politicians who are in a competition with other cities in attracting inhabitants and businesses (Giffinger et al., 2007). Rankings are based on scores, and several measurement systems to calculate such scores have been proposed. All specify a set of variables that are assumed or argued to be relevant to smart cities, and that - in principle - can be measured across each city. Examples are the International Organization for Standardization (ISO, 2014), which developed a standard set of 100 variables that can be compared worldwide. The European Union, on the other hand, uses 18 variables in assessing where funds should be applied for the Horizon 2020 project (ref and check and explain). Lombardi et al. (2012) base their assessment on the interaction between different actors in a smart city and different clusters of activities, yielding a total of 60 variables. However, the most prevalent (Vanolo, 2014) of these measurement systems is the one devised by Giffinger et al. (2007), who define separate characteristics first, and subsequently find factors defining these characteristics [table 1], which are in turn expressed by specific variables. The prevalence of the system comes from the use of these characteristics in describing, and sometimes defining, what a smart city entails in several works in the literature (Lombardi et al., 2012; Czupich, Kola-Bezka and Ignasiak-Szulc, 2016; Albino, Berardi and Dangelico, 2015) on the smart city subject.

| <b>Characteristic</b>                             | <b>Factors</b>  |
|---|---|
| Smart economy<br>- <i>competitiveness</i>         | Innovative spirit, entrepreneurship, economic image and trademarks, productivity, flexibility of labour market, international embeddedness                                  |
| Smart mobility<br>- <i>transport and ICT</i>      | Local accessibility, (inter-)national accessibility, availability of ICT infrastructure, transport systems that are innovative and safe                                     |
| Smart governance<br>- <i>participation</i>        | Participation in decision-making, public and social services, transparent governance  |
| Smart environment -<br><i>natural resources</i>   | Attractivity of natural conditions, pollution, environmental protection, sustainable resource management  |
| Smart living - <i>quality of life</i>             | Cultural facilities, health conditions, individual safety, housing quality, education facilities, touristic attractivity, social cohesion                                   |
| Smart people<br>- <i>social and human capital</i> | Level of qualification, affinity to long life learning, social and ethnic plurality, flexibility, creativity, cosmopolitanism/open-mindedness, participation in public life |

Table 1. Characteristics and their determining factors of smart cities according to Giffinger et al. (2007).

The framework outlined above in table 1, that Giffinger et al. (2007) provide in their work, will be the framework for this research. It is, as mentioned, a widely accepted overview of what a smart city constitutes as well as a common reference for other theory (such as Lombardi et al., 2012). The categories can be measured and assessed quantitatively through the variables that Giffinger et al. (2007) propose for each factor, but the characteristics and factors can also be used as a starting point in a qualitative research. Therefore, this framework is seen as a valuable tool that will help to provide answers to the research questions. The factors are used for assessing in which category a certain project or idea that the interviewee talks about belongs, and then for qualitatively assessing how each city performs if data is complete enough to do so. This first writing down of the data is then followed by the analysis in which the cities are compared to each other and to the theory.

### **3. Methods**

This thesis is an inductive comparative case study, testing smart city theory perceptions in practice in three European larger cities. We aim to discover whether these perceptions in theory are perceived in the same way by city officials. To achieve this, the theoretical framework was used that is described in the previous chapter, and apply this framework to each of the three cases. This comparative case study should then result in findings that may be different than those in the theory, which can then be used for identifying misperceptions in the theory, as well as for identifying suggestions for further research.

The comparative case study method is chosen because of the possibility to generalise findings (Saunders, Lewis and Thornhill, 2009). Even though a sample size of three is small, a pattern that emerges in more than one city is worth investigating beyond the scope of this thesis. The inductive nature of this study gives us the possibility to investigate discoveries from the first case in the other cities too.

The governmental managerial perspective was chosen for this study. This is considered an interesting perspective because of the different decision-making drivers that a politician or public official has compared to a manager in a profit-driven organisation (Montin, 2007). Especially in a management programme such as the one I have been a part of in the last year, it is a perspective that has not been covered and is therefore even more interesting. Having a better understanding of the government perspective can also be beneficial for me personally in case I would aim to work for a company that does business with governments. Taking the governmental perspective also means that the interviewees were in often crucial positions in the city government and have as such unique knowledge. Companies and their managers are, in this respect at least, more or less interchangeable.

#### **3.1 Case selection**

The cities were chosen on the basis of their size and position within their respective region, country and part of Europe. Warsaw, as the historical capital of Poland is the political center of the country, with all amenities that come with that - air, rail and road transportation hub, economical center, diplomatic center. Warsaw was as a case to investigate to what extent the 'smart city' is used in the further development of these features.

Gdynia is a relatively newly built industrial city that emerged after World War II and part of a larger cooperation (Triamiasto or Tricity) of cities in the region, together with Gdansk and Sopot. It is also has an important passenger and cargo port. Both Polish cities operate under Polish law and follow the general developmental history of Poland, as well its political history.

Malmö, too, is historically a harbour town, although it is today a city in transition. The third largest city in Sweden, it is moving from its industrial past to a knowledge-based future. Malmö is part of the Greater Copenhagen area, connected to central Copenhagen by the Öresund bridge and has as such access to many of the amenities of a national capital. However, it has no formal political power over these amenities. Lastly, the whole region of Skåne is and has always been the gateway to Sweden for many migrants, which brings its own challenges to Malmö, the biggest Scanian city. Malmö was chosen because of it being in Sweden, which gives the opportunity to compare the broader Polish political and legal context to the Swedish context. Within Sweden, Malmö was chosen because of its transition from a blue-collar industrial city to a more knowledge-based economy, which is assumed to yield an interesting angle on the smart city solutions and why they are provided.

### **3.2 Limitations**

The main challenge that is faced is securing a diversity of viewpoints from a limited number of interviews. The interviews are an appropriate way of finding information and experiences that are not displayed in a paper, but the risk exists that the data is automatically seen as true and is not explicitly tested to the literature and discussed. Securing validity, reliability and generalizability should be done through critical assessment and discussion of the data, including testing it to theory and literature. Since this is a case study comparison, generalizability is almost by definition a problem since it is far from given that what is the case or what works in one city or country, applies to other cities and countries too. It is therefore important to outline differences as well as similarities to establish a basic framework to which cities outside of the scope of this thesis can be compared to.

In addition, some obstacles were encountered during the interview preparation process. Aiming to use the distinctive expertise of specific individuals within city administration, created the situation when finding the right people to contact was rather problematic. Having little information about distribution of duties and tasks within city hall, means we were often redirected from one person to another, who were sometimes even in different departments. This created time constraints for this project, not only because it took a considerable amount of time before the right person was found, but also that the people we succeeded to interview were rather hard to reach and time-constrained. This also had consequences for following up interviews, as time constraints for the interviewees made it impossible for them to reply to further questions.

### **3.3 Interview conduction**

To prepare the interviewees, identical e-mails were sent to them prior the interviews' conduction with the general information about the research topic. The exact questions that can be found in Appendix A were not given beforehand, due to wanting to achieve authenticity in the received answers and expanding the topic during the conversations, while new questions arose as a consequence of discussed matters. The interviews were held in person at the interviewees' offices, or over Skype. The language of the interviews is English, with incidental words in Swedish or Polish that were understood by at least one of the authors. All the conversations were recorded on a mobile device with the consent of the interviewees and lasted between 30 and 75 minutes. One has to bear in mind that English is not the native language for any of interviewers and interviewees, therefore it could create some language misinterpretations (Hammersley and Foster and Gomm, 2000).

### **3.4 Interview participants**

For the interviews, it was crucial to find knowledgeable people within the public administration that had both knowledge about technology, sustainable development and smart cities within their city. While going through the hierarchical structure within city governments, it was aimed to obtain a comprehensive view of the city cases from an individual that holds substantial responsibility and holds considerable experience in the city's governing. Thus, we aimed to interview high-ranking officials, such as deputy mayors of the cities that were experts within smart city topics as well as project leaders and managers within strategy and digitisation projects. Expertise was the decisive factor when it comes to choosing interviewees, since the people that were aimed to reach were often one of a kind within city halls. In addition, the snowball sampling technique was applied. While choosing to contact certain interviewees in cases of Gdynia and Malmö, there was a willingness to participate in this research from the city overall. However, the division of labour in the city hall, that is often not transparent to the layman, resulted in redirection to other officials than initially intended.

After the time-consuming process of searching interviewees, interviews with the following three city officials were conducted, as shown in table 2.

| <b>City</b> | <b>Function</b>          | <b>Responsibilities</b>  |
|-------------|--------------------------|--|
| Warsaw      | Deputy Mayor             | Strategic planning, EU funds, housing, infrastructure, environment, waste, tourism, labour market, regional development strategy, revitalisation |
| Gdynia      | Deputy Mayor             | Education & healthcare services, smart city spokesman  |
| Malmö       | City Building Strategist | Urban development and redevelopment, city planning   |

*Table 2: Overview of interviewees*

It is important to know that in all of the above cases, interviewees were chosen based on their merits, knowledge, specific expertise and experience in fields of public administration such as city development, smart city, strategy and technology. It was also significant that these people, who are managers in charge of bigger departments, have a complete and holistic view of the processes happening within the city council and the work that is ongoing in the whole city, despite the city's size.

### **3.5 Focus change**

In the process of writing this thesis, the initial course and basic idea was changed. Initially, there was going to be more focus on public private partnerships (PPP) in smart cities, which is reflected in the questions that were asked in the interview. For the sake of clarity however, the PPPs were omitted from the theoretical framework and instead added in the data collection and the analysis. Arguably, it is within the range of expectation of inductive research to change course and structure. The gathered data is still valuable and relevant, and in many ways not what was expected to be found. As this decision was made, most of the interviews had already been conducted, which means that some parts of the theoretical framework were not discussed with all interviewees. This data was instead found through using primary data from government documents, some of which were already accessed in connection to the triangulation of the interview data.

Despite this change of scope, the author believes that the research in this paper still holds its validity. In the limitations, it is discussed to what extent this research can be applied to other cities, which is limited already. The change to a narrower scope means mostly that data is sourced from governmental documents in a greater extent than initially expected. However,

some categories in the theoretical framework will still have limited data present for some cases. This will be taken into account in the analysis and the drawing of conclusions.

## **4. Findings**

Interviews from Warsaw, Gdynia and Malmö are used as a basis for the findings from this study. Each case begins with what the officials argue is a smart city and what challenges that entails, after which the 6 categories follow and finally the author's observations that did not fit into the categories. Interviews are not explicitly referenced, all data that is from other sources is referenced as such.

With supplementary data from journal articles, municipalities' webpages, governmental documentation, governmental institutions' reports and projects information available online, a complete discussion will be held in the analysis.

### **4.1 Warsaw**

#### **4.1.1 Definitions and Challenges**

According to the deputy mayor of Warsaw, the smart city notion has been overused recently. Warsaw considers itself a smart city, but does not have the aspiration of emphasising its smartness, or being smart just for the sake of being smart. Instead serving the citizen is the number 1 priority. In the interview, no direct definition is given although many of the examples mentioned below have to do with technology and ICT.

A challenge that is mentioned is the learning from other cities, and how similar problems are solved there. The deputy mayor - who is a member of several European cooperation groups - estimates that cities across Europe tackle the same, or similar problems 80% of the time. The other 20% is specific to the city's status, legal framework, as well as cultural and societal considerations. Yet, the mayor argues that Warsaw should address these problems in its own way as the situation or the solution is nowhere identical - local variations should always be taken into account.

#### **4.1.2 Smart Economy**

There is an active Varsovian business community, and the deputy mayor and the city of Warsaw receive offers from these and other companies to execute smart city projects together. These are not always demand-driven solutions, and are not necessarily in a finished state either. Rather, the city would be involved for marketing purposes mostly, using the good reputation of the city government as a promotion ploy. The city has a competitive advantage that companies want to exploit, and there can be several reasons to accept such cooperations. Government officials, however, should and do ask the question 'what is in it for our citizens?' first. A simple monetary return for the city, especially when the city's reputation is at stake, is

not considered enough if there is no direct benefit for the citizens. This does not mean that there is no cooperation with companies - but when there is it is often the city that takes the initiative. What the city does aim to facilitate is use of its data for private commercial purposes. The city publishes all kinds of information on an open platform, free for anyone to use or develop under limited terms of use<sup>4</sup>. This is used for several applications, for example the public transport planner Jakdojade. Finally, there are solutions that are developed independently from the city government, for which it can decide to set up its own similar service. An example is an air quality measurement system that is set up parallel to an existing commercial system. In general, it is considered a challenge to decide which endeavours should be pursued with companies. Often, a company and the city have different objectives. However, as long as the goal is the same despite different objectives, there is a possibility for cooperation.

#### **4.1.3 Smart Mobility**

Warsaw is one of the most congested and polluted cities in Europe. Car ownership has increased sharply since the 1990s and parking space availability has not kept up. To make matters worse, there is a national cap on parking space pricing and fining, which makes it unprofitable to have extensive parking controls. To solve this, new technology was developed. These smart parking solutions make it easier for citizens to find a place to park and pay, decreases the operational as well as the costs of maintenance of parking in the city, and finally decreases vehicle emissions downtown, as people do not have to drive around anymore looking for a parking spot. Fining is made easier too, increasing the government's control efficiency. As a part of its efforts to increase mobility, Warsaw has a bike sharing system in the city center too in order to encourage citizens to cycle rather than drive short distances.

#### **4.1.4 Smart Governance**

Transparent government is considered important. 'The question is not how to deliver a service, but how to deliver it transparently', says the deputy mayor. Everything that is done in city hall is somehow controlled and checked for fraud. Decision-making should be transparent too, and especially in cases where there is no financial metric to defend the decision. The aforementioned open data is useful here too. The government uses a central smartphone application where citizens can report problems such as vandalism or failing waste collection,

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<sup>4</sup> The terms of use mainly prohibit taking payment from customers for relaying unprocessed data. When data is combined or otherwise processed (e.g. timetables become travel advice in a public transport app), businesses can take money.

and see reports that others made. Every day when he starts work, the deputy mayor checks the status of these reports - in the same version of the app as the citizens. As such, open data gives citizens the opportunity what the government sees in the city, and can track what the government is doing about it. The aforementioned app is part of Warszawa 19115, which is the central phone number for all government services, and which has become a brand<sup>5</sup> for all government services to also include a chat service, a website and e-mail.

These smart solutions help the government to run the city in an effective way. Solutions are claimed to be always adapted to the city's needs, so they can fulfill a purpose.

#### **4.1.5 Smart Environment**

Warsaw uses technology, in the form of open data, for environmental purposes too. The aforementioned governmental open data website can show where it is most profitable to invest in solar or geothermal energy. It has data too about flood sensitivity, fire brigade interventions and other risks. In the light of climate change, this data is valuable for the city to have, since environmental strategies are implemented for the long-term (20 years), spanning several election cycles. Several solutions (greenery, geothermal water circulation installations) require constant maintenance, and centrally observable sensors help in executing this maintenance efficiently.

#### **4.1.6 Smart Living**

Many of the discussed projects ultimately result in reaching the goals of smart living, such as health condition, housing quality and social cohesion. However, these projects fit better in the other categories and are mentioned there.

#### **4.1.7 Smart People**

Smart people is the human resources side of the smart city, and this was briefly touched upon in the interview. As has become visible, one of the uses of open data is providing an open democracy tool, which should be used. Offering people not only applications but also access to data is considered crucial to become a smart society. To encourage this, the city organises hackathons to find solutions to improve the quality of life in Warsaw, with the city-provided data as a basis to explore the possibilities.

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<sup>5</sup> The 19115 logo was observed on several governmental objects in the city by the author, such as the bike sharing stations.

### **4.1.8 Observations**

There are a few problems left that have little basis in smart city theory, that are important to consider. The first one of these is more specific to Poland and Central Europe than in Western Europe: the accessibility of financing, for both public and private organisations. The financing conditions are less favourable because of a higher perceived risk. This makes cooperating with companies difficult, since the financing of a project can be uncertain or withdrawn at short notice. The city has been forced to withdraw from such projects, to ultimately do it on its own without companies involved, even though private financing is in itself not seen as a bad idea. Reaching the market to execute PPP's or other forms of cooperation is difficult. To some tenders, no market parties reply, even though any European company could. There appear to be issues with profitability, trust in the government or communication towards potentially interested companies. Still, cooperation with companies within the field of smart cities is seen as easier than in other fields. This mainly stems from the fact that a certain competence is required to execute the project, a competence, such as developing applications, that the city government in these cases typically does not have.

Finally, the deputy mayor emphasises that solutions for e.g. Amsterdam and Copenhagen cannot be applicable to Warsaw, for the reason that they would simply not meet the demands of the environment. Every city has to, therefore, apply the solutions that are suitable for their own needs.

## **4.2 Gdynia**

### **4.2.1 Definitions and Challenges**

The deputy mayor considers it important to highlight what the notion of smart city really entails as there are different explanations of the term: the key elements are people and their participation in the city's development. Being 'smart' is an interesting notion. '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.' The deputy mayor says that even though smart city is often associated with ICT, software and technological advancements, the crucial feature is considered to be the climate that the city creates for its citizens. In Gdynia, being smart is giving residents opportunities and making sure they are satisfied with the place they live in.

### **4.2.2 Smart Economy**

According to the deputy mayor, a smart city is ‘an almost never-ending list of things to improve, a potential that every business might be interested in’, and ‘I can’t imagine a smart city without cooperating with business’. He does not see a way to be or to aspire to be smart, i.e. with satisfied citizens and a high level of services, without working with business, listening to people and building relations with them. Companies have an interest in pursuing involvement in city projects. They aim to increase revenue and expand and try to do so with the city’s brand. In practice, companies are mostly involved in fields where a business holds expertise that the government does not have, for instance in smartphone application building. The city should know what it expects from a company and decide whether or not it wants to work together based on that expectation. The city prefers to invest in something that will increase the standard of living or decreases costs. The long-term benefit - financial or living standard - consideration is important as the city has to be cautious in allocating future funds. To Much focus is put on cooperation between the public sector, the private sector and non-governmental organisations. All actors have to work together to talk about making the city function well, and look ahead in the future. The deputy mayor notes that all three sectors have different incentives and policies, but all should be included to run the city in an efficient way.

### **4.2.3 Smart Mobility**

To tackle the traffic issues that are present in and around the city, Gdynia is in the process of setting up an electric car sharing service. It takes into consideration that Gdynia already has a trolley bus network and with that widespread high-voltage electric infrastructure that is easy to access. The goal with this service is to diminish the number of cars in the city centre as well as diminish pollution. The electric car sharing service would be the first in Poland.

Together with the other cities in the tri-city cooperation, Gdynia has set up an intelligent transport system called Tristar. It regulates traffic flow in such a way that it is most beneficial for public transport, which has to stop and start for traffic lights less often and is as a result faster, more comfortable and uses less energy.

### **4.2.4 Smart Governance**

For Gdynia, being smart means being open and accessible. It is crucial for cities to use their budgets to their best capacities to offer the best available solutions, and to this end, Gdynia exercises a participatory budget over which citizens and ngo’s decide. It gives citizens direct

influence over what the government should put extra focus on. Non-governmental organisations take a big part in cooperating with the city, and cooperate extensively in cultural and social questions.

Smart solutions can be attractive for Gdynia for decreasing long-term costs on the budget. This can be achieved by lowering the cost of current services, or provide more service for the same amount of money. Citizens may not feel the effect directly, but it saves money for future plans. An example of technology that makes this possible is smart lighting, where street lights activation is limited to whether or not it is needed at any point in time, as well as a single phone number to call the government as seen in Warsaw. To further ensure transparency, Gdynia plans to open an open data service in three different formats just after the finalisation of this paper in June 2017. The idea is that city data is more accessible to companies as well as citizens. The idea is not that the city pays for any applications, but rather that the development and promoting should be done by a private partner based on the open data from the city. These solutions can be promoted by a sponsor too.

#### **4.2.5 Smart Environment**

Environmental efforts were, due to time constraints, not extensively discussed in the interview. Projects, especially within mobility, have environmental benefits too that are an important reason for pursuing said projects. However, the main focus is on another category and therefore these projects are mentioned in the most fitting category.

#### **4.2.6 Smart Living**

As a part of making the city attractive for residents and visitors, Gdynia offers their residents a wide scope of entertainment in the form of festivals, the Red Bull Air Race and sporting events such as the Iron Man.

A smart city must take minorities and underprivileged citizens into account and make sure their everyday life is not hindered. As such, smart solutions can be attractive for Gdynia for improving the standard of living. Upgrading the living standard in the city can be initially costly, but a wise decision in the long term. Examples are the single phone number to contact the government similar to the system in Warsaw, electric car sharing and open data - each discussed in other sections. Just like in Warsaw, smart living is the overarching goal in employing smart city concepts.

#### **4.2.7 Smart People**

According to the deputy mayor, the best indicator of being a smart city is seeing that citizens are happy with their city. The key element are the citizens and the relation the city has with them. Citizen participation and awareness about issues is a decisive ingredient of the city's future, and Gdynia's citizen involvement and awareness about their influence is one of the highest in Poland. Citizens feel that they have an impact on what is happening around them, in what is one of the youngest cities in Poland. The citizens of Gdynia are seen by the deputy mayor as proactive, and take charge when they face issues. This is expressed in engagement in neighbourhood initiatives, associations and other non-governmental organisations.

Gdynia has, as mentioned before, a participatory budget where citizens allocate government money to projects. Meetings with citizens are considered an essential part of this participatory budget, as it is a chance for city officials to listen to ideas and the needs of the citizens. The success of the cooperation was recognised when Gdynia received the European Public Sector Award for their cooperation with ngo's and citizens.

#### **4.2.8 Observations**

Gdynia, like Warsaw, goes by the adagium that the question 'why do we need it' should always be asked and answered while handling smart solutions. Hundreds of private companies approach the city government to offer their services or products, but the true question the public sector must always have in mind is whether it improves the quality of life, and if a certain solution is the best solution that will have a long-term effect. 'Any application on a smartphone, on mobile, is a tool. It is a tool which is very needed, but it is still a tool. The question is how we cooperate with citizens, whether we are open or not' is how the deputy mayor summarises the place of technology and cooperation in his city.

He argues too that smart city solutions that function well in Warsaw or Gdansk might not necessarily work well in Gdynia, and the other way around. Although these cities are in the same country and have the same legal framework, the issues that Warsaw deals with are 'much bigger' than in Gdynia. This includes financial capacity - 'some Varsovian city departments have a bigger budget than the whole of Gdynia' claims the deputy mayor.

However, the observed problem in Warsaw that it is difficult to reach out to companies to cooperate, is apparently non-existent in Gdynia. This is seen as a result of the smaller size of Gdynia, - the city has clear communication of where cooperation possibilities lie and is small enough to keep track of them.

A hindrance that is encountered in building relations with businesses is a lack of trust from the government's side. Some in the city government are convinced that ngo's, the public and private sector are all different and should not interfere with each other. Some public officials, often raised in the communist era, claim that business is something wrong. To counter this lack of trust, a will to cooperate and openness to new things could be a remedy according to the deputy mayor.

Problems that the government faces in cooperating with businesses are resolved by a continuous dialogue between the parties. Normally, issues are talked through and remedies are discussed. Only in some cases where companies can not deliver on the tendering contract they won is there incidentally 'reason to complain.'

## **4.3 Malmö**

### **4.3.1 Definitions and challenges**

Not unlike in Warsaw and Gdynia, the notion of smart city is seen as hard to define. Practical example that are mentioned are start-up incubators and business development hotspots. Additionally, there is a nationwide political ambition and support to develop smart city projects, such as the digital agenda that is under development.

### **4.3.2 Smart Economy**

Malmö is a city in change, towards a knowledge-based economy. IT companies are moving to Malmö, which is expressed in e.g. the large number of game and other software development studios that moved to or started in the city. Cooperation with the government, however, is not perceived to be easy and especially not when a company approaches the municipality with an idea. Cooperation exists, but in a principal-agent form where the government lays out the plans, and companies can sign up to execute them. Examples that the interviewee has experience with are the redevelopment of industrial areas into residential areas, with former oil harbour Västra Hamnen<sup>6</sup> as a prime example. The municipality decides the layout and size of building lots and establishes an idea of what type and size building should be built on these lots, and it is then up to developers to design, build and operate these buildings.

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<sup>6</sup> With the skyscraper Turning Torso as its most notable building

### **4.3.3 Smart Mobility**

Mobility too, is changing in Malmö especially since the opening of the Citytunnel for local, interregional and express trains to other parts of Skåne, Denmark and Sweden. The city aims to make a less car-dependent lifestyle possible, with better bike infrastructure and more pedestrian streets. New apartment buildings are built with inhabitants in mind that do not own, need or want to need a car apart from incidental instances. Public transport is improved too, with initiatives such as the hybrid MalmöExpressen bus service, and plans for reintroduction of trams and even a metro to Copenhagen in the more distant future (Malmö stad, 2009).

ICT infrastructure is part of mobility too. As part of the digitisation agenda, many more governmental services will be centrally connected. A problem reporting system similar to the one in Warsaw is already in place, as is an interactive map (Malmö stad, 2017c). The challenge that remains however, is that it is difficult to predict what technology will look like and how it will develop in the future. ‘Many things we can’t imagine today will be this [digital] kind of economics tomorrow’, says the strategist.

### **4.3.4 Smart Governance**

As there is less and less money in municipalities, the government has to reach out for investments elsewhere. The same applies to competence: others may be better at certain things than the municipality. Although it has been established that it is not easy, interest in working with companies is there when it is a question that neither company nor municipality can solve on their own.

Interaction with citizens and open government are identified as challenges in Malmö. The structure of the government itself has recently been simplified, but it can still be difficult for the citizen to find the right person to solve a certain issue. The same goes for small-scale projects such as street and parking infrastructure, where citizens can feel left out of the decision-making process. To this end, there is the traditional citizen suggestion option, which is rather bureaucratic and can take long to process and be put into practice, if it ever reaches that stage. New methods are applied to hear these ideas instead: in this case a website, the Malmö Initiative (Malmö stad, 2017a), where citizens can vote on each other’s ideas. At a certain number of votes, the municipality has to look into the idea and respond to it. Additionally, the municipality has surveys ongoing with several hundreds of citizens as part of the Malmö Panel. This survey is administered mainly through the internet, but to ensure

accessibility for all respondents, is given out on paper too. Smart and inclusive government is not necessarily digital.

#### **4.3.5 Smart Environment**

The city of Malmö has strict goals when it comes to the environment (Svännel, 2016). The whole municipality should be emission-free by 2030 for instance (Malmö stad, 2015a, 2015b). As is the case in other cities, initiatives that decrease cost or improve comfort in parking or public transport can also have beneficial effects on the environment. Companies are part of these ambitions too, whether it is municipal housing company MKB or private companies such as E.on, who cooperate in e.g. smart metering and other climate and energy challenges.

#### **4.3.6 Smart Living**

Smart living is an important challenge for Malmö, which is still a socially divided city with large differences in educational, income and gender equality between neighbourhoods (Malmö stad, 2014). This in turn leads to feelings of unsafety and slowing integration of immigrants, of which Malmö has traditionally had many. As a result, a holistic perspective on building has been established. This perspective has led to the realisation that a larger variety of buildings is needed.

#### **4.3.7 Smart People**

As mentioned before, Malmö is changing from a largely industrial to a knowledge-based economy. For the city strategy department, this has been established outside of the new knowledge institution in the tradition of learning between builders and the municipality. Citizens, too, are increasingly inclined to use smart techniques in shared economies and neighbourhood resources, such as the municipal bike system or car sharing schemes that some apartment buildings include in their rent. Expertise is also drawn locally and from other regions. The strategist mentions an example from Växjö in Kronoberg, where local builders proved to be the most suited and experienced to build a neighbourhood that had a much higher wood building focus than typical housing projects. The same should be possible in Malmö with similar projects.

#### **4.3.8 Observations**

The most striking observation is the high degree of organisation from the government's side, with rather limited company input on overall planning compared to Poland. It is as a result difficult, as a business, to propose a business plan to run something together with the city.

## **5. Analysis**

### **5.1 Theory vs. Data**

#### **5.1.1 Definitions and challenges**

The theoretical notion of ‘smart city’ is established to be diffuse. The interviewees indicate too that the notion is hard to define, or that it is overused. One interviewee, from Gdynia, clarifies by providing his own definition. All interviewees indicate that smart cities are often perceived to have something to do with technology and innovation, and a digital agenda.

#### **5.1.2 Smart Economy**

The theory mentions an innovative spirit, entrepreneurship, economic image and trademarks, productivity, the flexibility of the labour market, international embeddedness and ability to transform as factors to determine a smart economy.

In general, all three cities indicate that they are approached by companies to use or promote their service. This is viewed with initial scepticism from the government in Poland, where these proposals are evaluated for the usefulness towards the city and its citizens first and foremost, and a cooperation is only set up after the usefulness has been established. In Malmö, it is difficult to approach the government with a proposal and then execute it. Municipally owned or run companies such as MKB and VA SYD cooperate more extensively in developmental tasks with the city government but also with private actors, often existing suppliers or companies that are established in Malmö.

In the researched cities, this is expressed in different ways of cooperation between companies and the government. For larger infrastructural projects, concessions are given out and these are then executed by private companies. The city invests and is finally the owner of the infrastructure. Concessions also exist for other services, such as exploiting a market hall, healthcare services and public transport. A true public-private partnership, typically only known from larger infrastructure development projects (such as motorways) where the company designs, finances, builds, maintains and/or operates for a certain amount of time (ref) is unknown in all cities.

In housing projects, municipalities and project developers work together. The city envisions what a neighbourhood should look like, and project developers can then apply to develop property in accordance with the city’s vision.

Cooperation is generally happening when companies can provide specific competencies that municipalities do not have. Common examples in all cities are smartphone application development and mobility solutions such as rental bikes, and electric car sharing in Gdynia.

### **5.1.3 Smart Mobility**

In the theory, smart mobility is argued to include local accessibility, (inter)national accessibility, availability of ICT infrastructure and transportation systems that are innovative and secure.

All three cities are connected to the world through one or even two nearby international airports. Malmö and Warsaw have regular international train traffic as well as national intercity transport, which Gdynia enjoys too. Malmö, most notably, has become much easier to reach by train from Denmark since the opening of the Öresund bridge in 2000 and the Citytunnel in 2010, which has become the backbone of local and regional public transport.

All three cities invest heavily in systems to make public transport more attractive in effort to reduce congestion and pollution. This practically means that it is made faster, such as through the TriStar traffic management system in Gdynia or more quiet and comfortable, such as through the tram-like MalmöExpressen bus service in Malmö. All three cities have a bike sharing system modelled after the French examples from La Rochelle, Paris and Lyon, complementary to the existing public transport networks. This model is a clear example of the emerging sharing economy, where ownership of a vehicle is no longer necessary and several people can use the same vehicle per day. Gdynia goes a step further by setting up a shared electrical car system, reducing the need for owning an own car and as such for public parking space in the long term.

ICT infrastructure has developed into no longer being a responsibility for the city. Houses have progressively been connected to broadband internet and citizens use fast mobile internet through their private phone contracts. Public wifi is only available in Warsaw, on a limited scale and aimed at tourists. Since internet has been so ubiquitous and cheap, the argument can be made that it has become another utility, like water or electricity. The question can be asked if simply providing mobile internet access is still a valid criterion to assess smart solutions - or that an absence of it indicates serious development issues.

#### **5.1.4 Smart Governance**

Smart governance is expressed in the theory as [citizen] participation in decision making, public and social service availability, and transparent governance.

The most prominent exposition of smart government in this research is increasing transparency of the government through open data. Although it is most extensively provided by capitals and big cities (Amsterdam, Copenhagen, Stockholm, Warsaw), smaller cities such as Gdynia are founding platforms as well. Citizens have the same access to the same data that the government has and can as such gain an understanding of what decisions are being made, and have easier access to data to start a dialogue with or a procedure against the local government.

Access to the governmental and social services is focussed on too in both Polish cities. Both cities have a single phone number for reaching all government services. In Warsaw, this number has become a brand as a city contact center for all governmental communication in Warsaw, also including e-mail, an app and a chat function on the website. The City of Malmö has extensive information on their website about every aspect of city life, even the parts where it is not formally responsible. Through step-by-step guides, citizens get help in how to solve issues and which governmental service to go to. Contact details with departments or those responsible are given, but it can be difficult to find what is needed directly. To counter this inaccessibility problem, a project has started, called 'The Digital Malmö', with increased democracy and inclusivity, more accessible and relevant service, increased interaction within the city, and a more efficient municipal government with more personal time for meetings with citizens as goals.

As demonstrated above, citizen participation is one of the goals of Malmö's smart city project, together with the Malmöinitiative, Malmöpanel and citizen proposal mentioned in the data. The same goes for Gdynia in its cooperation with citizens in the participatory budget and the role of ngo's in city life. There is no data on similar projects in Warsaw, although these are possibly existent on a neighbourhood level.

All three parts of the theory are, in conclusion, actively pursued in all three cities. Technology is an aid in all three cities in reducing administrative workload for both citizens and government, by making it possible to easily access documentation and streamline communication, increasing the desired transparency for democratic purposes, making citizen participation easier, and services more accessible.

### **5.1.5 Smart Environment**

The environmental part of the theory covers the attractiveness of natural conditions, pollution, environmental protection and sustainable resource management.

In the interviews, environment was mentioned often, however mostly in a context of other parts of the theory. A clear example is mobility, traffic being among the biggest polluters in a city. Remedies against congestion and public transport fuel cost benefit the environment as well.

An important aspect that was mentioned by all officials and is missing in the theory framework, is climate change. Warsaw uses its open data to assess flooding risks that are increasing with expected increased rainfall due to climate change. Malmö, being located next to a shallow sea, sees the potential dangers of a rising sea level and the effects on its storm drains. The city has clear emission and energy production method goals. Climate change is a worldwide problem that, to an extent, has to be tackled locally too. It should therefore be in any framework aiming to assess city smartness - both a city's effort to combat climate change by reducing emissions, as well as being prepared for the consequences.

### **5.1.6 Smart Living**

Theory around smart living focuses on cultural facilities, health conditions, individual safety, housing quality, education facilities, touristic attractiveness and social cohesion.

Gdynia is the most explicit in stating that these factors are their main focus of being a smart city. The city organises events, and also cooperates with non-governmental organisations to improve conditions for all citizens. Malmö works actively with housing quality in cooperation with project developers. Old industrial areas are redeveloped into attractive housing areas, infrastructure to troubled neighbourhoods is improved with HOV lines and trains. Cultural and educational facilities are integrated with redevelopment projects (Malmö Högskola) and sometimes make use of existing historical buildings (Norra Sorgenfri). The question can be asked however, to what extent these are solutions that are smart in the definition of Malmö - which is more focused on digital development.

Smart living is Warsaw's goal too, with its claim to focus on the citizen in all the city does.

This is the general impression indeed in all three interviews.

### **5.1.7 Smart People**

The theory around smart people focuses on people as a resource - level of qualification, affinity to long life learning, social and ethnic plurality, flexibility, creativity, cosmopolitanism/open-

mindfulness, participation in public life. The citizen as a customer is discussed in smart living. The three cities are all somewhat active in this category, even if there was little time in the interviews to go deep into it. Warsaw uses its citizens as a resource by looking for input through its open data platform, as well as hackathons. These aim to have an impact on living conditions too. In Gdynia, citizens participate in public life through non-governmental organisations and actively work for their own well-being more than on average in Poland. Malmö changed to a more knowledge-based economy, and therefore increased its educational capability by formally establishing Malmö University in 1998 by merging older independent institutions and taking over faculties from Lund University, then expanding in the years after, attracting more high-skilled citizens and jobs to the city. Ethnic plurality has long been a key feature of Malmö.

## **5.2 Observations from the cases**

Giffinger et al. (2007) argue that a city is smart when it has high scores in all six measurement categories. As a comparison tool this makes sense (and officials from all three cities made clear that comparing cities to each other is not productive in the first place, since the circumstances are different in every city), but by merely ranking, the idea and purpose behind being a smart city is not highlighted. In the interviews, it was found that there is no focus on obtaining the highest scores in each of the six categories. Instead, the focus is on improving conditions for the city's citizens which is expressed most in just one of the six categories: living. The other five categories are important, but all serve as a subordinate to living conditions in the researched cities. One could argue that to be able to achieve a high standard of living, all other categories have to function. Points in case: the factor of health conditions is directly related to environment, which is partly related to mobility solutions in decreasing pollution. Education facilities relate to people's willingness to learn, as well as the government's role in providing and facilitating them. A smart, innovative economy helps living conditions through providing solutions to city problems and cooperating in solving them. And finally, smart citizens with access to their government can influence their own living conditions by affecting citywide policy. Most of these factors are already in the overview in Giffinger et al (2007), but as is argued: they support each other and ultimately living conditions more than they are a list of equally important characteristics. Figure 1 provides a visual explanation of this concept.

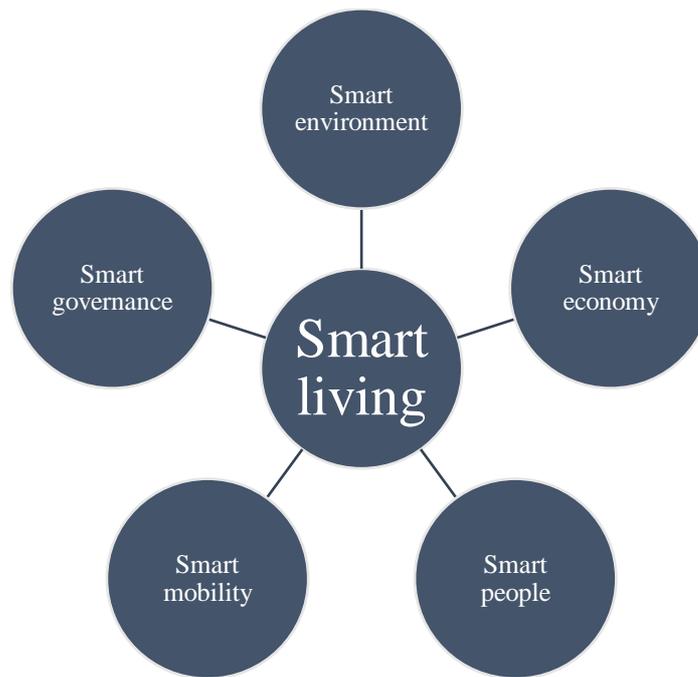


Figure 1. A visualisation of the updated smart city characteristics relationship

### 5.3 Testing research questions

To answer the main question of how smart city theory holds up against practice, two questions were asked, and answered below.

1. *What does the notion of smart city entail?*

It has become clear from both theory and confirmed in this qualitative research that ‘smart city’ is a rather vague concept that can be interpreted in many different ways, and executed in many different ways. The idea that it is inherently linked with ICT still stands after seeing several smartphone applications, traffic management systems and open data platforms. It is the goal, however, of being a smart city that has been the most striking difference between the theory and the observed practice. The citizens and their well-being stand are the goal of being a smart city. All cities deal with numerous challenges of similar and different kinds, and employing smart city techniques is essentially a method to maintain or improve this citizen well-being in the face of these challenges.

2. *What are the key characteristics of smart cities?*

The theory that the key characteristics are smart economy, mobility, environment, living and people mostly holds up. The change that is suggested is the making prominent of smart living as the overarching goal for a city government. The other five factors are to a more or lesser extent stepping stones on the way to establish smart living, with citizens that are doing well.

Some details within the larger characteristics categories should be critically assessed, too, most notably the preparedness and action-mindedness of cities when it comes to climate change.

## **6. Conclusion**

The notion of smart city is not more than that - a notion. Different cities approach problems differently and solve them differently. This starts already with the problem of defining the buzzword 'smart city' in the first place, and continues with applying it to city government and policy. The existing academic literature is assuming that what happens in one city, is comparable to another and that the same applies to solving this problem. Several ranking systems and scores have been devised to facilitate this thought. Rankings, however, are ultimately a city marketing tool. What actually matters, according to the interviewed city officials, is the improvement of the living conditions of the citizens, in whichever way this is expressed. Literature on smart cities ranks, conceptualises and categorises, but inevitably runs into the core problem: the problems are ubiquitous and similar but the circumstances and frameworks different which makes governing theories vague. Add to this the vague notion and it is clear why research into smart cities is difficult and disconnected from reality. The answer lies simply in this reality: the government is there for its people, and improving their living conditions. Being a smart city is increasingly a means to that end - and not the other way around. This idea would potentially help companies too in understanding what the government needs or what service it could from them, and how they can turn a profit out of more successful public private partnerships.

Of course, this conclusion is drawn only on a three-case basis. Further research should be done addressing this exact question on a broader scale to ensure this is a common thought in local government. It would be interesting to see the results and if these differ in different cultures, legal systems and political constellations to mention variables omitted from this thesis.

## 7. References

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