Decision-Making in Ecosystems for Responsible and Inclusive Smart Cities

First supervisor:

Dr. ir. U. (Udo) Pesch

Values, Technology and Innovation

Ethics/Philosophy of Technology

Second supervisor and Chair:

Dr. A.F. (Aad) Correljé

Values, Technology and Innovation

Economics of Technology and Innovation

Company supervisor:

Ir. J. (Janneke) Ten Kate MSc.

Platform31 – Projectleider

Ruimte & Economie

Master Thesis submitted to Delft University of Technology in partial fulfilment of the requirements of the degree of:

Master of Science in the degree of Management of Technology

Faculty of Technology, Policy and Management

M.J.M. (Marjolein) Heezen

4144783

TU Delft

PLATFORM31

kennis van stad en regio

Decision-Making in Ecosystems for Responsible and Inclusive Smart Cities

by

Marjolein Heezen

Master Thesis submitted to Delft University of Technology in partial fulfilment of the requirements of the degree of:

Master of Science in Management of Technology

Faculty of Technology, Policy and Management

To be defended publicly on August 28th, 2018

Student Number:	**4144783**	
Thesis Committee:	**Dr. ir. U. (Udo) Pesch**	TU Delft, First Supervisor
	Dr. A.F. (Aad) Correljé	TU Delft, Second Supervisor and Chair
	Ir. J. (Janneke) Ten Kate MSc.	Platform31, Company Supervisor

What is the city but the people?

William Shakespeare

EXECUTIVE SUMMARY

By the year 2050 over 70% of our world population will be living in cities, creating a lot of stress on our current infrastructures, resources, environment and the quality of life for those living in urban areas now or in the future. For tackling urbanization issues and to achieve environmental goals, Smart Cities have been proposed as solution and the way to create our future cities. However, these cities are mostly created by technology developers, questioning the way in which social interests and values as well as environmental goals are represented in these cities. Also, simply the application of technology does not mean that it is improving our current standard. The way how to use these Smart City technologies is therefore a very crucial topic. For the use of these technologies, knowledge transfer, transparency, decision-making and critical assessment are crucial for the effective and efficient development and implementation of the Smart City that is able to embed public values and interests. Therefore, *the research objective is to make recommendations on how to structure decision-making activities to embed public values within the Dutch Smart City Ecosystem for responsible and inclusive development and implementation of Smart Cities.* This Research objective will be achieved by the answering of the following main research question, and the corresponding research sub-questions:

How could municipal or public decision-makers embed relevant values and anticipate on emerging values in order to create Responsible Innovation for the Smart City Ecosystem?

1. ***What is the composition of the Smart City Ecosystem, and what is its corresponding sociotechnical landscape?***
2. ***What interests and values are represented and should be embedded in the development and implementation of Smart Cities within the Smart City Ecosystem?***
3. ***What is currently hampering Responsible Innovation in the Smart City Ecosystem? How to ensure public values are taken into account?***
4. ***Does the proposed framework stimulate and structure decision-making activities for embedding public values effectively?***

As for the theoretic context and methods used to answer these research questions, I would like to start off by introducing the concepts of Responsible Innovation and the Socio-Technical Value Map. Responsible innovation is defined differently by many researchers and organizations. An important aspect of responsible innovations, as was stressed by Von Schomberg's definition, is that public values are included in innovations and products. One of the broader definitions was given by Stilgoe, Owen and Macnaghten: "Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present." (Stilgoe, Owen, & Macnaghten, 2013). Following the framework created by Stilgoe, Owen and Macnaghten, there are four dimensions associated with responsible innovation. These are Anticipation (incorporating foresight into innovation), Reflexivity (reflection on intentions, impacts, interests, values involved), Inclusion (of values, interests, actors, etc), and Responsiveness (to societal needs and interests) (Stilgoe, Owen, & Macnaghten, 2013). Responsible Innovation is central to this thesis and will be analysed using the Sociotechnical Value Map (STVM), developed by Udo Pesch that allows for insights, leading recommendations to the technology developers, users, or policy-makers on how to incorporate relevant values into the design and implementation of a technology (Pesch, 2015). This analysis consists of four parts; the technology map (chapter four), sociotechnical public – the Smart City Ecosystem (chapter five), a value map (chapter six and seven), and design for values (chapter eight).

In this research an analysis is done on how technologies cause value conflicts, value problems and pose risks in the Smart City Ecosystem. For this part, I use the framework developed by Liesbet van Zoonen which was created to analyse privacy concerns, which I used for analysing and identifying value conflicts and problems. Van Zoonen published some very interesting research illustrating that the way we perceive something to be concerning or dependent on whether something contains personal information or impersonal information (the type of data); whether data is collected for a service purpose or for a surveillance purpose, and; which is using or collecting the

data (Zoonen, 2016). This framework is used to analyse thirty-seven sensor-based projects in Rotterdam that were studied for this research.

The Smart City Ecosystem and its characteristics in terms of technology development, landscape factors and interests and power relations are described in chapter four and five to answer the first research sub-question. Looking at the entire Ecosystem, the focus is nowadays too much on technology and there is a need for new skills and knowledge in order to deal with other issues occurring on the more social side of the Smart City. The need for new governance structure is required for better collaboration, knowledge transfer, task and role distributions, and responsibility. The Smart City is highly contextual and networked where the role of realtor, moderator, mediator or connector is not really fulfilled and is missing as a glue between scattered initiatives and Ecosystem participants. Due to the complex network of parties with all different perceptions, interests, backgrounds and opinions, collaboration and communication are problematic and create issues in offering transparency – especially when things do not work out as planned. The problems with collaboration and communication could be overcome if Ecosystem participants were able to leave their biases and specializations behind, and actually engage in meaningful conversations on the level of a common ground. This problem and its cause are however very characteristic to the Smart City Ecosystem and the Industry of the Smart City.

Other characteristics are the fact that the development is almost fully led by developers, creating privatisation and private interests meddling with public ones; the Smart City Ecosystem being highly dynamic, diverse, platformed and dependent on technology creating lock-in; the fact that there is a huge mismatch between public and private interests which could create value conflicts and a city where people might no longer feel as if they could live the life they desire, without being able to communicate about these issues. Also, the development is taking place via experiments and pilots, dealing with high levels of uncertainty, a shift from a technological innovation towards a social innovation process, difficulties in scaling-up these small test-initiatives thereby creating a very gradual development and a lack of information and skills for some of the Ecosystem participants. This lack of information could lead to difficulties in assessing the added value of technologies, determining where you should invest in, what will harm the city instead of bettering it, and issues in providing transparency, a critical stance and awareness on risks and value conflicts.

One of the insights from chapter six, on values in the smart City, is the fact that in the development trajectory there are some reoccurring problems that seem to be typical for the Smart City Ecosystem. These are on the topics of the *ethics of data*, on *struggles between private and public parties and interests*, on the *general impact of technology application in public space or for public functions*, and *transparency issues.* After the identifications of the problems that cause the difficulty for responsible innovation practices to occur, the values that generally get conflicted were identified based on the information provided in the technology and stakeholder map, an extrapolation of literature, and the information provided by the Rathenau Institute in their very elaborate research on pressurized values.

A very important insight is that value conflicts occurring in the Smart City Ecosystem are not static but dynamic. Therefore, the framework of Liesbet van Zoonen, which could not only be used to identify privacy concerns but to analyse shifts in the framework for all kinds of values coupled to technologies is highly relevant. In order to analyse technologies for Responsible Innovation, using *anticipation* and *reflexivity* to create some negative future scenarios, enables you to analyse the possible impacts of technology and to assess desirability of technology. These scenarios can create a shift in the framework, on which value problems could be analysed. Applying this method onto thirty-seven cases in the city of Rotterdam, allowed me to identify the status-quo of projects, the types of projects, whether these projects could pose a risk for value conflicts and shifts in the framework, how big of a risk they are, and where they will go once this shift occurs including the values that will get conflicted in the meantime. This shows that out of the eight identified values that might get pressurized or conflicted, all values experience conflict in these Smart City developments. Therefore, the values of *privacy, safety, autonomy, power relations, human dignity, justice, control, and economic values should be embedded in the development and implementation of the Smart City by the Smart City Ecosystem.*

Decision-making could be of significant influence on the creation of a Responsible Smart City due to creating better and inclusive technologies, by hampering the implementation of technologies that might harm citizens, or by offering explanations, good argumentations and transparency in the case of occurring value conflicts and value problems. There are technologies that are implemented, which are highly necessary for ensuring public safety, while conflicting the value of privacy. This does not mean that this technology should not be implemented, however, in order to decide on whether this technology is 'worth' conflicting values for, a critical assessment is needed and decisions on what values are most important must be made. In this specific example, the value of public safety might be more important than privacy, which is understandable once you are transparent about it and could explain yourself.

Therefore, to aid this critical assessment, I created a new use of the framework of Liesbet van Zoonen, to analyse not just quadrant shifts for technologies, but also to assess value conflicts that might occur in these future scenarios. The framework could be used as a tool for assessing and identifying values that are of importance and should be embedded into technology, into implementation, or processes. Also, the framework could be used as a discussion tool, offering very comprehensive, understandable assessment criteria on which a critical dialogue could be initiated. When using the framework as a discussion tool, the focus of its implications lays on the increased awareness on Smart City complexities, stimulating conversation and critical stance for policy and decision-makers, and indicating knowledge gaps, differences in opinion, perception and vision. When using the framework as an indicator for relevant values, it will function as a tool for assessing value conflicts and problems, could steer and guide decision-makers to base technology implementation on other values besides economic and practical ones, and provide solid argumentation behind choices and communicating these decisions in a transparent, honest way.

This framework thereby enables public or municipal decision-makers to debate technology in a new way, it offers visual aids by the framework and the shifts that are now visible instead of future, abstract scenarios. Using this framework as an aid for responsible decision-making, allows municipalities to be more in control, it enables them to structure debate or discussions on this topic, it could be used to take a more critical stance, it ensures the municipality to anticipate on future scenarios, it allows them to be reflexive on the values and interests held dearly by the actors involved and helps them to include them, as well as to be responsive on current and future needs and interests.

In chapter nine an initial evaluation on this framework was given. This concluded that there are some insights on the functioning of the proposed framework in terms of aiding decision-making processes for embedding public values. As far as I can say now, the framework is very useful to initiate a good, critical dialogue, which is lacking in the Smart City Ecosystem. Especially in context with some background information or a role-play structure, the framework is a useful tool in identifying and discussing risks taking a different stance. The fact that you have to classify the technology in either personal or impersonal data, and service or surveillance purpose, triggers a critical mindset and forces you to think about consequences of technology in a structured and visual way. The visual element of the shifts in the framework were perceived as being very helpful and also speaks to the mindset of non-technical oriented people. Also, it was interesting to see how much the role-play situation was able to simulate the real-life complexities of the Smart City Ecosystem, and by presenting them the roles and interests of other ecosystem-members, the *awareness* of the mismatch in interests increased, allowing them to be more critical towards each other. While further research is definitely needed before I could really conclude that this methodology is working, *it certainly could play a role in decision-making in terms of critical assessment, creating insights into risks and value conflicts, and might therefore be used for transparent and responsible decision-making in the Smart City Ecosystem*.

TABLE OF CONTENTS

List of Tables

List of Figures

CHAPTER 1: INTRODUCTION

1.1 GENERAL INTRODUCTION AND CONTEXT DESCRIPTION

1.1.1 URBANIZATION

The IPCC calculated that the average temperature on earth is projected to increase by 1.1 – 6.4°C during the 21st century (IPCC, 2007). Global warming, or climate change, is a widely discussed and researched topic of a very complex and conflicting nature. The IPCC says it is "highly likely" (certainty of 95%) that people, and their emission of greenhouse gases (GHGs), are for a large share responsible for this temperature increase, and its effects are said to be irreversible (IPCC, 2007). According to the New Urban Agenda of the United Nations, over half of the global population is living in cities. This number is expected to grow towards a record high 70% in the year 2050 (United Nations Conference on Housing and Sustainable Urban Development, 2015). Urbanization is defined as "an increase in population in cities and towns versus rural areas" following the Business Dictionary (Business Dictionary, 2017).

This increase in population, however, poses several threats to our society and environment. Since cities can be considered as the heart of economic activity, they also consume the largest share of primary energy (around 75%) and pollute the environment with a huge amount of Green House Gases (GHGs), up towards a level of 80% if GHG emissions world-wide that is caused in urban areas (Hendriquez & Van Timmeren, 2015f; United Nations Conference on Housing and Sustainable Urban Development, 2015). These numbers are especially high considering that cities nowadays only cover 2% of the earth's surface, while being the major malefactor to climate change problematics (Hendriquez & Van Timmeren, 2015f).

Urbanization and population growth also air other issues. Both in developing countries as western countries there are problems with sufficing urban water supply and sanitation for this growing demand. The same accounts for access to electricity in a sustainable and feasible way. As for our animal population, it was found that biodiversity losses that are significantly higher than it would naturally be (around a factor 1000 – could lead towards a factor 10.000 by 2050), resulting in a reduction of half of our animals on the planet in the past 50 years alone. Besides this there are also issues around urban waste management, infrastructure shortages and other societal and environmental challenges (Hendriquez & Van Timmeren, 2015f; United Nations Environment Programme, 2004).

By the definition of Rittel and Webber, a wicked problem is defined as a problem that has several characteristics among which: there is no definitive formulation, no stopping rule, a wicked problem is considered a symptom of another problem, it can be explained in numerous ways, and there is no immediate or ultimate test or solution to a wicked problem (Rittel & Webber, 1973). Following this definition, urbanization - and all related problems – could be termed a wicked problem, with the city as its epicentre. It is very difficult to predict or predetermine the various scenarios that could result from all of these various environmental, social or economic "shocks" that the addressed issues above introduce (Hendriquez & Van Timmeren, 2015e). The involvement in this problem from various actors (citizens, municipalities, corporations, governments, etc.) and common goods (e.g. the ocean, the atmosphere) makes it a multifaceted problem that is very difficult to solve.

1.1.2 THE ROLE OF ICT IN URBAN DEVELOPMENT

Due to the many projected issues, as mentioned earlier, there is a strong need for both governmental organizations as companies to start working on a possible solution to this wicked problem. Our future urban design and urban governance should be carried out in an innovative way, including technological, social and/or public, economic, and environmental aspects. The role of ICT in this transition could be significant. With the inclusion of ICT in our urban environment, cities have to opportunity to become Smart Cites (United Nations Conference on Housing and Sustainable Urban Development, 2015). Smart Cities are defined as, following the definition of the International Telecommunication Union's Focus Group on Smart Sustainable Cities: "A smart

sustainable city is an innovative city that uses ICTs and other means to improve the quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects" (International Telecommunication Union, 2015).

There are various other, multifaceted, definitions on Smart Cities that are a variation on this theme, or stress on the fact that it is an ongoing process, not a static, factual state. In the journal article written by Albino, Berardi, and Dangelico – an article on the definitions and dimensions of Smart Cities – it was stated that the most important characteristics, as was abducted from all dimensions or characteristics stated in earlier research, are: a networked infrastructure, a focus on business-led urban development, social inclusion and the natural environment as a strategic component (Albino, Berardi, & R.M., 2015). However, as a means of achieving the Smart City, a lot of agreement revolves around the concept that ICT technologies, such as the Internet of Things, could contribute towards a better, more sustainable and liveable city (United Nations Conference on Housing and Sustainable Urban Development, 2015). The working definition that I will use throughout my research will be based upon the definition of the International Telecommunications Union, the key dimensions as was defined by Albino, Berardi, and Dangelico, and the conceptual flow chart that I constructed analysing my personal perception of the Smart City (shown in *Appendix A*). Therefore, my working definition of a Smart City is:

Working Definition

"A Smart City is a networked city that focuses on achieving complex urban, social and sustainable development goals through the application of Smart Data-Based Technologies, supported by Smart Processes in a durable, inclusive, and responsible way.".

Internet of Things, or Internet of Everything, is a technology that could enable the Smart City to get access to rich data streams in order to monitor, regulate, understand or developing/planning the city (Kitchin, 2014). The data that will be generated using various types of sensors, networks, actuators or devices, will be able to contribute to citizens, municipalities and governments, and corporations (International Telecommunication Union, 2015). For corporates, it opens up a new market where the use of these technologies could enable them to become significant market players in the city. For municipalities and governments, the technology can help them manage and regulate the city in a more effective and efficient way. And last, but certainly not least, for citizens the Smart City could empower them in contributing towards city development, aid in decision-making and give more insight in all their daily life practice and consumption (Kitchin, 2014).

1.1.3 Big Brother is Watching You:

Besides the contribution this technology could serve to citizens, municipalities, corporates and governments, there are some serious issues that need to be addressed with the use and increased implementation. First and foremost; privacy. The Big Brother phenomenon that was depicted as an upsetting future scenario by George Orwell in 1948, nowadays is closer and more real than ever. When you de-board your train, hundreds of camera's and sensors are aware of your presence, the way you move through the train station, and digital advertising will adjust to your profile – e.g. are you a male or female; what age are you; what did you buy for dinner past week – as you walk by (Naafs, 2017a). As was beautifully stated in the book 'Ubikquity and the Illuminated City' about this rather unsettling truth: "What does it mean to society when in order to sustain our most iconic cities we must accept the loss of public space to advertising and adapt to being bombarded with even more corporately sponsored messages than we already are in our daily life?" (Hendriquez & Van Timmeren, 2015a).

Another way of depicting our loss of privacy is by explaining the Smart City as a panopticon. A panopticon is a prison, designed by Jeremy Bentham, where there is an observation tower placed in the middle of a circular prison, in order for guards to always see everybody in the cells while the prisoners cannot see the guards (Betekenis - Definitie, 2017). As Jeremy Bentham designed this type of prison, he achieved being able to change behaviour of the prisoners as they have the feeling that they are being watched. The same could be said about the Smart City with its continuous data collection in a rather dystopic way; if citizens are monitored 24/7, it will

affect the way they behave and act in the city (Balkan, 2017; Ballon, 2016a; Est & Korthagen, 2017c). As Pieter Ballon describes this phenomenon in his book Smart Cities; "No one can ever feel free or careless. This is already happening in our modern society; we are subjected to an anonymous, all seeing authority, making us scared, small guards of our own being." (Ballon, 2016a). This continuous monitoring of the Smart City may thus even affect our decisions and behaviour besides our loss of privacy. Aral Balkan – who is both cyborg activist as ethical designer – takes a very critical stance on this topic during his keynote speech at a conference on Smart Cities in Gent; comparing this influence technology can have on our behaviour to slavery – controlling everything but the physical (Balkan, 2017).

Where our society once traded gold or oil, data is becoming our future's most valuable currency (Naafs, 2017a). The possibilities of beautiful things that could be accomplished using this data for the greater good are endless, however, at what cost? Is this data really used for the greater good or is it driven by the financial gains of specific organizations? Also, acquired data is not essentially true or realistic information. Since the ways to retrieve and process data are perceived and programmed by technicians, this means that there is always bias involved (System I thinking as explained by Daniel Kahneman) making data a rather volatile yet powerful currency (Hendriquez & Van Timmeren, 2015b; Kahneman, 2011).

Another repercussion of the data collected by these Smart technologies, and the bias included in the perception of this data due to the programmer's demands or preferences is that there could arise a filter bubble (Ballon, 2016a). The filter bubble is defined as: "… the intellectual isolation that can occur when websites make use of algorithms to selectively assume the information a user would want to see, and then give information to the user according to this assumption." (Technopedia, 2018). Where this term originally arose due to algorithms used by Facebook or Google, could it also invade our Smart City technologies. This would mean that serendipity in the city no longer can occur and as a citizen or visitor you are only exposed to events, news, or policy changes that an algorithm decides is useful or interesting for you (Ballon, 2016a). This filter bubble could lead to "social cooling"; when you set a standard or a norm, people start behaving according to this norm (Est & Korthagen, 2017c). This could have as a result that you are missing out on events that you would actually like if you came across them, that you do not have a chance to express your thoughts on a policy change that is not directly involving you but especially, that you will not get tested for certain diseases because you do not fit a profile, that this algorithm could actually change you perception of the city and its inhabitants (Ballon, 2016a; Est & Korthagen, 2017c).

Another downside of this technological advancement of our urban environments is that the divides within society are increasing (Hendriquez & Van Timmeren, 2015a; Naafs, 2017a). When technology is likely to start playing a major role in our daily life, it is inevitable that in order to participate you should acquire some devices or applications. The risk we are then facing is that only the rich can contribute to and/or acquire these smart technologies, creating a gap between them and those who simply do not have the money to participate – which might lead to entire neighbourhoods in cities that are not accessible for people that are not able to pay for its smart services (Balkan, 2017; Bayer, 2017).

1.2 Problem statement

As was stated earlier, urbanization and its corresponding problems for our environment, society and economy is a problem that needs to be addressed as "wicked". A possible contribution to assessing this problem is to use (ICT) technologies in order to make the city a Smart City, as the epicentre of all problems mentioned is the city and the way we nowadays use it. However, by "simply" adding technology to our everyday objects and services, does not necessarily better our city and daily life. As is addressed in various literature sources, and was mentioned earlier, by incorporating technology to products and services you face the risk of social polarization that could lead to a more scattered society instead of an empowered one (Hendriquez & Van Timmeren, 2015a; Hollands, 2008; Ménascé, 2017). Also, a society that is increasingly becoming more and more dependent of technology and may experience a sense of captivity poses risks to our daily pursuits instead of improving our

quality of life (Ballon, 2016a; Est & Korthagen, 2017c; EUROCITIES, 2012; Ménascé, 2017). This, among others, shows us that technology itself never is a complete solution. It must serve as a means, not an end (Hollands, 2008).

Speaking of the use of technology; for governments and municipalities, there is a serious task ahead in order to shape, steer and decide on the use of technology in regulating and managing our future cities without turning into a technocracy. Technocracy is defined as "a government by technicians" or "management of society by technical experts" (Merriam-Webster, 2017). The risk of our current democracy turning into a technocracy puts pressure on the municipalities and governments to act and to actively shape and control the use of technology in Smart Cities (Kreijveld, 2016). The success of a Smart City will heavily depend upon the way our governments or municipalities will steer technology development, their choices in which technology to stimulate and implement and the amount of control they truly use in this process (Ballon, 2016f; New, Castro, & Beckwith, 2017). The course set on today is that municipalities or governments actually face the risk of becoming dependent of corporations, who in turn will gain the power to dictate the decisions of the city (Est & Korthagen, 2017c).

However, due to the large variety in stakeholders that are involved in this process, governments and municipalities need to deal with a very complex and networked environment where each stakeholder shows strategic behaviour (Hendriquez & Van Timmeren, 2015d). In the book by Hendriquez & Van Timmeren, the complexity of these networks is explained as: "Networks in cities are dynamic, cognitive agents each of which is itself a complex system and network existing due to interactions." (Hendriquez & Van Timmeren, 2015e). Most of those actors are aware of the complexity of Smart Cities and how to develop and implement them. However, they all seem to face this enormous task alone, where each individual municipality is attempting to discover their "best" way to become a Smart City. There are several issues at play within this context. Among them; the immense sizes of projects, diversity in organisations and users, lack of alignment of goals within the project and organizations, the lack of cross-sectoral cooperation and the lack of coordination between departments (Chourabi, et al., 2012). So, how should we deal with these complex networks, and how to use those networks in order to include all interests and values of our dynamic, cognitive agents? How to make sure that decisions made in the ecosystem represent these interests and values?

This leads us to one of the significantly large and complex problems that we nowadays face with Smart Cities, stressed by many researchers on this topic: the Smart City agenda is far too much led – almost solely led – by producers and their (mainly) economic interests (Ballon, 2016f; EIP-SCC, 2017; EUROCITIES, 2012; Hendriquez & Van Timmeren, 2015d; Hollands, 2008; Kreijveld, 2016; Ménascé, 2017; New, Castro, & Beckwith, 2017; United Nations Conference on Housing and Sustainable Urban Development, 2015). The fact that the technology producers themselves are responsible for the contents and application of the technology results in the fact that they are not necessarily designed for public good but for the creation of revenue and the realization of short-term goals (EIP-SCC, 2017; Hollands, 2008; Ménascé, 2017; United Nations Conference on Housing and Sustainable Urban Development, 2015). Municipalities and governments do *not* take their responsibility in the development and implementation process of these technologies, ensuring that it will not only contribute to the earnings of corporates but to the quality of life and the environment of our cities (Ballon, 2016f; Est & Korthagen, 2017b; New, Castro, & Beckwith, 2017). The way the process of Smart City technology implementation is now structured, the government and municipalities share the burdens while technology developers receive all benefits (Ballon, 2016b). We need a balance of social interests and values represented in the development of these technologies in order to truly contribute to our society (Hendriquez & Van Timmeren, 2015e; Hollands, 2008; Kitchin, 2014).

The responsibility of municipalities, their national associations and national governments, should also ensure the collaboration and learning between cities. Nowadays, almost every city interested in applying Smart City technologies, has its own standard, experiments or platforms they are using and shows no/little learning ability. This is not just very inefficient, but also ineffective when creating a solution to our urbanization issues which

should all strive for the same goals. We should be cautious of the label Smart City when it solely serves self-promotional purposes where a city tries to market itself as being Smart, according to Hollands: "Because the Smart City label can work to ideologically mask the nature of some of the underlying changes in cities, it may be a partial impediment toward progressive urban change." (Hollands, 2008). This "label-battle" for being the first, the best, or the different Smart City does not only induce competition, it also stimulates the communication and learning gap to grow even deeper, not allowing any space for collaboration or cooperation. There is a lack in global perspective in the sense that not only cities do not talk to each other, but also the technology developers are creating their innovations as if they are islands, focused on fighting for dominance (Hendriquez & Van Timmeren, 2015c; Kreijveld, 2016; Tranos & Gertner, 2012).

To summarize the problem statement, there are two main pillars on which problems I want to focus (see *figure 1*). First of all, technology-driven development and implementation of Smart Cities puts pressure on our public space and our values. Where the threat of a technocracy is right around the corner, public space is turning more and more into privately owned space, where the realization of short term (revenue driven) goals is more important than the inclusion of public values and increasing the quality of life. Secondly, the environment in which these developments are taking place is extremely complex and networked, and actors are operating as islands trying to reinvent the wheel when it comes to their own Smart City. I will call this complex, networked environment the Smart City Ecosystem (which is further explained later on in the core concepts). Within this ecosystem there are various types of stakeholders with different interests and backgrounds represented, making the process of knowledge transfer, learning and decision-making in the ecosystem very difficult.

These two pillars combined represent a decision-making problem within the Ecosystem. Decision-making in the Smart City Ecosystem could make the difference between the implementation of a technology that will *add* value, and a technology that will *conflict values*. Faulty decision-making based on polluted or competitive information and incentives, will lead to technologies that might not be desirable at all. The technology push on municipalities and other public organisations, as well as the image boost associated with Smart Cities creates situations where technologies are procured without the ability to critically assess or discuss (with the right parties) effects of technology on society and thereby the values and interests that they held dearly. There is therefore a need of a balancing mechanism, a tool that aids decision-makers to assess technology responsibly and inclusive for values and interests of relevant stakeholders.

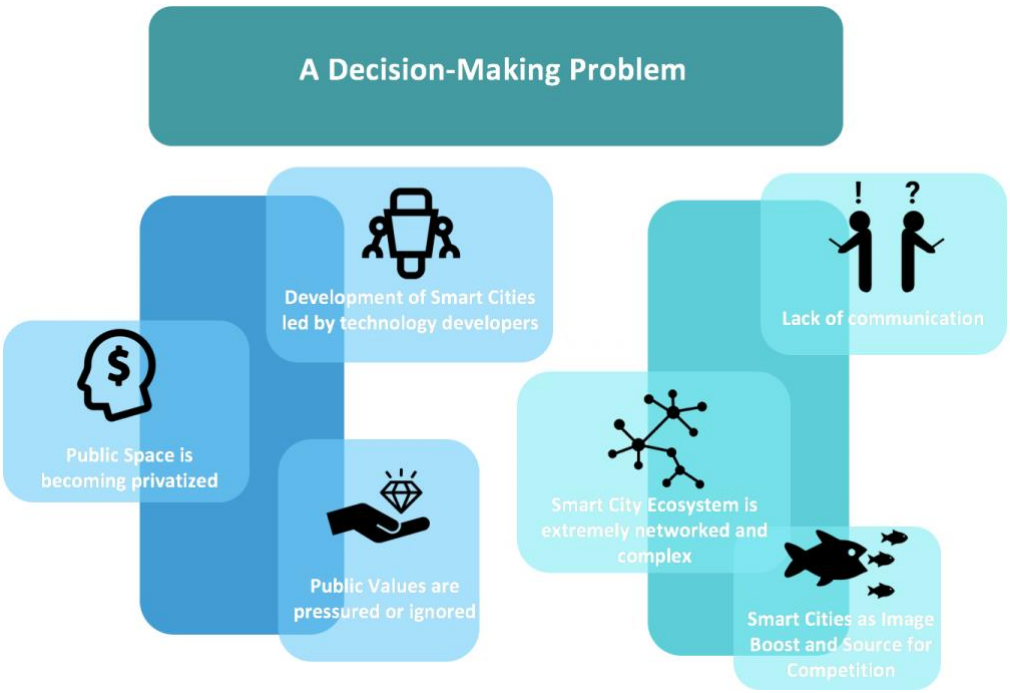


Figure 1: The Decision-Making Problem Context

1.3 Research Objective

In the previous section a lot of problems have been identified in relation to the development and implementation of Smart Cities. While identifying a research gap, what struck me most is that there is a very significant number of researchers that concluded their research with the problem of business-led development of Smart Cities, the lack of learning activities and knowledge transfer, the lack of balancing mechanisms for decision-making and the lack of inclusion of citizens and their interests, values and quality of life. The gap I identified is that there is no research focusing on globalized, inclusive (including interests and values of stakeholders) Smart City development beside the research that emphasizes this problem. Also, approaching this problem as a learning for values problem is something that has not been researched so far.

Research Objective

The research objective is to make recommendations on how to structure decision-making activities to embed public values within the Dutch Smart City Ecosystem for responsible and inclusive development and implementation of Smart Cities.

I aim to fulfil this objective by assessing the Smart City Ecosystem and its characteristics, by assessing the relevant values that face problems due to technology implementation and by coming up with a framework that allows to structure responsible and inclusive decision-making. In order to achieve this objective, the problem owners in my research will be the Dutch government and municipalities. The choice for municipalities and national government to be the problem owners is because they are the ideal party to combine both regional, national and global environmental and social objectives with citizen interests and (local) corporate or entrepreneurial activity, while having the ability to regulate and steer further development of these technologies. While researching this topic in collaboration with Platform31 (a knowledge and network organization situated in The Hague) and their network, that also focuses on Smart Cities, and conducting case studies in Rotterdam, conducting interviews with various actors from the Smart City Ecosystem (both Rotterdam-based as others) I hope to develop a method that could be generalizable for other Dutch municipalities or even other countries within the European Union, or other parts of the globe. Also, besides the immense innovation transition that we are facing with the Smart Cities, the balancing and decision-making tool for complex networks or ecosystem might also be relevant for different technologies and contexts. This could eliminate or reduce the battle of standards and branding strategies that is currently ongoing between technology producers and the cities in which these technologies are applied without consideration of public values and interests. Also, it might provide the basis for discussing technologies and their impacts while raising awareness for the potentially value problems that arise.

Why Rotterdam? While selecting a city in which I would perform an in-depth case study by studying several sensor-applications in public space Rotterdam came out very well. First of all, due to practical reasons, conducting an in-depth case study in a city that is very far away is simply not very feasible due to the large amount of time spent in a train instead of doing actual research. One other reason for selecting Rotterdam besides its proximity to my working and living area is that it is the second largest city in the Netherlands, its population is young (compared to other Dutch cities), the city has an interesting knowledge and business infrastructure due to the fact that there is tight collaboration with Universities (both Erasmus, Delft and Leiden are involved in projects ongoing in the city), Universities of applied science (Hogeschool Rotterdam and Hogeschool InHolland especially), several centres for entrepreneurship or start-up hubs, both large multinationals as a lot of medium or small businesses are represented within the city, and the largest port of Europe is located in this city (PBLQ, 2015). Besides the knowledge and business infrastructure, Rotterdam is an interesting city to watch due to the cultural diversity, the mixture of citizens that are either higher or lower educated, and the hands-on mentality of the municipality and their “Rotterdammers”. Also, the technical infrastructure that is available in Rotterdam is full of potential (LoRa-networks for sensors, 3G and 4G networks, glass fibre network “Glazen Maas”) and it is an active party willing to create an infrastructure that is fit for the future, constantly innovating (Binnenlands

Bestuur, 2016). What I personally also find very interesting is that there are a lot of initiatives in Rotterdam that are focusing on innovating in public space, however, there is not a lot of cohesion between projects (Gemeente Rotterdam, 2018). A lot of attempts for collaboration are made, however not structurally employed effectively at all times (PBLQ, 2015). These and other problems are very typical for Smart City development trajectories, which I hope to solve by creating a structure for learning and knowledge transfer within the Ecosystem of Rotterdam. The findings of information gathered in the Smart City Ecosystem will be generalized where possible for the creation of a broad solution instead of a local one.

1.4 Research Questions

In order to achieve my research objective, my main research question is:

Main Research Question

How could municipal or public decision-makers embed relevant values and anticipate on emerging values in order to create Responsible Innovation for the Smart City Ecosystem?

Sub-questions have been derived to support the process of answering the main research question. First of all, I want to find out what the Dutch Smart City Ecosystem entails, what parties are involved, what (power) position do they have within this ecosystem, etc. Also, the technological landscape will be defined for Smart Cities illustrating the technology developers that are involved, what their competition is, what their alternatives are, etc. These elements of my research will be structured using the first 'steps' of the Socio-Technical Value map (which will be elaborated on further in chapter two and three). This information will be gathered using literature, web-based sources and interviews conducted both inside and outside of the Rotterdam Ecosystem while generalizing the results for the assessment of the Dutch Smart City Ecosystem. Therefore, the question follows:

Sub-question 1

What is the composition of the Smart City Ecosystem and its corresponding sociotechnical landscape?

When this overview of this ecosystem and technological landscape is constructed, I want to find out what interests and values of these stakeholders are relevant for inclusion. Based on the Socio-Technical Value Map and an analysis of thirty-seven cases in the city of Rotterdam these interests and values will be explained and made explicit. Values and value conflicts or value problems that occur will be analysed – based on interviews, desk research and results derived from the first research questions – in order to answer the second research question:

Sub-question 2

What interests and values are represented and should be embedded in the development and implementation of Smart Cities within the Smart City Ecosystem?

After identifying the value and interest conditions to comply with in the process of developing and implementing Smart Cities, I want to find out what is hampering the Smart City development trajectory currently to innovate responsibly. These insights will lead towards the knowledge on how to embed these values for responsible innovation and how to balance the various interests in the ecosystem, in which decision-making and learning activities are studied. As was stressed in the problem statement and research objective, decision-making activities are very important in the context of Smart Cities and are momentarily lacking in the Smart City Ecosystem. To combine all knowledge, sub-question three needs to be answered:

Sub-question 3

What is currently hampering Responsible Innovation in the Smart City Ecosystem? How to ensure public values are taken into account?

The combination of knowledge and research done through answering the sub-questions, will result in the ability to answer the main research question through the generalization of data gathered in the case of Rotterdam. The relation between all question and research elements is represented in the research framework (*figure 2)*. In this framework the concepts related to the sub-questions and main research question will be shown in relation to each other, creating a research flow. Also, a slight hint of the research methods and materials to be used will be shown briefly.

As can be seen in the research framework (*figure 2*), there is a dotted line that indicates an optional, additional and iterative process to evaluate and validate the recommended methodology resulting from the research. This process is only to be carried out when the amount of time allows for it and will otherwise be suggested for further research. However, to provide insights to the developed tool or structure, there is an extra sub-question added in relation to this specific additional and optional "loop" in the research framework. This question focuses on the proposed method, and how it works in practice:

Sub-question 4

Does the proposed framework stimulate and structure decision-making activities for embedding public values effectively?

In answering this question, the functionality of the proposed framework is studied and evaluated through interviews, presentations and demonstrations and a workshop with policy makers. Ideally, this will contribute to new insights for answering the main research question and it can validate or contradict the results that were found earlier when answering the first three sub-questions. The reliability and validity of the results of these questions will increase when the process is iterated in more of these panel-sessions, creating more generalizable results, contributing to better decision-making for the inclusion of public values to be used in the Smart City Ecosystem.

1.5 Research Framework

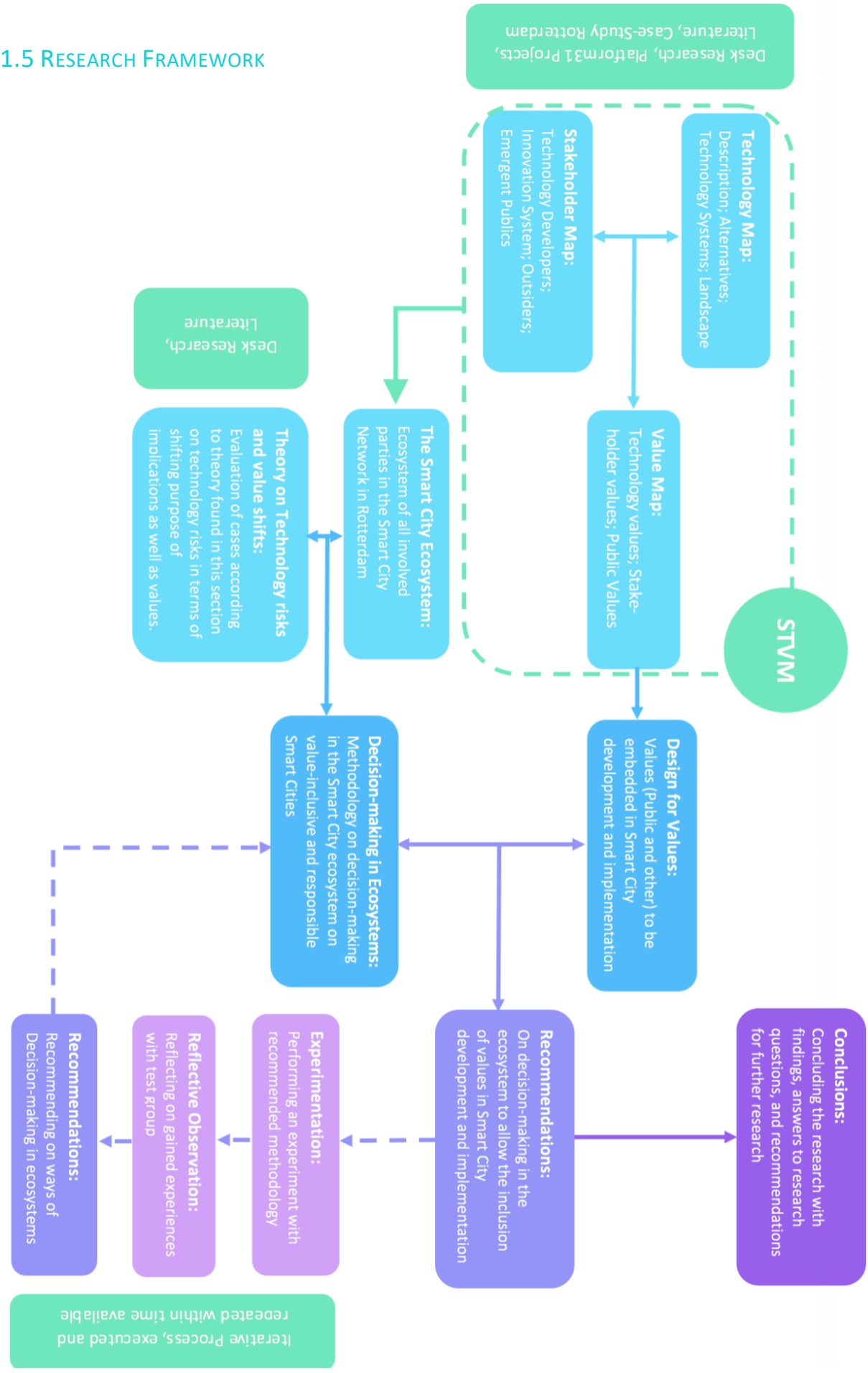


Figure 2: The research framework

Chapter 2: Theory and Core Concepts

In this chapter relevant Core Concepts will be further elaborated on and defined in order to provide insights into the context of my research. Also, the theory illustrating Responsible Innovation as well as theory I will use to analyse technology risks in terms of privacy concerns and value problems will be explained. The explanation will take place based on findings in literature and desk research and will provide the backbone of the methodology used in this research.

2.1 Defining the Smart City Ecosystem as a Core Concept to the research

This section will elaborate on a core concept that has not been defined and explained yet and needs to be addressed before proceeding in this research. This is the Smart City Ecosystem. The ecosystem itself is very complex, highly networked and an important element causing the problems defined earlier on in chapter one. The succeeding section pays attention to theories that will be used for the analysis of the Smart City ecosystem itself and the value problems or conflicts encountered in the Ecosystem by the implementation of Smart City technologies. When speaking of an ecosystem there are various (mostly biological) definitions that apply to this term. For example; "An ecosystem is all the plants and animals that live in a particular area together with the complex relationship that exists between them and their environment." (Collins Dictionary, 2018). However, the term Smart City Ecosystem goes beyond that biological definition and applies to all elements of urban life and planning. The fact that the Smart City Ecosystem describes a complex networked environment has resemblance to biology. Instead of plants and animals, the network and their interconnected relationships consists of citizens, policy makers, science and technology developers. Stakeholders involved are either large or small, have high or low power positions, and are in this ecosystem by choice or unintended, by accident or obligation. In the book by Hendriquez & Van Timmeren, the complexity of these networks is explained as: "Networks in cities are dynamic, cognitive agents each of which is itself a complex system and network existing due to interactions." (Hendriquez & Van Timmeren, 2015e). The conceptual flow chart leading towards the working definition of the Smart City Ecosystem is shown in *Appendix A* and depicted in *figure 3.* One of the objectives of my research is to specifically define these stakeholders within the context of my case study in Rotterdam and to generalize findings for the Netherlands as a country. Therefore, further specification of this Smart City Ecosystem will result from my research, using the Sociotechnical Value Map to construct this ecosystem.

Working Definition

"A Smart City Ecosystem consists of a complex, networked and interconnected environment where all stakeholders involved in the development and implementation of Smart Cities are represented."

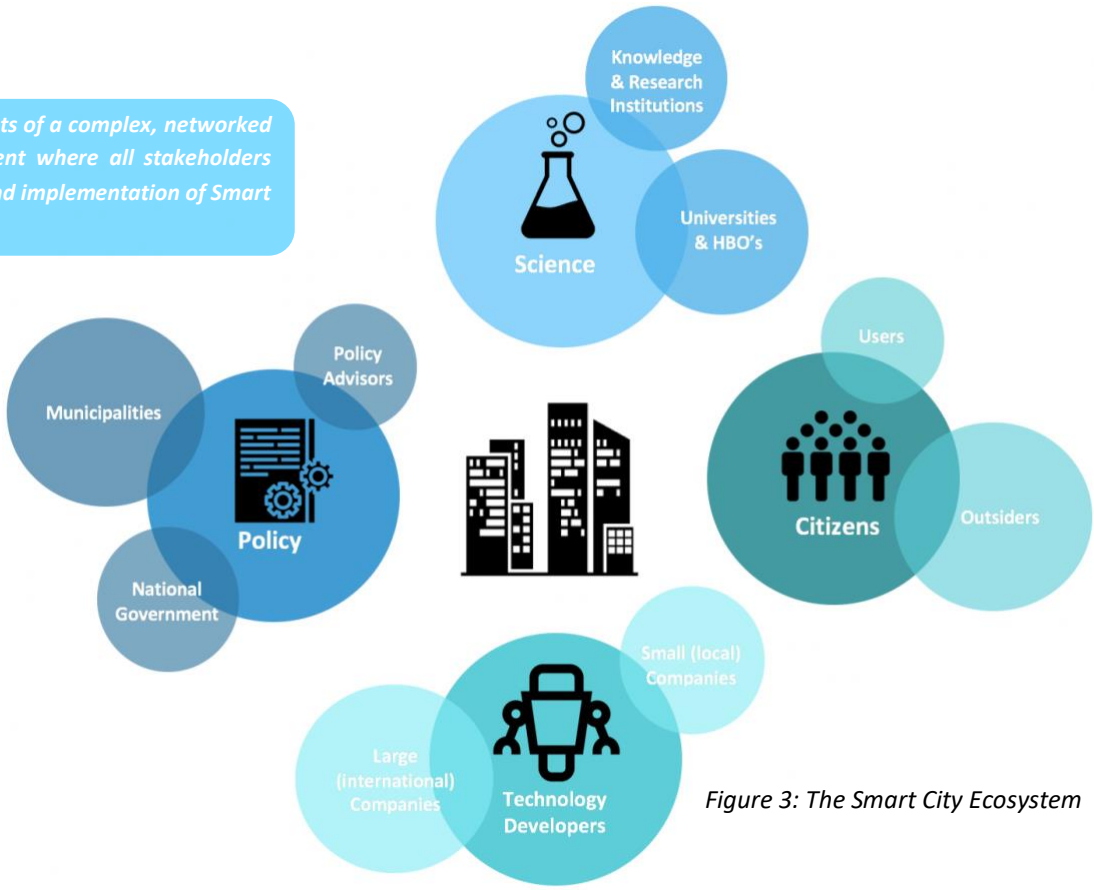


Figure 3: The Smart City Ecosystem

2.2: Theory illustrating Responsible Innovation

In this section I would like to address the theoretical context of the research that will serve as the basis of the methodologies used throughout this thesis as well as the point of view for the scope of the research. This theoretical context will elaborate on technology determinism as a starting point for responsible innovation, the dimensions of responsible innovation, the difference between active and passive responsibility and research methodologies that allow the researcher to assess responsible innovation practices for certain (technology) developments. This theoretical context will be used throughout the research for the analysis of the Smart City Ecosystem and its actors.

2.2.1: Technology Determinism

Before diving into theories on responsible innovation, I would like to explain a starting point for this notion; technology determinism. When studying Smart Cities, or any other technological development trajectory, there is a very strong focus on the technology aspect of the story. For example, when discussing the safety of Smart City technology, and the desirability to put it into use, people mention adding more technology that will allow for cyber secure practices. From the viewpoint of technology determinism, technology and technological innovations or progress determine the way our life is changing and provides solutions for societal problems (Pesch, 2015) (Smith & Marx, 1994). This cultural point of view might be hampering our ability to critically assess technologies. This deterministic point of view presents technology as an unadaptable process, which cannot be stopped or shaped (Pesch, 2015).

However, since technology is something that is created by humans, it is definitely a phenomenon or artefact that can be shaped by us, which can be adjusted to our needs, values or interests. In fact, the process of developing a technology could be described as a set of choices, consciously (or not) made by an engineer or a client (Pesch, 2015). And since technologies only exist because of the decisions we make and actions we perform, we are therefore *responsible* for doing the best we can in making these technologies desirable and intentional.

2.2.2: Responsible Innovation

I would like to introduce responsible innovation according to several theoretic points of views. First off, there is the notion of four dimensions on which responsible innovation should be based or scored. Then I will introduce the differences between active and passive responsibility and accordingly the concepts institutional domains and sociotechnical publics as accountability structures that enable us to make responsible decisions and evaluations.

2.2.2.1: Four dimensions of Responsible Innovation

Responsible innovation is defined differently by many researchers and organizations. An important aspect of responsible innovations, as was stressed by Von Schomberg's definition, is that public values are included in innovations and products. He defined responsible (research and) innovation as: "A transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)." (Von Schombergen, 2011). One of the broader definitions was given by Stilgoe, Owen and Macnaghten: "Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present." (Stilgoe, Owen, & Macnaghten, 2013). Following the framework created by Stilgoe, Owen and Macnaghten, there are four dimensions associated with responsible innovation. These are:

- **Anticipation:** This dimension focusses on the way in which foresight is used and incorporated in the innovation (Stilgoe, Owen, & Macnaghten, 2013). Are future possible scenario's including its corresponding impacts and benefits anticipated on?
- **Reflexivity:** This dimension is about the amount of reflection taking place on the topic of intentions, impacts, interests and values by the actors involved (Stilgoe, Owen, & Macnaghten, 2013).

- **Inclusion:** This dimension focusses on the rate of including involved values, interests, actors, opinions, and considerations (Stilgoe, Owen, & Macnaghten, 2013).
- **Responsiveness:** This dimension shows in what way the innovation is able to respond to societal needs and interests. Also, it demonstrates the way in which it is adaptable to *new* societal needs and interests - since in the case of grand challenges, needs might not always be evident from the start of innovating and creating (Stilgoe, Owen, & Macnaghten, 2013).

2.2.2.2: Active and Passive Responsibility

When discussing responsibility, decision-making plays an important role. This is because besides explaining responsibility among four dimensions, it also be explained by the notions of *active* and *passive* responsibility. In this way, responsibility can be viewed as the evaluation of a societal context or situation in a normative way and basing decisions on this evaluation to act accordingly. The difference between active and passive responsibility has to do with the difference in accountability structures. When an individual feels responsible for an outcome of a specific action or decision before it actually leads to an (undesirable) event, we speak about active responsibility. If this feeling of responsibility only occurs afterwards, we speak of passive responsibility, which focuses on punishment (Pesch, 2015). To be able to be actively responsible, we should be able to align our conscience (our accountability structure) with that of certain sociotechnical publics and institutional domains on which you can base decisions. This research will contribute to aid decision-making by municipalities or other public organisations in order to allow *active* responsibility in Smart City development.

2.2.3: Methods or tools for achieving Responsible Innovation

Value Sensitive Design and (Constructive) Technology Assessment, Social Innovation and the Sociotechnical Value Map are some of the practices for innovating responsibly. These concepts, methods or tools are explained in more detail below.

2.2.3.1: Value Sensitive Design

In the research conducted by Taebi, Correljé, Cuppen, Dignum and Pesch, it was noted that due to the proximity of stakeholders to innovations “an ideal approach to responsible innovation requires interdisciplinary research that incorporates: (i) the ethics of technology, to investigate the role of values in design; (ii) institutional theory, to understand the parts played by institutions in realizing values; and (iii) policy, planning and science, technology and society literature, to focus on stakeholder engagement.” (Taebi, Correljé, Cuppen, Dignum, & Pesch, 2014). In their research, responsible innovation practices were being expanded by the inclusion of a focus on public values, thereby drawing from the principles of Value Sensitive Design (VSD).

As was defined by Friedman; “Value Sensitive Design is a theoretically grounded approach to the design of technology that accounts for human values in a principled and comprehensive manner throughout the design process.” (Friedman, Value-sensitive Design, 1996). Human values are not solely corresponding to economic worth of an object. Human values have to do with emotions and what is important to an individual’s life; ranging from a painting on the wall to environmental standards that they feel important to be met (Friedman, Kahn, & Borning, Value Sensitive Design and Information Systems, 2008). It is yet to be discovered how to effectively select the values of all stakeholders and make decisions on how to weigh these values and how to make value trade-offs. Therefore, it is important to identify potential conflicting values for a specific technology or societal context as early and proactively as possible in order to include them into the technology development (Taebi, Correljé, Cuppen, Dignum, & Pesch, 2014). In the identification of values, however, the *control dilemma* rises since the impact on technology development is largest in early stages, however, value conflicts or problems might emerge at a later stage (Pesch, 2015; Taebi, Correljé, Cuppen, Dignum, & Pesch, 2014). Iteration is therefore desirable in the identification of values and their problems. Alternatively, or adding to VSD, you could also focus on social practices and opening design processes up to the public to allow for the inclusion of (public or societal) values. This is called Social Innovation. With social innovation the focus is not directly on values, but rather on the circumstances, conditions and social structures available.

2.2.3.2: Constructive Technology Assessment

Another way of adjusting technology to the demands and desires of society is by assessing technology via Constructive Technology Assessment. Technology Assessment (TA) is a tool that enables designers and decision makers to save costs by reducing the flaws of new technologies generating feedback for design or use changes. Constructive Technology Assessment (CTA) is a more specific form of TA that is defined by Schot and Rip as follows: "CTA can be seen as a new design practice (which includes tools) in which impacts are anticipated, users and other impacted communities are involved from the start and in an interactive way, and which contains an element of societal learning." (Schot & Rip, 1997). Again, the earlier stage of technology development you assess, the higher the chance is that you can make significant adjustment to it in order for it to be a responsible innovation in an active way.

2.2.3.3: The Sociotechnical Value Map

The Sociotechnical Value Map (STVM), as was developed by Udo Pesch, is a research tool that allows for a combination between two of the most used responsible innovation frameworks; Constructive Technology Assessment (CTA) and Value Sensitive Design (VSD) (Pesch, 2015). This tool allows researchers to identify the sociotechnical public for their specific case and technology. A sociotechnical public is a case-dependent group of actors that are either affected by the technology, users of the technology, or are in some way exposed to this technology (Pesch, 2015). Since the sociotechnical public is different for each case and each technology, there is no standard available. Therefore, while constructing this public, CTA frameworks will be used to identify and select a specific set of actors, and VSD practices will be used to select and include the right combination of values that ought to be included in the design process of this innovation or technology. The combination of these two frameworks will lead to the Sociotechnical Value Map (Pesch, 2015). In the case of the Smart City, the sociotechnical public is a representation of the actors in the Smart City Ecosystem.

An analysis of the thereby created insights, will lead to recommendations to the technology developers, users, or policy-makers in how to incorporate all relevant values into the design and implementation of this technology (Pesch, 2015). As for the case of Smart Cities, this means that while conducting case studies, a sociotechnical public of these cities will be created, thereby identifying the represented interests and values within each city, and through the combination of CTA and VSD determine which actors and which values are relevant for each case (or which type of actors, interests and values are generalizable over all studied cases). This allows me to create recommendations that are specific to the case studies, but which might be generalizable to other (Dutch) cities or ecosystems. The Sociotechnical Value Map and its components are summarized in *figure 4*. Highlighting the content of the Sociotechnical Value Map, there are four main parts; the technology map, the sociotechnical public, the value map, and the design for values.

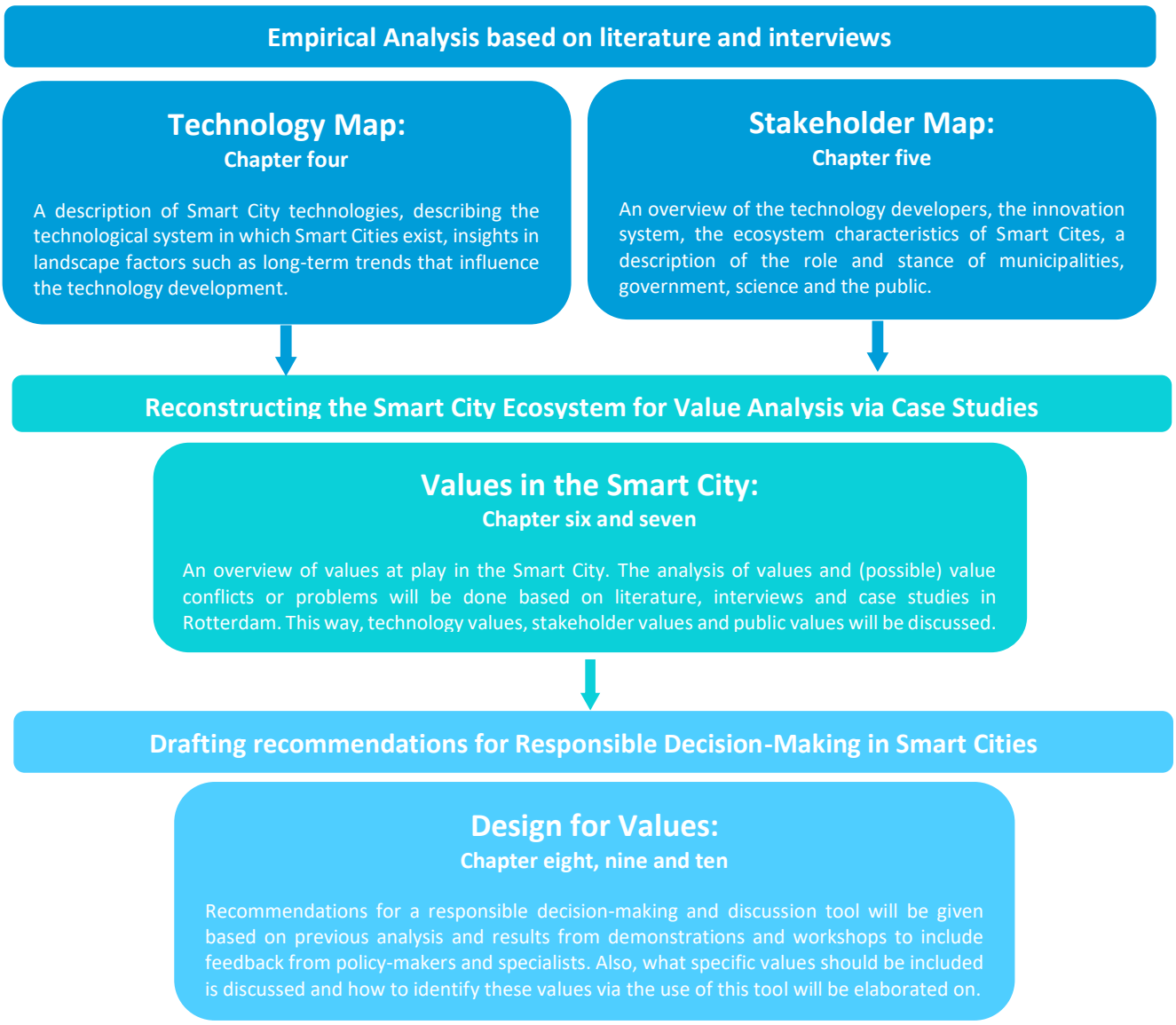


Figure 4: The Sociotechnical Value Map (Pesch, 2015)

2.3: Analysing Value Problems and Value Conflicts

The Sociotechnical Value Map as was depicted and described before, allows a researcher to try and identify values that may get conflicted with other values or situations where the use of a technology creates problems for values to be included. This analysis is however very static. The Sociotechnical Value Map might be able to identify current problems, however, does not pay enough attention to the dynamics of values and how these might shift and change over time. A sociotechnical system is not a static but a dynamic, highly interconnected one. The Smart City Ecosystem, consisting of rational, strategically behaving actors, is also subjected to the dynamics of a changing society influenced by various factors and contextual or temporal characteristics. ***Therefore, I would like to stress the importance of analysing the possible future scenarios of technology before implementation in order to be responsible by the inclusion of value analysis in decision-making processes.*** This insight is the result of the cases analysed in this thesis as well as the analysis of the Smart City Ecosystem and by demonstrations, presentations, discussions and workshops has been 'tested' for its performance with relevant stakeholders. The analysis, the results and conclusions on the tool developed in this research can be found in chapter seven, eight, nine and ten where sub-questions two, three and four are answered as well as the main research question. This section will introduce the framework of Liesbeth van Zoonen, which has been created for the analysis of privacy concerns, as well as a first indication of different use of this framework as a discussion tool as well as a tool for value conflict of problem identification in Smart City technologies for decision-making.

2.3.1: Van Zoonen's framework for Analysing Privacy Concerns

For analysing values that are represented among actors in the Smart City Ecosystems, one of them that immediately gains attention is privacy (a description of all relevant values that might get conflicted or experience problems in the Smart City will be given in chapter six and seven). Where some technologies are known for being sensitive for privacy struggles, there are differences in perception of privacy and to what extent people are concerned about privacy issues. Why do we mindlessly accept terms and conditions of our applications on our phones, why are still using Facebook or WhatsApp whilst knowing all of the (negative) repercussions at stake? We scream for privacy, and the desire to disclose personal information, however we do not act upon our own desires (Norberg, Horne, & Horne, 2007). When selecting a password, we almost always use the same one for all our accounts, and to "protect" our phone we simply use our date of birth. This is called the privacy paradox (Zoonen, Privacy concerns in smart cities, 2016). This paradox is only strengthened by another paradox called the *control paradox* which says that the more an individual feels as if he or she is controlling the (personal) data, the less he or she is worrying about data being wrongfully or without concern for their privacy is used, delivered or registered by third parties (Zoonen, Privacy concerns in smart cities, 2016).

To analyse privacy issues that arise by the application of Smart City technologies, Liesbet van Zoonen published some very interesting research demonstrating that the way we perceive something to be concerning or not is dependent upon some factors. These factors, derived from various literature sources, are: The perception that something is concerning personal information or impersonal information (the type of data); The data collected by the technology is collected for a service purpose or for a surveillance purpose, and; The organisation or person using collecting the data (Zoonen, Privacy concerns in smart cities, 2016). They will be addressed in more detail below.

2.3.1.1: The Type of Data

The perception of sensitive information, or personal information, is different and less consistent in concept or definition than it could ever be defined in the General Data Protection Regulation or national privacy laws. Whereas the perceived privacy-sensitiveness of financial or medical data is agreed upon by most people, there is almost no concern for the privacy issues that could be connected to the combination of various less 'exciting' types of data to create highly personal profiles (Zoonen, Privacy concerns in smart cities, 2016). However, this does not necessarily mean that this will not hamper the value of privacy in general, but it might be by perception.

2.3.1.2: The Purpose of Data Collection and Use

When data is collected or used, there is always a certain trade-off taking place where the benefits experienced by the individual who is targeted for data collection are weighed opposite to the loss of privacy or the pressure on other personal or public values. The main difference lies within the fact if this data is collected for a service purpose or whether it is collected for a surveillance purpose (Zoonen, Privacy concerns in smart cities, 2016). In general, people tend to be more negative toward the feeling of being watched. A big issue with Smart City (and other) technologies is that it often happens that data collection might occur via the means of providing a service, however, the data collected is thereafter used for other purposes than it was originally intended to (Zoonen, Privacy concerns in smart cities, 2016). Especially the lack of transparency in the use cases of data collection creates problems for privacy perception.

2.3.1.3: The Collector of the data

When analysing privacy concerns, another factor that is contributing to the nature of concerns, is the individual or organisation that is behind the data collection or use. In the context of the Smart City, (local) government is often the collector of or initiator in using and processing data (Campbell & Goldsmith, 2016). As for the trust in these organisations, it was studied in the US and the UK that local government receives more trust than national government (US: 72% versus 24%; UK: 79% versus 11%). Whether that is the same in the Netherlands is to be debated. Also, these number represent the trust citizens have in general, not specifically in handling and collecting data (Zoonen, Privacy concerns in smart cities, 2016).

2.3.2: QUADRANTS FOR ANALYSING PRIVACY CONCERNS

In the previous section was explained what factors are of importance when analysing privacy concerns. The two most important ones are the type of data (e.g. personal or impersonal) and the purpose of data collection or usage (e.g. service or surveillance purpose). These properties could be mapped out in a quadrant framework as is shown in *figure 5*. When analysing whether a technology is likely to raise concerns, whether it is likely that values are conflicting, the technology can be plotted on the quadrant scheme (Zoonen, Privacy concerns in smart cities, 2016). As you can imagine, technologies that are created for a service purpose collecting impersonal data are less likely to raise concerns or to conflict values than technologies that are installed for surveillance purposes collecting personal data. Besides identifying the privacy concerns, this quadrant scheme might also be used to help municipalities and national government understand the challenges they are facing in terms of policy (Zoonen, Privacy concerns in smart cities, 2016).

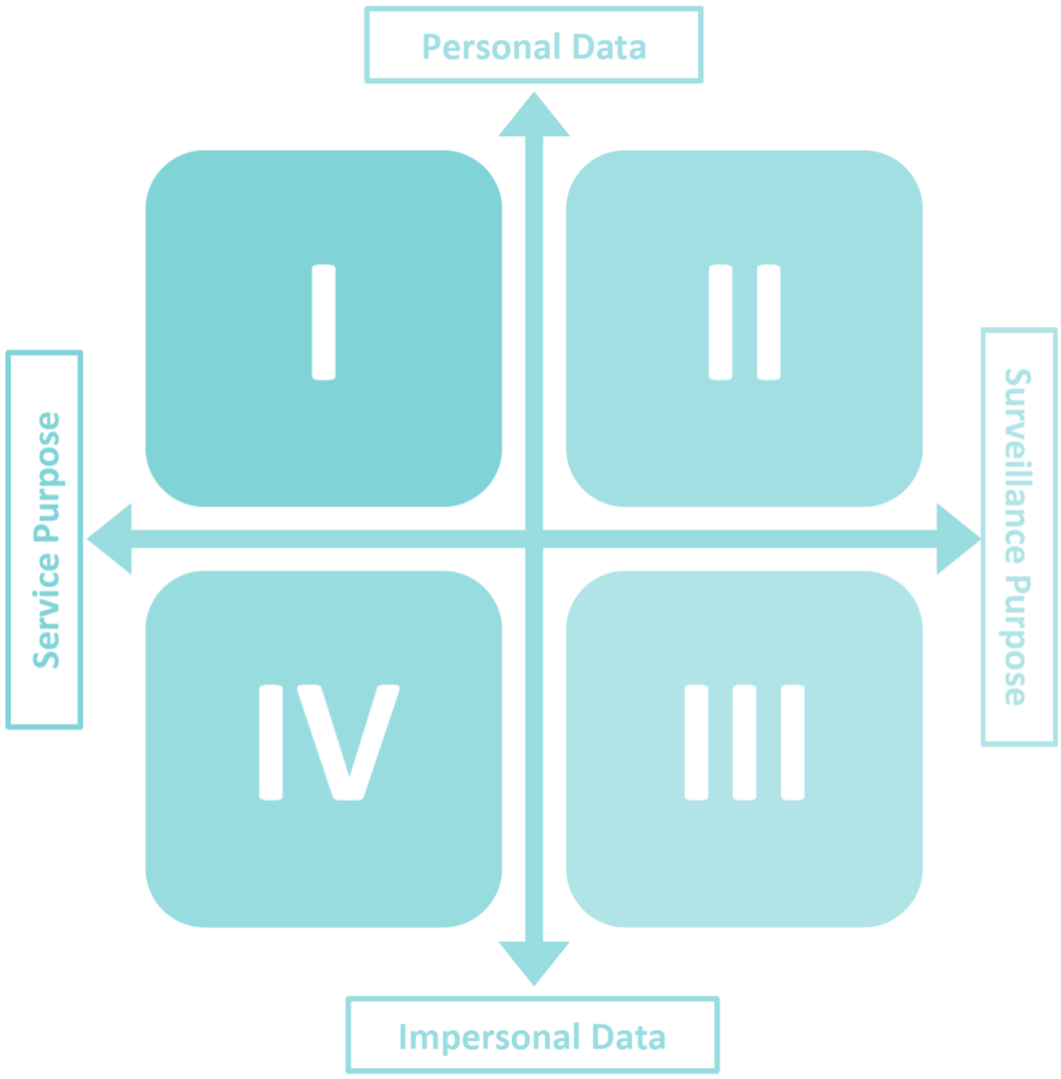


Figure 5: The Quadrant Framework of Liesbet van Zoonen (Zoonen, 2016)

2.3.3: Explaining Value Shifts

In this section I would like to present how the framework explained above could be used as much more than an analysis for privacy concerns. In chapter 7, it is shown that the tool could be used to analyse technologies and their future positions in the framework, whether they are posing a risk for shifts in the framework, and by shifting (or not shifting) whether the technology causes value problems or conflicts. As can be seen in chapter six, privacy might be an important value that gets conflicted or experiences problems in the Smart City, however, is actually only one out of the eight identified values in this research. These values will be analysed for several cases in Rotterdam later on in chapter seven, however, what is an important insight is that the values that are conflicted might change when technology develops further or gets implemented on a wider scale. They are not set in stone and when we identify a technology that can cause conflicts with the value privacy, it does not mean that when the technology develops, the values conflicted remain the same. For the analysis of these shifts, the framework proposed by Liesbet van Zoonen will be used (Zoonen, 2016). The framework, depicted in *figure 5*, has been developed to visualize and analyse privacy concerns, however could also be used for technology analysis in the Smart City and value analysis. When analysing Smart City initiatives in Rotterdam, technologies will be placed somewhere in either one of the four quadrants, based on their level of personal or impersonal information, and whether the technology serves a service or surveillance purpose. However, technology is not a static object, it is something that will keep on developing itself, and the sociotechnical landscape in which this technology is placed is also of a dynamic and transitional nature. These facts given might explain the fact that the perception of technology or the intention of technology might change. These changes will then influence the position these technologies hold in the framework, shifting inside or outside of their original quadrant.

While some of these shifts might not actually occur, for responsible innovation, according to Stilgoe, Owen and Macnaghten, the four dimensions of associated with responsible innovation should be represented: anticipation, reflexivity, inclusion, and responsiveness. The analysis of the way technology will or could develop is therefore an outing of Responsible Innovation where especially the dimensions Anticipation and Reflexivity are well represented, and attention is paid to Responsiveness. Anticipation focusses on the way in which foresight is used and incorporated in the innovation; are future possible scenario's including its corresponding impacts and benefits anticipated on? Reflexivity is about the amount of reflection taking place on the topic of intentions, impacts, interests and values by the actors involved. Responsiveness shows in what way the innovation is able to respond to societal needs and interests. Also, it demonstrates the way in which it is adaptable to new societal needs and interests - since in the case of grand challenges, needs might not always be evident from the start of innovating and creating (Stilgoe, Owen, & Macnaghten, 2013).

This view of responsible innovation is future oriented and therefore very relevant in analysing the future effects of Smart City inventions, the shifts that they could make in the framework of Van Zoonen and the possible value conflicts that could arise now or after shifts in the framework. Combining these insights with practices of Value Sensitive Design, a methodology that aims to include relevant values into the design of technology and its implementation, could allow you to formulate recommendations on how to improve the technology itself, how to change the implementation process and trajectory, or to aid in decision-making for implementation and development (Friedman, Value-sensitive Design, 1996). By iterating the process of identifying relevant actors, processes and ecosystems, identifying their values and the potential value conflicts that could occur, and/or identifying shifts in the framework, you can remain proactive on this aspect (Pesch, 2015; Taebi, Correljé, Cuppen, Dignum, & Pesch, 2014).

Theoretical Contribution

This research will also show, in chapter eight, nine, and ten, that this 'tool' has a twofold purpose; it could both serve as an identifier of value problems and conflicts, and its corresponding shifts in technology in the framework, as well as a discussion tool for policy-makers to address topics that were initially being very abstract or complex to discuss. This theory on value shifts and the use of the framework as a tool for value analysis and discussion is a very important finding of the research.

CHAPTER 3: METHODOLOGY

Within this chapter I will elaborate on the empirical domain, the reasons behind case selection, which theory I will put into use, and I will illustrate the boundaries for my research and the choices that motivate those boundaries. Then I will dive into the methods used to answer the research questions. As for the empirical domain, I will describe Platform31 and their contribution, the research boundaries that include sensors in public space, the choices made for case analysis and their criteria, and the role of the municipality of Rotterdam. Then I will briefly describe methods for each research question as well as the chapter in which the specific questions will be answered (sub-question 1: chapter four and five; sub-question 2: chapter six and seven; sub-question 3: chapter eight; sub-question 4: chapter nine; main research question: chapter ten).

3.1: EMPIRICAL DOMAIN

The approach and focus chosen within my research will be qualitative, empirical and rather explorative. In order to develop new theories or methodologies, an exploratory research approach will best suit my objectives, gaining in depth information through case studies in the city of Rotterdam, and getting a broad perspective through the construction of a Smart City Ecosystem and a decision-making tool that will stimulate the responsible and inclusive development of Smart Cities. The results obtained in Rotterdam will be generalized as far as possible in order to draw recommendations and conclusions from the study applicable to the Netherlands or other Smart City Ecosystems in general.

3.1.1: PLATFORM31

Within this section I will briefly describe and elaborate on the project that is currently ongoing within Platform31 that will contribute to my research and in what way this contribution will take place. Platform31 is a knowledge and network organization that specializes on trends in the city and the region. They aim to connect policy, science and practice to relevant and current issues in our society to provide policy makers, managers and executors with an approach that is immediately applicable in their context. They are participant or executor of various (research) projects within various themes or subjects. Among them are; cities and neighbourhoods, (public) space and region, society and health, energy and sustainability and housing (Platform31, 2018). As for their Smart City experience, I contributed to a research project commissioned by the 'Kadaster' (an organization that has the legal task to deal with the registration of objects (Kadaster, 2018)) in which sensor use was studied in five pioneering cities in the Netherlands where policy-maker perspectives were combined with those of citizens (Heezen, Riedstra, & Louwerse, 2018). For my thesis, I decided to use the interview guidelines that were created for this project to use for my own interviews, which can be found in *Appendix B.* As for the actual interview notes and transcripts, they are available upon request.

3.1.2: CHOICES FOR RESEARCH BOUNDARIES AND CASE SELECTION

In order to keep the research manageable and doable in the amount of time given for a graduation research, I want to describe my choices of chosen boundaries within this thesis.

3.1.2.1: BOUNDARIES FOR THE FRAMEWORK

As for the research, the decision-making framework I want to develop will be developed for municipalities (or from the perspective of a municipality) in the first place, while the actual usability of the framework or tool might be more wide spread. The choice to develop the decision-making framework for municipalities is because they are for a great deal of Smart City initiatives the executing party, the party responsible for results, the party that deals with insecurity in terms of success of the initiative, in terms of feasibility, bearing the risk and dealing with unsatisfied citizens, companies or policy makers, the party that invests time and money into these initiatives, the party that is responsible for the citizens' interests and values, the party that is (often) lacking technological knowledge, and the party that has to deal with this complex networked environment that is typically represented in the Smart City Ecosystem.

3.1.2.2: Selecting Cases for Analysis

The working definition of a Smart City as I described earlier was: "*A Smart City is a networked city that focuses on achieving complex urban, social and sustainable development goals through the application of Smart Data-Based Technologies, supported by Smart Processes in a durable, inclusive, and responsible way*.". Since there are a lot of ways to think of data-based technologies, for this research project I want to limit my cases to sensor-based initiatives operating in public space. These initiatives to be studied all are implemented in Rotterdam, initiated either by the municipality of Rotterdam, a partnership with the municipality, initiated by scientists from universities or research institutions, initiated by citizens themselves (citizen science projects), initiated by either large or smaller technology developers, or initiated by other actors in the Smart City Ecosystem. From all these initiatives, a comparative case study will be done with several of those sensor-based initiatives, selected on convenience, some criteria and similarities that are interesting to compare.

With the selection of cases in Rotterdam, the first criterium will be the type of data the sensor is collecting. This is based on the research done by Liesbet van Zoonen, as was explained in Chapter two. Within her research she identified three main factors that were of importance for assessing privacy concerns, and she created a visual mapping quadrant scheme that allows to analyse these concerns. The first of these factors is the type of data the sensor is collecting. This could be split up into either personal or impersonal data (Zoonen, Privacy concerns in smart cities, 2016). Other literature sources have identified the same distinction in types of data that could be collected using sensors, however, calling it differently. For example, the distinction could be made between the notion of *hard* or *soft data.* In this case, the sensors generating hard data focus on for example air quality, lighting, water management, environmental factors, waste management, transportation, etc. Within the soft data are topics represented like tourism, public governance, economy and public welfare (PBLQ, 2015). The cases that I will select for analysis will initially be 'scored' upon the fact whether they are dealing with personal or impersonal data.

The second criterium I will use for case selection is the purpose of data collection. This will distinguish between a service or a surveillance purpose. Where service purposes are (mostly) less 'exciting' in terms of concerns for value conflicts, surveillance projects are more often accompanied with some fuzz (Zoonen, Privacy concerns in smart cities, 2016). Therefore, in order to get a good grip on the situations taking place in the Smart City Ecosystem, projects of both purpose-types will be analysed. Where the previously mentioned factors are criteria for analysis, the following factor is less determinant, however interesting to analyse. This final factor is the collector of the data. As was mentioned earlier in Chapter 2, the initiator or collector of data can influence the amount of trust the public experience in handling their (personal) data well. I'm curious whether the projects initiated by a certain party face similar or different challenges during the project, whether the collaboration structures are different, and whether the values at stake are comparative.

So, to summarize, there are two main criteria for case selection; the type of data (either personal or impersonal) and the purpose of data collection (either service or surveillance oriented). These two criteria are established to select a number of cases that allow me to draw conclusions on value conflict, shifts in values, and differences in values for different stakeholder groups. Additionally, I would like to analyse whether the collector of data is of any influence on the value conflicts represented in the case. This relationship between selection criteria and factors is summarized in *figure 6*. The results of this case study will be addressed in chapter seven, where all thirty-seven cases that have been conducted will be analysed and discussed.

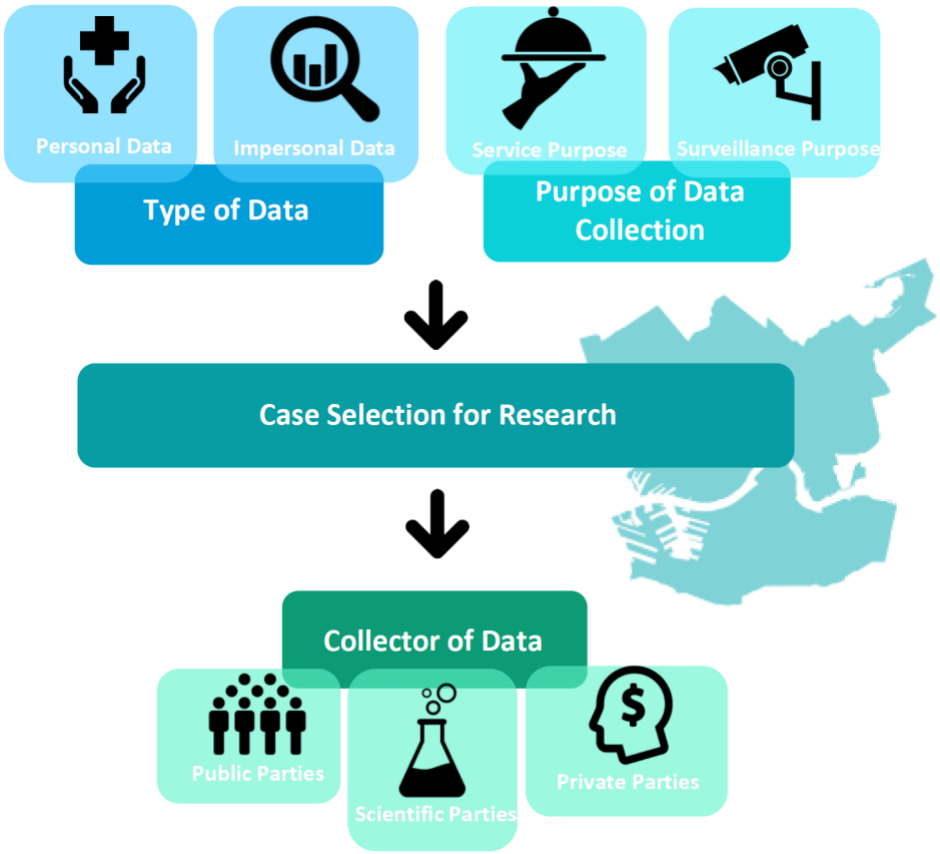


Figure 6: Selection criteria for Case Studies in Rotterdam

3.1.2.3: Municipality of Rotterdam

The decision for the municipality of Rotterdam to be the subject of analysis was done for various reasons which have already been addressed in chapter 1.3. As for the studying of the Rotterdam cases, I conducted various interviews with actors of the Smart City Ecosystem of Rotterdam as well as some less localized experts or policy-makers on this subject. The interviews have been conducted via 'snowball sampling', which entails that most relevant individuals and organizations will present themselves when other interviews are taking place and therefore cannot be selected beforehand. This is a method often used while studying networks and information flows, which is specifically relevant in my case (Verschuren & Doorewaard, 2010). Therefore, I did not plan all interviews beforehand. Eventually I conducted seventeen interviews, of which ten were with employees of the Municipality of Rotterdam and four were with Smart City collaboration partners specific to the city of Rotterdam. The other interviews were with another municipality, with a Smart City advisor or expert, and a Smart City researcher from the Erasmus University of Rotterdam. The findings of information gathered in the Smart City Ecosystem of Rotterdam will be generalized where possible for the creation of a broad instead of a local solution.

3.2: Methods

In order to answer the main research question and the corresponding sub-questions, within this section I would like to address the participants in my research, the materials that will be used and how they will be collected, and the design of the research methodologies.

3.2.1: Sub-Question one

Within this section I will describe the proposed methods to use while answering the first research sub-question:

Sub-question 1

What is the composition of the Smart City Ecosystem and its corresponding sociotechnical landscape?

In order to answer the first sub-question, I will mostly rely on the Sociotechnical Value Map which was explained earlier in chapter two. This map consists of a technology map, stakeholder map, a value map and a recommendations section that explains what values should be embedded via design for values (see *figure 4).* Via the technology map and stakeholder map I will provide a very broad view on technological aspects of the Smart City, landscape factors in play, and a description of the technological system that serves as the backbone of Smart Cities. Via the stakeholder map, I will give insight into the 'soft' side of the technology developers; what are the promises and desires, what are reasons to engage in the technology according to several stakeholders, what is the role and functioning of (local) government, how does science contribute, and what is the role of the public. Also; I will give a very elaborate description on the general characteristics of the industry the Smart City is located in; the Smart City Ecosystem so to speak. Where the later part of the research will be based on local findings in the Rotterdam Ecosystem using Rotterdam-based cases, I would like to use generalizable information only for answering the first sub-question to provide a broader insight into the Smart City Ecosystem and its characteristics.

To be able to collect all this information needed for the stakeholder map (chapter five) and technology map (chapter four), I will conduct several interviews and consult various literature sources. As for the literature sources, I will use both local (focused on either the Dutch or Rotterdam Ecosystem) and general information sources. Interviews will be mostly conducted within the scope of the case-studies, the municipality of Rotterdam, when desirable other municipalities, advisory parties that are specialized in Smart Cities, and private parties selling or developing Smart City technologies. Additionally, I have attended several events that are treating the topic of Smart Cities one way or another and use relevant information. Interviews are arranged through snowball sampling. Conclusions on this research question will be given at the end of chapter five (chapter 5.6). The analysis for answering this question will be done in chapter four and chapter five, where chapter four focusses on the description of the technology used in the Smart City including landscape factors and characteristics of the technology, and chapter five focusses on the actors of the ecosystem including the technology developers, municipalities, national government, knowledge institutions and citizens. Insights will be given on both the generalizable aspects of the Smart City Ecosystem as context specific information for the case of Rotterdam.

3.2.2: Sub-Question two

Within this section I will describe the proposed methods to use while answering the second research sub-question:

Sub-question 2

What interests and values are represented and should be embedded in the development and implementation of Smart Cities within the Smart City Ecosystem?

For answering this research question, I will combine knowledge from the technology map and the stakeholder map and will project this knowledge onto selected cases in Rotterdam to identify and deduct important and relevant values and interests of the stakeholders involved in these cases. Also, the characteristics of the Smart

City Ecosystem and the Smart City technologies (landscape) will help deducing important reoccurring problems, conflicts and values. This will be based on the projection of earlier findings as well as supported arguments from literature and interview data. The concept of values in the Smart City Ecosystem will be discussed drawing from the insights of the Rathenau Institute – who conducted a very elaborate study on which pubic values could be conflicted of pressured due to the increasing application of digital technology and the use of data (Kool, Timmer, Royakkers, & Est, 2017). Values indicated by the Rathenau institute will be tested for relevance for the Smart City, and additional values are identified according to the ecosystem that was described in answering the first research question. The description of general reoccurring problems and values will be given in chapter six.

The way of identifying and selecting cases already was explained earlier in this chapter (mostly based on the type of data and the purpose for data collection). I aim to analyse multiple Rotterdam cases in the quadrant scheme of Liesbet van Zoonen (see *figure 5)*, and then select one case from each of the quadrants to explain how the analysis depicted in the figures in chapter seven have been done. The selection of these four cases, one for each quadrant, will be done based on convenience of information availability as well as providing different types of cases in terms of subject, initiator of the project, collaboration structure, whether there are risks or not and whether there are issues with values. Also, the cases that are selected for analysis in this part of the chapter will represent different types of projects in terms of collaboration, focus and values involved. For all other selected cases, I will try and identify types of projects (e.g. environmental, mobility, smart lighting, energy), collectors of data and/or initiators of the project (e.g. public, private, scientific), and collaboration structures within the projects. The evaluation of all projects will be given in *Appendix* C, of which the most important information and findings will be highlighted in chapter seven. When parallels are available between projects based on one or more of the analysis factors, value conflicts or interests might also overlap, and generalizable conclusions might be drawn from the analysis. This analysis and conclusions will be given in chapter seven.

Gathering all obtained information acquired through the case studies, the interviews, desk research, literature study, and other relevant information will be structured using the STVM methodology by Udo Pesch and the quadrant scheme for analysing privacy concerns of Liesbet van Zoonen. This will be the foundation for answering the second research sub-question as well as the first test of the proposed tool for value-analysis and inclusion that will result from this research.

3.2.3: SUB-QUESTION THREE

Within this section I will describe the proposed methods to use while answering the third research sub-question:

Sub-question 3

What is currently hampering Responsible Innovation in the Smart City Ecosystem? How to ensure public values are taken into account?

Where the first research sub-question considered generalized data, the second dealt with localized information on specific project in Rotterdam. However, the combination of findings in chapters four, five, six and seven can lead to again generalized insights in how the characteristics of the Smart City Ecosystem, its technology applications and information on value problems and conflicts. Recommendations on how to include public values are therefore not only applicable for the Smart City Ecosystem of Rotterdam but for all sorts of policy-makers, or other public decision-makers. Answering this question (in chapter 8) can only take place after the Smart City Ecosystem has been mapped out in (enough) detail to know what the characteristics of this network are (the ecosystem will be the generalized for the Netherlands, case studies in Rotterdam will identify value conflicts which are generalized enough to draw wider conclusions). Based on these characteristics, a thorough analysis of earlier findings leads to insights in how to overcome decision-making problems that cause a great deal of the issues experienced in the Smart City Ecosystem for Responsible Innovation. Tinkering these practices to the specific application in Smart Cities and likewise transitions, while aiming to embed values for responsible innovation, will then provide the answer to the third research sub-question. Also, it will lead to a set of recommendations for a decision-making framework that will suit answering my main research question.

3.2.4: Evaluation through Sub-Question four

Within this section I will describe the proposed methods to use while answering the fourth research sub-question:

Sub-question 4

Does the proposed framework stimulate and structure decision-making activities for embedding public values effectively?

In order to answer this question, a panel discussion or meeting should take place. This will consist of a mix of members of the Smart City Ecosystem (could be people from in and out of the Rotterdam Ecosystem – or solely outside of Rotterdam to test generalizability), to test the proposed tool for decision-making to use in embedding public values, to gain insights to their desires, demands and opinions, what they think is useful or helpful and what is not. This session can consist of an actual test case, with an evaluation part, a dialogue between involved parties on structuring new ways of collaboration and a representation of the idea itself. Ideally, this would have happened iteratively and is something that I would highly recommend doing in future research, however, was outside of my ability to perform this way due to time constraints.

However, the analysis for answering this sub-question *did* occur (chapter nine). The framework for decision-making could be analysed through dialogues with relevant Ecosystem participants such as employees of the municipality of Rotterdam, or public advisors experienced in the problems in the Smart City development trajectory. An important element of analysis was the workshop at the 'Nacht van de Digitale Innovatie' (translated; Night of the digital innovation) which was organized on June 7th, 2018 by the ministry of Economic Affairs and Climate Policy. The organisation of the event approached me to provide a session on Smart Cities, which will consist of an introductory presentation on Smart Cities, an interactive workshop element where a 'fictional' case was discussed and analysed using role-play, and a concluding plenary discussion where the decision-making framework was used as a tool to engage discussion on the technology, on values and decision-making from various roles. Information on the roles used during the role play is shown in *Appendix D*.

Besides the workshop with policy-makers of the ministry, I tested the framework during interviews with employees of the municipality of Rotterdam, as well as a presentation with demonstration given at Platform31 where I retrieved relevant feedback. These validations and evaluations will be the input for answering the final research question on the recommended method or framework and the ways to change and shape this framework, my research recommendations and conclusions further.

3.2.5: Main research Question

Combining the obtained knowledge throughout answering sub-questions one to four I would like to draw final recommendations for the Smart City Ecosystem in the Netherlands on ways to structure decision-making activities in a responsible and inclusive way through answering the main research question:

Main Research Question

How could municipal or public decision-makers embed relevant values and anticipate on emerging values in order to create Responsible Innovation for the Smart City Ecosystem?

The construction of the STVM, the desk research, literature study, interviews and case studies mapped out into the quadrant framework should all be bundled and structured together into recommendations for municipalities in order to achieve my research objective and to answer the main research question. After the evaluation process described in chapter nine, new recommendations are constructed, conclusions can be drawn and suggestions for further research are made. The results and conclusions can be found in chapter ten.

Chapter 4: The Sociotechnical Landscape of the Smart City

In this chapter the so-called technology map is created by presenting information on the characteristics of Smart City Technologies, the risks and challenges faced in Smart City development trajectories, reasons to engage in Smart City practices, an elaboration on the technological system including rules and regulations backing the system up, and landscape factors of the Smart City describing some noticeable trends which might influence technology development. This chapter will focus on general information which is not necessarily context specific in order to provide a good image of the characteristics of the Smart City from the technology perspective. This will provide the necessary information that will be used later on to analyse conflicts with Responsible Innovation practices in the Smart City on both a local and general level. This chapter is partially answering the first research sub-question and will be concluded in chapter five on the Smart City Ecosystem where additional information on both a local and general level will be given.

4.1: Smart City Technology

As was explained in chapter 2 on concepts and theory, the Smart City does not have a singular, or correct, definition. In literature there are numerous ways to describe what a Smart City entails, where some papers focus on the smartness of society, others of the application of technology as much as possible, and others define the Smart City as a way to save money in asset or city management. Even what the key dimensions of a Smart City (is it people, is it ICTs or networks?) are is a topic that we have yet to find consensus on (Albino, Berardi, & R.M., 2015). Others express the importance of expressing a Smart City vision as a city strategy to distinguish themselves and to act according to this vision and strategy (PBLQ, 2015). As for the working definition in this thesis, I adopted the following:

Working Definition

"A Smart City is a networked city that focuses on achieving complex urban, social and sustainable development goals through the application of Smart Data-Based Technologies, supported by Smart Processes in a durable, inclusive, and responsible way.".

However, not all of the Smart City initiatives will be able to match the working definition as presented above. The development trajectory of these technologies is focussed on many other things and might not be all that responsible, sustainable or inclusive at all. What these technologies consist of, what their characteristics are and what risks or challenges they face in their development trajectory will be explained here. Also, reasons for engaging in these technologies – even if they do not match the working definition – will be given.

4.1.1: Characteristics of Smart City Technology

Just like there is no conclusive answer as to what *the* definition of Smart Cities is, there are also no unambiguous list of characteristics. There are multiple ways to describe the Smart City. For example, you could describe it according to the functions a Smart City can host, according to the domains represented, or according to the characteristics of the way data plays a role in them. The most important or prominent characteristics will be described.

4.1.1.1: Domains of Smart

One way to explain Smart City technology is on the domains on which it could have an effect. Among other sources, Ballon explained that smart could be expressed among six domains; Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living (Ballon, 2016d). It is a matter of perception, of what you find important or necessary, when trying to describe the application domains of the Smart City. As a private party earning money on this concept, IBM presents the domains of Smart Cities according to the products and services that they offer. They say that the domains of the Smart City could be described using three main domains; People, Planning and Management, and Infrastructure (IBM, 2018).

Anthopoulos performed a study that compared numerous literature sources, the models they presented to explain the Smart City. This led to a table summarizing all definitions, conceptual models and their descriptions

(Anthopoulos L. , 2015). Later on, he distilled eight domains out of this table that describes the components that are represented within the Smart City Ecosystem. Among this eight, the six domains of Ballon were represented, adding Smart Infrastructure and Smart Services to it (Anthopoulos L. , 2017).

4.1.1.2: CHARACTERISTICS OF SMART

In a Smart City, objects, functions or decisions are suddenly depending on technology such as the internet or ICTs. Objects made from cement and concrete get the ability to communicate with each other and with its users, creating a sort of network of connected things and a network that is able to generate, store, share and analyse data (Kemmerling, 2018). According to the study done by Holland, there are five main characteristics to be observed within the Smart City. These are: A high availability of ICTs throughout the city; Development of the city is business-led and governance is approached from a neoliberal perspective; The city is viewed creatively with social dimensions as a focal point; The city has adopted some sort of smart agenda with elements focusing on social learning and capital, and education; There is a focus on sustainability in both a social and environmental way (Kitchin, 2014).

In order to be Smart, there are four principles, according to literature, that have to be met which are focused on achieving information and communication structures needed for applying Smart City technologies. These are monitoring, control, optimisation and autonomy. Monitoring can be explained as collecting, distributing and analysing (real-time) data from various parts and functions of the city surroundings (Ballon, 2016d). *Control* is of a higher complexity level and needs the availability of monitoring practices in order to be functioning and applying data to certain functions (Ballon, 2016d). Subsequently comes *optimisation*, where the functions created in the control-step are optimized to the most preferable practices based on for example efficiency and efficacy. Then, the last principle, on the highest complexity level, is *autonomy* that means that the city no longer needs human interference.

As was illustrated by the criteria that lead towards a Smart City, data plays an important role for the functioning of the Smart City. The Smart City is about connecting objects to people and to each other, about generating data, about analysing data and about decision making based on data. The characteristics of these data are that it comes in high *volumes*, at high *velocity*, and with high *variety* (Ballon, 2016e). Pieter Ballon called this the three V's of Big Data and discussed how there should actually be a fourth; high *value* (Ballon, 2016e). Since without meaningful data that we actually want to use, and which is applied to meaningful causes, this enormous amount of data might only be clogging up our information systems.

To facilitate and explore all these possibilities, we need to have a reliable (technical) infrastructure at our possession. This data does not appear from thin air, we have to capture all the information streams in the city in one way or another (Dustar, Nastić, & Šćekić, 2017)r. One option is via sensors in public space, which is the main technological application of the Smart City that will be analysed in this thesis. These sensors, when combined with actuators, can watch and adjust a large number of issues such as energy consumption, traffic flows, or personal health and wellbeing (PBLQ, 2015). This could happen without any human intervention, which can therefore be a reduction in costs and can offer a new dimension to urban management (Vries, 2018).

Dealing with sensors however, brings up a lot of reoccurring problems such as data ownership, privacy concerns, the inability to register where and how sensors there are [1]. At the moment municipalities and industry partners are trying to gain experience on this topic as much as possible through pilots and living labs. Living labs can be defined as a real-life, local context where innovation and research processes are brought together in order to test and to learn from this process. A problem with these pilots and living labs is the involvement of relevant stakeholders. Especially citizens themselves are rarely truly involved and engaged in the process (Krassimira

[1] Interview Irma van Bergen Bravenboer – Trainee at the Municipality of Rotterdam

Paskaleva, 2015). This means that the real-life context might not be that real-life at all without the correct representation of the values and interests of relevant stakeholders.

4.1.2: Risks or Challenges in smart City Development

There are several risks or challenges to be identified when developing or aspiring to develop a Smart City. The first challenge I want to highlight is the fact that there is a lot of risk. Meaning; engaging in a Smart City project of technology is mostly very uncertain in outcome, costs, time for the trajectory and there is uncertainty whether it will be economically profitable, whether you will experience a great loss, and whether the technology itself is accepted (New, Castro, & Beckwith, 2017). Technological systems in the Smart City are very vulnerable in the sense that there is no real standard available and knowledge is fragmented or unavailable. Also, the systems have to be very complex in order to deal with the high connectivity between components, involved companies and organisations and the stakeholders that are responsible for or on the receiving end of the technologies (Ballon, 2016b). This problem will keep on occurring due to the current lack of priority and focus on a real Smart infrastructure, and ways to interconnect Smart Cities (New, Castro, & Beckwith, 2017).

Another problem in the development of Smart Cities all over the world is the lack or lagging of communities of practice and good (public private) partnerships (Ballon, 2016b; New, Castro, & Beckwith, 2017). This results in the lack of developing a workable vision from the side of the municipality and defective collaboration between parties. Besides, there is barely any result to be shown from successful cross-fertilization of initiatives for Smart Cities [2]. Communication and effective partnerships could resolve this issue and thereby be a stimulating factor for the Smart City. However, as it is dealt with today it is only hampering the development. As for the problems with developing a vision or workable plan, this is caused by the bias that mayors think their citizens do not desire a Smart City since they fear it will not solve the actual problem. Also, there is a fear of being punished for failed 'experiments' or pilots and there is a lack of technological knowledge to reduce this fear. Last, when collaborating with private parties, it is often the case that the private parties reap what the public parties sow (Ballon, 2016b).

From the perspective of governance and organising the Smart City there are yet some other challenges to overcome. There is the risk of turning into a technocratic government, making decisions based on technology, developing de city based on the advice and insights of engineers rather than socially oriented people. This is something that could lead to technological lock-ins and to corporatization of the city. Due to these concerns, the challenge in developing a Smart City is dealing with the politics of the situation (Kitchin, 2014). Besides political and governmental issues, the speed of development itself could also hamper the Smart City trajectory. What we see in the field is that municipalities act rather slow on technological impulses coming from the development side due to the conservative way of approaching these projects. Especially with larger, complex projects, it would be beneficial if the project was approached in a lean way; doing multiple short sprints instead of trying to oversee everything at once [2].

4.1.3: Reasons to engage in Smart Cities

From the point of view of technology developers, municipalities, and national government there are multiple reasons to engage in Smart Cities. First, there is a strong focus on achieving more efficient and effective policy making, which is perceived as highly valuable for policy makers. Within the Smart City, the availability of data leads to more information, better information and more relevant information is expected. This way, policy makers can not only formulate better and more accurate policies, but executing these policies is also supported by the technological applications in the city (Est & Korthagen, 2017b). By means of this data and smart technology, opportunities arise to manage the city smarter (and thus more effectively and efficiently) (PBLQ, 2015).

The potential of Smart Cities is considered to be that high that policy-makers are willing to take risks. Besides the improvement in efficiency and efficacy in policy making, it could also mean that you can realise participation with

[2] Interview Pim Stevens – KPN | City Advisors

your citizens so that they can influence policy making (Est & Korthagen, 2017b). It offers chances in terms of service improvement, and there are chances for education – which in turn offers societal chances (Rijksoverheid, 2018). The Smart City can function as a stimulator of innovation in the city, by making full use of the digital transition we are currently experiencing (Est & Korthagen, 2017b; Hiemstra, 2018).

Innovation for the city and city management can have other beneficial effects for municipalities or countries; it could lead to a better image which in turn could lead to more visitors and happier citizens (Hollands, 2008). It could also be a source for competition between cities. When one city is in possession of 60 WIFI trackers in the city centre, the other city will desire to have at least the same amount or more not to be overridden by the other city [3]. Of course, this image or competition driven way of doing business and making decisions that affect an entire city could also mean that you act merely self-promotional, not purely solving any problems (Hollands, 2008). Also, the initiators of the technology applications are not always, or often not, municipalities but business communities and private parties. It is often the case that these businesses are paying for the entire project, and the municipality does not have to invest anything other than their cooperation. For the technology developer, Smart Cities are a source of earning money, which is the ultimate goal of their generous investment (Teeffelen & Naafs, 2017a). However, solely focusing on a Return on Investment is not how any innovation project works. According to Pim Stevens, (Smart) City Advisor, you first have to believe in your product or service before you desire to make money [4].

Smart City technology offers opportunities for collecting and analysing data on various topics, such as visitor movements, energy usage, quality of water or air, sentimental analysis in streets and neighbourhoods, and several other applications which could aid your means of monitoring and controlling the city (Zoonen, 2016). For municipalities or governments that have environmental goals to achieve, who want to get a better grasp of the situation in order to formulate policy and to act upon this, Smart Cities are a goldmine of information. Cities are causing a large share of the environmental issues that are on the agenda to solve. This means that they might also be the place to look for possible solutions or improvements (Tranos & Gertner, 2012).

Finally, Smart Cities offer solutions to various types of problems and, adding to solving problems, they can create social and human capital, they can generate and increase the quality of life for citizens and visitors and stimulate economic development (Bolívar, 2015). Since the world we are currently living in, facing all kinds of transitions such as climate change, digitalisation, population growth and urbanisation, there is an increasing need for economic restructuring (Anttiroiko, 2015). In order for us to realise this type of restructuring, the Smart City with all of its applications might be able to give us the practical tools and practices to deal with this ever-increasing and fastening level of complexity.

4.2: The Technological System of Smart Cities

In this subsection the technological systems will be described which consists of an elaboration on the backdrop in which the Smart City development takes place, and laws and regulations that guide and structure the development. In this section, the origin of the Smart City is described, the neoliberalist point of view that is causing development to go a certain way, as well as an analysis of laws that are of high influence such as procurement and tendering laws and the General Data Protection Regulation which focusses on privacy.

4.2.1: The Technological System behind the Smart City

When describing the technological system of which the Smart City is part, there is no better place to start then to describe its origin. IBM realised in 2008 that their business as usual was probably not enough and that they should be able to distinguish themselves in new areas of business to keep on being profitable and competitive.

[3] Interview Hans Nouwens – Specialist digitalisation and public space | Connected Worlds
[4] Interview Pim Stevens – KPN Smart City | Founder and Owner City Advisors

They decided then and there to perceive the city as their new market [5]. This is seen by many as the starting point of the Smart City movement. Several other technology companies followed, such as Cisco, Oracle, and Google. There are numerous examples of cities functioning as test ground and playground where experiments are conducted in real life settings. One of these examples is Hitachi experimenting in Copenhagen with a Data Marketplace (Hitachi, 2016). They are not necessarily experimenting here because of the enormous potential of Copenhagen as a Smart City, but to gain experience so they can make other cities adopt their technologies as well [5]. Cities like Copenhagen from all over the world are experiencing this push from the market side offering all kinds of technologies, just like Hitachi is offering.

The idea of the Smart City is clearly represented by neoliberalism (Kitchin, 2014). Within this view, there is a push for deregulation, increasing interest in open market mechanisms and competition and transferring governmental tasks to external parties via privatisation. As this idea was summarized by the Guardian: "In short, 'neoliberalism' is not simply a name for pro-market policies, or for the compromises with finance capitalism made by failing social democratic parties. It is a name for a premise that, quietly, has come to regulate all we practise and believe: that competition is the only legitimate organising principle for human activity." (Metcalf, 2017). This view can partly explain the strong push from private parties and why it is mainly these multinational technology companies that are extremely interested in the Smart City (Kitchin, 2014). This neoliberalization process is criticized by many because of the fact that the privatized approach to developing a city, could have an effect on the city's priorities, levels of equality and social polarization (Grossi & Pianezzi, 2017).

This technology push also expresses itself in the sense that innovation always seems to be about adding more technology or discussing types of applications of technology. However, when discussing what is smart, it does not necessarily have to mean that technology is applied [6]. Problems and challenges of the Smart City are not only considering technology, but especially governance of this technology, and choosing whether or not technology should be applied. This is extremely complex since there is no singular definition of what this city is, but also, there is a wide variety of models, standards and technologies of which you could choose [7] (Grossi & Pianezzi, 2017). Besides, most of the time there is no specific technological solution that is needed to address a problem. There is a spectrum of solutions needed to tackle the complex problems our society is currently experiencing. There are a lot of forced solutions that do not actually solve anything besides realising market interests [7].

Since Smart City technologies are in more than one way interwoven with the city itself, city management, its citizens and visitors, it often happens that technology is not fully understood by the users and organisations exposed to these technologies. Either the message does not come across because of the different perception of ecosystem parties, or the technology developers are too far ahead in their way of thinking for the rather conservative mindset of government parties [7]. The defective means of communication within the ecosystem therefor may lead to the mismatch in needs from both sides. The issues that are now discussed as being innovative, revolutionary, radical or smart might be terms that in a few years will be taken over by the more classical terms in economics. Since Smart Cities are originated from a new business model, it might merely be a 'hype' that will fade, and will gradually become normal [6,7] (Ballon, 2016d). After all, these Smart Cities are still dealing with the classical issues that we are dealing with for hundreds of years such as security, privacy, and inclusion [5,7] (Meijer, 2015b).

4.2.2: Laws and Regulation

With our transition towards a more digital time, where everything and everyone is connected and generating and using data, we need rules that guide us. The protection of human rights in this situation is only one of the challenges faced by this transition. According to the Dutch national government, human rights are protected in the Constitution and other conventions such as the UN and the EU. Besides these fundamental rights, there are

[5] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam
[6] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam
[7] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq

also 'ordinary' laws that embed public values such as the Personal Data Protection Act that is replaced with the General Data Protection Regulation (GDPR) May 2018 (Rijksoverheid, 2018). While these mechanisms *do* exist, legal aspects are often overlooked in the Smart City. Legal frameworks are often not sufficient to structure new initiatives or innovation processes and run behind the developments that are going on in the field. Besides, the people responsible for the Smart City projects, most of the time do not – or at a very late stage – involve legal counsellors into the tendering or decisions making process [8].

To explain the legal complexity of the Smart City, you would have to start by acknowledging the multidisciplinary nature of the Smart City. The legal aspect is only one of the many different elements that should be considered when engaging in a Smart City project. The legal element itself is not very concrete or tangible, it is fragmented, and numerous laws and regulations must be consulted in the Smart City. For example, in the Netherlands we have an Environmental law or the "Omgevingswet" which is focusses on combining and simplifying various existing regulations and laws in order for easier building and development processes, which could heavily affect the course of the Smart City trajectory since it aids experimentation in public space [9]. This is only *one* of the laws that affects Smart Cities where some others are: Procurement law; Subsidy arrangements; State aid; Privacy Laws; Humanitarian rights; Intellectual Property; Contract Law; Building law; Energy law; and exemptions on laws and regulations [8].

As Louisa Engels from the service law firm Pels Rijcken & Droogleever Fortuijn explained: "In a way it is one big legal black box that deals with both legal and ethical issues. With technology developing this quickly, our legal system has no idea how to catch up in time to foresee problems in the future. Also, by the complex nature of the Smart City, and the fact that it touches upon so many different topics, it is almost undoable to get a complete overview of all possible laws and regulations that are at stake within a Smart City project or initiative" [8]. This issue was also stressed by Liesbet van Zoonen in her analysis on the Privacy Concerns. She stated that cities: "have struggled to share and integrate data streams in ways that support comprehensive analysis. Issues around data ownership, as well as privacy laws and public perception, have been significant stumbling blocks." (Zoonen, 2016).

From literature sources and various interviews conducted within my research, the General Data Protection Regulation and Procurement and Tender regulations appeared to have the highest impact in developing Smart Cities and their corresponding technologies. These two will therefore be briefly explained in some more detail in the successive sub-chapters.

4.2.2.1: The General Data Protection Regulation

Albert Meijer, a researcher who specializes on the governance side of the Smart City, debated at the 'VNG-realisatie congres' (an association for Dutch Municipalities) that the way we handle privacy in our country, and in Europe in general, might hamper innovation [10]. A KPN employee commented that the European speed of development compared with China shows that our regulations might not be beneficial in terms of innovative capacity. In the Netherlands some innovations will not be allowed to implement due to our laws and regulations, of which the European law, the General Data Protection Regulation (GDPR), is one of the newest and most complete additions to our legal system.

The GDPR standardizes the processing of personal data in virtually all social sectors for virtually all types of processing, including processing of personal data that take place in the context of big data, robots or the Internet of Things. Smart Cities are subjected to this regulation because of the handling and analysis of personal data collected via sensors, applications and other big data sources (Rijksoverheid, 2018). The GDPR starts with grounds when it is allowed to collect data: When you have permission of the user; For vital interests (health

[8] Workshop by Daan Corver & Louisa Engels at the Smart City Update – Pels Rijcken & Droogleever Fortuijn
[9] Workshop by Linda Carton at the Smart City Update – Nijmegen Smart Emission Project
[10] Workshop by Albert Meijer at VNG-realisatie congres – Professor at the University of Utrecht

purposes); When it is legally obligated; When agreement is reached; When you serve general interests, or; When it serves legal interests (Autoriteit Persoonsgegevens, 2018). Privacy-by-design practices follow with impact assessments and is analysed by the Data Protection Officer (Autoriteit Persoonsgegevens, 2017). The project then has to fulfil organisational and technical requirements such as cyber security measures, registering processed data, and data protection policies. Finally, the GDPR offers people the opportunity to see, change, delete and share data collected about you (Autoriteit Persoonsgegevens, 2018).

In comparison with the previous valid laws in the Netherlands explaining our rights when it comes to personal data, we had to deal with the Wet bescherming persoonsgegevens (Wbp - law for the protection of personal information). This law stated that everybody should be transparent on the personal data that they process for own means, however, these information and transparency obligations were very limited. Only an individuals' identity, the purpose of data processing and 'further information that might be needed to ensure careful data processing' were stated in this law (Jansen, 2017). In the GDPR, the list of information that should be distributed among those involved is very comprehensive in comparison to those three points listed in the Wbp, of which one of them is a vaguely formulated 'further information' statement with no real obligations. However, do we really desire this transparency? The amount of information that we should legally be exposed to according to the new regulations is extremely large, consisting of numerous documents that contain chunks of legal texts, which might not at all be understandable for its readers (if they bother to read it at all) (Jansen, 2017). This is a discussion on whether the *perceived* transparency and privacy is in fact as high as the *aspired* transparency and privacy in the GDPR.

4.2.2.2: Tenders and Procurement

When a Dutch public organisation wants to procure new assets or technology, they have to follow the tender rules. These tender rules specify how these organisations can achieve the best price to quality ratio for the specific request following guidelines that include non-discrimination, equal treatment of entrepreneurs, transparency on procedures, and proportionality (Rijksoverheid, 2017). The proportionality principle is also instated to be able to set certain requirements towards contractors within reason, and to protect these contractors for unfair demands from the clients (Rijksoverheid, 2016).

The tendering process is something that municipalities and other public organisations are legally bound to, however, the satisfaction level about this process is not always that high. This feeling is not only expressed by the public organisations itself, but also about the contractors that are on the other side of the equation that have to deal with these legal implications [11,12,13,14,15,16] (Bravenboer, 2018). There is room for improvement in the tendering procedures that are now leading this process. For example, when municipalities are conducting experiments in the city with a private party or multiple parties, as soon as you exceed the tendering limit, or when your current project is finalizing, to procede your project should be tendered. Below this tendering limit there is a lot of room to play and innovate, but as soon as you exceed this, other factors are also starting to play a role [11,16].

Another complexity of this tendering process is that choices for new projects, products or collaborations are often made based on things that do not matter most, such as economical factors, while quality, reliability and some innovation criteria are not weighed neccesarily [17]. This is an issue that illustrates the difficulty that public organisations experience in decision-making on other criteria than obvious ones such as price. The difficulty is

[11] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq
[12] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam
[13] Interview Marije ten Kate – Main Planner Urban Development at the Municipality of Rotterdam
[14] Interview Maarten Keesman – Project Manager Economy at the Municipality of Rotterdam
[15] Interview Ineke Nierstrasz – Strategic Advisor Safety at the Municipality of Rotterdam
[16] Interview Pim Stevens – KPN Smart City | Founder and Owner City Advisors
[17] Interview Ineke Nierstrasz – Strategic Advisor Safety at the Municipality of Rotterdam

that it is hard to express desirable criteria in tangile, concrete words when you are realising an innovation project. The *control* paradox here is that beforehand you will have difficulty expressing the criteria since you do not know how the technology, product or service is developing, while afterwards you have no control on the direction of development (Pesch, 2015).

Speaking about innovating, the tendering procedure is considered to be one of the reasons for the slowness in innovation processes in the government. Interesting is that as soon as innovation can be politically motivated, the process will be speedier and tender criteria are easily redirected from financial criteria towards more innovative and quality based criteria [18]. There are however types of procurement that are stimulating or allowing space for innovation. These are Design, Build, Finance & Maintain (DBFM) contracts, Public Private Partnerships or Innovation Partnerships and Concessions (Bravenboer, 2018; Europa Decentraal, 2017). With the Innovation Partnership, collaboration between a public organisation and a developing party that could create innovative products, services or civil works is laid down in a procedure. The phases in this partnership are; selection of partners based on requirements; research and development phase; and finally, a commercial phase where results obtained from the partnership are realized. The advantage of this type of partnership is that both parties are inveseted in the development, therefore the public organisation does not have to buy the product, service or civil work afterwards (European Commission, 2016).

An interesting topic to also discuss when speaking of tendering for the Smart City; how to deal with data and ownership of not-physical objects. Organisations such as Geonovum (an organisation focussed on developing standards in all types of geo-information) have initiated drawing up some rules on how to deal with data acquired in public space. This topic is very tricky and difficult, municipalities and other involved organisations do not share the same vision for this, and there still is not singular standard available (at least in the Netherlands). What happens now with tenders and projects within the municipality, most of the times standard terms and conditions are applied, which do not say anything about data. Tenders should also be about the non-physical aspects such as data generated, the data analysis, sensors, and an information management systems (Bravenboer, 2018).

4.3: Landscape Factors of the Smart City

The landscape factors of the Smart City will be described along some long-term trends or foreseeable events that might influence the development trajectory of the Smart City. A trend that is currently strongly showing in the Smart City landscape is that its main customer – the municipality – is set up sectoral, and it is very difficult to find and create integral solutions to the problems our society presents [19]. This is partly due to the way municipalities are – generally – structured, and partly due to the nature of the Smart City that is very broad, not very tangible, and the black box perception [18,19]. Another problem of this sectoral structuring is that people are not aware of the developments taking place in another organisational tube, therefore communication and finding the right person is diffucult [20]. This requires a new approach that allows people to work more cross-sectoral and integral, where discussion and involvement should be on higher, strategical levels [19]. This trend will keep on developing slowly. Democracy and bureaucracy can offer stability, reliability, that has been percieved as the backbone for good governance [20]. People might not want a (local) government that is constantly experimenting, changing things, therefore this process of change is happening very slowly when happening at all.

Trends in terms of technology are ranging from very tangible innovations such as the Internet of Things, Open or Big Data innovations or Smart Grids, to the more abstract developments happening due to this technology on societal level such as technology determinism, or the development of new business models (Anthopoulos L. , 2017). We could call these new business models a form of a digital economy, where services gain importance over products, where people tend to buy more products online instead of inside a store, where robots replace

[18] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq
[19] Interview Wiebe Oosterhoff by Martin Hendriksma titled “Smart City is a Black Box for municipalities”
[20] Interview Gerard Nijboer – Process manager Innovation at the Municipality of Rotterdam

humans, and new technologies can determine the way we build houses, what food we eat and how and where we park our car (if we still own one of our own) (Mulder, 2018). These changes can have major impact on our society, ranging from job loss or job creation towards a movement where we do not need to be in a specific place anymore in order for us to work, communicate or be entertained [21]. This movement of the digital economy is not only happening in the Smart City landscape, but is the result from the digitalisation transition that is happening in our society pressurizing existing businesses and bussiness models, public and societal values and governance or legal structures. There is a significant trade-off between the range of opportunities due to digitalization, and the difficulty experienced dealing with this swiftly developing society without sufficient (legal) guidance (Vries, 2018).

The terminology 'Smart' can also be viewed as a trend that is currenly dominating industries. In the case of the Smart City, it is mostly combined with the notions data, decision-making and improvement or efficiency. Whereas there are also more 'purely' technical industries where smart is about Artificial Intelligence, by adding a chip into your brain in order for us to see or hear better or to speak Spanish whenever we want to without any prior knowledge [22]. Smart is a term that is highly favoured by marketing people, making services or products attractive by the superior perception of 'smart'. However, people are due to digitalization living with increasing amounts of technology every day. This might mean that everything that we call *smart* now, will soon be just plain *reality* [23]. As long as the pace of development is not too high for people to cope with, it might also be that the innovations that are sold as being radical, might actually not be that life-changing for people that are gradually getting used to them as normal, new things that make life easier, better, or nicer.

The perception of these technologies is as a trend in itself. Documentaries or TV-shows depicting technologies as some sort of evil power or Big Brother are very popular nowadays. One of these is Black Mirror, where each episode describes a technology gone bad, presented as a awareness campaign – if you do not act now, this might happen. Technology is, according to them, most of the time the bad guy [22]. Then, on the other side of the spectrum there are the Google's, the marketing people, the tech-enthusiasts that are trying to convince you of the exact opposite. *Technology enthusiasm* is therefor also a trend to be noticed in this landscape and this might make it tricky for people to decide for themselves what they truly think of a technology since they are exposed to either one or both of these rather extreme views (Balkan, 2017).

[21] Presentation by Jan-Willem Wesselink at the Future City Meet-up – Future City Foundation | Kennislab voor Urbanisme
[22] Interview Hans Nouwens – Specialist digitalisation and public space | Connected Worlds
[23] Interview Martijn Peltenburg – Policy Maker Digital Public Space at the Municipality of The Hague

CHAPTER 5: SMART CITY ECOSYSTEMS

In this chapter I will illustrate the participants in the Smart City Ecosystem based on both generalized information deduced from literature and interviews as well as context-specific information on the Ecosystem of Rotterdam. This will sketch a written representation of the stakeholder map for the Smart City, with the actors that are playing a role (either active or passive) and the actors that are affected by the presence of technology in their direct environment. After mapping the characteristics of the type of actors represented in the Ecosystem, values and interests can be derived accordingly (this will be done in chapter six and seven). The description of the Ecosystem serves the purpose of creating a detailed context description from which problems and complexities could be deduced which are important input for the analysis of cases in the Smart City Ecosystem of Rotterdam as well as the deduction of relevant values that might experience conflict or problems.

The participants of the Smart City Ecosystem that will be described below will be: Technology Developers; the Innovation System consisting of Cities, National and Local Government, and Outsiders involved in development; and the Public that can play various roles and represent various interests in this Ecosystem. In figure 7*, the Smart City Ecosystem is depicted with the general participants divided into four main categories. For each ecosystem participant a generalized description and analysis will be given in order to create results that are relevant for a wider public. Also, interesting findings about the Ecosystem of Rotterdam which are context specific will be highlighted since this description is especially relevant for the analysis of the cases in chapter seven. A more elaborate description of the Rotterdam Smart City Ecosystem will be given in Appendix C. Also, conclusions on this and the previous chapter can be found both in figure 8 (page 60) as well as a textual description in the concluding remarks (chapter 5.6 starting on page 58). These conclusions will answer the first research question: "What is the composition of the Smart City Ecosystem and its corresponding sociotechnical landscape?".*

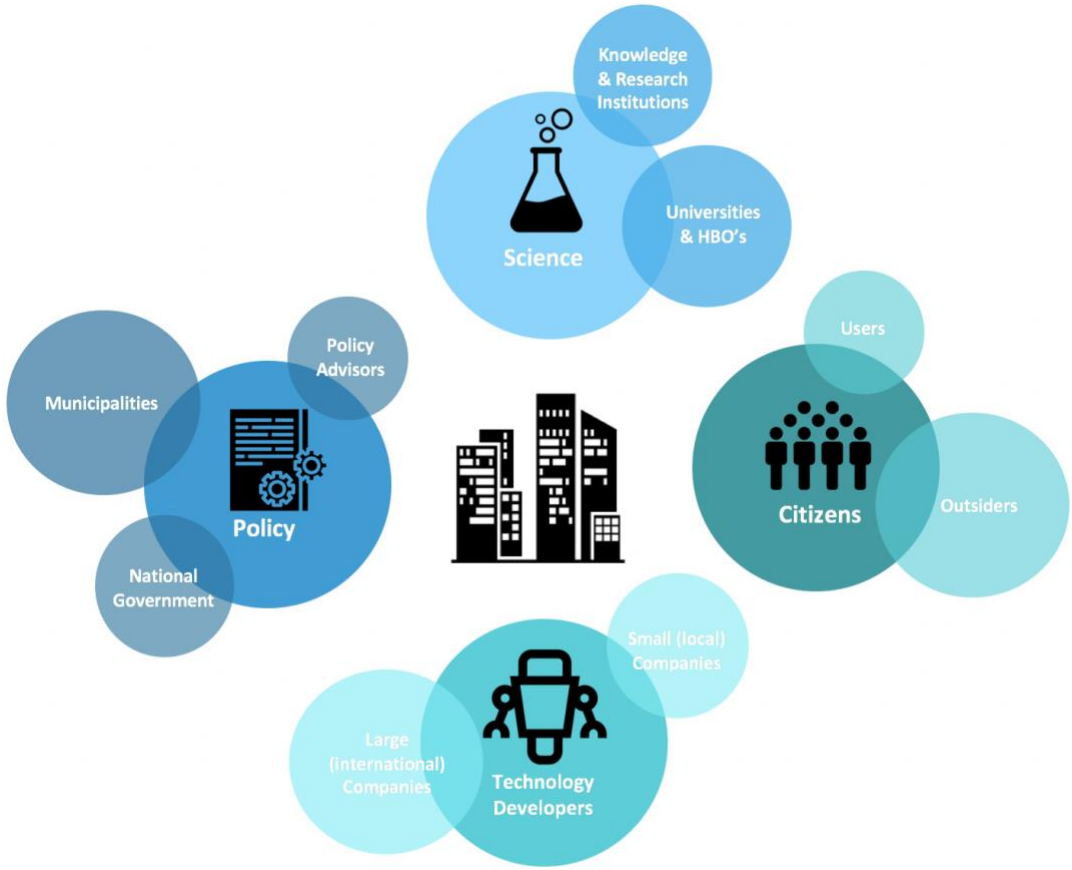
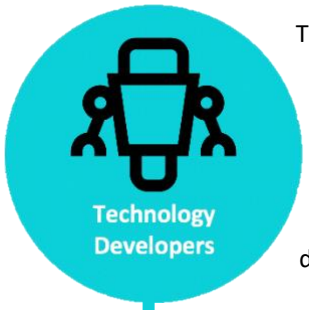


Figure 7: The Smart City Ecosystem

5.1: Technology Developers



The first participant of the Smart City Ecosystem to be elaborated on are the Technology Developers. These private parties are of high influence in creating and realising the Smart City. Roles they assume can range from facilitator, to creator or organization, and initiator or stimulator. They are responsible for the technological infrastructure and elements in the city that allows all kinds of clients to collect, analyse and distribute data (Mulder, 2018). Within this section, the activities they are involved in will be discussed, followed by the promises on the technology made by the developers, and the problem or need they are trying to resolve by their practices will be discussed.

5.1.1: Activities of the developers

Technology Developers can deliver and attribute to the Smart City by developing mesmerizing technologies that can potentially change the world as we know it, creating attractive visions on our future to privatise our cities (Meijer, 2015b). It is in the best interest of the technology developers to convince municipalities, and every other party that is willing to listen, of their corporate visions. Their main activity is to sell or test a technology or service, for (future) possibilities of cashflow. Technology is therefore often presented as a solution. Solving a problem, for little or no costs, without abrupt or invasive interventions in the city itself, or presenting technology as an investment that will save expenses on the long run is very interesting to their target audience.

The application of data-practices and technology in the city are not the only activity; attention is paid to relationships and power structures in the Smart City. Because of the interlacing of technology in the city, urban policy, service, communication, decision-making and surveillance cannot be viewed separately from these private constructions and the data generated or used (Meijer, 2015b). Technology is nowadays often a substitution for activities that originally were carried out by municipalities, NGO's, or the public. These technologies might lead to higher information availability; however, more information might not always be *better* information and thus might not be a solution to urban complexities (Meijer, 2015b).

The Smart City could also be viewed as a playground for private innovation possibilities, where the private party plays an initiator's role, which is perceived as a desirable and logical role for them to take on [24,25]. Another perspective is that of private parties being parasites, learning on the complexity of the Smart City on the backs of their clients such as municipalities [26]. Private parties, or middlemen that try to act as a real estate agent for Smart City intiatives, are desiring to drive this innovation, to organise it, to influence the course of developement. When influencing this course, you have the ability to match it to your own abilities and capacities, in order to create an even bigger role for your technology. Since the development of the Smart City is – and will remain for a while – a technology push, the source for competition in this environment is the ability to be unique and to be available [25].

The dillemma on who is the responsible party, or when responsibility is shared, how should this be balanced, remains extremely difficult. When from a technology push perspective, a technology is presented to a municipality, and the municipality *chooses* to implement this, is it not *their* responsibility that the technology is the right one [25]? It is desirable that the technology developers would also take on a share of the responsibility [26]. This responsibiity could express itself in ensuring the greater interest of the public, such as not wasting tax payers money by selling technologies that will not contribute to society, or by informing clients better on alternatives, and how to correctly use and implement technology [27].

A different role or activity that technology developers could take on is the development and management of the much neede technological infrastructure to support the Smart City via ownership or maintenance structures [26].

[24] Interview Tom Boot – Senior Advisor at the Metropoolregio Rotterdam Den Haag
[25] Interview Hans Nouwens – Specialist Digitalisation and Public Space | Connected Worlds
[26] Interview Vita Bakker & Ed Bal – Trainee & Strategic Information Manager at the Municipality of Rotterdam
[27] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam

This could save municipalities money and manpower, however, also creates a very high dependency on the technology developers. In the classical distribution of roles and interests, private parties have the incentive to earn money from their innovation practices, and municipalities and national governments have the incentive to harbour social interests [28]. When private parties take over, who will represent social interests?

Finally, investing is an important activity for technology developers which should mainly focus on achieving benefits in the long run [29]. This financial engagement in the Smart City is all about balancing private interests, versus realising successful Smart City initiatives. Return on Investment *is* important, but not the most important criterium when you are involved in an innovation trajectory [30].

5.1.2: The promises of the Technology Developers

There are a lot of promises on the potential impact of the technologies and its corresponding infrastructure for the Smart City. It is said to be radically changing our life, the way we work, and our governance system in the city, all by the use and deployment of ICTs. These ICTs have the capacity to change the way we communicate, our living standards and conditions, and it provides heaps of data (PBLQ, 2015). The availability of information promises to make events, situations, problems, or other information visible where it was not visible before, promising to improve decision-making and public management systems such as crowd control, sentiment analysis (PBLQ, 2015; Zoonen, 2016). It promises to create a higher efficiency, it promises innovativeness in the city by knowing its shortfalls and opportunities, and it promises legitimacy by better information provision for citizens therefor enlarging perceived trust (Meijer, 2015c).

The main promise of the Smart City, according to the technology developers, is that technology plays a role in solving complex, urban problems. This role is also assumed to be a vital one to realise the Smart City. This technology in term provides economic potential, therefore growth can be achieved, and cost reductions can be realized (PBLQ, 2015). Technology developers promise to be able to provide solutions for many types of problems, and they promise that the impact they can have on these problems is very high.

Finally, technology developers promise that the world is better off *with* technology than *without* it. The Smart City is marketed as a city that leads to happier citizens (Meijer, 2015b). This is a rather utopian view on the Smart City, that completely ignores the fact that not every individual has equal opportunities in terms of engagement. Besides, this view completely ignores the fact that technology might not always be key in solving a problem. The promise that technology is able to solve everything, creates a tunnel vision that insinuates that technology is the only option in solving a specific problem [29].

5.1.3: Problem or need intended to resolve with Technology

The Smart City agenda is structured in a way that it will improve the citizens' life by increasing the quality of life, services, and increasing the efficiency of city management. These activities are guided by the need to improve, and the economic, societal, practical or pragmatic problems in the city that are supposedly solvable by technology (Bolívar, 2015). Because of the technology push character of the Smart City, it is sometimes unclear whether there really is a problem or that it is a mere opportunity for the creation of cashflow.

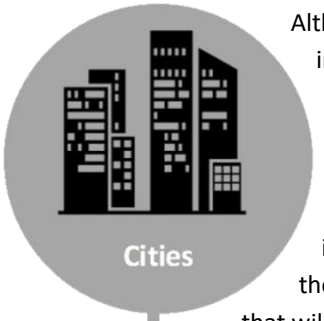
The Smart City is potentially a 'solution' to some wicked problems that we are currently facing as a society such as urbanisation, climate change and digitalization (Meijer, 2016). The involvement in this problem from various actors (citizens, municipalities, corporations, governments, etc.) and common goods (e.g. the ocean, the atmosphere) makes it a multifaceted problem that is very difficult to solve and could both address global (e.g. climate) as well as local (e.g. safety, mobility, waste management) complexities as well as aiding to adjust to our fast-paced, dynamic society that thrives on technology (Ballon, 2016; Meijer, 2016).

[28] Interview Irma van Bergen Bravenboer – Trainee at the Municipality of Rotterdam
[29] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq
[30] Interview Pim Stevens – KPN Smart City | Founder and Owner City Advisors

5.2: The Innovation System of the Smart City

In this section the innovation system will be described which can be viewed as the background upon which the actions, decisions, promises and problem definitions of the technology developers take place. This innovation system has specific characteristics that determine how innovations created by the developers are perceived, used, and accepted (Pesch, 2015). Among the actors that are represented in the innovation system, are the city itself, national government and local government (municipalities). These actors combined form the main backdrop for innovation in the Smart City Ecosystem.

5.2.1: Cities



Although the city itself cannot really be viewed as a rational actor, its characteristics are of high importance for a functioning Smart City. The characteristics of this city might be highly correlated with the mindset and acting of the municipality, however, since the city itself is the direct object suffering or benefitting from the technology, it deserved its own paragraph. As the combined efforts program EUROCITIES stated; "Cities have an essential role in accomplishing successful Smart Cities; delivering smart, sustainable and inclusive growth. They can be seen as leaders and innovators in their own right. Not just customers and facilitators" (EUROCITIES, 2012). They are at the epicentre of problems experienced by society, they are also at the epicentre of creating a future that will realize change (Habitat, 2012). Cities are also highly vulnerable places, that are not only acting as the epicentre for problems and solutions, they are also housing over half of the entire world population and are in just a few years hosting over 70% of our people (United Nations Conference on Housing and Sustainable Urban Development, 2015).

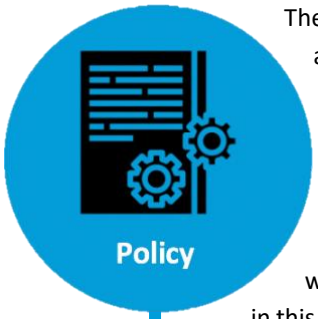
The social structure represented in cities has very paradoxical characteristics. On the one hand it could be the most productive and efficient structure to be thought of, and at the same time it is also the structure creating the most problems (Ballon, 2016d). There is no single way to define an ideal city, just like explaining or approaching Smart Cities. It is a social structure that is very dynamic, constantly changing, influenced by internal and external shocks and stresses, viewed from local perspectives and whose image is created and judged by the public at large. Also, since Smart Cities cannot develop fully on its own, extra-urban links are highly important for a more global focus. There should be a balance of handling local and global facets of the city's development, therefore broadening the vision from a city in its local sense, to a world city perspective (Tranos & Gertner, 2012).

5.2.1.1: The City of Rotterdam

The City of Rotterdam has great potential as a Smart City due to political ambitions, economic foundation, innovation structures and mentality. The city should however, in order to really profit from this potential, create coherence between initiatives in the city and Smart City Rotterdam should be developed from a clear strategy which in turn should be communicated, as well as a clear distribution of roles, tasks and responsibility (PBLQ, 2015). The connection to market parties and business models that could be formulated around these connections as well as technological applications could be viewed as the starting point for Smart City Rotterdam [31]. For the municipality of Rotterdam, the Smart City is "a city that dramatically increases the pace at which it improves its sustainability and resilience, by fundamentally improving how it engages society, how it applies collaborative leadership methods, how it works across disciplines and city systems, and how it uses data and integrated technologies, in order to transform services and quality of life to those in and involved with the city (residents, businesses, visitors)." (Bravenboer, 2018). Smart City Rotterdam did not originate from a clearly developed strategy or vision but was a result of the innovative capacity of the city itself, however, they could invest more into the development of innovative competencies (that support their Smart City development) in their region (PBLQ, 2015).

[31] Interview Tom Boot – Senior Advisor at the Metropoolregio Rotterdam Den Haag

5.2.2: National Government



The Smart City touches upon various policy terrains. Therefore, the government should be able to adjust to this and be agile and innovative in tackling occurring complexities. This could start with making agreements with private sector parties to find fitting solutions (Rijksoverheid, 2018). However, the governments vision is very ambiguous, and it remains unclear what is exactly needed to develop Smart Cities further (and proper). Since the Smart City is still in development, and in a very experimental, innovative stage, it is difficult and uncertain. However, it also offers opportunities to influence these processes, to improve them, to improve the organizations working with or developing the technologies, and to guide more effective collaboration and communication in this industry (Bravenboer, 2018). General facilities in terms of technological infrastructure might be the responsibility of the government, while they are now mostly fragmented and privatized. To prevent this fragmentation, action has to be undertaken since infrastructure spans municipality boundaries, province boundaries and even national ones [32].

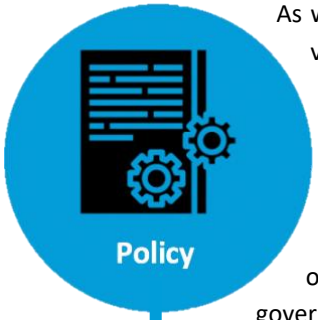
In its most classical structure, national government has a *control* function, which could be used to create frameworks, and to set guidelines or regulations. As a result of decentralisation this control function is now scattered across different organisations, the European Union and the private sector. However, there are major themes involved with the Smart City and other urban changes affecting society that potentially have enormous impact allowing for the involvement of governmental organisations is desired. This might consider topics such as standardisation, or investments in technological infrastructure, or the creations of frameworks [33]. The development of the Smart City occurs at municipality level, so; to what extend do you have to act as national government? How can you force a top-down view onto a bottom-up development? This raises questions in what role a government should take on and how this role will be accepted by the other actors in this ecosystem [34].

The roles identified for the national government are *Solution Enabler* – connecting relevant people and organisations; *Strategist and Advocate* – creating a clear vision and to act accordingly; *Director and Regulator* – institutionalizing regulation and legislation as well as enforcing them; *Connector and Protector* – achieving resilience and safety; *Innovator and Investor* – providing financial boosts and being a launching; and *Steward* – provide infrastructure for innovations to blossom (Dubbeldeman & Ward, 2015). Whether these roles are actually represented in the national government of whether they are taken care of by municipalities, private parties, or others is not clear.

Where some may perceive the national government – in the Netherlands – to be inactive on the topic of Smart Cities, they are in fact very busy with formulating all kinds of digital agendas to allow political debate and policy making. These agendas do not usually address very local aspects on municipality level, however do give remarks for provincial and national levels. The national government could have a role in slowing down market parties by regulating the industry, or they could coordinate and connect parties in the Smart City Ecosystem to allow for effective and efficient Smart City development trajectories [35].The national government can have revolutionary effects on industry, just like it did when they decided not to privatize the energy sector many years ago. This kind of decisions should also be made in the context of the Smart Cities, where risks in terms of cyber security, privacy and inclusion are affecting the entire population, therefor it is also the responsibility of our *national* government to act [36].

[32] Interview Hans Nouwens – Specialist Digitalisation and Public Space | Connected Worlds
[33] Interview Tom Boot – Senior Advisor at the Metropoolregio Rotterdam Den Haag
[34] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam
[35] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam
[36] Interview Marije ten Kate – Planner Urban Development at the Municipality of Rotterdam

5.2.3: Municipalities or Local Government



As was also presented earlier on in this research, city management is taking on a neoliberal point of view, where the main activities might no longer revolve around controlling, but more on steering and guiding city development (Grossi & Pianezzi, 2017). In this neoliberal point of view, corporate and economic interests may gain importance over social and political ones. Along with the neoliberal views, and the incorporation of technology in the city, come new ethical dilemmas (Kemmerling, 2018). In terms of data that is produced and analysed for city management purposes, which algorithms use as fuel for their predictions, operational issues also put pressure on local governments (Zoonen, 2016). These challenges and a changing landscape require new governance structures where local governments might carry out different roles (Bolívar, 2015).

Additionally, it is required to develop competencies that are naturally not represented within the government such as data management and analysis by investing in the creation of strategical alliances, developing data skills and data ethics with employees, develop strategies and vision, and invest in technological infrastructure such as data management platforms [37]. Strategical alliances with private, specialist parties, can contribute to knowledge creation in areas that are naturally not represented in the Ecosystem. Also, collaboration with other municipalities and public umbrella organisations such as the VNG (the Dutch Association of Municipalities) and national government might be desirable to future proof the governance system[38].

Roles (either new or existing) that are needed to be represented in this new structure should be that of a *facilitator*, *connector*, *launching customer* and ambassador, initiator of social innovations, *funder*, and *regulator* (Bolívar, 2015; PBLQ, 2015). Also the inclusion of citizens into *decision-making processes* is a typically new structure of governance used in the Smart City municipality. However, it is important to note that the power structure is shifting, decreasing the influence of a municipality and increasing private influences (Bolívar, 2015). This might result in a more technocratic rather than democratic structure of city management, with all its implications and concequences. As Bolívar briefly summarized the challenges a *smart* government is facing: “Smart Government, hence, has to cope wit (a) complexity, (b) uncertainty, and by doing so, has to (c) build competencies and (d) achieve resilience” (Bolívar, 2015).

It is very interesting to see that there is a big diversity in the way municipalities approach the Smart City. Some municipalities decide to work with Smart City experts in team structures, or by attributing ‘smart’ responsibility to specialists in the previously conservative approach (e.g. smart lamp post management)[39]. Whatever the structure used, Smart City creators should at least be courageous willing to take risks due to the associated unpredictability and complexity [40]. This is especially difficult since local government is not the ideal party to initiate and stimulate innovative development trajectories and transitions. Policy making is about predicting, which is easiest when there is a straight-lined trend to be observed, not when there are unexpected peaks and turns [41]. Another characteristic of local government is that they work in an organized and sectoral way. These sectors might hamper the creation of integral solutions since most of the discussion, communication, collaboration and invention remains within the rather narrow borders of their sector [42]. Limiting both impact and innovative capacity.

The innovative capacity of cities is highly dependent upon the actions, vision, and policy of local governments [43]. However, local governments can be rather conservative when it comes to innovation and renewing procedures

[37] Workshop Frans Jorna & Chris Batist at the VNG realisatie congres
[38] Workshop Olha Boldarenko & Theo Veldman at the VNG realisatie congres
[39] Interview Hans Nouwens – Specialist Digitalisation and Public Space | Connected Worlds
[40] Interview Martijn Peltenburg – Policy Maker Digital Public Space at the Municipality of The Hague
[41] Interview Marije ten Kate – Planner Urban Development at the Municipality of Rotterdam
[42] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq
[43] Interview Maarten Keesman – Project Manager Economy at the Municipality of Rotterdam

or assets. This might have something to do with the fact that public assets such as bridges or lampposts have a lifetime that is ranging somewhere between 10 and 100 years, corresponding with the drive for innovation [44]. Also, when procuring or investing in products, or services, economic interests most of the time weigh heavier than other interests such as innovativeness or sustainability [45]. Most of the innovation processes are happening in the private sector, within municipal borders, sometimes in public space raising questions on responsibility for public interests and values. Ignorance on this subject is very problematic and awareness should be raised within the municipal system.

5.2.3.1: The Municipality of Rotterdam

For Rotterdam to develop into a real Smart City there are high hopes and expectations. Due to the connections that the city has with both market parties from various industries, as the connection to a solid knowledge base with universities and universities of applied science in the city itself or in its close proximity, innovation and creation are at the core of the city. Also, the city has a lot of energy, young people, diversity, a nice hands-on mentality and a loyal constituency (PBLQ, 2015). The municipality experiences some trouble in trying to decide what projects to engage in and initiatives to exploit, how to deal with bottom-up inventions and suggestions and how stop fragmentation [46].

Rotterdam sees the Smart City as an urban development strategy, where citizens, businesses, and other ecosystem connections are all involved (PBLQ, 2015). The Smart City is a proposed solution to adjusting city management to dealing with transitions, which cannot be planned or predicted, but simply could be dealt with in an agile, flexible, disruptive and innovative way [47]. This could mean that people have to change the way they execute their job, or that their job is not taken over by a *smart* system (Binnenlands Bestuur, 2016).

The economic crisis of 2008 created somewhat of a 'survival' culture for municipality focussing on things that *must* happen, thereby sometimes excluding innovation. This culture still resides in most parts of the municipality, making it difficult to find time, budget and understanding for the need to innovate and there are only a few people that can afford to do so [47,48]. While it is true you have to be strict when it comes to spending public money, there should be some space to manoeuvre, and to create a more modern organisation that allows or stimulates innovation [47].

In terms of knowledge and awareness, there is a big gap to be seen between the people that are higher or lower educated, that are technology oriented or are technophobic, people who speak Dutch, people who do not, etc. Not just citizens of Rotterdam experience a lack of knowledge, also the municipality itself is missing some crucial information and skills to deal with the Smart City developments [49]. Whether this is due to the budget cuts made due to the financial crisis, where 'unnecessary' experts were out of a job, or because of the transition character, creating this highly complex and dynamic development trajectory is unclear.

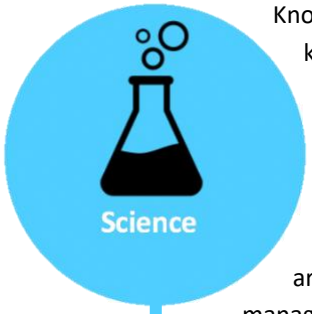
While there are various reasons to engage in Smart Cites, such as improving the quality of life of citizens, creating a better image as a city, and realizing economic growth and change, the municipality experiences difficulty in making choices in what to engage [48,50]. The municipality experience a strong technology-push, a fear for faulty decision-making, naivity, unawareness and ignorance on the promises of technology versus its risk, and difficulty in handling societal transitions [50]. There is a lack of knowledge or insight and overview to aid policy-makers in decision-making processes in Smart Cities, which is characterized by many complexities [46,47,50].

[44] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq
[45] Interview Maarten Keesman – Project Manager Economy at the Municipality of Rotterdam
[46] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam
[47] Interview Marije ten Kate – Planner Urban Development at the Municipality of Rotterdam
[48] Interview Irma van Bergen Bravenboer – Trainee at the Municipality of Rotterdam
[49] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam
[50] Interview Vita Bakker & Ed Bal – Trainee & Strategic Information Manager at the Municipality of Rotterdam

5.3: Outsiders to the Smart City Innovation System

Within this section outsiders and knowledge institutions will be discussed. These outsiders are not completely excluded from the technology development trajectory and may have significant impact upon its course. These outsider parties could impact development processes little or a lot, expressing coherent or different views. However, the Smart City Ecosystem is highly connected and networked, leaving less room for real outsiders. Knowledge institutions are one of the outsider parties since they do not have a direct influence, however could have significant contributions. This makes them outsiders to the innovation system, however, not to the Smart City Ecosystem.

5.3.1: Knowledge Institutions



Knowledge institutions play a role in the development in the Smart City that is mostly focused on knowledge creation, transfer and transcribing this knowledge for practical use. These institutions can test new ideas, develop ideas, describe experiences gained from tests and thereby build up relevant knowledge on technology or policy (KPN, 2016). The Smart City domain is widely oriented, works cross-sectoral and fragmented, and its research domain is characterised the same way. This means that alfa, beta and gamma domains should be combined to achieve the knowledge backdrop needed for analysis in the Smart City. Therefore, research should not only focus on technology (it is argued that technology is rather mature), but also on policy-making, decision-making, stakeholder management, (open data) framework development and standardisation practices [51].

Another important role for knowledge institutions is a network function with municipalities, where collective experimentation and testing leads to quicker or better implementation in the city. Several cities partner up with the local universities (of applied science) to develop or test technologies or methodologies in experimental settings. Experimenting with knowledge institutions is cheaper and probably more efficient than hiring consultants to develop this knowledge [52]. Research should pay more attention to the citizens' side of the Smart City as well as effective participation structures [53].There are some issues that are widely occurring and reoccurring in terms of privacy concerns, participation that only works for the 'usual suspects' (white, retired, higher educated men), and a lack of awareness on these issues by the citizens themselves as well as policy-makers.

5.3.2: Outsider Collaboration Structures

There are a lot of platforms and collaboration structures to be found in the Smart City Ecosystem. One of the major collaboration structures created by outsiders (in the Netherlands) is the NL Smart City Strategy. This strategy was created commissioned by the Dutch Prime Minister Rutte to overcome implementation and development issues on a national scale [54]. This strategy should contribute to the competitive position of the Netherlands, and collaboratively overcoming frequently occurring issues (Institute for Future of Living, 2017). This strategy is created through collaboration however did not receive the traction and support that was expected therefore limiting its impact.

This is a reoccurring issue. The Smart City Ecosystem and landscape is fragmented making it is extremely complex to formulate any of the many available approaches, framework, strategies, or methodologies that will gain support by the majority of the actors represented in this industry. When studying the city of Rotterdam there are at least 56 collaboration structures that are relevant for Smart City Development, illustrating the overflow of availability and the lack of coordination – even on city-level (Vieveen, 2018).

[51] Workshop Iemke Idsingh at the Smart City Update – Smart City Academy
[52] Interview Maarten Keesman – Project Manager Economy at the Municipality of Rotterdam
[53] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam
[54] Interview Bram Reinders – NL Smart City Strategy | GSC3 | Alliander

Then there is also collaboration per specific topic or technology with European initiatives (humble lamp post, RUGGEDISED), or industry collaborations between energy providers (e.g. Eneco), Transmission System Operators (e.g. TenneT), and Distribution System Operator (e.g. Alliander, Enexis, Stedin) (Bravenboer, 2018). There are also actors or organisations that are playing a role as an advisor in this sector, specialising either in stakeholder management (e.g. City Advisors), in a specific technology such as the intelligent traffic lights (e.g. CityTec), or in collaboration between public and private parties (e.g. PBLQ). Then finally, there are collaboration structures within the public sector such as VNG, Agenda Stad and Urban Big Data Rotterdam (Vieveen, 2018).

5.3.2.1: Collaboration Structures of the Rotterdam Ecosystem

Rotterdam's collaboration approach can be seen as distinctive due to the role of a broker for the Smart City, connecting parties, creating and seeking opportunities, create internal and external connections with relevant departments or sectors and being the go-to contact for questions and ideas on this topic. An example is the collaboration between the municipality and KPN who is responsible for realizing the technological infrastructure needed for digital innovations such as the 3G, 4G and LoRa networks available in the city. This collaboration creates innovation as well as boosting economic activity, create new jobs and possibly increase the quality of life for citizens (Binnenlands Bestuur, 2016).

In an attempt to identify all collaborative efforts that the municipality of Rotterdam is involved in in context of the Smart City, 56 collaboration structures have been identified. These collaborations are occurring on several themes, involving public organisations, private organisations, NGO's, citizens, the national government, province South Holland, the European Union, start-ups, foundations specialized in knowledge transfer, collaboration, innovation, or technologies, etc. The themes that the municipality of Rotterdam is mostly collaborating on are (in no particular order): economic growth; Smart grids; energy; sustainability; health; (social and cyber) safety; service development; innovation (stimulating, realising, collective); digital infrastructures; societal challenges; collaboration; entrepreneurship; knowledge transfer; technology promotion; mobility; transparency, ethics and value creation; standardisation; open and Big data; and realising public debate (Vieveen, 2018). It is interesting to see that the collaboration efforts of the municipality are all theme-specific, involving different parties and municipality employees per theme. This could create barriers for integral problem solving and creating an effortless connection between theory and practice.

Another important collaboration structure for the municipality of Rotterdam is the MRDH – Metropoolregio Rotterdam Den Haag. The MRDH is an umbrella organisation that houses 23 municipalities from the region surrounding Rotterdam and The Hague. The MRDH is the place where cross-fertilisation should take place between municipalities and knowledge institutes such as the universities of Leiden, Delft and Erasmus, business partners and the Innovation Quarter, where ideas are shared, problems can be discussed, and strategic choices are negotiated on. It is an organisation that could help steer in the Ecosystem in a certain direction by addressing important topics in meetings, gathering knowledge, or drafting new policy and frameworks [55,56]. Beside the MRDH, there are other structures of collaboration such as 'Kenniswerkplaats Urban Big Data', which is focused on the sharing of knowledge, means to realize digitalisation and how to involve citizens [57]. For innovation purposes, cooperation is also facilitated between organisations such as TNO (scientific research organisation on technologies), Rijkswaterstaat (Water management organisation of the state) and the Port of Rotterdam, where a lot of economic activity for the city of Rotterdam is originating [58]. The collaborative approach of combining the Port with the city, is a reoccurring strategy for the municipality of Rotterdam that has created many fruitful innovations and strategies [59].

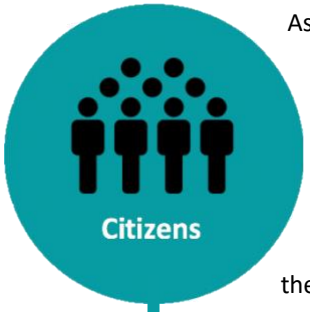
[55] Interview Tom Boot – Senior Advisor at the Metropoolregio Rotterdam Den Haag
[56] Interview Marije ten Kate – Planner Urban Development at the Municipality of Rotterdam
[57] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam
[58] Interview Maarten Keesman – Project Manager Economy at the Municipality of Rotterdam
[59] Interview Ineke Nierstrasz – Strategic Advisor Safety at the Municipality of Rotterdam

5.3.3: Standardisation practices

Since there is a high fragmentation ongoing in the Smart City industry, there is also a big desire to create some order in this chaos by standardising. In this standardisation are various (outsider) actors involved such as the NEN which is delivering multiple standards for the Smart City, amongst others a standardisation for IoT practices. Another example is the Kadaster, working on standards to register sensors for municipalities to get a grip on sensor use in their city (Kadaster, 2018). GEONOVUM, an organisation that focusses on the interchangeability and usability of geological data for all types of users and collectors, is also of importance for standardisation by formulating agreements on data storage, processing and analysis (GEONOVUM, 2018).

A promising standardisation initiative is the one by the NEN, that created the Smart Cities Standardisation Advice Group (SC-SAG) where representatives from various cities, national government bodies, industry and knowledge institutions meet on a regular basis to discuss standardisation issues in the Smart City development trajectory. These standards may differ in topic such as types of lighting columns used in the smart lamp post to standards on data management. This group of actors should represent the Smart City Ecosystem in a realistic way in order for the standard to be widely accepted (Bravenboer, 2018). In addition to some individual stakeholders or organisations, some interests from the Ecosystem will be represented via umbrella organisations that will speak on behalf of their constituency. This process of standardisation should allow for a national strategy for coordinating the Smart City in terms of approach, processes and technologies. Also, the 'frequently asked questions' of the Smart City could be resolved by the support of the outcomes of the SC-SAG, and connections could be made toward both national and international networks that focus on similar standardisation issues (NEN, 2018).

5.4: The role of the Public in the Smart City



As a citizen of the Smart City, your role in development is different. You are the subject of problem analyses, you should be profiting from these developments, however, you are also the actor that has little power and might not enjoy the developments at all. There are different opinions about whether citizens should be scared. However, since developments are very gradually, it makes the threshold for worrying about these developments lower [60], and our perception of them might be as a new normal [61]. The point of view of a citizen is very different from that of a technology developer or a policy maker. A citizen might be experiencing results of the applications of sensors in the city centre, however, will not care that much about the technology side, or about data [62]. Citizens are more an object than an influential actor in the Smart City.

This, however, is not the only role a citizen could have in either the development or implementation of the Smart City. Since the transitions that are perceived as a starting point for the Smart City are mostly created by people, they can also play an interesting role in being the solution [63]. When analysing collaboration structures that occur in this sector with Smart City related projects and initiatives, we mostly use triple helix structures; where government, science and private industry come together. However, it seems more and more of importance to involve citizens in these processes, even if it concerns 'invisible' infrastructure elements such as a Smart Grids, or sensor networks; the Quadruple helix structure [64]. When innovations in public space are concerning people, you should involve them instead of creating a black box around public space, with a lack of transparency, which is dangerous and undesirable [65].

[60] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq
[61] Interview Martijn Peltenburg – Policy Maker Digital Public Space at the Municipality of The Hague
[62] Interview Pim Stevens – KPN Smart City | Founder and Owner City Advisors
[63] Workshop by Linda Carton at the Smart City Update – Nijmegen Smart Emission Project
[64] Interview Dieuwertje de Jonge – Graduate research intern at the Municipality of Rotterdam
[65] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam

The lack of involving citizens in the Smart City concept is actually one of the biggest problems indicated for successful development (Bravenboer, 2018). The realisation that citizens are a crucial element in the Smart City industry is coming relatively late (Teeffelen & Naafs, 2017a). The top-down process that is currently ongoing, is excluding these citizens, while at the same time is promoting participation as the way to go. How can you expect citizens to participate while on the other side of the spectrum, you are deciding everything for yourselves? There are multiple roles for citizens to take on in the Smart City, and not just that of an object or registration. Alternatively, citizens could be users of the technology, or as a co-producer (PBLQ, 2015).

Citizens could also be a powerful actor via Citizen Science projects. These projects are generally involving the use of cheap sensors that could measure environmental properties such as air quality, humidity, noise pollution, changes in the atmosphere, and various other data [66]. The access to this data could strengthen citizens position towards the government (Kreijveld, 2016). The risk of the application of these sensors with the public is that it could also lead to faulty conclusions, to statements that are not scientifically grounded, and that could create a lot of unfair stigmatization by misinterpretation of measurement data or misfunctioning sensors (Rijksinstituut voor Volksgezondheid en Milieu, 2017).. On the other hand, could self-analysis also result in feelings of reassurance when citizens were worrying about issues that are proven 'not to exist'.

The underlying issue is that citizens are not fully trusting their government for providing the correct data at all times, resulting in a need for citizen empowerment [66]. Via citizen science, democracy could be strengthened allowing for citizen engagement and actual participation instead of only relying on voting and voice (Kreijveld, 2016). Data acquired via this type of projects only will gain meaningful importance when there are enough participants and citizens have insight into data in a way that it is understandable and gives action perspective [66]. You cannot expect from citizens to feel engaged when they are merely producing numbers on a screen, it has to be something insightful and meaningful. On the other side of the equation, (local) governments should seriously evaluate this data. This requires a level of trust from governmental parties towards the public and vice versa [67].

It is fairly easy to find participants for these Citizen Science projects; however, it is very difficult to find a participant sample that is representative for the Dutch population [66]. As is with all participation projects, we have to deal with the 'usual suspects'; older, retired, white, technology-oriented, male participants that are higher educated and usually know their way around the municipality [66,67]. These citizens might not represent all relevant interests and values for the general public. The issue is not that there is no participation, the issue is the lack of transparency in motivations behind choices, and when participation is used, the public might not really be represented, and it is not always used as a fair instrument but rather as a trojan horse for political motives.

5.5: The Smart City Ecosystem

As was illustrated by this chapter, the complexity of this ecosystem and the variety of involved actors is very high. This is also the reasoning behind choosing the term ecosystem, since it corresponds to a complex network of co-dependent actors that vary in terms of background, power, interests, etc. The Smart City is a way of combining the knowledge, interests, and problems created by this ecosystem and try to make a tangible, useful, technological application where opportunities arise for parties of the Ecosystem. This Ecosystem therefor must be an open system that allows new parties to enter or exit, without any prefixed boundaries to allow for efficient and effective knowledge transfer practices and collaboration between all these different actors (PBLQ, 2015). The role of citizens should not be forgotten as a party that is not only an object of registration but also a party that could create profit, gain and give trust and convenience to other parties. Therefore, a Quadruple Helix structure is desired.

[66] Interview Roel van de Loo & Dick Jansen – Partner at SPPS-consultants & Environmental Consultant NG2
[67] Interview Irma van Bergen Bravenboer – Trainee at the Municipality of Rotterdam

The development of Smart Cities is too much, almost completely, led by technology producers, or technology firms (EUROCITIES, 2012; Grossi & Pianezzi, 2017). The rather opportunistic approach of these private parties allows them to be involved in policy-making, decision-making and city management. The problem with this is that the people that are representing or developing these technologies are not the people that were elected to carry out a powerful governance function (Grossi & Pianezzi, 2017). The technology push could mean developers force themselves upon municipalities until someone takes bait. This is not completely to blame on the private parties, it is in *their* interest to sell. Municipalities will need to learn how to think and assess technologies critically, in order for them to present clearer problem definitions, clearer communication and better decision-making [68]. This requires the Ecosystem to also focus on other disciplines rather than solely technology. Ecosystems revolve around the idea that one actor might complement the other, meaning that not just the knowledge and experience of the technology developers in this Ecosystems are of importance. The Ecosystem could be the basis for cross-fertilization, emphasizing the openness of the Ecosystem and the lack of limiting boundaries.

With the introduction of an Ecosystem, there are some changes to be made in terms of collaboration, governance, knowledge transfer and task division. The Smart City offers structural economic challenges due to the fact that it is highly contextual, and this context might impact the way technology influences a city (Anttiroiko, 2015). In a classical division, the municipality or government decides, without the actual interference of other parties. With this Smart City structure, where the municipality is dependent upon relations and collaborations with private parties, this is no longer viable [69]. Also, the way citizens are involved and engaged in these processes are different than they used to be, creating another level of complexity.

Collaboration in the Ecosystem raises some additional issues such as questions about ownership of data and technology, questions about financial engagement and investment incentives and on how to manage these complex relationships while safeguarding your own interests and values (Teeffelen & Naafs, 2017a). Adding to this complexity is the fact that the collaboration structures are different for each project. This means that the private and scientific parties that are relevant partners in these projects are highly context and topic dependent [70]. The added value of real collaboration and communication is often overlooked in the Smart City. This is something that should be invested in for more effective knowledge exchange, trust building and cross-fertilization [68,69]. This also means that municipalities and other parties must stop to solely communicate their wins and should start communicating everything that did *not* work out [71]. This requires a vulnerability. Knowledge sharing, and *effective* communication should be stimulated in the Smart City Ecosystem, not just for municipalities, but also with citizens and market parties [68,70,72].

Communication on the Smart Cities leads to a strange view on its development. The average citizen will only hear about the existence of Smart Cities when something is going terribly wrong or extremely well. There is however not enough information easily accessible on the trade-offs of the Smart City. Only when actively searching, the Big Brother, or Black Mirror views of the Smart City will be presented. This does not mean that there is one true version of the story, however, it means that not all facets of the story are accessible at this moment and the Smart City is severely lacking in transparency (Buijs, 2018). A large share of the Ecosystem is unaware of the danger and risks that the Smart City may pose to our society, while in the meantime, the majority does not even seem interested (Liukku, 2017).

[68] Interview Gerard Nijboer – Process manager Innovation at the Municipality of Rotterdam
[69] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam
[70] Interview Martijn Peltenburg – Policy Maker Digital Public Space at the Municipality of The Hague
[71] Interview Tom Boot – Senior Advisor at the Metropoolregio Rotterdam Den Haag
[72] Interview Rob Schmidt – Projectmanager Smart Cities and Digital Economy at the Municipality of Rotterdam

5.5.1: Collaboration in the Ecosystem

A popular collaboration structure is that of a public private partnership where municipalities partner up with industry. These private parties might create risks for the municipality by trojan horsing corporate interests into city management, therefore municipalities should be alert, collaborate consciously and combine forces with other municipalities, knowledge institutions, or platforms. These organisations could guide the collaboration process, and help in developing standards, realize collective procurement, raise awareness on power shifts, dependency on technology developers, transparency, and mobilize knowledge [73].

For successful collaboration parties should be able to find each other on an equal level, a common ground. Where technology developers might possess technology knowledge and skills, municipality might possess information on values, interests, legal structures or governance which could complement each other. They are acting in a different pace, speaking a different language, striving to achieve different goals. Market parties, knowledge institutions and government parties should be able to leave their background and bias behind and try to really understand each other [74]. This way, collaboration will lead to more valuable results and insights, better suited for its clients or users, which might be as important as the innovation itself.

5.6: Concluding remarks on the Smart City and the Smart city Ecosystem

To conclude all findings in this chapter, the first research sub-question should be answered:

Sub-question 1

What is the composition of the Smart City Ecosystem and its corresponding sociotechnical landscape?

This research question covers the contents of both chapter four and chapter five and relies on the constructed Sociotechnical Value Map elements focusing on the Technology and the Stakeholders (in this research, stakeholders are presented to be part of the Ecosystem). Besides the explanation in text, an overview is given in *figure 8.* To start answering the question, a recapitulation on the information available on the (socio)technical landscape will be given, as well as an overview of ecosystem participants and their roles, traits and interests. Starting with the Smart City sociotechnical landscape, a first characteristic is that the Smart City is multi-facetted and subjected to perception. The Smart City is highly dependent on ICTs, is known for its business-led development trajectory and usually operates from a neoliberal perspective.

There are high risks involved by engaging in the Smart City, such as the fact that there is a high level of uncertainty due to the dynamic and complex context of the Smart City and its Ecosystem. There are challenges in creating good collaboration structures, developers experience performance anxiety, and it is difficult to solve the many complex urban problems. Also, due to the technology push experienced by municipalities, there are risks associated with the general implementation of technology such as vendor lock-in. However, there are also reasons to engage in the Smart City, such as the high potential it has to offer in terms of new services, cost reductions, reduced need for maintenance and repairs for assets, the increase in efficiency and efficacy of policy and organisation practices, it could create (new) insights into problems and situations, it offers new practices, new business models, could solve environmental problems or at least contribute to sustainable activities.

As for the sociotechnical system that functions as the backdrop for the development of the Smart City, the city is a new market, a test ground for innovation, with the mindset of neoliberalism at the core of its development. There is a push for deregulation, open market mechanisms and competition. Also, this technology push results in the transferring of originally public tasks to private parties. The Smart City is lacking transparency or effective, clear communication. Legislation could guide and steer this process, however, is developing slower than the technology gets implemented. There are however two laws or regulations that directly influence the Smart City

[73] Interview Marije ten Kate – Planner Urban Development at the Municipality of Rotterdam
[74] Interview Marijn van Dijk – Commercial Manager Mobility at Dynniq

development; the General Data Protection Regulation, and the national Tender and procurement regulations. These regulations might slow down innovation due to the suggested selection by mostly economic requirements. Municipalities are trying via all sorts of ways to avoid these rules in order to make it easier to innovate.

Technology Developers are the first participants of the Smart City Ecosystem to be described, who are responsible for the invention of the Smart City. They are promising their technology to be of high value to the clients, they steer towards privatizing public tasks in the city, and they present their technology as a problem solver in a very broad context. They establish relationships, take on different roles, engage in public functions, provide cities with more or new information, they innovate, experiment and try to distinguish themselves from the other competitors. Also, they are involved in the debate about whether they are responsible for the technologies that are placed in the city or not, and they could invest in technological development to further their own position. The types of problems they solve could range from economic ones, to societal, pragmatic, urbanisation, climate change or other wicked problems up to the most locally oriented problems for safety, mobility and waste management.

The city could be seen as the locus of a lot of the urban problems, as well as the locus for creating a solution, thereby being a non-rational Ecosystem participant. Since a lot of problems presented in cities span their municipal boundaries, the National Government needs to be involved in the Ecosystem. The national governments task in the most classical sense is a controller, which is increasingly becoming scattered due to decentralisation and privatisation. The National Government could have the role of a solution enabler, strategist and advocate, a director and regulator, a connector and protector, as well as a steward. Also, it could be desirable to act as a facilitator and a party to have impact on subjects such as privacy, cyber security and inclusion.

While the national government focusses on boundary-spanning activities on a higher aggregation level, the municipality is context dependent. They are increasingly operating from a neoliberal model where outsourcing is gaining dominance, new governance is desired, new competencies are required, and strategic alliances need to be formed for Smart Cities. Roles for the municipality could be that of a facilitator, connector, launching customers, ambassador, initiator of social innovations, funder, regulator and investor in innovative capacity. Within the municipal borders, power is shifting to private parties and citizens via citizen science and participation. A technocracy is lurking around the corner. While there is no good or bad way to engage in Smart Cities, in general, municipalities are not that good with unpredictable scenarios and transitions due to the complex characteristics, the inability to efficiently and effectively share knowledge, the distribution of responsibilities for these innovations and the highly sectoral approach of doing business in the municipality.

As for knowledge institutions such as research facilities and universities, they are considered to be outsiders of the innovation system since they do not directly influence the Smart City, however, they are a part of the Smart City Ecosystem for attributing valuable information. Especially desirable is knowledge on the subjects of policy-making, decision-making, stakeholder management, open data frameworks, and standardisation practices for the Smart City; making them a highly relevant collaboration partner.

A very important member of the Smart City Ecosystem is the citizen, the public. In the Smart City, citizens are objects of registration, the cause of several problems, solution enablers, profiteers from these technologies, as well as having to face the risks they pose. The lack of involvement of citizens is perceived as a big problem, where public private partnerships are the way to go, while the citizen is often forgotten. Participation and citizen science could strengthen democracy and inclusion, however is nowadays burdened with the ‘usual-suspect’ syndrome that does not allow a true representation of society in these projects.

Looking at the Ecosystem as a whole, the focus is nowadays too much on technology and there is a need for new skills and knowledge in order to deal with other issues occurring on the more social side of the Smart City. The need for new governance structure is required for better collaboration, knowledge transfer, task and role distributions, and responsibility. The Smart City is highly contextual and networked where the role of realtor,

moderator, mediator or connector is not really fulfilled and is missing as a glue between scattered initiatives and Ecosystem participants. Due to the complex network of parties with all different perceptions, interests, backgrounds and opinions, collaboration and communication are problematic and create issues in offering transparency – especially when things do not work out as planned. The problems with collaboration and communication could be overcome if Ecosystem participants were able to leave their biases and specializations behind, and actually engage in meaningful conversations on the level of a common ground. This problem and its cause are however very characteristic to the Smart City Ecosystem and the Industry of the Smart City. An overview of the Ecosystem and the landscape is given below in *figure 8.*

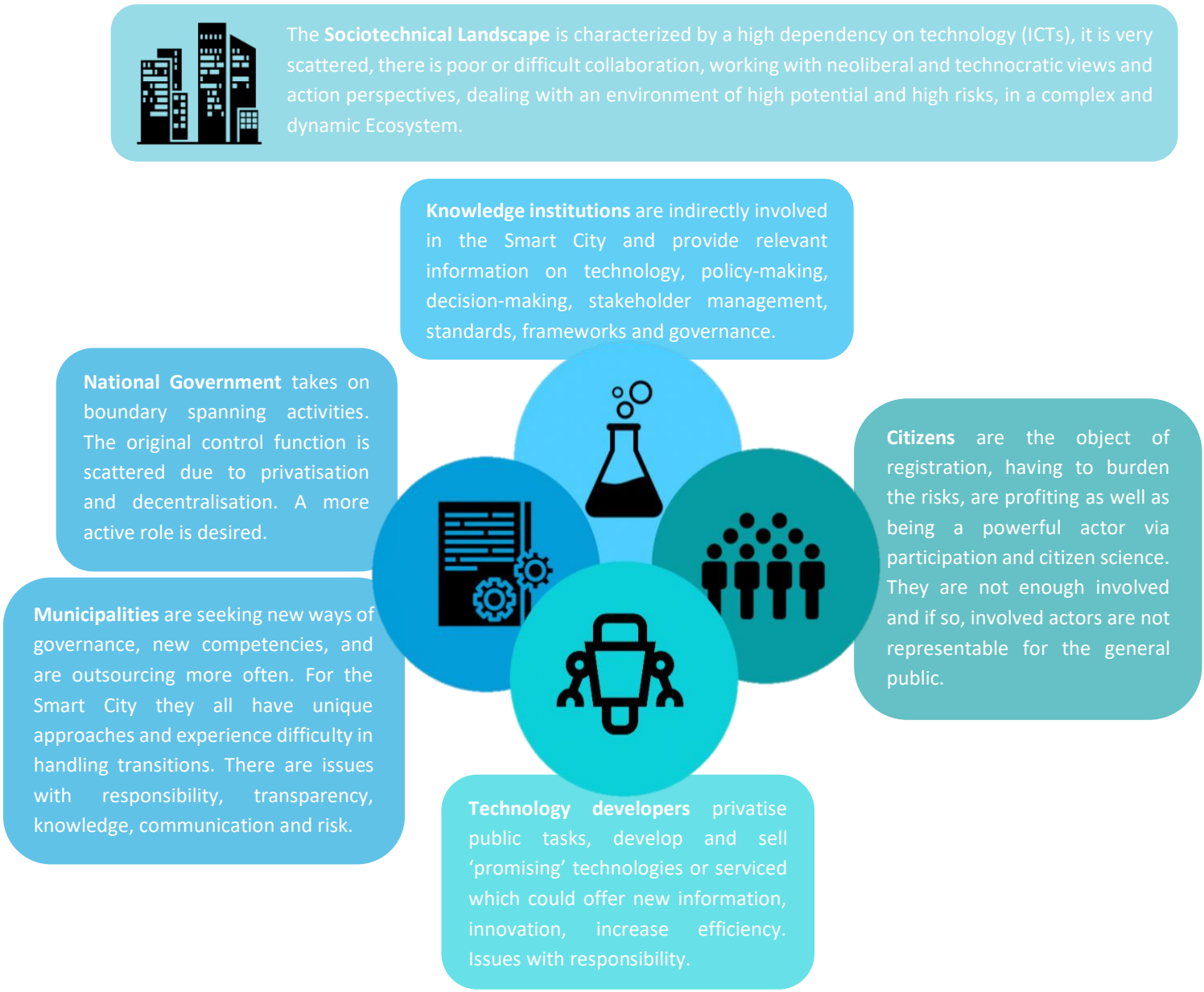


Figure 8: Concluding Remarks on the Smart City Ecosystem and the Sociotechnical Landscape

CHAPTER 6: VALUES IN SMART CITIES

Within this chapter the values will be identified that are potentially being pressured or conflicted due to the developments ongoing with Smart Cities. Besides the identification of values, the actors experiencing these value conflicts or problems will be identified. The values will be identified using literature, interview data, and mostly will be extracted from the characteristics of the Smart City Ecosystem and the Sociotechnical Landscape that has been illustrated in chapter four and five. In this chapter I will start by presenting the most occurring problems that can cause value conflicts and problems; the ethics of data, struggles between public and private parties, risks of the Smart City and technology implementation, as well as transparency issues. Then I will identify the public, economic and technological values that are generally conflicted; privacy, autonomy, safety, power relations, human dignity, justice, control, and economic values. These values will be studied in the following chapter in the context of various Smart City initiatives in Rotterdam. The values identified in this chapter will be generalizable to a wider (national) context and are not specifically relevant for Rotterdam. This chapter will be concluded in chapter seven, where the second research question will be answered in the conclusions.

6.1: ISSUES CAUSING VALUE PROBLEMS AND CONFLICTS IN THE SMART CITY

There are several structural, reoccurring problems that are (potentially) creating value conflicts or problems in the Smart City. In this research, I define a ***value conflict*** as a situation where two (or more) values experience mutual conflict. An example could be; surveillance could increase *safety,* however will harm *privacy*. The conflict between safety and privacy will lead to a trade-off where it should be decided which value should be embedded and how. A ***value problem*** will be defined as a situation where technology pressurizes or harms a certain (public) value. An example could be; technology takes over a job or function previously carried out by people. In this case the value of *human dignity,* and *economic values* could get pressured or harmed. Value problems and value conflicts might occur simultaneously in the Smart City, for example when technology enhances safety by surveillance which in turn harms privacy. The issues causing the conflicts and problems will be explained below.

6.1.1: THE ETHICS OF DATA

Data and algorithms are increasingly gaining importance in the Smart City Ecosystem, however, there are several issues concerning the *ethics* of the use, processing and collection of data. First of all, there is no clarity on the ownership and responsibility concerning data in the Smart City. Ownership of data is very difficult since available regulations perceive ownership in terms of physical assets (Bravenboer, 2018). This creates situations where privacy and other public values in relation to data are unaccounted for (Naafs, 2017a). One of the reasons behind the value problems and conflicts is the lacking awareness on being monitored, data being collected about people in public areas, without consciously permitting this (Vries, 2018). Cities argue that they are not collecting personal data, solely anonymized, aggregated data, and ask permission when needed. However, citizens may not know *what* they are giving permission for, and truly anonymous data does not exist since highly personal profiles could be deducted by recombination of 'anonymous' sources (Ballon, 2016a).

Data is increasingly becoming open and linked, with the objective of allowing more people to benefit from the data availability and to increase transparency. This could be used as an argument against privacy concerns, however, who should actually have access to these data? Open and linked data might not achieve its goal of making the city better and might just turn the city into an even more corporate-driven, automated place where coincidences are ruled out (Zoonen, 2016). It is also argued that there is no such thing as real open data since there will always be a translation between the raw unprocessed data and the data that is published or actually used for problem solving and decision-making [75].

An issue with very high impact and occurrence is *stigmatization* in programming and analysis for data collection. By faulty programming, and use of non-realistic algorithms, you could exclude individuals, or include them for

[75] Interview Roel van de Loo & Dick Jansen – Partner at SPPS-consultants & Environmental Consultant NG2

the wrong reasons. There is no transparency on the reasoning behind the programming thereby creating a black box society, that makes decisions based on disclosed arguments and algorithms (Est & Korthagen, 2017c). In some cases, stigmatisation might lead to social cooling; which entails that you will adjust your behaviour to fit a norm that is introduced by technologies (Est & Korthagen, 2017b). It might give you model-type citizens, that behave in the 'correct' way, however, this behaviour is far from stimulating creativity, serendipity and autonomy in the city (Meijer, 2015d). The behaviour according to imposed standards also resembles a lot with the panopticon ideology. Which is a design for a *prison*, created by Jeremy Bentham, where the feeling of being watched creates 'desirable' behaviour (Betekenis - Definitie, 2017). This could also be said about the Smart City, where you might constantly be watched, monitored and exposed to sensors, cameras and other objects (Balkan, 2017; Ballon, 2016a; Est & Korthagen, 2017c).

There are also concerns about the *politics of data*, the way data is perceived or interpreted and how action perspectives are created based on these data. Will the political view on the data represent public and social values, creating a Smart City for societal good, or will it solely reflect corporate interests and act accordingly (Kitchin, 2014)? While data is gaining importance in status, being described as 'new currency', it creates the perception that when no data is available, the issue is non-existent. On the other hand, by stigmatization, when there is a high availability of data, issues tend to be blown up and perceived more important. This is dangerous when data is being used as the main driver for new policy or solving urban problems, with a lacking critical stance from both policy-makers as technology developers, who have rather utopic perceptions (Meijer, 2015c).

The lack of critical stance is also an issue for assessing quality, reliability and validity of data and methods used for processing and analysis (Est & Korthagen, 2017b). Measurement errors and faulty sensors are tricky when data is perceived being true while being unable to be critical on data and its meaning. It happens too often that people are trusting data that is contaminated [76]. This is why we should shift from the idea of data-*driven* to data-*based* policy-making. People and real-life situations cannot be fully translated into data, and therefore cannot be the only basis of decision-making that might affect the lives of these individuals and our society [77]. Albert Meijer wrote in his book about the data polis, the city that is thriving on technology and data, a chapter on the critique we should have on the premises of the Smart City and data. These premises and critiques are summarized in *table 1* below and correspond with a lot of the issues addressed in the text above. The table is added for a quick overview of the (ethical) issues of data use, processing, analysis and collection in the Smart City.

Table 1: Overview of critique and premises corresponding with Data in the Smart city derived from (Meijer, 2015)

Premise	Critique
The usage of data is controllable	The mutual influencing of technology and social systems result in emerging behaviour patterns, socio-technological structures and unpredictable development dynamics
Everybody benefits from the data polis	Technological systems serve the interests of the powerful; Technology creates both opportunities as it creates risks; Technology is used by the government to *control* society
With the data polis we know more about the world	We are looking at the world in a different way because of technology; Data structures determine what problems are visible, and which are not; Soft data usually does not have a place in data systems
With data we could solve problems	Societal problems are usually not an information issue; Data systems also create new problems

[76] Interview Irma van Bergen Bravenboer – Trainee at the Municipality of Rotterdam
[77] Interview Hans Nouwens – Specialist Digitalisation and Public Space | Connected Worlds

6.1.2: Struggles between public and private parties

Outsourcing city management tasks that used to be fully public responsibility to private parties gaining dominance. Public parties are currently lacking a critical examination of the terms and conditions associated with this outsourcing, there is a lack of concrete agreements on the ownership of data, which could result in parasite-like behaviour by private parties and great dependency for public parties (Naafs, 2018). Smart City is often used as a positively marketed trojan horse, that enables market parties to present corporate interests in an attractive way, entering and dominating public space (Naafs, 2017a; Zoonen, 2016). This creates tension between the classical division between public and private, it blurs task distributions and responsibility, and it tends to hide or exclude aspects of society that you would rather not see or deal with (Hollands, 2008).

Where ICT used to be a topic that was only interesting to specialists, engineers and technocrats, it is now a topic that is inevitably interwoven with our society and way of living. This creates dangers in terms of the risk for (vendor) lock-in, and silo formation that could lead to inoperability of systems which makes the dependency upon the market parties very high. Private parties are the ones that provide public parties with the necessary tools and services in order for them to move forward, innovate and digitalize, however, they take away their control and ability to steer (Ballon, 2016f). The level of exposure to private parties and their corporate interests is rising, limiting our level of independence and autonomy (Ménascé, 2017).

The Smart City should have the citizens' wellbeing as a starting point and use technologies to serve as a means to an end (EIP-SCC, 2017). This is, however, not the case since this starting point resides on the side of the private parties. The promotors of Smart City initiatives are often market parties, thereby delivering projects that are created out of private interests instead of societal issues (Est & Korthagen, 2017c). There is a real risk of our society turning into a technocracy, which threatens the legitimacy of our government and democracy, creating new power structures and divisions, where the possession of information could enable parties to control society (Kreijveld, 2016). In a way, the Smart City might be the ideal representation of the neoliberal ideology, where corporate interests are drawing away focus from real societal issues, to the ones that are profitable for their business. The neoliberal point of view emphasizes the good in technology while completely ignoring political, social and environmental aspects (Grossi & Pianezzi, 2017). This stresses the need for a methodology that aids parties in making a critical analysis on the appropriateness of technologies and initiatives (Patrizia Lombardi, 2015).

6.1.3: Risks occurring due to the implementation of Technology

The greatest risk for the municipality in relation to smart cities is naivety, the lack of awareness and expertise [78]. When we talk about Smart City projects, issues like privacy and cyber security are often forgotten. People who are involved in this type of project focus too much on technology, and risks are ranked lower on their list of priorities [79]. This also applies for awareness. There are several general risks of technology applications; citizens are increasingly lacking control, and due to outsourcing practices, a steady knowledge base and expertise is decreasing (Ménascé, 2017). This might blind us for risks of the Smart City (Ballon, 2016d; Kool, Timmer, Royakkers, & Est, 2017).

Currently, only a smaller group understands what is going on in terms of technology and implementation. This knowledge is unavailable, inaccessible, or incomprehensible for citizens and other parties, creating a knowledge gap that will only increase without investment in learning, knowledge development, and clear communication (Teeffelen & Naafs, 2017c). The national government could play a role by initiating political debate and raise awareness. This might also remove the bias that all concerns in the Smart City are about privacy, ignoring other (public) value conflicts and problems. Since the Smart City is located in public space, citizens have no choice but to accept the conditions if they do not want to adjust their behaviour. Which is conflicting many more values

[78] Interview Vita Bakker & Ed Bal – Trainee & Strategic Information Manager at the Municipality of Rotterdam
[79] Interview Maarten Keesman – Project Manager Economy at the Municipality of Rotterdam

than just privacy (Teeffelen & Naafs, 2017a). Better information should lead to less ignorance and initiate good public dialogue.

With data-driven policy-making citizens are reduced to data, thereby creating an unrealistic view of society. This will lead to a lost sight of human values and individual treatment. The Smart City uses data as input for their predictive algorithms. Risks are that these algorithms are not really doing what you want them to do, basing policy on faulty and incomplete information, without being transparent. Human behaviour should not be reduced to one-dimensional data (Beerends, 2018). Also, trusting algorithms and data to be value neutral is very risky. Since technology is created by people, engineers, programmers, in collaboration with clients, their values will be underlying in the design of these technologies.

In communication on the Smart City, there is little attention paid to the counter-noise, to create real dialogue on an understandable level, where all participants of the Smart City Ecosystem could contribute. There should be room for alternative visions, ideas, and solutions. Also, the very negative view presented by some Smart City opponents, should not be the only alternative to the utopic, fairy-tale version [80]. The technology push creates a very short-sightedness, presenting clients with solutions that they might not even need and offers no room for alternatives (Est & Korthagen, 2017c). Before we end up with a scenario that is completely undesirable, we should focus on the possibilities that technologies could offer to us and see if these are scenarios that are desirable or that cause conflict (Baars, 2018).

6.1.4: Transparency Issues

Citizens should be able to know what is being monitored, when data is collected about them, why this monitoring is taking place, by whom, why and for what purpose. Also, they should, based on this information, be able to have a say in all this. Obviously, this is not happening (Teeffelen & Naafs, 2017a). However, it is these citizens that have to deal with their privacy being ignored, their information that is out on the street, so why is there no transparency? From the municipality side there is no real investment made in terms of time, energy and money to inform citizens on the ongoing Smart City projects in their city. On the citizen side; there seems very little interest in hearing about this [80].

Even when municipalities are aspiring to be transparent about Smart City activities in the city, they could never fully be, since it is near to impossible to know about every sensor, every owner, every purpose – there is no overview. Municipalities should take their responsibility in informing the citizens (Brandsma, 2017). Whether they are not taking this responsibility because of the lack of interest from the citizen side, because they are unaware of this need, or that they simply do not have the knowledge or expertise remains unclear. Which parties are responsible for the placement, data processing and analysis is vague, and municipalities can only guess at it [80]. The creation of a sensor register is a solution that has been suggested by several parties (VNG, Kadaster, GEONOVUM), however, inventory is extremely difficult, and municipalities do not know where to start [81].

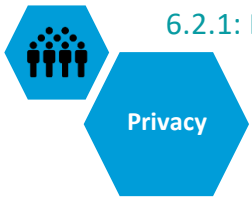
The Smart City is a topic that is balancing on a very thin line between illegal and legal practices. Due to the innovative element of the Smart City, legislation is running behind and there is no way to enforce legal issues with all Smart City problems. When information is asked on the agreements made between parties leading towards these Smart City initiatives, they are concealing contracts due to the competitive information involved (Naafs, 2017b). This lacking in transparency is occurring on all facets of the Smart City. Since the data collected in public space is used for commercial purposes, and could be used as a sort of currency, complete transparency is required and desired.

[80] Interview Martijn Peltenburg – Policy Maker Digital Public Space at the Municipality of The Hague
[81] Interview Vita Bakker & Ed Bal – Trainee & Strategic Information Manager at the Municipality of Rotterdam

6.2: Value conflicts and problems in the Smart City

From the issues described in the previous section, as well as literature and interview data values that might be pressured, harmed or conflicted can be deduced. From these value conflicts and problems, most often, the public is the Ecosystem participant that is victimized. These values are conflicted or pressured due to digitalisation and the lack of ability to create a new, digital society in an ethical and responsible way. The Smart City might be about technology implementation, however, currently is more a societal transition. To identify the values that are susceptible for problems and conflict in the Smart City, the analysis of the Smart City Ecosystem, the Sociotechnical Landscape, the issues identified, as well as substantial research on this topic by the Rathenau Institute will be used. In their research, based on a systemic reflection on all public values residing in society, and a thorough literature study, value conflicts have been identified for different types of technology that could be deduced to seven public values that generally get conflicted in the context of digitalization (Kool, Timmer, Royakkers, & Est, 2017). These seven values will be discussed below, where evidence supports that these public values are relevant for Smart City developments. Additionally, some economic values will be identified, adding to this list of seven. An overview of these values, the affected Ecosystem participants, and reasons for conflict will be summarized in *figure 9*. When, how, and to what extend these values will get conflicted or pressured, will be determined when real-life Smart City cases in Rotterdam will be analysed in chapter seven.

6.2.1: Privacy



The first value to be identified is privacy, the most discussed, most addressed and maybe most conflicted public value. Privacy has been identified as a key issue in terms of policy, legislation, regulation and a typical twenty first century challenge (Zoonen, 2016). An increasing amount of services are provided via digital platforms and ICTs, creating privacy issues by collecting immense amounts of data while the regulations and guidelines are lacking. Privacy concerns rise when data sources are combined, aggregated, making impersonal information personal by recombination. While these practices balance on the edge of being illegal, big data methods are increasingly gaining importance (Kool, Timmer, Royakkers, & Est, 2017). This raises questions on the protection of data, privacy of data, mental privacy, surveillance and target shifts in data recollection.

There are approaches such as privacy-by-design that could be used to prevent privacy concerns (Geurts & Haans, 2018). This approach also considers different facets of privacy such as the ability to not allow monitoring, or to influence what information you share, to adjust personal information and what information should be concealed. However, privacy issues go further than privacy of personal data, it also considers issues like stigmatization, transparency and profiling (Kool, Timmer, Royakkers, & Est, 2017). Privacy as a public value is also about the perception people have of it. This perception could be adjusted by redirecting focus from the technology to the individual and real-life repercussions technologies have on privacy. However, we should be careful to focus too much on privacy since the perception of this being an issue will then only increase (Zoonen, 2016).

The Rathenau Institute presents the privacy value conflict with a very typical problem that will illustrate the *responsibility* issue on privacy. They quoted the Samsung Smart TV manual: “Please be aware that if your spoken words include personal or other sensitive information, that information will be among the data captured and transmitted to a third party.” (Kool, Timmer, Royakkers, & Est, 2017). It presumes citizens agree with this data capture, possibly containing highly personal information, and is marketed as a fun, innovative, € 2.000 listening device. When May 25th, 2018 the new privacy regulation (GDPR) entered force, people were flooded with updated privacy statement, new terms and conditions, and personally I could not bear to see another one. This is a fatigue experienced by everybody, resulting in the mindless acceptance of terms (Pereira, Benessia & Curvelo 2013). Investing the time and effort in reading all these statements, formulate an opinion on this, is simply not doable or worth it. Privacy settings or information is not easily accessible, it is not communicated in understandable language, and the awareness of privacy concerns is lacking giving little incentive to act upon these concerns (Kool, Timmer, Royakkers, & Est, 2017).

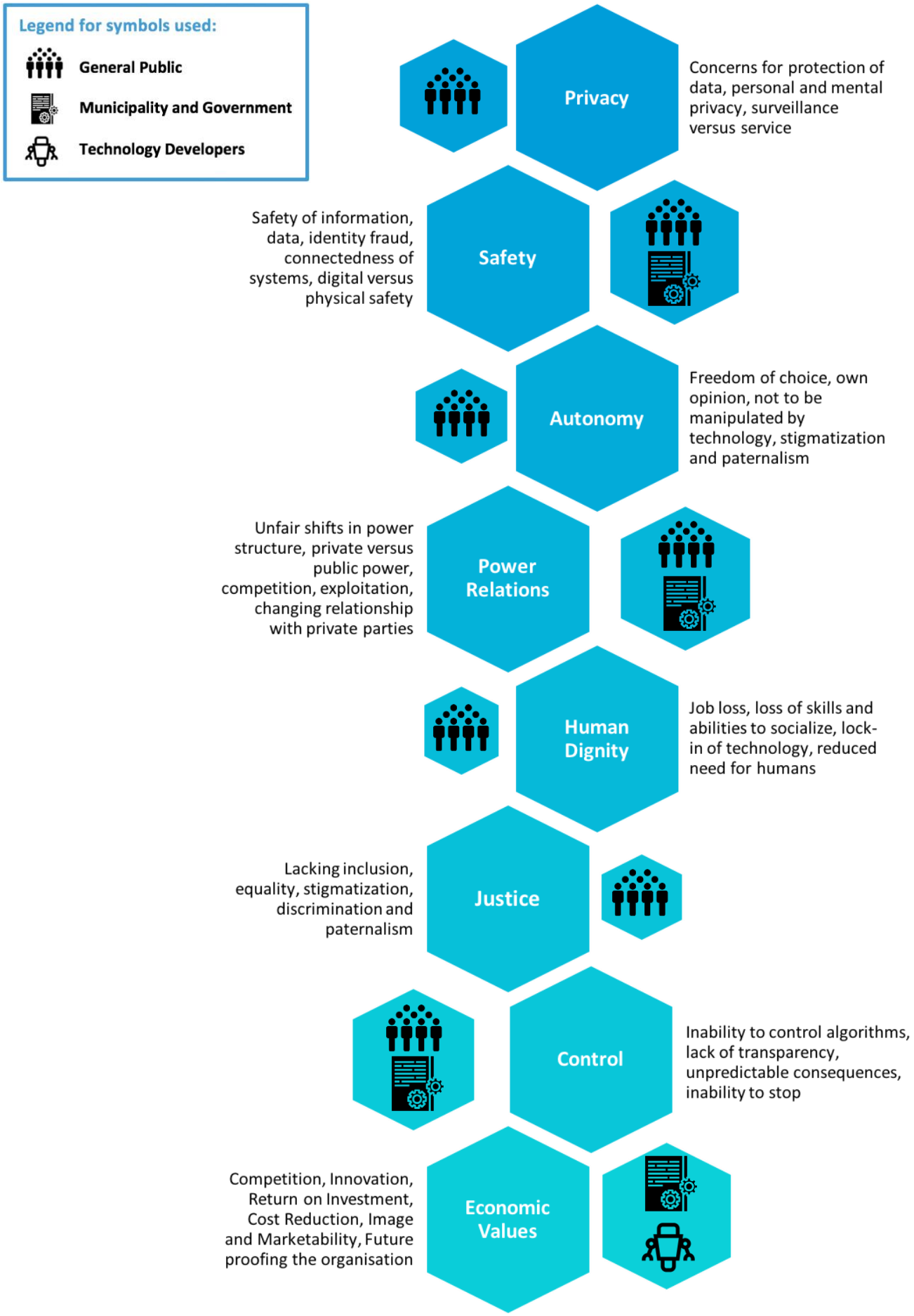
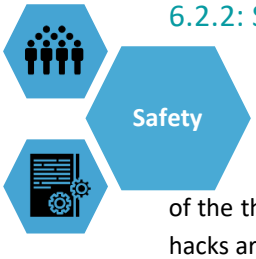


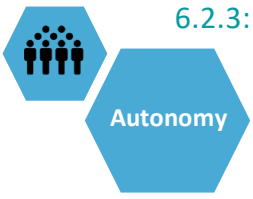
Figure 9: Overview of Value Problems and Conflicts occurring in the Smart City Ecosystem based on table 3.1 from the Rathenau Institute (Kool, Timmer, Royakkers, & Est, 2017).



6.2.2: SAFETY

Digitization and the increased use of ICTs means that there are also risks associated to these technologies that could hamper safety. Cybercrime and cyber resilience are themes that keep many people awake at night, and might be the new type of warfare, where unsafe systems can shut down entire cities by the click of a mouse [82]. The dependency upon technology is getting dangerously high. Hacking into one of the thousands of systems that control the city or an individual's life could have severe consequences. These hacks are usually associated with huge sums of money and can derail, due to the connectedness of systems and things introduced by IoT, not just the attacked system, but all things connected to it. This way, 'simple' systems such as the smart fridge, could give access to electronic locks on your house or car when hacked. When we do not sufficiently protect these simple systems, we also risk exposing the systems that actually *do* matter to us by their connectivity to other systems (Kool, Timmer, Royakkers, & Est, 2017).

In terms of the value safety, technology plays a very paradoxical, conflicting role. On the one hand it offers opportunities for more secure practices and organising systems in new ways (e.g. block chain, end-to-end encryptions, and distributed data storage). On the other hand, technology is a source of the existence of these problems and value problems and conflicts. The one invention is causing very fertile ground for the other invention to sprout. This way, the focus of these problems remains oriented on technology. However, due to the dependency upon technology, and high connectivity, we cannot live without them and have to find a way to overcome shocks and stresses in this digital environment [82]. This sparks the interest in practices like privacy by design and cyber resilience strategies. It is no longer just engineers and programmers that worry about these technological developments, it is intertwined with our physical living environment, thereby speaking to every individual using technology or individual exposed to technology (Kool, Timmer, Royakkers, & Est, 2017).



6.2.3: AUTONOMY

A big problem in terms of autonomy is technological paternalism, stating that technology knows best, and we should assume that technology might even know more about ourselves than we do. This might lead to technology having a (too) large influence on our freedom to act and think in certain ways, thereby limiting autonomy. In the Smart City decisions are being automated, therefore not offering any transparency in terms of what is guiding the algorithms making them (Autoriteit Persoonsgegevens, 2018). This could influence the autonomy of the citizen and transparency is a desirable condition however challenging to achieve. Besides, there are also technologies introduced that could be described as persuasive technology. This technology is created for realizing behavioural change, such as creating an annoying sound when you forget to use your seatbelt in the car. The ethical dilemma is then, whether it is desirable to change behaviour, even when it is for the greater good. Also, if we realize behavioural change through technology, it might mean that the change is not because of an individuals' feeling of being morally responsible.

For guaranteeing the value of autonomy, decisions made by people should be intentional, uncontrolled and be executed by choice. The reasons behind *choosing* to use these technologies could however justify the end. For example, when collective safety is created by applying technology such as speed limits or alcohol locks. In terms of persuasive technologies in the Smart City, you might think of light that adjusts to the atmosphere to influence public sentiment, and applications that will direct you towards a gas station to fill up you tank which might not be the closest, cheapest, but the one that they get commission for. In this case, autonomy might be limited, or get conflicted, but the real problem is caused by the fact that citizens do not get informed about these changes in their environment, that they do not know that they are influenced (Kool, Timmer, Royakkers, & Est, 2017).

[82] Interview Ineke Nierstrasz – Strategic Advisor Safety at the Municipality of Rotterdam

6.2.4: Power Relations in the Smart City Ecosystem:

Currently, there is an increase in offering services rather than products. This means that the power relations between parties are shifting, responsibilities are changing, and incentives are suddenly different than before. The Service Economy is characterized by dependency upon private parties and gives these parties control where it used to be the other way around. This does not only apply for government bodies or municipalities, this also applies for individual customers. On the one hand does this service economy forces market parties to offer good products, in order for them to keep their expenses low in the long term, is a positive trait. However, ownership comes control, and thereby dependency upon these parties could be perceived a downside (Kool, Timmer, Royakkers, & Est, 2017).

The issue with power relationships might originates from a technology-based product, however is more a social issue than a technical one. Public space and public social networks that reside online are often, if not almost always, owned by market parties. This gives them a lot of power and could lead towards a society where we no longer control our own decisions, relationships, and network due to these private parties that meddle with it. In a way, these practices could be described as illegal, however are widely adopted as a method of survival and gaining a competitive spot. The effects of these methods are very disruptive, and the effects trickle though society creating self-sustaining monopolies; we can simply no longer imagine living without these services, locking us in (Kool, Timmer, Royakkers, & Est, 2017).

Another issue influencing this value problem and conflict in power relationships is not between citizens and private parties, but between citizens and their own governmental bodies. Public parties are increasingly collecting data about citizens via Smart City initiatives with the incentive to monitor, steer, or control their behaviour. This also has an effect on the power relationship between a citizen and its government, since the government nowadays knows much more about you than you know about your government. This is called an information asymmetry which is caused due to a lack of transparency towards these citizens (Kool, Timmer, Royakkers, & Est, 2017).

6.2.5: Human Dignity:

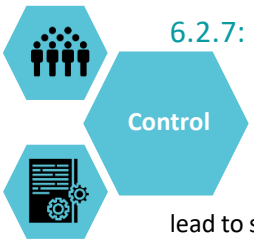
As was stated in chapter 6.1, it often happens that technology is reducing persons to a number, to data or a system. Citizens are merely objects of registration rather than living, breathing, rational beings which obviously poses a risk of conflicting the value of human dignity (Balkan, 2017). The desire to realize controllable citizens, that behave in the way you want them to, might be realistic to achieve by for example persuasive technologies or by expressing power and control, however, creates citizens that only act the way you want them to because they have to. Not because of their own morals, principles and beliefs in what is right and what is wrong. This might reduce the ability for people to express deliberate behaviour, to reflect upon actions, thoughts or statements and change behaviour accordingly.

On a very different note, technology might also take away some of the functions that we used to perform for a living (Kool, Timmer, Royakkers, & Est, 2017). Jobs that used to be available, are not anymore, or are taken over by automated systems, which might lead to unemployment issues. Technology has been changing the way we communicate, learn, and act for a while now. For example, my parents and I both have been taught French in high school, however, for me there was no real incentive to remember every word I encountered since I could simply look it up online (or speak English if Frenchmen were not too stubborn). I do not think we want this happening with moral topics, that we no longer can rely on our own ability to rationally decide whether something is right or wrong and that we start to depend on the technologies provided to us.

6.2.6: JUSTICE:

Stigmatisation has earlier been addressed as one of the problems causing value problems and conflicts. Stigmatisation, created by the reduction of information on individuals to mere statistics and data, could cause faulty classification and perception of an individual. Since all data is stored somewhere, it is very difficult, or impossible, to reverse this stigmatisation – which adds to the problem. As a result, someone could have a male digital identify while actually being female, or worse, be registered as a threat to national security without any valid reasoning behind it (Kool, Timmer, Royakkers, & Est, 2017). This classification is not just wrong, it is also doing no justice to the actual person.

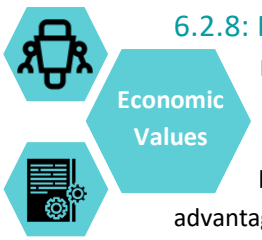
It could also be the case that due to your address or postal code, which might be associated with elevated crime rates, or a high share of foreign citizens, you will be assumed to be someone that is likely to commit crime. In this scenario, you will lose the assumption of being innocent until proven and you might actually have to prove to be innocent [83]. Smart systems that result in discriminating judgements prove in this case not to be that smart. Again, the wrongdoing of these systems is strengthened by the lack of transparency that can explain on what these decisions, judgements, differences in treatment due to profiling and analysis are based.



6.2.7: CONTROL:

One of the issues with control is the use of algorithms that are increasingly functioning as a way of deciding for new policy, determining what we see and what we do not when we open social media, or applied for city management practices. These algorithms are created by programmers but have the ability to 'learn' and develop themselves further giving no insight into what they actually entail. It could lead to severe damage when the algorithms used by for example Google or Facebook can determine what places we go, where we want to live and what we want to vote. This level of control could be threatening to democracy and to the public value of being in control of your own life. And it is maybe not even our own life that is threatened by these algorithms, it might also be problematic on a wider scale where we no longer control the course of development of these self-learning algorithms, which could have consequences for not only individuals but for an entire city, province, or target group (Kool, Timmer, Royakkers, & Est, 2017).

Who is responsible for these algorithms and the decisions that they make? Who takes responsibility? How can we make them transparent? Is it really revealing competitive information if these algorithms were open? The ability for people to still make their own decisions, to be able to control the technologies that impact our lives, is seriously being hampered by these algorithms used in the Smart City and various other industries. There is a need for transparency and a critical stance towards the use and implications of these algorithms. Besides algorithms hampering the ability to express control, knowledge or power asymmetry by certain Ecosystem participants might be equally disturbing.



6.2.8: ECONOMIC VALUES:

Besides the values addressed above, which are public or societal values, there are also other values that are possibly getting conflicted or could hamper the Responsible Innovation of the Smart City. These values are context specific, however, could generally be accredited to economic values or values held by technology developers. For technology developers, economic values such as sustained competitive advantage, realising profit or return or investment are weighed higher than the public values of the recipients of their technology (Bravenboer, 2018) . Also, the image and marketability of their technologies and their brand are important economic values for the private parties, to gain access to the municipalities to sell their services and technology applications. These values nowadays often get prioritised over the public values that are conflicted or pressured and create very different incentives for these parties in the ecosystem than the values held by municipalities, and citizens.

[83] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Eramus University of Rotterdam

Speaking of these municipalities and government bodies, beside the fact that it is considered to be their responsibility to guarantee public values, they have other issues that spark their interest and they feel responsible for. These interests and values might be following up on political promises and agendas which might include issues in terms of sustainability and the energy transitions, how to deal with digitalisation, urbanisation, and other future developments. Creating a governmental landscape that is fit for these future developments is an important value or interest that they are trying to guarantee. Also, making their organisation an efficient and effective one is important, which might allow them to reduce expenses in areas that are inefficient or less important to spend money on. Image and marketability are not just for private parties an important economic value, this too accounts for cities and countries. Being an attractive location for businesses, for residents, for tourists is something that attracts a lot of economic activity and status (towards other cities, provinces, other countries or organisations such as the European Union), which could be profited from and allow for interesting developments and innovation.

CHAPTER 7: ANALYSIS FOR PUBLIC VALUES AND SHIFTS IN ROTTERDAM

In this chapter information gathered about the Smart City, its Ecosystem, and the problems it has to overcome in terms of context as well as value problems and conflicts will be used for an analysis of thirty-seven Smart City projects in the City of Rotterdam. These projects have been selected based on information availability, time available for analysis and on whether they fit the requirements of the research boundaries – which is elaborated on in chapter three. This analysis will study each project as a case using the methodology described in chapter two on analysing values via the framework of Liesbet van Zoonen. This framework originally was created for analysing privacy concerns, however – as this chapter will indicate – is relevant too for the analysis of other public values and technology implications over time, via shifts in the framework. As for the analysis itself, all individual cases have been described in Appendix D.

*In this chapter, the aggregated results as well as four examples will be described. The results of both chapter six and seven will be concluded in chapter 7.6 where the second research sub-question will be answered: "*What interests and values are represented and should be embedded in the development and implementation of Smart Cities within the Smart City Ecosystem?*". The eight (public) values indicated in chapter six, will be shown to be relevant for (some of) the cases studied in this chapter, where occurring value conflicts and problems are shown in chapter 7.1 for all thirty-seven studied cases. The analysis starts with a 'status-quo' of the projects, where they will be classified to a spot in the framework of Van Zoonen according to the information available. After the initial classification, an indication is made whether these projects pose any 'risk' for shifting in the framework – thereby putting pressure on public values. Finally, projects that supposedly would shift, have been reclassified into the framework and projected onto a certain negative future scenario to study possible outcomes of technology development. To explain these shifts and results, out of each quadrant, one case will be elaborated on in chapters 7.2 – 7.5, showing argumentation for risk-identification and shifts.*

The purpose of this analysis is not to blame technology developers, municipalities or other involved parties for causing value conflicts of pressuring them. I would like to stress the importance of decision-making for responsible innovation*, where it is not about the fact that technologies or services are conflicting or pressuring (public) values but about being aware of this fact while deciding to implement them. Knowing what conflicts and problems are possibly caused by technologies might also gain insight into methods to include these values a in decision-making revolving around the design and implementation of the technology.*

7.1: ANALYSIS OF THIRTY-SEVEN ROTTERDAM CASES

Since the cases in Rotterdam concern technologies that are not just implemented there but in many other cities, the results of this study are rather generalizable for other cities with similar applications. Within this section, thirty-seven cases will be analysed using the methodology proposed earlier on in chapter two and three. The methods explain that technologies and projects using technology could be classified based on two dimensions; is the data collected and used in the project concerning personal or impersonal data, and: is the purpose for data collection either for service purposes or for surveillance purposes (Zoonen, 2016). This could then be used to analyse value problems conflicts that occur for this technology by creating negative future scenarios in which the technology could develop or employ itself. When technology is no longer in pilot phase, but fully implemented all over the city, it might not be desirable at all, or create (new) conflicts and problems with values and shifts in quadrants of the framework. These situations are very worrisome, however might be plausible or expected to occur when there is no transparency, no dialogue, and no awareness of the existence of these issues.

The analysis that will be shown in the successive paragraphs is based on the information gathered in the preceding chapters that identify industry characteristics, describe the sociotechnical landscape, ecosystem characteristics, and specific information on the Ecosystem of Rotterdam. Also, reoccurring problems that were described in chapter six provide a basis of 'predicting' negative future scenarios for these technologies and projects using these technologies. The values that might get conflicted or pressured in these future scenarios are

derived from the overview of value conflicts that was created in chapter 6.2, based on various literature sources, ecosystem characteristics and interview data. The information availability on the cases themselves was not abundant. It is interesting that a lot of the 'Smart City Initiatives' in Rotterdam (and probably on many other cities in the Netherlands) are very hard to find, and there is barely any transparent communication on these projects. Whether that is because of the large number of projects and pilots that are ongoing in the city, whether it is because of the lack of awareness that these projects are Smart City projects to begin with, or that there is no more information available on both sides is unclear. The thirty-seven cases that have been analysed for this thesis could be found in *Appendix D*, with a description on the characteristics of each case, and the analysis itself.

7.1.1: Status quo for the Rotterdam Cases

In this section, an initial analysis will be shown for all of the cases. The classification of the cases in the framework of Van Zoonen was made based on the characteristics of personal versus impersonal data collection, and service or surveillance purposes used for analysis, to be classified in either one of the quadrants of the framework. For the analysis, I have made a distinction between levels of personal information and levels of service/surveillance. This has led to an initial classification as could be seen in *figure 10.* Some interesting information to note is the fact that of the thirty-seven projects, nineteen projects could be classified as being quadrant IV projects concerning impersonal data and service purpose. Then, three projects are on the borders of quadrants IV and III or IV and I. One project is on the border of all four quadrants, eight projects are classified as quadrant III projects, six projects as quadrant I, and only one project is classified as quadrant II. When analysing projects in the quadrants, generally speaking are projects pitched in quadrant IV more popular than projects in quadrant II, due to the fact that this deals with personal information on surveillance level, posing more risk. Maybe the distribution of projects could be attributed to the difference in popularity or ease of getting permission to execute such a project. There are generally speaking not many concerns for projects on impersonal data for a service purpose, since it seems a harmless way of innovating, with almost guaranteed benefits for involved parties.

There are also other possible reasons for the distribution of projects among the framework. For example, projects analysed for this study have (almost all) been derived from the inventory document created by Frank Vieveen, who made an overview of all Smart City initiatives that he could find out about. The reason for using this document is due to the fact that it is very difficult to find information on the application of sensors in the city, or something called a Smart City project, and due to time constraints for not being able to identify more or other projects. These projects identified by Vieveen also include a lot of projects initiated by the municipality, however, a lot of private companies in the city might also be active in Smart City projects but when there is no accessible information, these projects seem to be non-existent. Also, for the projects that could be classified as a quadrant II project, involving personal data and surveillance purposes, it could be that projects in this quadrant are intentionally being withheld. These projects might be projects that are led by the police, by the safety department of the municipality, or a national safety body such as the AIVD. These projects should not be made public, however, that could create a wrong perception on the ongoing projects involving surveillance activities.

From the thirty-seven projects that have been analysed, the municipality plays an important role as initiator or collaborating party. From all projects analysed, twenty-nine have been initiated by the municipality of Rotterdam, two projects were initiated a European Union project, two by private parties, two by collaboration platforms (such as MRDH), one by another public body, and one by a scientific party. Not just the initiator or party ultimately responsible for the project implementation and results could influence the course and success of Smart City projects, their collaboration partners are also an interesting input for analysis. When analysing the collaboration structures of the thirty-seven cases in Rotterdam most of the collaboration structures (fifteen) are unknown or not available. This could mean either that the project initiator is fully responsible for the entire project, or that there are parties involved which are disclosed or I was unable identify them. These partners could be private parties (a likely assumption since technology needs to be procured or designed somewhere), scientific partners or other public partners. As for the other projects, fourteen projects are created and executed in a

public private partnership, four projects are a triple helix collaboration (public, private and scientific partners), two projects are collaborating with another public body, one project is a citizen science project, and one is a collaboration between public and scientific parties. The involvement of private parties in the Smart City projects is thereby notably high, which is one of the characteristics of the development of the Smart City (at least in eighteen of the thirty-seven projects private parties are explicitly mentioned as being involved – presumably in the fifteen unknown collaboration structures, private parties were involved too).

Where each Smart City project analysed is somewhat different, you could classify them by the focus of the project and thereby reduce the project types to nine project types; Environmental projects, Smart Lighting projects, Asset Management projects, Application projects, Social Media projects, Monitoring projects, Mobility projects, Energy projects, Energy projects and Safety projects, which can be seen in *Table 2* and *Appendix D*. Most of the projects had a focus or impact on multiple aspects (e.g. both monitoring as environmental project type). In *table 2* an overview of the occurrence of project types is given. Most interesting is that twenty-two out of the thirty-seven projects have been classified as being a monitoring project, which is resembling surveillance, however, there are only nine projects placed on the surveillance side of the framework (see *figure 10)*. The focus for the municipality of Rotterdam in terms of Smart City projects seems to lay on increasing Monitoring activities (twenty-two projects), Asset Management improvement (eleven projects), Mobility projects (fourteen projects), Environmental projects (ten projects), and projects using Applications (nine projects).

Table 2: Overview of project classifications for analysis.

Project Types	Number of Projects	Project Numbers
Monitoring	22 projects	7; 8; 9; 10; 11; 13; 14; 19; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 31; 32; 34; 37
Mobility	14 projects	8; 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 30; 35
Asset Management	11 projects	3; 4; 15; 21; 22; 23; 24; 27; 28; 30; 36
Environmental	10 projects	1; 3; 21; 22; 23; 27; 30; 31; 32; 36
Application	9 projects	6; 8; 14; 17; 18; 19; 25; 29; 32
Smart Lighting	4 projects	2; 5; 30; 33
Safety	3 projects	26; 30; 37
Energy	2 projects	20; 30
Social Media	1 project	6

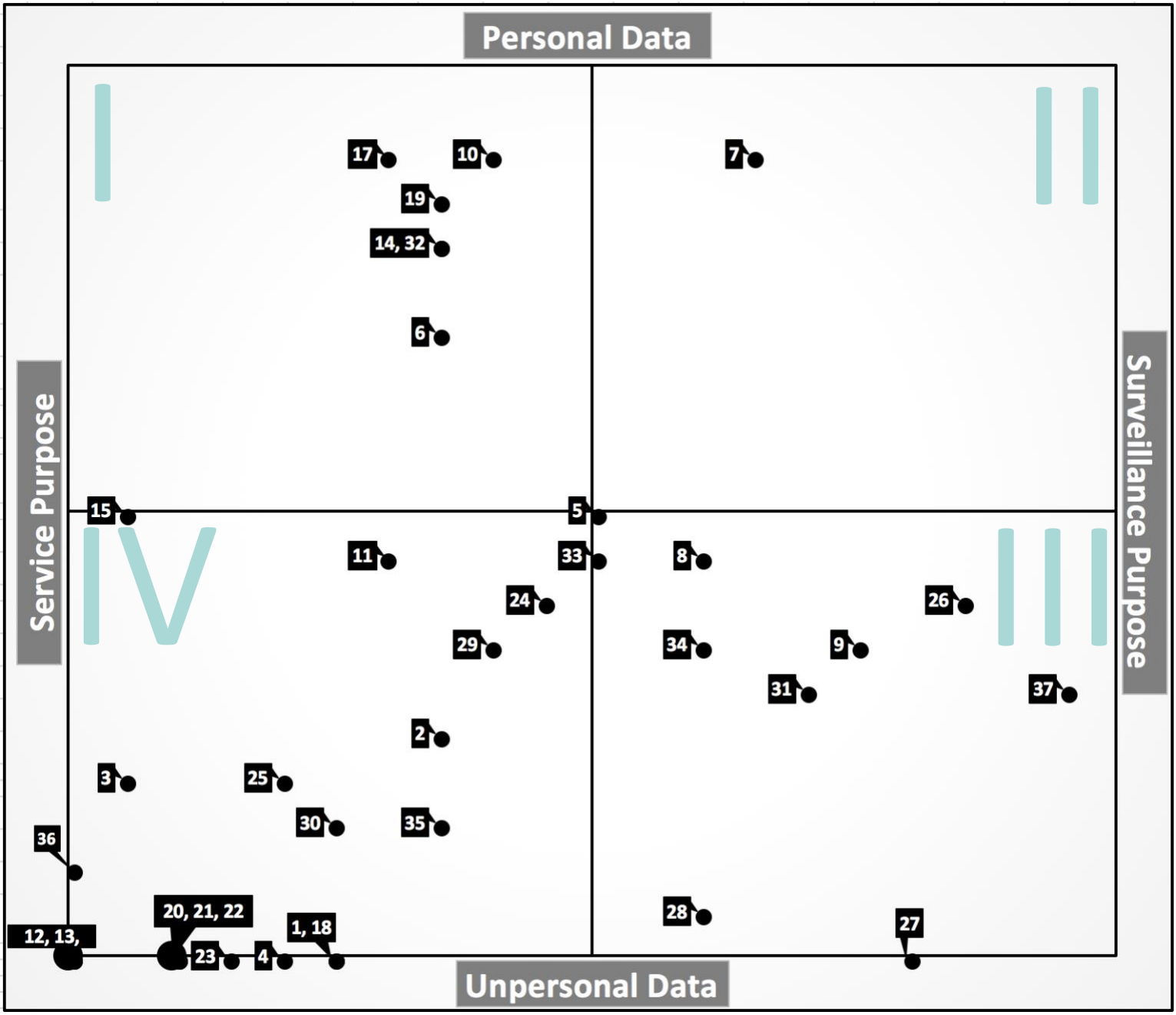


Figure 10: Status-Quo of thirty-seven Smart City projects in Rotterdam using sensors distributed among the quadrant framework of Van Zoonen.

7.1.2: IDENTIFYING RISKS FOR SHIFTING CASES AND VALUE PROBLEMS OR CONFLICTS

In *figure 11* the same plot of all projects in the quadrant framework is depicted, only with one crucial difference: the dots that used to be black are now colour-coded. In the analysis of the cases, it occurred that technologies now might be implemented in smaller scale, in pilot or experiment structures, however, in a few years these technologies will have developed themselves further, will be implemented widely, especially when this process of evolution is ignored for analysis. When analysing Smart City initiatives in Rotterdam, technologies have been placed somewhere in either one of the four quadrants, based on their level of personal or impersonal information, and whether the technology serves a service or surveillance purpose. However, technology is not a static object, it is something that will keep on developing itself, and the sociotechnical landscape in which this technology is placed is also of a dynamic and transitional nature. These facts given might explain the fact that the perception of technology or the intention of technology might change. These changes will then influence the position these technologies hold in the framework, shifting inside or outside of their original quadrant. If negative future scenarios around these technologies turn out to be true, the technologies might have very large impact in a way that is not necessarily desirable (Zoonen, 2016). These negative future scenarios are used to 'predict' the impact of technologies in terms of causing value conflicts, pressuring values or creating shifts in the framework from a generally more 'innocent' quadrant to a less popular one in terms of concerns and perception.

Following this approach, the colours in *figure 11* represent the amount of risk these specific projects pose for shifting in the framework to another quadrant or another location within the same quadrant, thereby causing (new) value conflicts or problems to arise. Projects that have been colour-coded in green have been identified as 'not likely' to cause any problems in the future, even if the technology gets widely implemented. The yellow projects have been identified as creating a 'plausible negative future scenario', in which the technology might develop into something undesirable and conflicting. The red projects have been identified as creating an 'expected negative future scenario', in which the technology is expected develop into something undesirable and conflicting.

To classify these projects as either harmless or expecting to cause trouble in the future, a quite negative scenario is used. This negative scenario has been derived from all information gathered in earlier chapters such as insights on the ecosystem dynamics, the characteristics of the industry and the reoccurring problems that we know cause value conflicts. This is due to the fact that for Responsible Innovation, anticipation and reflexivity are important dimensions to pursue. To be able to anticipate on these future scenarios, and to be able to critically reflect upon these scenarios could allow us to draw recommendations on how to be actively responsible, making sure that these scenarios will not be our future (Pesch, 2015; Stilgoe, Owen, & Macnaghten, 2013; Taebi, Correljé, Cuppen, Dignum & Pesch, 2014). These methods and trains of thought have motivated the choices for analysis displayed in *figure 11* and *Appendix D*.

Interesting to note is that the location of the project in the framework is no guarantee for a project to pose a risk on whatever level. The initially considered 'innocent' or 'harmless' quadrant IV, where no personal data is used, and the purpose of data use or collection is for service activities, shows that even in this quadrant there are some projects that pose a risk for shifting and pressuring values. Out of the twenty-two projects that are located inside or on the border of quadrant IV, eight are posing a threat to shift and conflict values, and out of these eight projects, three projects are classified as to create an 'expected negative future scenario'. This insight is a valuable lesson for every civil servant who is exposed to or approving projects that seem to be harmless, bringing nothing more than cheer and joy. It shows that a critical stance is desired for each and every project, and simply classifying projects in either one of the four quadrants might have disillusioned effects which are hard to reverse.

In total, out of the thirty-seven cases analysed, eight-teen projects are classified as being no risk, thirteen projects are said to create a 'plausible negative future scenario', and six projects could be identified as creating an 'expected negative future scenario'. Further argumentation on the classification could be found in *Appendix D.*

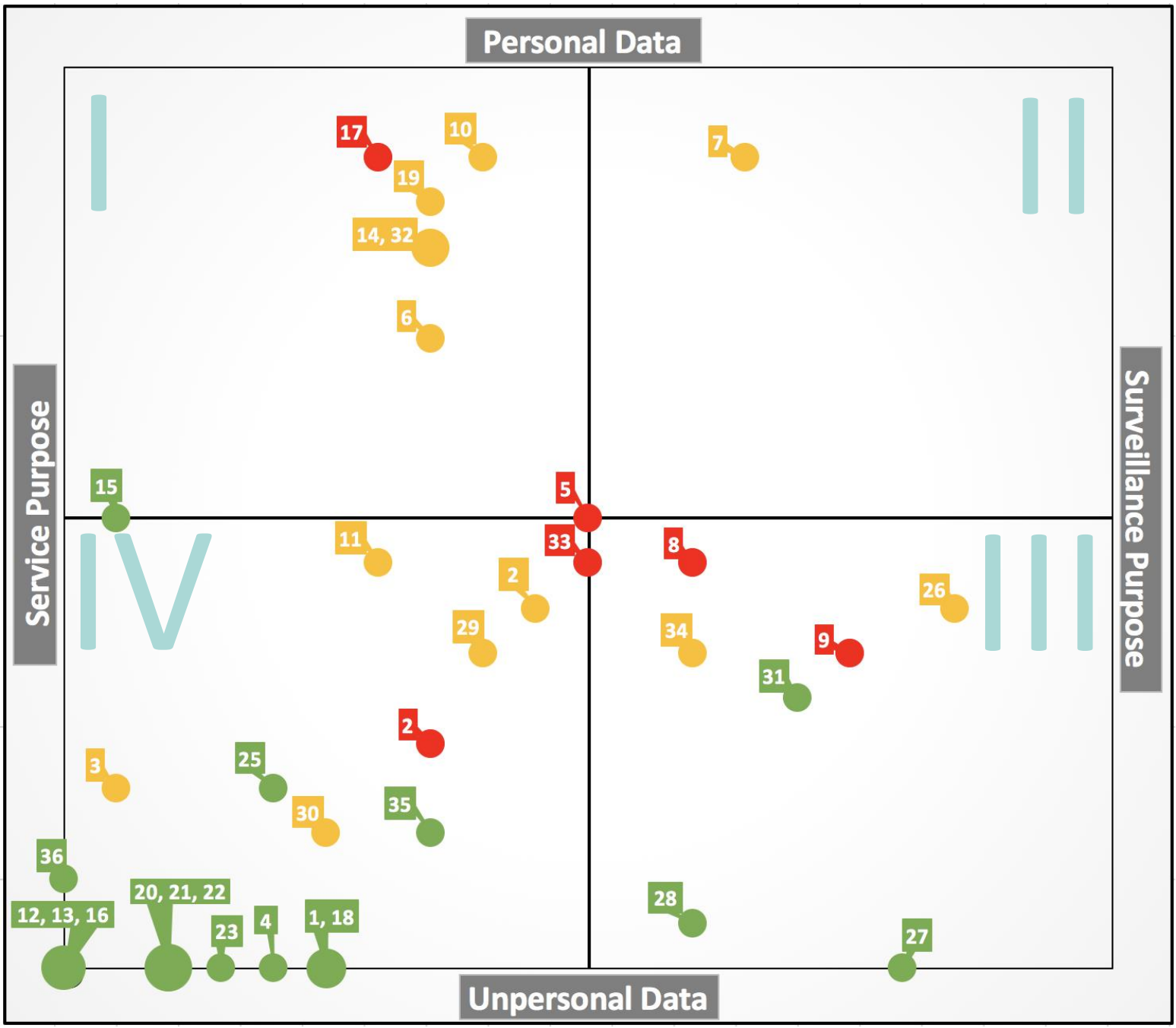


Figure 11: Identifying projects that could pose a risk for shifts in quadrants and creating value conflicts. In this picture, green poses no risk or not likely, yellow means plausible negative future scenarios, red means expected negative future scenario.

7.1.3: Analysing shifts in the framework and value conflicts

With project that have been identified as posing a risk for shifting, there are (new) value problems and conflicts to be noted. Interesting to note is that while 'only' nineteen projects were identified as being a risk for a shift, it turns out that in twenty-eight of the thirty-seven projects, value problems have occurred. When analysing the types of projects in which these value conflicts occur, it turns out that out of the fourteen projects that collaborate via a public private partnership, ten of these projects cause conflicts in values. As for the unknown collaboration types, out of the fifteen projects, ten cause conflicts; for the triple helix collaborations, all four projects cause conflicts. While there is no real conclusion to draw from this information, it could illustrate the types of collaboration structures that deserve some more attention.

Maybe even more insightful is what values are conflicted or pressured most often. While the use of the framework of Van Zoonen has somewhat changed due to the value analysis method used, privacy is the most occurring value problem. Out of the twenty-eight projects that have caused a value problem, twenty-two pressure of conflict privacy. Other values that score high are the values of power relations (nineteen projects), control (sixteen projects), and justice (sixteen projects). When describing what values could be pressured of conflicted (in chapter six, *figure 9)* it was identified that they might not just occur for the public, but also for the municipality and/or government or other parties. The value problems for the municipality in these cases analysed were safety, power relations, control, economic values and justice. Especially power relations seemed to be a value problem that could hamper the municipality (seven projects), but economic values and control also seemed troubling (five projects that caused value problems for the municipality). This information is summarized in *table 3*, where the values pressured are shown, the number of occurrence for each value, the projects in which these conflicts or problems occur for the public, the projects in which these occur for the municipality, the projects that were classified as either no risk (green), plausible risk (yellow), or expected risk (red), and what type of collaboration structure was involved in the project.

Table 3: Overview of Value Conflicts and Problems occurring in the analysis or thirty-seven cases. In this table, the colours of the project numbers correspond with the classification used for determining whether there is a risk for shifting and/or value problems (e.g. green, yellow, red). The projects that are ***bold****, represent public private partnership projects; the projects that are in 'italic', represent unknown collaboration structures, the projects with and underscore, represent triple helix or public-scientific collaboration structures, the projects using* normal *typing, are either public-public collaboration, or citizen science.*

Values Pressured:	Total occurrence:	Projects in which this public value conflict or problem occurs:	Projects with municipal value conflicts or problems occurs:
Privacy	22 projects	1; **2**; **3**; **5**; *6*; **7**; **8**; **9**; *10*; *11*; *14*; 17; **19**; **21**; 24; *26*; 30; 31; **32**; **33**; 34; 37	
Power Relations	19 projects	**3**; **5**; *6*; *10*; *11*; 17; **19**; **21**; 24; 30; 31; **32**; **33**; 37	**2**; **5**; **7**; **9**; *25*; 30; **33**
Control	16 projects	**2**; **5**; *6*; **7**; **9**; *10*; *11*; *14*; **19**; *26*; 30; **33**; 34; 36; 37	**5**; **9**; 17; 30; **33**
Justice	16 projects	**3**; **5**; *6*; **7**; *10*; *12*; *14*; *16*; **21**; 24; *26*; 30; 31; **33**; 37	*4*
Autonomy	9 projects	1; **5**; **7**; **8**; 17; **19**; 30; **32**; **33**	
Economic Values	7 projects	24; 36	**2**; *4*; **7**; *12*; *16*
Safety	6 projects	**5**; *11*; **19**; 30; **33**; 37	**5**; 30; **33**
Human Dignity	2 projects	*29*; 36	

When trying to distinguish a relationship between the type of project and the value conflicts that occur, for some projects a correlation seems to be existing, however, there are no valid conclusions to draw upon this rather small analysis. However, for the projects that have been analysed, a distribution on types of projects was made in *table 2.* In *table 4*, these project types again are listed, but now the number of problematic projects were analysed, and on which values these conflicts or problems occurred. This creates some insights. Out of the twenty-two monitoring projects, sixteen express conflicting/problematic behaviour, of which fifteen projects experience issues on the value of privacy, and twelve projects on power relations. For mobility projects, ten out of the fourteen projects analyse cause problems, of which most occur on the values of privacy (eight projects) and control (seven projects). Application projects are also relatively high in terms of relative problems that occur. Out of the nine application projects, seven are problematic (on which six projects create problems with privacy and five with power relations). Also, interesting, is the fact that all projects that are focused on some form of Smart lighting are exhibit value problems. Four out of the four Smart lighting projects analysed, create conflict on the values of privacy, power relations and control, which are the three most pressured values, and which could seriously decrease the quality of life, perception of safety and privacy of citizens. All project types and value conflicts or problems are summarized in *table 4*.

Table 4: Overview of the relation between project types and value conflicts.

Projects vs. value conflicts	Privacy	Power Relations	Control	Justice	Autonomy	Economic Values	Safety	Human Dignity
Monitoring (16 out of 22 projects)	7; 8; 9; 10; 11; 14; 19; 21; 24; 26; 30; 31; 32; 34; 37	7; 9; 10; 11; 19; 21; 24; 25; 30; 31; 32; 37	7; 9; 10; 11; 14; 19; 26; 30; 34; 37	7; 10; 14; 21; 24; 26; 30; 31; 37	7; 8; 19; 30; 32	7; 24	11; 19; 30; 37	29
Mobility (10 out of 14 projects)	8; 9; 10; 11; 14; 17; 19; 30	9; 10; 11; 17; 19; 30	9; 10; 11; 14; 17; 19; 30	10; 12; 14; 16; 30	8; 17; 19; 30	12; 16;	11; 19; 30	
Asset Management (6 out of 11 projects)	3; 21; 24; 30	3; 21; 24; 30	30; 36	3; 4; 21; 24; 30	30	4; 24; 36	30	36
Environmental (6 out of 10 projects)	1; 3; 21; 30; 31; 32	3; 21; 30; 31; 32	30; 36	3; 21; 30; 31	1; 30; 32	36	30	36
Application (7 out of 9 projects)	6; 8; 14; 17; 19; 32	6; 17; 19; 25; 32	6; 14; 17; 19	6; 14;	8; 17; 19; 32		19	29
Smart Lighting (4 out of 4 projects)	2; 5; 30; 33	2; 5; 30; 33	2; 5; 30; 33	5; 30; 33	5; 30; 33	2	5; 30; 33	
Safety (2 out of 3 projects)	26; 37	37	26; 37	26; 37			37	
Energy (1out of 2 projects)	30	30	30	30	30		30	
Social Media (1 out of 1 project)	6	6	6	6				

In *figure 11* the projects that were analysed have been depicted showing potential or expected risks for shifts in the quadrants framework. How these shifts might occur is depicted in *figure 12*, where shifted projects have been identified with a dot with the similar colour that it used to have, and a subscript 'b' after the project number. The previous locations are indicated with a grey dot, with the original project number and no subscript. The framework now presents a different view, where instead of a majority of projects residing in quadrant IV, the majority now is located in quadrant II (sixteen projects in II, versus zero projects in I, seven projects in III, thirteen projects in IV, and one project on the border of quadrant I and IV). This is quite a difference from the view depicted in *figure 10,* and maybe an unexpected or undesirable one. While there is no certainty that these shifts will happen, or that if they occur they might occur in different ways, however, it is something to keep in mind while deciding to implement a technology in your city, or when to decide on regulation, or make new agreements.

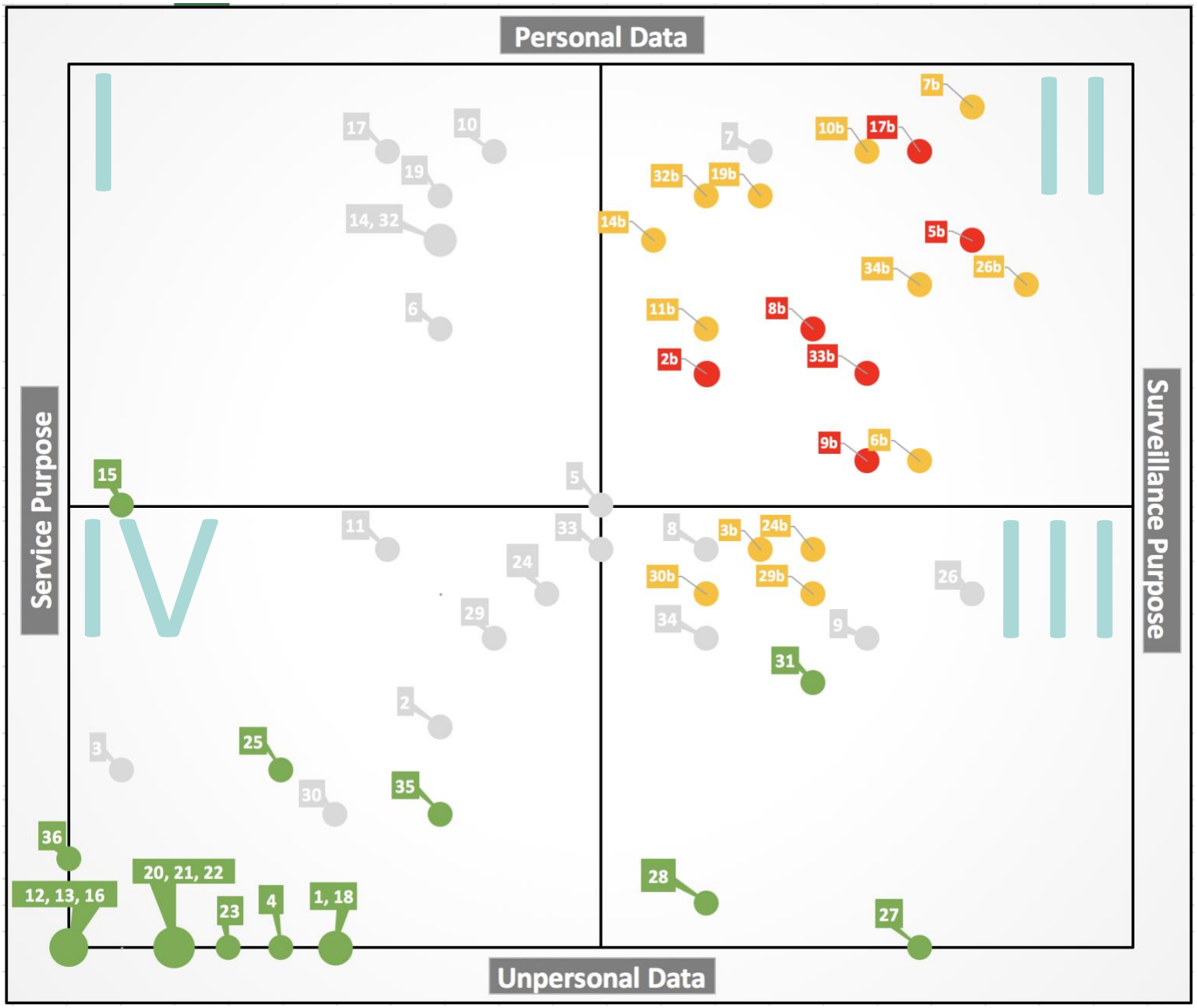


Figure 12: Quadrant shifts that could occur for projects in Rotterdam. Grey projects represent the previous location, the coloured projects with a subscript 'b', represent the shifted location of these project in the framework.

7.2: Analysis for Case in quadrant I

To illustrate the reasoning behind the shifts and value conflicts and/or problems identified, cases from each quadrant have been identified and discussed in some more detail below. This will describe both the type of collaboration, the type of project, the status-quo as well as the (potential) shift in the framework, and the values that might get conflicted, pressured and why. For quadrant one, which considers personal data used for a service purpose, the case of talking traffics is discussed.

Talking Traffics is a national collaboration between both private and public parties, that collectively try to create solutions for all types of trouble experienced with traffic. The project consists of multiple tests, pilots and experiments, which in the end should create solutions for a sustainable, non-congested, economically viable future (Vieveen, 2018). The reason for initiating this project is due to the projected increase in congestion in the country. All over the Netherlands, congestion is expected to increase with 38%. In cities, this problem is even larger, and they expect to have an increase of 50% by the year 2021, which is only 3 years away. Besides the fact that traffic congestions are a waste of time, are really frustrating and are not necessarily beneficial for the environment, they also cause economic problems. The financial damage due to these congestion patterns is increasing from 840 million euro's in 2017 to about 1,7 billion euro's in 2021 (Talking Traffics, 2018). Time for action is what Talking Traffics thought.

Nowadays, 86% of our citizens is in possession of a smartphone, which might be a building block in the solution for these problems. The project includes an application that could be downloaded onto your phone, which allows you to be connected to traffic lights, road signs, traffic centres and other road users, creating an Internet of Things environment for road users (Platform Beter Benutten, 2016). This application could then aid you in all kinds of ways; it provides information on the allowed driving speed, whether there are accidents or dangerous situation ahead on the road, it could determine if there is priority traffic at a crossroad (such as an ambulance, public transportation or cyclists), it could make traffic lights anticipate traffic that will create a better flow through the city and it aids you to the most affordable, close to your destination, spot to park your car (Talking Traffic, 2018). Therefore, this application could both enhance efficiency in traffic as safety and comfort. By the use of iVRI's (intelligent Traffic Regulation Information systems), that communicate with all sorts of devices such as your smartphone, or navigation system, the flow of traffic will be adjusted to the users, making it more efficient and comfortable.

Talking Traffics is a Smart Mobility initiative that country-wide is testing all sorts of applications of their technology, in collaboration with a large amount of both public and private parties. Rotterdam is only one of the 60 cities that are connected to the project. Other parties involved are: De Verkeersonderneming, MRDH, 60 municipalities, Ministry of Infrastructure and the Environment, BeMobile, Dynniq, Ericsson, KPN, Flitsmeister, KoHartog, Locatienet, Mobiele TV NL, Royal Haskoning DHV, Siemens, Simacan, Swarco, Sweco, Vialis, Ziut, Monotch, vtron, all4elevation, Metropoolregio Amsterdam, Rijkswaterstaat, Goed op Weg, Clean Tech Regio. The project could therefore be identified as a public private partnership project, which is a monitoring project, mobility project and an application project.

The placing of the project in the first quadrant is due to the fact that the data collected is connected to an individual mobility or user profile, which makes the data collected in this project personal. The purpose for data collection is however an example of service-based data collection, that could aid road users and logistics companies in various ways to achieve more efficient, comfortable and safer transportation. The location of the project is shown in *figure 13*, on which also the plausible shift is indicated. The project has been identified as a project that will have a plausible negative future scenario. This is because of the high involvement of private parties and the abilities to reuse data for other purposes. Combining all this collected data on people's whereabouts in the city, individual profiles can be deduced and used for other applications than traffic flow. Users have no choice to be excluded from this analysis. This database, containing personal information and mobility patterns, is of great commercial value for both marketing purposes and consumer behaviour analysis.

The added value will increase when you combine this information to other data sources; you will have a goldmine. The involvement of the large amount of private parties might create the incentive to use this data and experience for different applications. Another important implication is the fact that this technology is supposed to make traffic safer whilst stimulating you to use your phone in traffic. Therefore, privacy, control, autonomy, safety and power relations might get pressured for the public consisting both of users and non-users of the application. The shift in the quadrant framework is depicted in *figure 13* by the yellow dots.

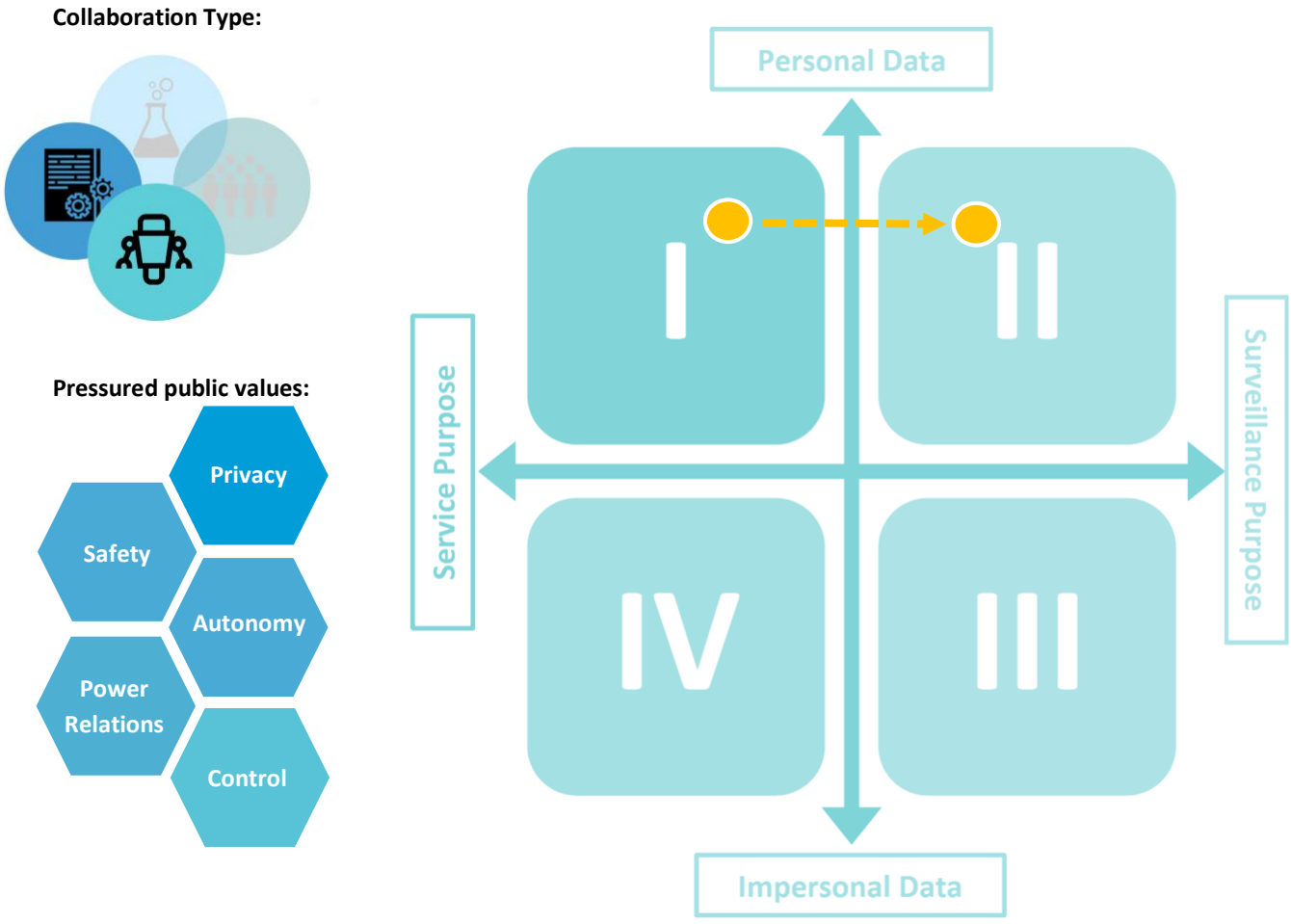


Figure 13: Shifts in the framework for the Talking Traffic project.

7.3: Analysis for Case in quadrant II

To illustrate the reasoning behind the shifts and value conflicts identified, cases from each quadrant have been identified and discussed in some more detail below. This case will describe both the type of collaboration, the type of project, the status-quo as well as the (potential) shift in the framework, as well as the values that might get conflicted and why. For quadrant two, which considers personal data used for a surveillance purpose, the case of City Traffic is discussed.

City Traffic is a public private partnership involving only the collaboration partners City Traffic (private party) and the municipality of Rotterdam (Vieveen, Inventarisatie Smart City Initiatieven, 2018). Within this project, by the use of sensors, citizens, visitors, and pedestrian flows could be monitored via the MAC-address of their phone. City traffic offers technologies and services that allow the municipality not only to track the amount of people in the city or in a certain street, they can also monitor how many unique individuals pass by (so they can register whether you are walking by only once, twice or ten times), how often people return to the street, city, specific neighbourhoods or shops, how long people stay in this place, which routes they take and under what environmental circumstances their time spent was occurring. This is due to the fact that there might be a relation between the weather conditions or time of the year and the number of visitors in the city centre (City Traffic, 2017). This information could be used for statistical insights into the popularity of the city, whether policy is working or not, and could be used for predictive activities.

The project is classified as being a Quadrant II project – using personal data for a surveillance purpose. According to several legal experts and lawyers, the MAC-address monitoring might not be based on a personal profile, with information on for example your date of birth and your name, however, it is an address that is connected to one specific devise, such as your smart phone (Bethlehem, 2017). Since people generally always carry their phones around, it is highly connected to them as a person and not just to their anonymous device. This device creates the ability to make highly personalized user profiles by tracking unique visitors and combining this data with other sources (Bouman, 2016; Verhoeven, 2015).

The purpose of this technology is also obviously not a service. The municipality and shop or restaurant owners of the city centre might benefit from this data for analysis, however, for the people who are the object of registration, there is no added value, solely the risk of conflicting their values. When determining the risk of this project, it was identified as a project with an expected negative future scenario. A MAC-address might not be an address coupled to your personal profile, however, it is a unique code, that only requires little effort to combine with other data to achieve very personal data about your whereabouts, what time you spend in a certain area, and other information as was explained earlier. The recombination of data is very dangerous and could make the impersonal information of a single device in a certain place, combined with other data sources, into a very private method for analysing every move of an individual. This does not only harm privacy, but this data could also be used for stigmatization, nudging of influencing, and monitoring individuals.

Another issue is the fact that citizens are not aware of the fact that they are being followed all around town, there is no transparency and there is no permission. If and when this scenario becomes reality, the public will experience value conflicts on privacy, justice, control, and autonomy. On the other side there are the municipality and the entrepreneurs in the city who could benefit from this data for whom mostly the values of power relations and economic values are of importance. The shift is depicted in *figure 14.*

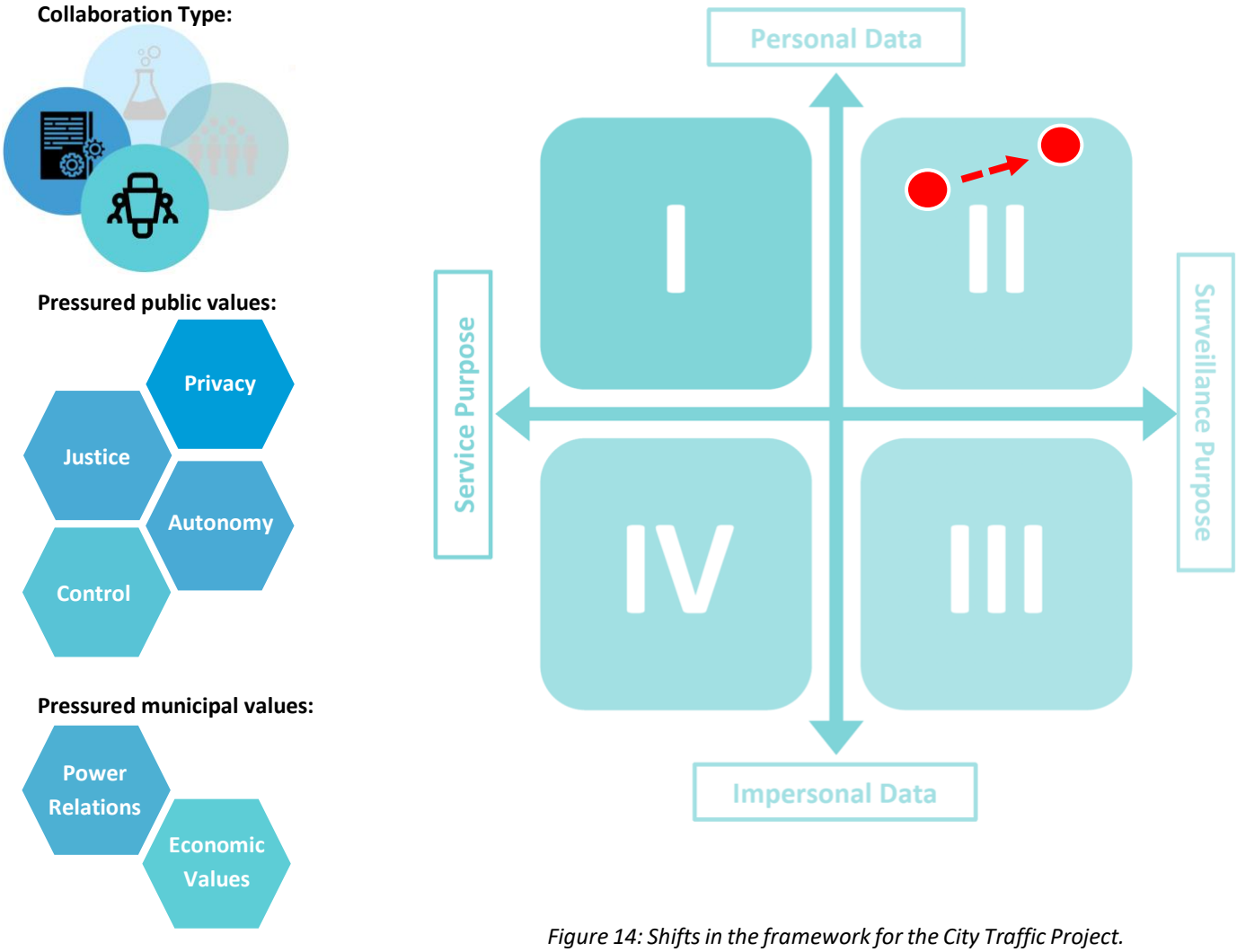


Figure 14: Shifts in the framework for the City Traffic Project.

7.4: Analysis for Case in quadrant III

To illustrate the reasoning behind the shifts and value conflicts identified, cases from each quadrant have been identified and discussed in some more detail below. This case will describe both the type of collaboration, the type of project, the status-quo as well as the (potential) shift in the framework, as well as the values that might get conflicted and why. For quadrant three, which considers impersonal data used for a surveillance purpose, the case of Citizen Science is discussed.

This project focusses on the testing the use of cheap(er) sensors for air quality and other environmental measurements, where citizens can achieve a powerful position by expressing concerns about environmental data in their living environment. When, previously, people could complain about the fact that they were concerned about industry in their living environment, or a road with loads of cars, they had no evidence to back up their concerns. Citizen Science projects offers them insight, raises awareness of our environment, and gives the opportunity to act (Rijksinstituut voor Volksgezondheid en Milieu, 2017). The project could therefore be described as an Environmental project as well as a Monitoring project, in which the citizens of Rotterdam (and other cities participating in this project), RIVM, and DMCR play an important role (Vieveen, 2018).

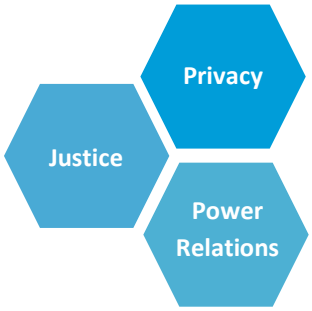
The project has been identified as a project in the third quadrant, because the information gathered in these projects is most of the time used for surveillance of environmental data. The data is not directly linked to a specific action of policy – in that case it could be described as a service purpose. It is however a mechanism that citizens could use to control their government, to back up their complaints and issues in order to be taken

seriously. Also, citizen science projects could monitor change in the environment when and the effects of these changes could be measured over time. For example; what is the effect of the maintenance done on the Coolsingel in Rotterdam, which used to be a busy road, which could now no longer be used as before. Is this something to notice in the atmosphere? Does it improve air quality locally? And does it worsen the pollution in other locations since traffic is redirected? These questions could be answered by means of these measurements. This is all environmental data therefor it is not personal information.

While the risk of a quadrant shift is very unlikely for these projects, when used to monitor the behaviour of your neighbour's fire place, it might get personal and effects might be negative. Resolving personal conflicts due to sensor applications is not the intention of the project, therefore a shift might occur, however on very local and personal scale. This means that the shift will probably not happen in the quadrant, however, it could still mean that values get pressured. The values that might get pressured when the citizen science is used for resolving personal feuds, are privacy (your neighbour is monitoring you, your behaviour, without asking or permission), justice (that you happen to have a neighbour with a sensor might make the result of these actions feel unjust doe to the fact that maybe a lot of other people experience the same issues, however do not get taken seriously because of their lack of data), and power relations (people with data could get a powerful position in comparison to citizens that do not monitor, and the relationship with government bodies changes, citizen could suddenly have a powerful position). The project is depicted in *figure 15.* Since the project was classified as not being a risk for a shift, there has not been a shift depicted in the figure. However, the project illustrates that also projects that do not shift, could cause value conflicts or problems and thereby should be subjected to a critical review.

Collaboration Type:

Pressured public values:



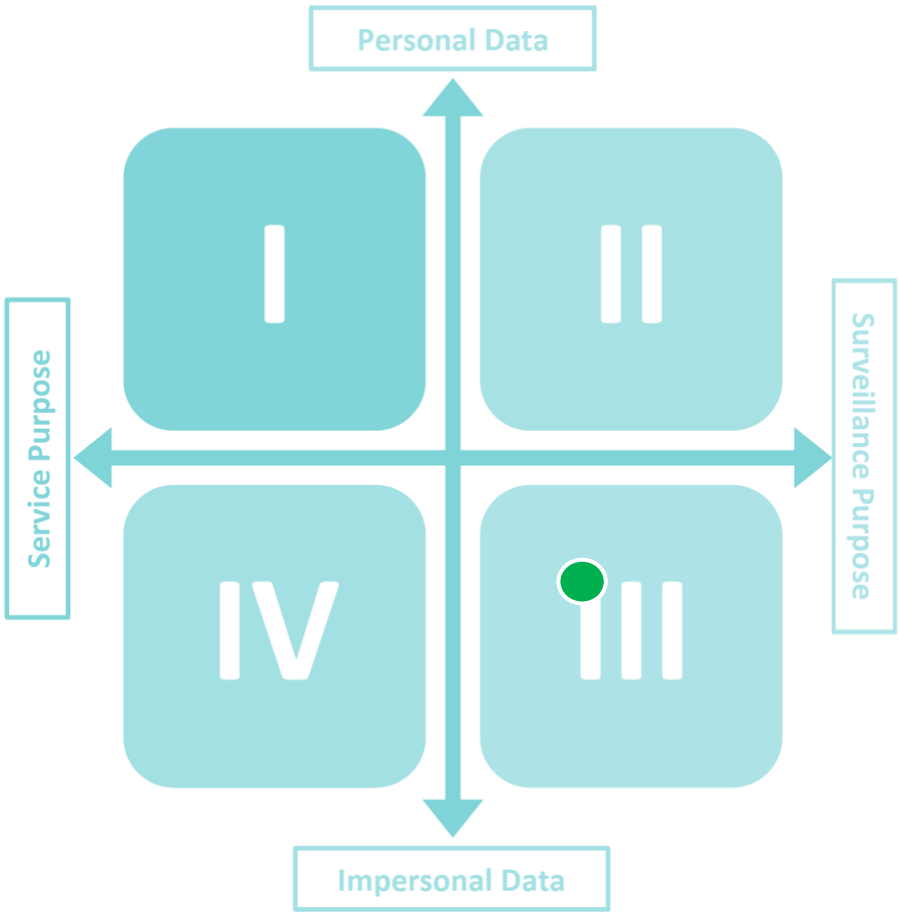


Figure 15: Shifts in the framework for the Citizen Science Project.

7.5: Analysis for Case in quadrant IV

To illustrate the reasoning behind the shifts and value conflicts identified, cases from each quadrant have been identified and discussed in some more detail below. This case will describe both the type of collaboration, the type of project, the status-quo as well as the (potential) shift in the framework, as well as the values that might get conflicted and why. For quadrant four, which considers impersonal data used for a service purpose, the case of sensor-equipped trash containers is discussed.

Some of the trash containers in Rotterdam are equipped with a filling degree meter. This way, trash collection can be scheduled in a smart and efficient way, problems can be detected early on, municipality can save money, time and realise CO2 reduction. These trashcans equipped with the filling degree meter are currently located on several test locations throughout the city. The project/pilot will, in case of a success, be widely implemented, allowing for even better and more efficient waste collection (RTV Rijnmond, 2017). The project is therefore identified as being both an Environmental project (for the realisation of CO2 reduction and a cleaner, more pleasant public space) and an Asset Management project (since waste containers are a typical municipal asset, on which the collection is a typical asset management process which is improved upon). For the realisation of this project, the municipality of Rotterdam collaborates with two private parties; BBF Holding BV and Roteb Lease (Vieveen, 2018).

The sensors inside the trash containers are merely measuring whether the container is full, or empty, and how full or how empty it is. It could also detect clogging in the system, in that case a maintenance employee could be sent to this specific container to quickly resolve the issue (Gemeente Rotterdam, 2018);. The sensor is therefore solely measuring impersonal data, and its purpose is initially to offer a better service to the citizens of Rotterdam who no longer have to deal with overflowing, congested containers. For the municipality it serves the purpose of reducing costs and time therefore also a service purpose. The project has therefore been assigned to the fourth quadrant of the framework.

However, the project is also identified as creating a plausible negative future scenario. When the sensors can be coupled to a personal profile – for example via personalized waste cards, as is happening in several other municipalities – there is a risk of profiling individuals, and eventually, using this to adjust taxes accordingly to it. While it might be ‘fair’ in some way, there is a significant loss of privacy for the citizens. In the most negative way, where the shift will be going towards monitoring practices on personal level, this is especially an issue.

The most likely scenario is however a shift to a monitoring practice with impersonal data, where aggregated data could be used to create waste management policies on neighbourhood or street area, on which tax for waste management could be based. This might create negative incentives such as walking to another neighbourhood with your trash in order to keep your own expenses low (Zoonen, 2016). This might not actually solve any problem and might create some social problems where justice and privacy are again an issue. If this negative future scenario becomes reality, it would affect the privacy, power relations and feeling of justice for the public. The information asymmetry the municipality could gain access to, could cause these issues. The shift towards the third quadrant has been depicted in *figure 16* as well as the preceding shifts that also might occur, however, less likely.

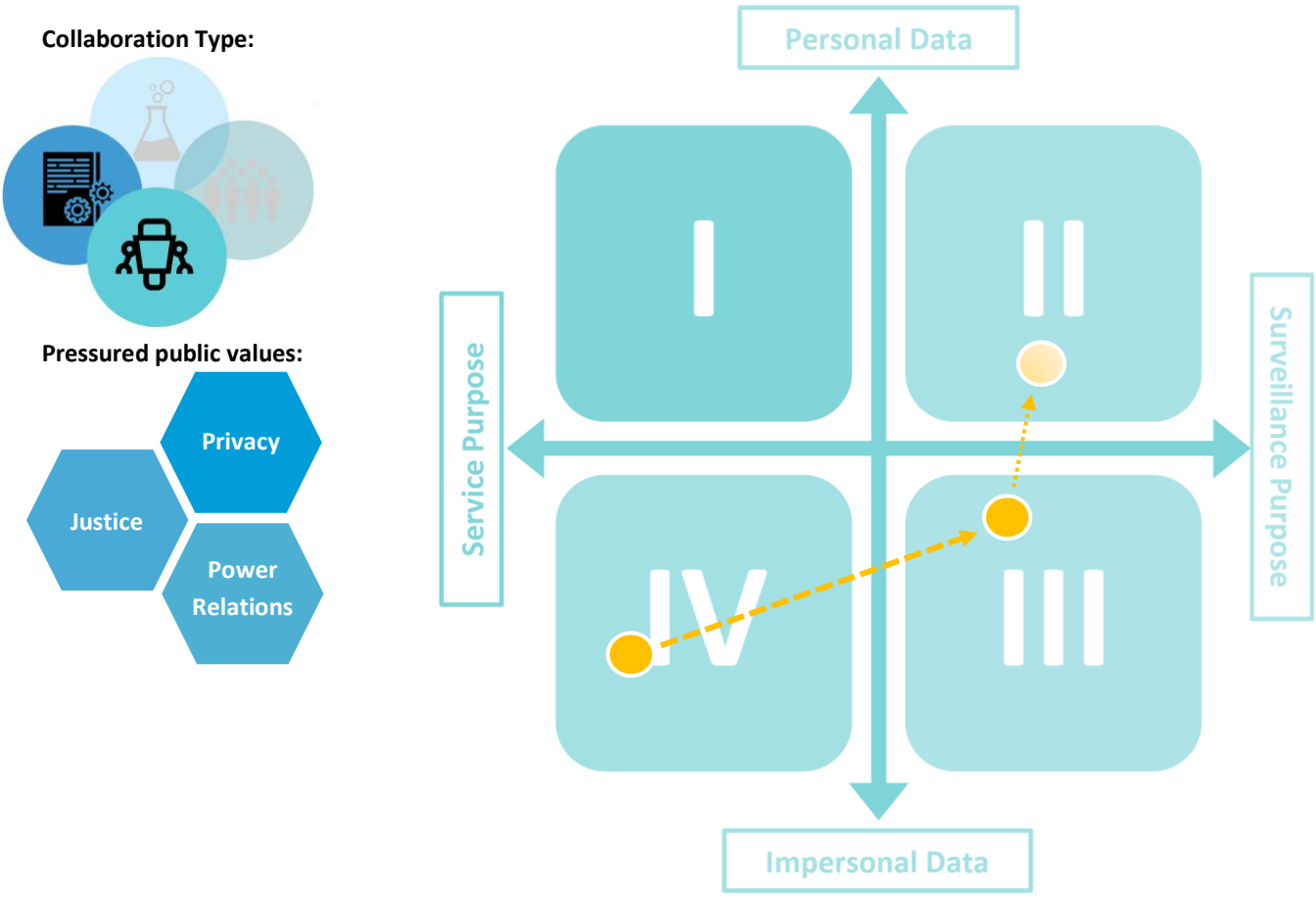


Figure 16: Shifts in the framework for the Filling Degree Project.

7.6: Conclusions on Values in the Smart City Ecosystem deduced from the Cases

To conclude all findings in this chapter, the second research sub-question should be answered:

Sub-question 2

What interests and values are represented and should be embedded in the development and implementation of Smart Cities within the Smart City Ecosystem?

One of the insights from this chapter is the fact that in the Smart City development trajectory there are some reoccurring problems that seem to be typical for the Smart City Ecosystem. The first problem area was for the *ethics of data*, which considers for example the issues around ownership; the lack of awareness of being monitored; the lack of information available for real awareness and critical stances; the fact that permission might be asked, however not in a clear and explicit way that is understandable; the trend of data becoming more and more linked; the fact that data could lead to unfair stigmatization, and; the inability to critically assess the quality, reliability and validity of data. These issues are especially problematic since the use of data is increasing over time, and policies or decisions might be based on faulty, polluted data that might not represent the society as it is.

Second, the *struggles between private and public parties* were indicated as a problematic area for development. This is due to the fact that for the increasing privatisation of public space and public tasks, the classical distribution of roles, responsibilities and power positions is shifting and changing. Interests are very different for public and private parties, and when collaborating with or outsourcing to private parties, the private (economically driven) interests always get a say in development too. The new distribution of functions and roles also affects the general public. Trust expressed towards public parties is much higher than the trust in private parties, so when private parties take over public functions, this could create concerns.

The third problem area identified was the general addition of *technology applications in public space and for public functions.* This is especially problematic for the lack of awareness and relevant if not critical knowledge which might blind citizens, municipal decision-makers and other parties for the risks technology could pose on society. There is a lack of political debate and dialogue which further hampers the ability to take on a critical stance. Citizens get reduced to one-dimensional data, which could create an unrealistic view on society, where tricky algorithms and data are unjustified trusted to be able to execute decision-making tasks and policy-making activities.

Finally, the *transparency issues* occurring were identified as the final problem area. This is due to the fact that there is very little information available on the technology application in the city, there is also no real investment made by public parties to inform citizens, and citizens do not seem interested. Adding to this problem is that municipalities often do not know who is using sensors in the city, for what purpose, and what type of data is collected. This increases their inability to inform and be transparent about these activities. Also, legislation is running behind on these developments, allowing for the development to happen in the way it is happening now, where it is increasingly becoming a black box society.

After the identifications of the problems that cause the difficulty for responsible innovation practices to occur, the values that generally get conflicted were identified based on the information via the Ecosystem and sociotechnical landscape, the extrapolation of literature on problems that occur and the effects that they might have, and the information provided by the Rathenau Institute. Combining this knowledge, I identified that for the value conflicts that might occur, there are generally speaking eight values that are important to analyse for occurring conflicts or problems. These are:

Privacy could get conflicted or pressured due to issues with the protection of data, by mental or personal privacy issues with monitoring practices, due to the very thin line between service and surveillance activities, a lack of transparency and clear, understandable communication. Privacy generally experiences problems for the public.

Safety could get conflicted or pressured due to the lack of safety of information, data, occurring identity fraud, the high connectivity causing risk in terms of digital and physical safety. Another important aspect is the perception of safety. Safety generally experiences problems for the public and municipalities (public bodies).

Autonomy could get conflicted or pressured due to the increasing lack for freedom of choice and opinion due to nudging and manipulation activities induced by technologies. Autonomy is further pressured by stigmatization and paternalism views of data. This value generally will experience problems for the public.

Power relations could get conflicted or pressured due the unfair shifts in power structures and roles, where private versus public struggles play an important role when outsourcing, collaborating or partnering, creating competition and exploitation, and changing relationships. This value generally will experience problems for the public and the municipality (public bodies).

Human Dignity could get conflicted or pressured because of job loss occurring due to technology, a society that is de-skilling (gaining dependency upon technology) and de-socializing, lock-ins and decreased need for humans. This value generally will experience conflict for the public.

Justice could get conflicted or pressured because of the lack of inclusion of values, interests or people, unfair or unequal treatment, stigmatization, discrimination, paternalism and fairness in judgement of data. This value will generally experience conflict for the public.

Control could get conflicted or pressured due to the inability to control, influence or *feel* as if you are in control of data and algorithms, and the implications they hold. Also the lack of transparency, knowledge and correct information availability and legislation. The perception of inability to predict, influence or stop technology also creates problems. This value will generally experience problems for the public and the municipality.

Economic Values

Economic values could get conflicted or pressured due to the competition in the ecosystem, a pressure on innovation, and on achieving return on investment. Also, the image is an important pressurizing factor, as well as cost reduction, marketability, and future-proofing your organisation. This value will generally experience conflict for the municipality and private parties.

A very important insight is that value conflicts occurring in the Smart City Ecosystem are not static but dynamic. The framework of Liesbet van Zoonen, which could not only be used to identify privacy concerns but to analyse shifts in the quadrant for all kinds of value conflicts or problems. The shifts occurring in the framework could be explained by the dynamics in the sociotechnical landscape as well as in the technology itself which is evolving and dynamic. Therefore, in order to analyse technologies for Responsible Innovation, *anticipation* and *reflexivity* should create some negative future scenarios in order to analyse the possible impacts of technology and to assess desirability of the innovation in development. These negative future scenarios can create the shift in the framework, on which value conflicts and problems could be analysed.

Applying this method onto thirty-seven cases in the city of Rotterdam, using sensors in public space in one way or another, allowed me to identify the status-quo of projects, the types of projects, whether these projects could pose a risk for value conflicts and shifts in the quadrant framework, how big of a risk they are, and where they will go once this shift occurs including the values that will get conflicted in the meantime. Some interesting insights from this analysis were that the majority of all projects (nineteen out of thirty-seven) initially started off into quadrant IV – which is generally seen as the least risky quadrant since it considers impersonal data for a service purpose. Also, there was only one project residing in quadrant II (personal data for a surveillance purpose). This does however not mean that the distribution of projects around the city of Rotterdam (and the rest of the Netherlands) is like the scatterplot in *figure 10*. The reason for this distribution might be due to the fact that these projects tend to stay disclosed for privacy reasons, due to the unpopular image of this type of project, or because it is operated by an organisation such as the police.

When identifying risks for the projects, eighteen projects were identified as not posing a risk, thirteen projects were identified as creating a plausible risk, and six projects have been identified as being expected to create value problems and shifts in the framework. After identifying risks, shifts in the framework occurred as was depicted in *figure 12*, where suddenly the majority of all projects reside in Quadrant II. These shifts show how undecisive and uncritical behaviour could create a city in which public values are often pressured. When analysing these value problems, the first insight is that also projects that were identified as not posing a risk, might just as well cause value problems. While ‘only’ nineteen projects were identified as a risk for shifts in a negative future scenario, twenty-seven projects out of the thirty-seven cause value problems. Among the pressured values, privacy scored highest (twenty-two projects), followed by power relations (nineteen projects), justice and control (sixteen projects), and autonomy (nine projects). Also, amongst these projects, the municipality also experienced problems with power relations (seven projects), control and economic values (five projects), safety (three projects), and justice (one project). The value of justice was initially not defined as a value that generally might get conflicted for the municipality, however, the analysis proves otherwise. The same is true for economic values, which initially was identified as a value that generally only conflicts for the municipality and private parties, however proved to be conflicting for the public in two projects.

The analysis xshows that out of the eight identified values that might get pressured, all values experience problems. Therefore, the values of privacy, safety, autonomy, power relations, human dignity, justice, control, and economic values should be embedded in the development and implementation of the Smart City by the Smart City Ecosystem. Whether this is embedded by decision-making, by knowledge creation, by increasing transparency levels or by raising awareness and public debate is yet to be decided. I would like to stress the fact that projects pose a risk for shifts towards another quadrant, might not be ‘bad’ projects. However, when a project is causing – or will cause – value problems, for responsible innovation there should be some level of anticipation and reflexivity that will allow you to motivate your decision for the technology implementation, creating and implementing technologies as intended, and to be transparent and clear in your reasoning.

CHAPTER 8: DECISION-MAKING IN THE SMART CITY ECOSYSTEM

This chapter will offer some insights in how to design the Smart City, keeping values and interests in mind. This design for values approach is considered the last step of the Socio-technical Value Map and will provide some guidelines and a framework for including values and their potential conflicts into the decisions of public decision-makers that create the Smart City. Since this is very explorative and a design activity, this chapter will both be based on previously gathered information on the Smart City Ecosystem, problems occurring in the development trajectory and the values that are pressured or conflicted by the Smart City.

*In the conclusions this chapter (chapter 8.4) the third research question will be answered: "*What is currently hampering Responsible Innovation in the Smart City Ecosystem? How to ensure public values are taken into account?*". To answer this, I will start off by describing the complexities of the Smart City Ecosystem as a complex, networked environment. Then, I will elaborate on how to overcome development issues that are currently experienced in the Smart City. Then, most importantly, I will address the importance of decision-making for value inclusion, where the framework used for analysis in chapter seven, will be used as a tool for decision-making as well as a method for raising awareness and providing good discussion between policy-makers, technology developers and other Ecosystem participants. This will then be concluded by answering the second research sub-question.*

8.1: DEALING WITH THE NETWORKED CONTEXT OF THE SMART CITY ECOSYSTEM

The Smart City Ecosystem was said to be very networked and complex in terms of participants and their relations, power structures, expectations, values and interests that are perceived important, they have difference skills, backgrounds, knowledge availability and means of communication. The most important participants of the Smart City Ecosystem are the Municipalities, National Government, Citizens and/or the public, Technology Developers, and scientific or knowledge institutions. These parties are scattered across the ecosystem while are relying on each other for achieving their goals. Whether it is the technology developer needing the 'help' of municipalities for being a launching customer or the other way around, where the municipality needs technology developers in order to innovate and to create a more digital, efficient and future-proof organisation – they are co-dependent.

The Smart City is highly contextual and networked where the role of realtor, moderator, mediator or connector is not really fulfilled and is missing as a glue between scattered initiatives and Ecosystem participants. The problems with collaboration and communication could be overcome if Ecosystem participants were able to leave their biases and specializations behind, and actually engage in meaningful conversations on the level of a common ground. This problem and its cause are however very characteristic to the Smart City Ecosystem and the Industry of the Smart City. Other characteristics are the fact that the development is almost fully led by developers, creating privatisation and private interests meddling with public ones; the Smart City Ecosystem being highly dynamic, diverse, platformed and dependent on technology creating lock-in; the fact that there is a huge mismatch between public and private interests which could create value conflicts and a city where people might no longer feel as if they could live the life they desire, without being able to communicate about these issues. Also, the development is taking place via experiments and pilots, dealing with high levels of uncertainty, a shift from a technological innovation towards a social innovation process, difficulties in scaling-up these small test-initiatives thereby creating a very gradual development and a lack of information and skills for some of the Ecosystem participants. This lack of information could lead to difficulties in assessing the added value of technologies, determining in what to invest, what will harm the city instead of bettering it, and issues in providing transparency, a critical stance and awareness on risks and value conflicts or problems.

Based on this brief but complete description of the difficulties the Smart City Ecosystem experiences in terms of collaboration, communication and learning, the need is identified for cities to no longer try to exist in vacuum. There are interdependencies on urban levels that are crossing municipal, provincial or even national borders. These interdependencies should be stressed and identified in policy frameworks for the Smart City (Tranos &

Gertner, 2012). While some of the characteristics of the Smart City are highly localized, there is a level on which cities could communicate and learn from each other in terms of knowledge, implementation trajectories for technology, Smart City strategies, and what *not* to engage in. This discussion should not just consider other municipalities, but also private parties. For them to be engaged means that they need to provide the Smart City Ecosystem much more transparency, however, in return they might be part of the creation of new frameworks and policies that not just represent public but also private interests due to their involvement (Teeffelen & Naafs, 2017c; Tranos & Gertner, 2012).

A lot of literature states the importance of real stakeholder engagement for Smart City devleopment. Krassima Paskaleva (2015) created some propositions in how to achieve this. Some of the propositions are the early invovlement of stakeholders, that allows for inclusive problem definitions and solutions, the engagement of a variety of stakeholders, an elaborate assessment of the impact technology might or might not have on society, politics, industry, or economy, use the stakeholer engagement for co-production activities and create awareness of conflicts and risks (Krassimira Paskaleva, 2015). While engagement and collaboration are tricky and very complex in the Smart City ecosystem, efforts should be put in the exploitation of existing relationships as well as in the creation of good network structures that allow for future relations to blossom (Kreijveld, 2016).

8.2: Overcoming development issues

In chapter six, some reoccurring problems were identified which are typical to the Smart City Ecosystem. These are; *the ethics of data; struggles between private and public parties; the addition of technology application in public space or public functions,* and; *transparency issues.* As for overcoming these issues, generally speaking it is true that everything that you give your attention will grow (Buijs, 2018). This means that if you for example want to achieve more awareness and to be more transparent, this should be prioritized, and budget and time should be allocated to this cause. This is something that is nowadays not really prioritized, and the attention is mainly focussed on the technology side of the story, on how to implement, how to develop, how to innovate, how to distinguish. This focus on technology is typical for the Smart City Ecosystem, however, in order to solve more societal problems occurring due to the Smart City, attention must be paid towards these issues and they must be taken seriously. This might also mean that in order to create more awareness and transparency, citizens should be more involved, and that municipalities or technology developers have to reach out to parties that normally were not considered (Buijs, 2018; EIP-SCC, 2017; Liukku, 2017).

The involvement of locals or citizens is also suggested as a means of examining the impact and desirability of technology and the use of data in the city (Ménascé, 2017). Communication is then again very important, both on the progress of Smart City Initiatives as well as the processes behind it [84]. For this collaborative approach of developing the Smart City, the municipality and other public bodies must learn how to integrate bottom-up initiatives with top-down visions (Ballon, 2016c). This process might be stimulated or guided by the development of standards or policies that are based on a shared understanding, a common ground, as well as investing in knowledge transfer practices (New, Castro, & Beckwith, 2017). Although the dilemma with standardized policies or other standards is the fact that on the one hand the Smart City is very locally oriented and could be hampered in its development by too much standardization. There should be some sort of evaluation on the amount of flexibility offered in standards for them to be adjusted to local context when desired (EUROCITIES, 2012).

For cities to be smart, serious attention must be paid to the human capital side of the story (Hollands, 2008). On the social side of the Smart City, more attention is paid to inequalities, power structures, and responsibility, which could arguably be the real Smart Cities, where technology itself does not necessarily mean anything. For this to be realized, the national government as well as the local governments should carry out their steering role more dominantly and provide a link between large and small parties either in size or in power (Kreijveld, 2016). This need for better coordination could be summarized in some steps to be taken by the municipality (and maybe

[84] Workshop by Gemeente Breda at the Smart City Update

national government); develop a vision for the Smart City that represents relevant interests and values; make sure this vision is carried out by offering the needed leadership style; invest in collaboration for both top-down as bottom-up initiatives to blossom and impact the city in a desirable way; and facilitate and coordinate Smart City activities (Ballon, 2016e; PBLQ, 2015). In order to involve the social innovation side of the Smart City, it is also important to learn to ask the right questions that lead to beter choices in the decision-making processes [85].

It happens many times too often that technologies get implemented that really did not have that much potential, which is to blame on a lack of knowledge and the ability to ask the right questions to be able to really be critical and to assess a technology on other aspects than just economical characteristics. This is partly also due to the way procurement and evaluation processes are currently structured (EIP-SCC, 2017). Before we know it, due to bad decision-making processes based on faulty or limited information we could create a very dystopic city (Ballon, 2016a). Albert Meijer (2015) presented in his book on the Smart City or Datapolis an Agile Public Innovation suggestion for the Smart City focussing on mobilising innovation capacity, improvising, vitalising and balancing. This last trait is especially important since it considers and evaluates interests and values involved in the Smart City by the identification of risks and downsides to technology, by creating new roles for the municipality such as acting as a mediator in conflict scenarios, analysing the ethical considerations via technology assessment and to act out ethical leadership (Meijer, 2015f). The addition of a *balancing mechanism* in the Smart City development is crucial for the *inclusion of (public) values* in the Smart City.

8.3: Decision-making for value inclusion

As was indicated by various sources, there is a lack of knowledge in the Smart City Ecosystem, or at least the lack of relevant knowledge in the right place to make good decisions for development trajectories [85,86,87,88,89,90](Ojo, Curry, Janowski, & Dzhusupova, 2015). Especially knowledge to *critically assess* tenders and procurement agreements, where ethical and societal aspects are analysed *beforehand* and *included* into the *decision-making process* to acquire or implement a technology. In a way, municipalities need knowledge to *not* invest or procure since a lot of initiatives are unnecessary or the existing structures are excessive [89]. By deciding on technology procurement via tenders, which municipalities are legally bound to use, the evaluation criteria of technologies are mostly economically focused; a decent price for a decent quality product or service. However, there are more important criteria to include such as; not pressuring public values, or not excluding citizens from participation based on background, age, income, address or whether they understand technology. This requires the involvement, input or support of citizens and the *representation of their interests and values* in the development of the Smart City (Zoonen, 2016). It is ultimately them that have to live in this city, who are the objects of registration and one of the bearers of the risks.

This gives way for different innovation practices such as social innovation; which means that you open up the design process to the public, thereby including social practices in several ways (Howaldt, Domanski, & Kaletka, 2016). However, the public is not the only stakeholder involved, and participation also has its limitations (Ojo, Curry, Janowski, & Dzhusupova, 2015). Therefore, *a framework should be created that is able to assess technology for all relevant stakeholders involved, by taking an ethical and responsible innovation perspective*. The Responsible Innovation perspective of Stilgoe, Owen and Macnaghten (2013) could be very helpful in realizing this perspective for the Smart City by evaluating the representations of the dimensions in the Smart City development. These dimensions are; *Anticipation* (the way in which foresight is used and incorporated in innovation), R*eflexivity* (the amount of reflection taking place on the topic of intentions, impacts, interests and

[85] Interview Hans Nouwens – Specialist Digitalisation and Public Space | Connected Worlds
[86] Interview Tom Boot – Senior Advisor at the Metropoolregio Rotterdam Den Haag
[87] Interview Irma van Bergen Bravenboer – Trainee at the Municipality of Rotterdam
[88] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam
[89] Interview Martijn Peltenburg – Policy Maker Digital Public Space at the Municipality of The Hague
[90] Interview Liesbet van Zoonen – Social Sciences and Humanities at the Erasmus University of Rotterdam

values by the actors involved), *Inclusion* (the rate of including involved values, interests, actors, opinions, considerations), and *Responsiveness* (what way the innovation is able to respond to societal needs and interests – also future ones) (Stilgoe, Owen, & Macnaghten, 2013).

As for the current state of Responsible Innovation according to this theory, all dimensions are underrepresented in the Smart City. Value conflicts and problems are arising on almost all identified public values, as well as economic values. The analysis done on the thirty-seven different technology applications in Rotterdam in chapter seven, shows that out of the eight identified values that might get pressured or conflicted, all values experience problems in these Smart City developments. Therefore, the values of privacy, safety, autonomy, power relations, human dignity, justice, control, and economic values should be embedded in the development and implementation of the Smart City by the Smart City Ecosystem.

Decision-making could be of significant influence on the creation of a Responsible Smart City due to creating better and inclusive technologies, by hampering the implementation of technologies that might harm citizens, or by offering explanations, good argumentations and transparency in the case of occurring value conflicts and value problems. There are technologies that are implemented, which are highly necessary for ensuring public safety, while conflicting the value of privacy. This does not mean that this technology should not be implemented, however, in order to decide on whether this technology is 'worth' conflicting values for, a critical assessment is needed and decisions on what values are most important must be made. In this specific example, the value of public safety might be more important than privacy, which is understandable once you are transparent about it and could explain yourself.

Therefore, to aid this critical assessment, I created a new use of the framework of Liesbet van Zoonen, to analyse not just quadrant shifts for technologies, but also to assess value conflicts that might occur in these future scenarios. The framework could be used as a tool for assessing and identifying values that are of importance and should be embedded into technology, into implementation, or processes. Also, the framework could be used as a discussion tool, offering very comprehensive, understandable assessment criteria on which a critical dialogue could be initiated. When using the framework as a discussion tool, the focus of its implications lays on the increased awareness on Smart City complexities, stimulating conversation and critical stance for policy and decision-makers, and indicating knowledge gaps, differences in opinion, perception and vision. When using the framework as an indicator for relevant values, it will function as a tool for assessing value conflicts and problems, could steer and guide decision-makers to base technology implementation on other values besides economic and practical ones, and provide solid argumentation behind choices and communicating these decisions in a transparent, honest way.

This framework thereby enables public or municipal decision-makers to debate technology in a new way, it offers visual aids by the framework and the shifts that are now visible instead of future, abstract scenarios. The framework and method used was already explained in chapter two and seven, as well as an analysis of its functionality which is given in chapter nine.

Decision-making for Value Inclusion

Using this framework as an aid for responsible decision-making, allows municipalities to be more in control, it enables them to structure debate or discussions on this topic, it could be used to take a more critical stance, it ensures the municipality to *anticipate* on future scenarios, it allows them to be *reflexive* on the values and interests held dearly by the actors involved and helps them to *include* them, as well as to be *responsive* on current and future needs and interests.

8.4: Conclusions on decision-making for value inclusion

To conclude all findings in this chapter, the third research sub-question should be answered:

Sub-question 3

What is currently hampering Responsible Innovation in the Smart City Ecosystem? How to ensure public values are taken into account?

To start off by answering the first part of the question; what is currently hampering responsible innovation is the fact that there are a lot of reoccurring problems, issues in collaboration, knowledge transfer, learning, and decision-making for responsible technology implementation to occur. These all have been addressed in chapter 6.1, 8.1 and 8.2 and will be briefly be summarized here. The Smart City Ecosystem was said to be very networked and complex in terms of participants and their relations, power structures, expectations, values and interests that are perceived important, they have difference skills, backgrounds, knowledge availability and means of communication. The most important participants of the Smart City Ecosystem are the Municipalities, National Government, Citizens and/or the public, Technology Developers, knowledge institutions and knowledge creators. These parties are scattered across the ecosystem while are needing each other to achieve their goals. The Smart City is highly contextual and networked where the role of realtor, moderator, mediator or connector is not really fulfilled and is missing as a glue between scattered initiatives and Ecosystem participants.

Further characteristics of this Ecosystem are the fact that development is almost fully led by developers, where public space and services get privatized; the Ecosystem is highly dynamic, diverse, and dependent on technology creating lock-in; there is a huge mismatch between public and private interests which could create value conflicts. Also, the development is taking place via experiments and pilots, dealing with high levels of uncertainty, there is a shift from a technological innovation towards a social innovation process, and a lack of information and skills for some of the Ecosystem participants. While some of the characteristics of the Smart City are highly localized, there is a level on which cities could communicate and learn from each other in terms of knowledge, implementation trajectories for technology, Smart City strategies, and what *not* to engage in.

Besides the problematic context and the complexities created by the Smart City development, there are also issues on the awareness, transparency, and critical stance of the Ecosystem participants. These topics are somewhat related to the issues presented on knowledge transfer and communication issues, however, are crucial in hampering the responsible innovation of the Smart City as well as the focus and attention paid to technology above all other aspects. This focus on technology is typical for the Smart City Ecosystem, however, in order to solve more societal problems occurring due to the Smart City, attention must be paid towards these issues and they must be taken seriously. On the social side of the Smart City, more attention is paid to inequalities, power structures, and responsibility, which could arguably be the real Smart Cities, where technology itself does not necessarily mean anything. For this to be realized, the national government as well as the local governments should carry out their steering role more dominantly and provide a link between large and small parties either in size or in power.

In order to involve the social innovation side of the Smart City more, it is also important to learn to ask the right questions that lead to beter choices in the decision-making processes. This is partly also due to the way procurement and evaluation processes are currently structured, where there is a lack of a balancing mechanism that allows decision-makers to be really critical. The addition of a balancing mechanism in the Smart City development, one way or another, is crucial for the inclusion of public values in the Smart City. Especially to critically assess tenders and procurement agreements, where ethical and societal aspects are analysed beforehand and included into the decision-making process to acquire or implement a technology. In a way, municipalities need knowledge to *not* invest or procure since a lot of initiatives are unnecessary, excessive or irresponsible.

For answering the second part of the research question, on how to take values into account, a recapitulation on the proposed framework in 8.3 is given which could aid decision-making for responsible innovation. Decision-making could be of significant influence on the creation of a Responsible Smart City due to creating better implemented technologies, by hampering the implementation of technologies that might harm citizens, or by offering explanations, good argumentations and transparency in the case of occurring value conflicts and problems. While pressuring or conflicting certain (public) values is sometimes unavoidable, this creates situations that require critical assessment, transparency on argumentation and decisions.

To aid this critical assessment, I created a new use of the framework of Liesbet van Zoonen, to analyse not just quadrant shifts for technologies, but also to assess value conflicts and problems that might occur in these future (or current) scenarios. This enables public or municipal decision-makers to debate technology in a new way, it offers visual aids by the framework and the shifts that are now visible instead of future, abstract scenarios. Using this framework as an aid for responsible decision-making, allows municipalities to be more in control, it enables them to structure debate or discussions on this topic, it could be used to take a more critical stance, it ensures the municipality to *anticipate* on future scenarios, it allows them to be *reflexive* on the values and interests held dearly by the actors involved and helps them to *include* them, as well as to be *responsive* on current and future needs and interests.

CHAPTER 9: AN INITIAL EVALUATION ON THE PROPOSED FRAMEWORK

The final research sub-question focussed on whether the framework created and proposed in chapter seven and eight is suitable for achieving the objectives, whether it would really aid in decision-making processes for Responsible Innovation for Smart Cities. The question to be answered this chapter therefore is:

Sub-question 4

Does the proposed framework stimulate and structure decision-making activities for embedding public values effectively?

While time allowed for evaluation was very limited, I would like to use this chapter to present the evaluation details that I could gather despite the difficulty in fully analysing the functioning of the framework since the initial findings might present some useful information for further analysis. The first time I drew the quadrant framework of Liesbet van Zoonen, simply on a piece of paper, during an interview with Corjan Gebraad (Strategy Advisor for the Urban Development Program of the municipality of Rotterdam), the response I received was surprisingly positive and enthusiastic. As he said during our interview: "I think what you are drawing here is very concrete. Just the picture of the framework quadrants allows me to create overview and insight"[91]. When discussing the proper use for this framework, Gebraad immediately suggested how suited the methodology is to assess whether you want to implement a technology or not. This assessment could now involve not just what technology offers you, but also what you have to give up when technology is implemented in the way presented. As he stated; "This is useful for the citizen as well as for the government itself. Not all innovations in these quadrants are per definition good or bad, it is about whether you could substantiate your decisions as a municipality in choosing for a technology, as well as communicating about these decisions in a transparent way." [91].

The need for such a methodology is high according to Gebraad and might be equally applicable for other technologies or purposes than value analysis. Since he is working on achieving a resilient city, technologies and projects could also be ranked in terms of resilient or not resilient instead of personal versus impersonal. This way, you could assess what contribution technology could give towards the functioning of the city, as well as an assessment on the negative impact of technology. Especially since the increase in outsourcing activities and collaboration structures where private parties and public parties are increasingly being confronted with each other's interests and values. The method proposed could offer valuable insights into these new practices, and the functioning of technology in society, and not just in a pilot phase[91]. Unfortunately, I did not have the opportunity to discuss this framework during all my interviews, however received similar positive responses from Marije ten Kate (Urban planner at the municipality of Rotterdam), and Marijn van Dijk (Commercial Manager Mobility at Dynniq) while drawing the framework.

When presenting the progress of my research at Platform31 and showed them the same figures as were presented in chapter seven on shifts in the quadrants (*figure 10, 11* and *12*), their responses were very interesting. When explaining the structure of the framework, before plotting the thirty-seven cases analysed in it, there were some nodding heads, while when the shift was visualized there was a reaction containing both awe, laughter, as well as a lot of questions. These images immediately created some discussion, created some stir and caused people to think about technologies differently. The researchers presented examples of technologies they had encountered in their personal life or in the news and pitched this technology as an object for analysis. One of the technologies that was discussed was the bike sharing services where you rent a bike via an application. Collectively we discussed the way this technology could be placed in the framework in the way the technology presents itself (offering the service of easy access to a bicycle at low cost), and how all sorts of information about its users is collected via the application. It was very interesting to see what the 'participants' of my presentation had to say about this, taking different points of view and finally agreeing on the

[91] Interview Corjan Gebraad – Strategy Advisor for Urban Development Program at the Municipality of Rotterdam

fact that however the existence of this technology might be desirable, the fact that your values might get conflicted due to the surveillance activities of an application, are not [92].

Finally, I also provided two workshops at the Night of the Digital Innovation, an event organized by the Ministry of Economic Affairs and Climate Policy for increasing the awareness on (digital) innovation and the possibilities that the ministry has to engage in these innovation processes. The organisation of the event approached me to provide a session on Smart Cities, which started off with an introductory presentation on what Smart Cities are, what problem they intend to solve, and what issues are typically represented in the Smart City Ecosystem. After this brief introduction, the group had the opportunity to ask some questions before continuing to explain the case study that was the main activity of the workshop. In this case, the 'municipality of Nooitgedacht' was approached by a technology developer called 'Calitech', who suggested their parking app to solve the parking problems in the city. The city was known for these problems, and while they tried to create more parking space, people simply cannot find the places available. The municipality also had as a target to be CO2-neutral in 2025, so for this cause, the reduction in cars driving around aimlessly could also be beneficial. However, the question is what problems this parking app could create, when private parties could easily access licence plate information for example, or when they could track users of the app even when the application is not actively used.

These issues were debated via a role-play in which the role of citizen of the municipality, policy-maker at the municipality, sales (wo)men of Calitech, and representative of the national government. The participants of the work shop were handed a card on which their role was described, as well as the values and interests that they had in this case. For example, citizens desired to easily find a parking space, do not want to pay more taxes, however expect a solution in some way. The municipality had to keep in mind that they have some political targets that were agreed upon, as well as the incentive to create a more efficient and less costly organisation. The sales (wo)men of Calitech wants to score this project since they are still learning and want to gain as much experience as possible, the municipality of Nooitgedacht is considered a stepping stone towards other clients. And, the national government representative was mostly worried about the image of our country as being innovative and future-proof, thereby aiding and guiding these processes of public private collaborations and signalize knowledge gaps. The complete description of roles is given in *Appendix E*.

The role-play was somewhat structured through questions to answer for each role, which were discussed and debated plenary after the groups had some time to think about their answers. I did this workshop twice in one evening, with different groups, however all employees of the Ministry of Economic Affairs and Climate Policy. The answers and the type of debate were quite comparable where the overall conclusion was that it is very interesting for a public party to 'play' the role of private party. This role was perceived as being the easiest and the participants enjoyed being commercially oriented and focused on making sure they were the one scoring this deal. The role of the municipality was perceived as hardest, since they realized that there really is not one truly good solution and it is difficult to evaluate choices. What was simulated in this workshop, is the pressure experienced by municipalities by the private parties, forcing their technologies down their throat. Considering alternatives for the parking problem was not even thought of and is very hard when you have the idea that you simply have to choose whether you want *this* technology or no solution at all.

After the questions asked during the case study were answered by all parties, and they agreed upon the fact that there was no solution to be found in which all parties were satisfied, we started discussing where in the quadrant framework this technology could be placed. After explaining how the framework works, and by giving an example of a technology that has shifted towards another quadrant the participants were challenged to think about the parking app once more and trying to figure out where they think the technology should go. By handing all participants a post-it they could stick it on the A0-poster with the framework printed on in the location that they found soothing. All participants chose to place this technology in Quadrant I and II, and when trying to find out what line of reasoning they used for this location, they all said that the technology developers would sell it as a

[92] Presentation at Platform31 by Marjolein Heezen

project for quadrant IV (impersonal data, service purpose), the real activities carried out are more and more shifting towards surveillance purposes, and the collection of personal data. As was also the case with the presentation at Platform31, the group started discussing their own examples and trying to find out where in the framework these technologies would go, and what values they might conflict. There was agreement upon the fact that while privacy is an important value, it was not always the most important one conflicted. One of the examples that was presented by a participant from the first group, was the fact that he recently booked a holiday to Norway, and he now gets spammed by various websites offering him advice on what gear to bring for hiking, what routes to take, which places to visit, etc. He was very agitated that without him asking for their 'advice', he felt nudged and manipulated by the technology to buy gear he did not want, to go places he initially did not want to go and to take routes that he did not find interesting. In this sense, the values of autonomy and control were conflicted more than the value of privacy. A woman from the group responded to this that she found it very pleasant that she did not have to figure everything out by herself, and that if she was stigmatized as being an avocado-lover, vegetarian, fit-girl, it would only serve her well since she will be exposed to the things that she actually likes and would otherwise not have found out about. This shows that the value conflicts experienced are not just context specific, but also bound to a personal perception and emotional reasoning.

Figure 17: An impression of the presentation given at the Night of the Digital Innovation at the Ministry of Economic Affairs and Climate Policy.

To conclude, there are some insights on the functioning of the proposed framework in terms of aiding decision-making processes for embedding public values. As far as I can say now, the framework is very useful to initiate a good, critical dialogue, which is one thing that was missing from the Smart City Ecosystem. Especially in context with some background information or a role-play structure, the framework is a useful tool in identifying risks when you are looking at the technology from a different point of view. The fact that you have to classify the technology in either personal or impersonal data, and service or surveillance purpose, triggers the critical mindset and forces you to think about the consequences of technology in a structured and visual way. The visual element of the shifts in the framework was perceived as being very helpful and also speaks to the mindset of the non-technical oriented people. Also, it was interesting to see how much the role-play situation was able to simulate the real-life complexities of the Smart City Ecosystem, and by presenting them the roles and interests of other ecosystem-members, the awareness on the mismatch in interests increased and it allowed them to be more critical towards each other. While further research is definitely needed before I could really conclude that this methodology is working, *it certainly could play a role in decision-making in terms of critical assessment, creating insights into risks and value conflicts, and might therefore be used for transparent and responsible decision-making in the Smart City Ecosystem*.

CHAPTER 10: CONCLUSIONS

To conclude this research, I will present my final findings by answering the main research question of this thesis:

Main Research Question

How could municipal or public decision-makers embed relevant values and anticipate on emerging values in order to create Responsible Innovation for the Smart City Ecosystem?

To start off with identifying the values that should be embedded, which was done in chapter six and seven by analysing literature and thirty-seven Smart City cases in Rotterdam, there are eight values that get pressured by technology applications in the city. These values are; *privacy, autonomy, control, justice, power relations, human dignity, safety, and economic values.* A very important insight is that value conflicts and problems occurring in the Smart City Ecosystem are not static but *dynamic,* meaning that they can change over time, that they can shift, increase, decrease or be highly dependent upon context. In chapter two and seven an explanation on the value shifts and conflicts was given by further elaboration on the framework of Liesbet van Zoonen, which could not only be used to identify privacy concerns but to analyse shifts in the quadrant for all kinds of value problems.

Technology is not a static object, but something that will keep on developing itself, and the sociotechnical landscape in which this technology is placed is also of a dynamic and transitional nature. These facts might explain the fact that the perception of technology or the intention of technology might change. These changes will then influence the position technologies hold in the framework, shifting inside or outside of their original quadrant. Therefore, in order to analyse technologies for Responsible Innovation, using *anticipation* and *reflexivity* should create some negative future scenarios in order to analyse the *possible impacts* of technology and to assess desirability of the innovation in development. These negative future scenarios can create the shift in the framework, on which value conflicts and problems could be analysed.

Applying this method onto thirty-seven cases in the city of Rotterdam, allowed me to identify the 'status-quo' of projects, the types of projects, whether these projects could pose a risk for value problems and shifts in the framework, how big of a risk they are, what quadrant they will shift towards, and identifying values that will get pressured by technology. When identifying risks for the projects, over half of all projects analysed turned out 'risky', and the majority of all projects shifted towards Quadrant II (personal data and surveillance purpose) after projecting negative future scenarios. This projected shift shows how undecisive and uncritical behaviour *could* create a city in which value problems are likely to occur. When analysing these value problems, the first insight is that also projects that were identified as not posing a risk for shifts in the framework, might just as well cause value problems as other projects. The analysis shows that out of the eight identified values that might get pressured or conflicted, *all* values experience problems. Therefore, the values of privacy, safety, autonomy, power relations, human dignity, justice, control, and economic values should be embedded in the development and implementation of the Smart City by the Smart City Ecosystem.

The process of embedding these values into the Smart City Ecosystem, could be done by using the chosen method of this research as a way to analyse technologies for decision-making and assessing suitability, desirability, risk, and pressured values. From the analysis of the Ecosystem combined with the analysis of the cases, it turned out that awareness, transparency, knowledge transfer and critical stance are lacking, which might result in the situation where technologies get implemented whilst not really fulfilling any societal need or really solving a problem. The municipal or other public decision-maker should therefore be to critically assess technology on these aspects before allowing implementation in their municipality. *Decision-making* could be of significant influence on the creation of a Responsible Smart City due to creating better and inclusive technologies, by hampering the implementation of technologies that might harm citizens, or by offering explanations, good argumentations and transparency in the case of occurring value conflicts and value problems. There are technologies that are implemented, which are highly necessary for ensuring public safety, while conflicting the value of privacy. This does not mean that this technology should not be implemented, however, in order to

decide on whether this technology is 'worth' conflicting values for, a critical assessment is needed and decisions on what values are most important must be made. In this specific example, the value of public safety might be more important than privacy, which is understandable once you are transparent about it and could explain yourself.

Therefore, to aid this critical assessment, I created a new use of the framework of Liesbet van Zoonen, to analyse not just quadrant shifts for technologies, but also to assess value conflicts that might occur in these future scenarios. The framework could be used as a tool for assessing and identifying values that are of importance and should be embedded into technology, into implementation, or processes. Also, the framework could be used as a discussion tool, offering very comprehensive, understandable assessment criteria on which a critical dialogue could be initiated. When using the framework as a discussion tool, the focus of its implications lays on the increased awareness on Smart City complexities, stimulating conversation and critical stance for policy and decision-makers, and indicating knowledge gaps, differences in opinion, perception and vision. When using the framework as an indicator for relevant values, it will function as a tool for assessing value conflicts and problems, could steer and guide decision-makers to base technology implementation on other values besides economic and practical ones, and provide solid argumentation behind choices and communicating these decisions in a transparent, honest way. *Using this framework as an aid for responsible decision-making, allows municipalities to be more in control, it enables them to structure debate or discussions on this topic, it could be used to take a more critical stance, it ensures the municipality to anticipate on future scenarios, it allows them to be reflexive on the values and interests held dearly by the actors involved and helps them to include them, as well as to be responsive on current and future needs and interests.*

In chapter nine an initial evaluation on this framework was given. This concluded that there are some insights on the functioning of the proposed framework in terms of aiding decision-making processes for embedding public values. As far as I can say now, the framework is very useful to initiate a good, critical dialogue, which is lacking in the Smart City Ecosystem. Especially in context with some background information or a role-play structure, the framework is a useful tool in identifying and discussing risks taking a different stance. The fact that you have to classify the technology in either personal or impersonal data, and service or surveillance purpose, triggers a critical mindset and forces you to think about consequences of technology in a structured and visual way. The visual element of the shifts in the framework were perceived as being very helpful and also speaks to the mindset of non-technical oriented people. Also, it was interesting to see how much the role-play situation was able to simulate the real-life complexities of the Smart City Ecosystem, and by presenting them the roles and interests of other ecosystem-members, the *awareness* of the mismatch in interests increased, allowing them to be more critical towards each other. While further research is definitely needed before I could really conclude that this methodology is working, *it certainly could play a role in decision-making in terms of critical assessment, creating insights into risks and value conflicts, and might therefore be used for transparent and responsible decision-making in the Smart City Ecosystem*.

My research objective for this thesis was:

> *…to make recommendations on how to structure decision-making activities to embed public values within the Smart City Ecosystem for responsible and inclusive development and implementation of Smart Cities.*

This objective might have been a little ambitious, and fully structuring the decision-making activities is not really the result of my research. However, I created a use for a framework that could definitely aid decision-making processes for municipal decision-makers to allow for a better and more critical evaluation of technology. The framework allows non-specialist to think about their stance by offering them simple questions such as; will this technology gather personal or impersonal data. It triggers discussion and also enables the users of this framework to identify their own knowledge gaps when they cannot answer questions that need answering when analysing the project in this framework. Therefore, the research objective is satisfactory reached, while further research is required in order to fully analyse the potential of the framework created.

CHAPTER 11: REFLECTION

There are some parts that I would like to reflect on and provide thereby some suggestions for further research. First of all, and maybe most important, the framework that is used and the application of this framework I created, is tested on thirty-seven cases based in Rotterdam, which are all already implemented via pilot or experiment phases or are widely implemented. The framework is therefor used for analysis and evaluation of risks for technology shifts and value conflicts and problems or shifts for technologies that were already decided upon. However, the framework should ideally be used as some sort of an analysis tool – just like the cost-benefit analysis – ***before*** technologies get implemented to allow for responsible decisions in the Smart City. Since the cases used were all consisting of 'historical' data, this aspect of the framework could not be evaluated.

The evaluation that *did* occur, with data from interviews, a presentation for a group of researchers and advisors in the public sector (Platform31), and the workshop with the role-play given at the Ministry of Economic Affairs and Climate Policy, presented some interesting and promising findings. As far as I can say now, *the framework is very useful to initiate a good, critical dialogue*, which is lacking in the Smart City Ecosystem. Especially in context with some background information or a role-play structure, the framework is a useful tool for identifying risks. The fact that you have to classify the technology in either personal or impersonal data, and service or surveillance purpose, triggers the critical mindset and forces you to think about the consequences of technology in a structured and visual way. The visual element of the shifts in the framework was perceived as being very helpful and also speaks to the mindset of the non-technical oriented people. While further research is definitely needed before I could really conclude that this methodology could certainly play a role in decision-making in terms of critical assessment, creating insights into risks and value conflicts, and might therefore be used for transparent and responsible decision-making in the Smart City Ecosystem. However, for an assessment and evaluation on the functioning of this framework in decision-making processes, an analysis with real-time decisions on Smart City projects should be done, in collaboration with the municipal or other public decision-makers and to gain their feedback on the framework and to see its effect when using it to make decisions instead of analysing the consequences of decisions made in the past.

What is also interesting to study is whether this analysis via the framework proposed is also applicable for other technology applications. *The Smart City was the scope or research, while I think that the methodology could be applied to all sorts of decisions, discussions and assessments for (new) technologies and procurement.* However, this will require more research on other types of applications of the same framework. In general, the framework is not specified to the Smart City technologies. Once of the differences might be that the value problems arising with other technology applications are very different than the ones of the Smart City, or the context as well as the ecosystem dynamics are varied from those of the Smart City. Also, whether the value problems identified for the Smart City are sufficient and cover all issues is to be determined by the research of more and different projects in other contexts. While the thirty-seven cases might have been quite representable for the types of projects that are to be identified for the Smart City (where the classification on project-types could aid generalizability), there is a chance that some types of projects are not represented in the analysis done in this study. Adding to this; the scope of my research was focused on sensor use in public space. There are however some Smart City technologies that might not rely on sensors at all. These projects might express different characteristics, pose different risks, and cause different value problems than the projects using sensors. This again provides some interesting perspective for further research.

When this type of study will be repeated, I would like to stress the importance of gathering data from a different city than Rotterdam to assure generalizability and create comparability of cities, ecosystems and projects. This could lead to valuable insights in the influence of local context on the Smart City development, both in terms of network and ecosystem dynamics, as for the type of projects that are generally pursued, and the associated risks and value conflicts that in turn occur.

Additionally, I would like to reflect upon the Sociotechnical Value Map (STVM), which was my chosen method for analysing the Smart City as a technological development, with its corresponding Ecosystem, and a design for values part. The STVM aims at studying technology for responsible innovation by – amongst others – identifying value conflicts. I would like to add to this approach that it is of great importance to stress the dynamics of values, which are not static and could therefore not be analysed as being static. Anticipating future needs and values has been a highly relevant element of my research, as it will be for other technologies, scopes, and researchers. Also, the focus of the STVM lies on identifying value *conflicts,* while value *problems* might just as well hamper responsible innovation. Pressuring (public) values without necessarily conflicting them is something that occurred often in my analysis of the Smart City and solely focussing on value conflicts is, in my opinion, not the complete picture of development issues from an ethical, or responsible point of view. Studying and including both value conflicts as value problems might be more complete and more realistic.

Finally, I would like to mention the fact that the Smart City topic is very broad and requires different types of expertise which could – by my opinion – not be researched by an individual or a single perspective. There are themes that I came across that were simply not my expertise, or not my field of interest. However, these topics might be of great importance. Therefore, the Smart City is a subject that we should evaluate and assess in a collaborative way, in order to really connect the dots, and to broaden each other's perspectives. One of the subjects that requires more attention than I could give it was tendering and procurement procedures and regulations. These regulations could in a way determine the course of development of the Smart City by limiting choices municipalities have for procurement and the conditions under which they could procure a new technology or service. I have encountered the term tendering as being a problematic hurdle for municipalities to really innovate and collaborate with partners from the private sector. However, this is not something I know a lot about. I tried to be as explicit about this topic as I could possibly be, while there are researchers that might have much more interesting notes on this topic. I would therefore like to invite researchers and simply interested individuals to put their heads together. The Smart City is no longer a technological innovation process, it is a social one, and a very complex one at that. If we really want to achieve a Smart City that is there to fulfil a valuable function in society, we should not leave it to the techies to decide and develop this. We should all be involved and have an opinion as well as the means to express this.

REFERENCES

Agenda Stad. (2017, September). *Brochure Agenda Stad*. Retrieved from Agenda Stad: https://agendastad.nl/brochure-agenda-stad/

Albino, V., Berardi, U., & R.M., D. (2015). Smart Cities: Definitions, Dimensions, Performance, and Initiatives. *Journal of Urban Technology*, 1-16.

Anthopoulos, L. (2015). Understanding the Smart City Domain: A Literature Review. *Public Administration and Information Technology 8*, 9-21.

Anthopoulos, L. (2017). The Rise of the Smart City. In L. Anthopoulos, *Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick* (pp. 5-45). Berlin: Springer.

Anttiroiko, A.-V. (2015). Smart Cities: Building Platforms for Innovative Local Economic Restructuring. *Public Administration and Information Technology 8*, 23-41.

Astrin. (2018). *Havenspoorpad klaar voor fase 2*. Retrieved from Astrin: http://www.astrin.nl/havenspoorpad-klaar-voor-fase-2-en-alis-1-2/;

Autoriteit Persoonsgegevens. (2017, December). *Functionaris voor de gegevensbescherming (FG)*. Retrieved from Autoriteit Persoonsgegevens: https://autoriteitpersoonsgegevens.nl/nl/onderwerpen/avg-europese-privacywetgeving/functionaris-voor-de-gegevensbescherming-fg

Autoriteit Persoonsgegevens. (2018, February). *De AVG in een notendop*. Retrieved from Autoriteit Persoonsgegevens: https://autoriteitpersoonsgegevens.nl/sites/default/files/atoms/files/avg_in_een_notendop.pdf

Baars, E. v. (2018, April 23). *Wat kan de smart city-beweging leren van de serie Black Mirror?* Retrieved from Stadszaken: http://www.stadszaken.nl/smart/technologie/1533/black-mirror-verplichte-kost-voor-urbanisten-en-bestuurders-met-toekomstplannen/

Bakker, V., & Bal, E. (2018, April 11). Trainee & Strategisch Informatiemanager Gemeente Rotterdam. (M. Heezen, Interviewer)

Balkan, A. (2017, September 7). *Media: Foreplay keynote - Aral Balkan*. Retrieved from Foreplay Gent: http://foreplay.gent/media.html

Ballon, P. (2016a). Het privacy-probleem: meer dan een voetnoot. In P. Ballon, *Smart Cities* (pp. 89-108). Tielt: LannooCampus.

Ballon, P. (2016b). Knopen doorhakken: het probleem van bestuurlijke versnippering. In P. Ballon, *Smart Cities.* Tielt: LannooCampus.

Ballon, P. (2016b). Knopen doorhakken: het probleem van bestuurlijke versnippering. In P. Ballon, *Smart Cities* (pp. 127 - 146). Tielt: LannooCampus.

Ballon, P. (2016c). Over planmatige en anarchistische utopisten. In P. Ballon, *Smart Cities.* Tielt: LannooCampus.

Ballon, P. (2016d). Smart Cities: What's in a name? In P. Ballon, *Smart Cities.* Tielt: LannooCampus.

Ballon, P. (2016e). Technologische Bouwstenen van de stad. In P. Ballon, *Smart Cities.* Tielt: LannooCampus.

Ballon, P. (2016f). Wie wint de 'battle for the streets'? In P. Ballon, *Smart Cities.* Tielt: LannooCampus.

Bayer, M. (2017, November). De slimme stad als zegen of vloek? Mag dat? Willen we dat? *Future City*, pp. 84 - 87.

Beerends, S. (2018, March 21). *Is uw gemeente al overnomen door algoritmen?* Retrieved from Sociale Vraagstukken: https://www.socialevraagstukken.nl/is-uw-gemeente-al-overgenomen-door-algoritmen/

Benders, L. (2017, March 17). Meer warmtegevoelige fietsstoplichten in Rotterdam na succesvolle proef. *de Volkskrant*.

Betekenis - Definitie. (2017). *Betekenis Panopticon*. Retrieved from Betekenis - Definitie: http://www.betekenis-definitie.nl/Panopticon

Bethlehem, H. (2017, August 31). *Mac-adres: wel of geen persoonsgegeven?* Retrieved from Bout Advocaten: https://boutadvocaten.nl/blog/mac-bluetrace-adres-wel-geen-persoonsgegeven/

Binnenlands Bestuur. (2012, September 5). *Verkiezingsapp Rotterdam Controleert Stempas*. Retrieved from Binnenlands Bestuur: https://www.binnenlandsbestuur.nl/digitaal/nieuws/verkiezingsapp-rotterdam-controleert-stempas.8500892.lynkx

Binnenlands Bestuur. (2016, August 2). *Rotterdam: epicentrum van innovatie*. Retrieved from Binnenlands Bestuur: https://www.binnenlandsbestuur.nl/digitaal/kennispartners/kpn-lokale-overheid/rotterdam-epicentrum-van-innovatie.9545100.lynkx

Binnenlands Bestuur. (2016, August 2). *Rotterdam: Epicentrum van Innovatie*. Retrieved from Binnenlands Bestuur: https://www.binnenlandsbestuur.nl/digitaal/kennispartners/kpn-lokale-overheid/rotterdam-epicentrum-van-innovatie.9545100.lynkx

Bolívar, M. P. (2015). Smart Cities: Big Cities, Complex Governments? *Public Administration and Information Technology 8*, 1-7.

Boot, T. (2018, April 3). Directie-adviseur Metropoolregio Rotterdam Den Haag. (M. Heezen, Interviewer)

Bouman, V. (2016 , July 7). *Wifi-tracking en de bescherming van persoonsgegevens*. Retrieved from Wieringa Advocaten: http://www.wieringa-advocaten.nl/nl/weblog/2016/07/13/wifitracking-en-de-bescherming-van-persoonsgegevens

Brandsma, J. (2017, December 6). Dekker: onmogelijk om volledig overzicht te krijgen van alle sensoren. *TROUW*.

Bravenboer, I. v. (2018). *Slimme Lichtmast: Inventarisatie- & Adviesdocument - Externe Versie.* Rotterdam: Gemeente Rotterdam.

Bravenboer, I. v. (2018, April 12). Trainee Gemeente Rotterdam. (M. Heezen, Interviewer)

Breda, G. (2018, March 7). Smart City Update. (M. Heezen, Interviewer)

Buijs, S. (2018, March 23). *Smart mobility kan veel leren van energietransitie*. Retrieved from LinkedIn: https://www.linkedin.com/pulse/smart-mobility-kan-veel-leren-van-energietransitie-steffart-buijs/

Buiten Beter. (2016, March 9). *Over BuitenBeter*. Retrieved from Buiten Beter: http://www.buitenbeter.nl/over-buitenbeter

Business Dictionary. (2017). *Urbanization*. Retrieved from Business Dictionary: http://www.businessdictionary.com/definition/urbanization.html

Campbell, C., & Goldsmith, S. (2016, August 31). *Restoring Trust in the Responsive City*. Retrieved from Data-Smart City Solutions: https://datasmart.ash.harvard.edu/news/article/restoring-trust-in-the-responsive-city-901

Carton, L. (2018, March 7). Nijmegen Smart Emission Project - Smart City Update. (M. Heezen, Interviewer)

Carton, L. (2018, March 7). Smart City Update. (M. Heezen, Interviewer)

Chourabi, H., Gil-Garcia, J., Pardo, T., Nam, T., Mellouli, S., Scholl, H., . . . Nahon, K. (2012). Understanding Smart Cities: An Integrative Framework. *2012 45th Hawaii International Conference on System Sciences* (pp. 2289-2297). Maui, HI, USA: IEEE Computer Society.

City Traffic. (2017, October 3). *De metingen die CityTraffic voor u doet*. Retrieved from CityTraffic: https://www.citytraffic.nl/site/metingen

Collins Dictionary. (2018). *Definition of 'ecosystem'*. Retrieved from Collins English Dictionary: https://www.collinsdictionary.com/dictionary/english/ecosystem

Connecting Mobility. (2015, September 28). *Smart Services: Smart Public transport*. Retrieved from Youtube: https://www.youtube.com/watch?v=JPPjdBjLuxI

Corver, D., & Engels, L. (2018, March 7). Pels Rijcken & Droogleever Fortuijn. (M. Heezen, Interviewer)

De Verkeersonderneming. (2017, March). *Elektrische deelfietsen en zelfrijdend vervoer winnen aanbesteding*. Retrieved from De Verkeersonderneming: http://www.verkeersonderneming.nl/nieuws/elektrische-deelfietsen-en-zelfrijdend-vervoer-winnen-aanbesteding/

Dijk, M. v. (2018, May 8). Commercial Manager Mobility Dynniq. (M. Heezen, Interviewer)

Dubbeldeman, R., & Ward, S. (2015). *Smart Cities: How rapid advances in technology are reshaping our economy and society.* the Netherlands: Deloitte Gov Lab.

Dunn, M. (2017, October 2). *How do bike sharing services like oBike and ReddyGo make money?* Retrieved from News: https://www.news.com.au/technology/innovation/inventions/how-do-bike-sharing-services-like-obike-and-reddygo-make-money/news-story/882c22777c7ecf3bef587e0fb8bf44f9

Dustar, S., Nastić, S., & Šćekić, O. (2017). In S. Dustar, S. Nastić, & O. Šćekić, *Smart Cities: The Internet of Things, People and Systems* (pp. 1-274). Cham, Switzerland: Springer International Publishing AG.

EIP-SCC. (2017, 11 28). *EIP-SCC Manifesto on Citizen Engagement & Inclusive Smart Cities.* Retrieved from EU Smartcities: http://eu-smartcities.eu/search?keywords=manifesto&action_cluster=all&initiative=all&city=all&op=Search&sc_search_mode=&form_build_id=form-ZyMcqbBRyentmJ8kkb4u2hp3IsXDWyRc-yBQ_IF1t-k&form_id=smart_cities_search_form

EIP-SCC. (2017, November 28). *EIP-SCC Manifesto on Citizen Engagement & Inclusive Smart Cities.* Retrieved from EU Smartcities: smartcities.eu/search?keywords=manifesto&action_cluster=all&initiative=all&city=all&op=Search&sc_search_mode=&form_build_id=form-ZyMcqbBRyentmJ8kkb4u2hp3IsXDWyRc-yBQ_IF1t-k&form_id=smart_cities_search_form

Est, R. v., & Korthagen, I. (2017a, November 30). *Hoe beschermen gemeenten publieke waarden in de slimme stad?* Retrieved from Rathenau Instituut: https://www.rathenau.nl/nl/publicatie/hoe-beschermen-gemeenten-publieke-waarden-de-slimme-stad

Est, R. v., & Korthagen, I. (2017b, November 17). *Steden gedreven door data.* Retrieved from Rathenau Instituut: https://www.rathenau.nl/nl/publicatie/steden-gedreven-door-data

Est, R. v., & Korthagen, I. (2017c, November 23). *Zetten slimme steden publieke belangen onder druk?* Retrieved from Rathenau Instituut: https://www.rathenau.nl/nl/publicatie/zetten-slimme-steden-publieke-belangen-onder-druk

EUROCITIES. (2012, October). *EUROCITIES Statement on Smart Cities and Communities Communication.* Retrieved from EU Smartcities: http://eu-smartcities.eu/documents

EUROCITIES. (2012, October). *EUROCITIES Statement on Smart Cities and Communities Communication.* Retrieved from EU Smartcities: http://eu-smartcities.eu/documents

Europa Decentraal. (2017, April). *Innovatief Aanbesteden*. Retrieved from Europa Decentraal: https://europadecentraal.nl/onderwerp/aanbestedingen/innovatie-en-aanbesteden/

European Commission. (2016, March 3). *Innovation partnerships keep public services up to date*. Retrieved from European Commission: https://ec.europa.eu/growth/content/8699-innovation-partnerships-keep-public-services-date_en

Fietsfan010. (2016, September 22). *Warmtesensor geeft fietsers meer groen*. Retrieved from Fietsfan010: http://fietsfan010.nl/uitgelicht/warmtesensor-%ef%bb%bfgeeft-fietsers-meer-groen/

Films Gemeente rotterdam. (2015). *Slimme verlichting in Rotterdam*. Retrieved from Vimeo: https://vimeo.com/130526814

Friedman, B. (1996). Value-sensitive Design. *Interactions, 3*(6), 16-23.

Friedman, B., Kahn, P. H., & Borning, A. (2008). Value Sensitive Design and Information Systems. In B. Friedman, P. H. Kahn, & A. Borning, *The Handbook of Information and Computer Ethics* (pp. 69-94). Hoboken: Wiley & Sons, Inc.

Gebraad, C. (2018, May 2). Strategy Advisor for Urban Development Gemeente Rotterdam. (M. Heezen, Interviewer)

Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy 31*, 1257-1274.

Gemeente Rotterdam. (2016, August 5). *Binnenstad*. Retrieved from Gemeente Rotterdam: https://www.rotterdam.nl/wonen-leven/binnenstad/

Gemeente Rotterdam. (2016, April 15). *Bouwtrillingsmeter DEMO*. Retrieved from Google Playstore: https://play.google.com/store/apps/details?id=com.gemeenterotterdam.bouwtrillingsmeter

Gemeente Rotterdam. (2017, March). *Europees samenwerken aan de toekomst van Zuid*. Retrieved from Gemeente Rotterdam: https://www.rotterdam.nl/wonen-leven/ruggedised-rotterdam/

Gemeente Rotterdam. (2018). *Havenspoorpad*. Retrieved from Gemeente Rotterdam: http://www.rotterdam.nl/havenspoorpad

Gemeente Rotterdam. (2018, January). *Innovatieve projecten in de buitenruimte*. Retrieved from Rotterdam: https://www.rotterdam.nl/wonen-leven/innovaties/

Gemeente Rotterdam. (2018, March). *Kentekenparkeren*. Retrieved from Gemeente Rotterdam: http://www.rotterdam.nl/product:kentekenparkeren

Gemeente Rotterdam. (2018, January 3). *Regenradar Rijnmond*. Retrieved from Gemeente Rotterdam: https://www.rotterdam.nl/wonen-leven/regenradar/

Gemeente Rotterdam. (2018). *Sensoren voor wateroverlast*. Retrieved from RIO Rotterdam: https://rio.rotterdam.nl/Project/Stadsbeheer/Pages/mr_SbQHDH0aw1LYpKhaIaQ

Gemeente Rotterdam. (2018). *Slimme wijkcontainers*. Retrieved from Gemeente Rotterdam: https://www.rotterdam.nl/wonen-leven/slimme-wijkcontainers/

GEONOVUM. (2018, june 1). *De verbindende kracht van standaardisatie*. Retrieved from GEONOVUM: https://www.geonovum.nl

Geurts, P., & Haans, R. (2018, March 23). Smart City Experts Gemeente Nijmegen. (D. Louwerse, & M. Heezen, Interviewers)

Grossi, G., & Pianezzi, D. (2017). Smart cities: Utopia or neoliberal ideology? *Cities*, 79-85.

Habitat, U. (2012). *UN Human Settlements Program.* UN-HABITAT: State of the World's Cities Report 2012/2013.

Halkes, J. (2015, November 20). *Fietser krijgt vaker groen licht dankzij regensensor*. Retrieved from Metro Nieuws: https://www.metronieuws.nl/binnenland/rotterdam/2015/11/fietser-krijgt-vaker-groen-licht-dankzij-regensensor

Heezen, M., Riedstra, E., & Louwerse, D. (2018). *Smart City? Graag. Maar dan wel met bewuste burgers!* Den Haag: Platform31.

Hendriquez, L., & Van Timmeren, A. (2015a). Digital Divides and Elite Enclaves. In L. Hendriquez, & A. Van Timmeren, *Ubikquity & the illuminated city* (pp. 98-109). Delft: Delft University of Technology.

Hendriquez, L., & Van Timmeren, A. (2015b). Give Us Your Data and We'll Give You a Techno-Utopia. In L. Hendriquez, & A. Van Timmeren, *Ubikquity and the Illuminated City* (pp. 110-123). Delft: Delft University of Technology.

Hendriquez, L., & Van Timmeren, A. (2015c). Illuminated Cities. In L. Hendriquez, & A. Van Timmeren, *Ubikquity and the illuminated city* (pp. 146-168). Delft: Delft University of Technology.

Hendriquez, L., & Van Timmeren, A. (2015d). Is something rotten in the state of Denmark? In L. Hendriquez, & A. Van Timmeren, *Ubikquity and the illuminated city* (pp. 88-97). Delft: Delft University of Technology.

Hendriquez, L., & Van Timmeren, A. (2015e). Networked Environements. In L. Hendriquez, & A. Van Timmeren, *Ubikquity and the illuminated city* (pp. 28-35). Delft: Delft University of Technology.

Hendriquez, L., & Van Timmeren, A. (2015f). Urbanization in Crisis. In L. Hendriquez, & A. Van Timmeren, *Ubikquity and the illuminated city* (pp. 16-27). Delft: Delft University of Technology.

Hiemstra, J. (2018, March 13). *Wat digitale transformatie echt betekent (en hoe je succes boekt)*. Retrieved from LinkedIn: https://www.linkedin.com/pulse/wat-digitale-transformatie-echt-betekent-en-hoe-je-succes-hiemstra/?trackingId=DvW5U5nxmBFRmBzby1NcnQ%3D%3D

Hitachi. (2016, May 18). *Hitachi Sets Data Free to Give Copenhagen Smart City Insights*. Retrieved from Hitachi Vantara: https://www.hitachivantara.com/en-us/news-resources/press-releases/2016/gl160518.html

Hollands, R. (2008). Will the real smart city please stand up? *City, 12*(3), 303-320.

Howaldt, J., Domanski, D., & Kaletka, C. (2016). Social Innovation; Towards a New Innovation Paradigm. *Mackenzie Management Review*, 20-44.

IBM. (2018, May 26). *Smarter Cities*. Retrieved from IBM: https://www.ibm.com/smarterplanet/us/en/smarter_cities/solutions/planning_mgt_solutions/

Idsingh, I. (2018, March 7). Smart City Update. (M. Heezen, Interviewer)

Institute for Future of Living. (2017). *NL Smart City Strategie.* Den Haag: Institute for Future of Living.

International Telecommunication Union. (2015, October). *Focus Group on Smart Sustainable Cities*. Retrieved from ITU.int: http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx

IPCC. (2007). *IPCC Fourth Assessment Report: Climate Change 2007. Projected Climate Change and its Impacts*. Retrieved from www.IPCC.ch: http://www.ipcc.ch/publications_and_data/ar4/syr/en/spms3.html

Jansen, M. (2017, January 5). *De privacy-paradox: steeds meer informatie verstrekken, maar wel zo compact en simpel mogelijk alstublieft*. Retrieved from Dirkzwager Advocaten & Notarissen N.V.: https://www.dirkzwager.nl/kennis/artikelen/de-privacy-paradox-steeds-meer-informatie-verstrekken-maar-wel-zo-compact-en-simpel-mogelijk-alstublieft/

Jonge, D. d. (2018, April 12). Afstudeerder Gemeente Rotterdam. (M. Heezen, Interviewer)

Jorna, F., & Batist, C. (2018, March 28). VNG realisatie congres. (M. Heezen, Interviewer)

Kadaster. (2018). *Wat doen we?* Retrieved from Het Kadaster: https://www.kadaster.nl/wat-doen-we

Kahneman, D. (2011). A machine for jumping to conclusions. In D. Kahneman, *Thinking, fast and slow* (pp. 79-88). New York: Farrar, Straus and Giroux.

Kate, M. t. (2018, April 17). Hoofdplanoloog Stadsontwikkeling Gemeente Rotterdam. (M. Heezen, Interviewer)

Keesman, M. (2018, April 18). Projectmanager Economie Gemeente Rotterdam - Innovatie Ecosystemen. (M. Heezen, Interviewer)

Kemmerling, Y. (2018, March 13). *Bereid bestuurder voor op nieuwe tijd: besturen wordt voorspellen*. Retrieved from Stadszaken: http://www.stadszaken.nl/ruimte/organisatie/1429/besturen-wordt-voorspellen

Kitchin, R. (2014). The real-time city? Bit Data and Smart Urbanism. *GeoJournal*, 1-14.

Kool, L., Timmer, J., Royakkers, L., & Est, R. v. (2017). *Opwaarderen: Borgen van publieke waarden in de digitale samenleving.* Den Haag : Rathenau Instituut.

KPN. (2016, June 16). *Alfa + Bèta + Gamma = Smart City*. Retrieved from iBestuur: https://ibestuur.nl/partner-kpn/alfa-beta-gamma-smart-city

Krassimira Paskaleva, I. C. (2015). Stakeholder Engagement in the Smart City: Making Living Labs Work. *Public Administration and Information Technology 8*, 115-145.

Kreijveld, M. (2016). *De maatschappelijke impact van technologische ontwikkelingen op de provincie Zuid-Holland.* MINT. Zuid-Holland: Provincie Zuid-Holland.

Lightwell. (2018, April 13). *Smart Lighting*. Retrieved from Lightwell: https://www.lightwell.eu/lightwell-smart-lighting-systems/

Liukku, A. (2017, May 29). *Gevaar ligt op de loer in slimme stad*. Retrieved from AD: https://www.ad.nl/rotterdam/gevaar-ligt-op-de-loer-in-slimme-stad~a567f626/

Loo, R. v., & Jansen, D. (2018, April 4). Citizen Science projecten in Rotterdam. (M. Heezen, Interviewer)

Maastunnel. (2017, November). *Onderhoud aan de Maastunnel*. Retrieved from Maastunnel: https://www.maastunnel.nl/#/all

Meijer, A. (2015a). Cockpit en vogelzwerm. In A. Meijer, *Bestuur in de datapolis* (pp. 13-20). Den Haag: Boom Bestuurskunde.

Meijer, A. (2015b). Dataficatie van de stad. In A. Meijer, *Bestuur in de datapolis* (pp. 7-12). Den Haag: Boom Bestuurskunde.

Meijer, A. (2015c). De beloften van de datapolis. In A. Meijer, *Bestuur in de datapolis* (pp. 21 - 24). Den Haag: Boom Bestuurskunde.

Meijer, A. (2015d). Kritiek op de premissen van de datapolis. In A. Meijer, *Bestuur in de datapolis* (pp. 25 - 36). Den Haag: Boom Bestuurskunde.

Meijer, A. (2015e). Stad van alle mensen. In A. Meijer, *Bestuur in de datapolis* (pp. 43-47). Den Haag: Boom Bestuurskunde.

Meijer, A. (2015f). Wendbare Publieke Innovatie. In A. Meijer, *Bestuur in de datapolis* (pp. 37-42). Den Haag: Boom Bestuurskunde.

Meijer, A. (2016). Smart City Governance: A Local Emergent Perspective. *Public Administration and Information Technology 11*, 73-85.

Meijer, A. (2018, March 28). VNG realisatie congres. (M. Heezen, Interviewer)

Ménascé, D. (2017). *Smart cities and technologies: Connected or Disconnected citizens?* Retrieved from factsreport: http://factsreports.revues.org/4264

Ménascé, D. (2017). *Smart cities and technologies: Connected or Disconnected citizens? .* Retrieved from factsreport: http://factsreports.revues.org/4264

Merriam-Webster. (2017). *Technocracy*. Retrieved from Merriam-Webster: https://www.merriam-webster.com/dictionary/technocracy

Metcalf, S. (2017, August 18). *Neoliberalism: the idea that swallowed the world*. Retrieved from The Guardian: https://www.theguardian.com/news/2017/aug/18/neoliberalism-the-idea-that-changed-the-world

Mulder, E.-J. (2018, March). *Wie wordt de wethouder Digitale Transitie?* Retrieved from Smart City Academie: http://smartcityacademie.nl/wie-wordt-wethouder-digitale-transitie/

Naafs, S. (2017a, December 6). *De Muren hebben Sensoren*. Retrieved from De Groene Amsterdammer: https://www.groene.nl/artikel/de-muren-hebben-sensoren

Naafs, S. (2017a, 12 6). *De Muren hebben Sensoren*. Retrieved from De Groene Amsterdammer: https://www.groene.nl/artikel/de-muren-hebben-sensoren

Naafs, S. (2017b, December 5). Smart cities lopen grote kans de privacywetgeving te schenden. *De Groene Amsterdammer*.

Naafs, S. (2018, March 1). 'Living laboratories': the Dutch cities amassing data on oblivious residents. *The Guardian*.

NEN. (2018, February 2). *NEN Smart Cities*. Retrieved from NEN: https://www.nen.nl/Normontwikkeling/Doe-mee/Normcommissies-en-nieuwe-trajecten/NEN-Smartcities.htm

New, J., Castro, D., & Beckwith, M. (2017, October 30). *How national governments can help smart cities succeed.* Retrieved from EU Smartcities: http://eu-smartcities.eu/search?keywords=national+government&op=Search&form_build_id=form-WCe7h0MtA2zX9JLDnOcPfVdiZOCFgw_ZVcqKKV-jiW8&form_id=smart_cities_search_block_form

New, J., Castro, D., & Beckwith, M. (2017, October 30). *How national governments can help smart cities succeed.* Retrieved from EU Smartcities: http://eu-smartcities.eu/search?keywords=national+government&op=Search&form_build_id=form-WCe7h0MtA2zX9JLDnOcPfV

Nierstrasz, I. (2018, June 12). Strategisch Adviseur Directie Veilig - Gemeente Rotterdam. (M. Heezen, Interviewer)

Nijboer, G. (2018, May 3). Procesmanager Innovatie Gemeente Rotterdam. (M. Heezen, Interviewer)

Norberg, P. A., Horne, D. R., & Horne, D. A. (2007). The Privacy Paradox: Personal Information Disclosure Intentions versus Behaviors. *Journal of Consumer Affairs*, 100-126.

Nouwens, H. (2018, April 9). Specialist Digitalisering van de Openbare Ruimte - Connected Worlds. (M. Heezen, Interviewer)

Ojo, A., Curry, E., Janowski, T., & Dzhusupova, Z. (2015). Designing Next Generation Smart City Initiatives: The SCID Framework. *Public Administration and Information Technology*, 43 - 67.

Oosterhoff, W. (2018, March 13). Voor gemeentelijk beheer is de Smart City als een Black Box. (M. Hendriksma, Interviewer)

Ousseur, S. (2015, December 15). Rotterdam gaat met sensor strijd knalvuurwerk aan. *Metro* .

Patrizia Lombardi, A. V. (2015). Smart City as a Mobile Technology: Critical Perspectives on Urban Development Policies. *Public Administration and Information Technology 8*, 147-161.

PBLQ. (2015, Februari). *Smart City Rotterdam: een visie op een slimme toekomst.* Retrieved from PBLQ: https://www.pblq.nl/sites/default/files/samenvatting_advies_pblq_smart_city_rotterdam_2015.pdf

Peltenburg, M. (2018, March 26). Digitale Openbare Ruimte Gemeente Den Haag. (M. Heezen, Interviewer)

Pesch, U. (2015). *Mapping Values for Responsible Innovation.* Delft: Delft University of Technology.

Platform Beter Benutten. (2016, December). *Talking Traffic*. Retrieved from Beter Benutten: https://www.beterbenutten.nl/talking-traffic

Platform31. (2017). *SURF*. Retrieved from Platform31: http://www.platform31.nl/wat-we-doen/onderzoek/surf

Platform31. (2018, June 11). Presentatie Smart City onderzoek Marjolein Heezen. (M. Heezen, Interviewer)

Platform31. (2018). *Wat we doen*. Retrieved from Platform31: http://www.platform31.nl/wat-we-doen

Port of Rotterdam. (2018, January 31). *Havenbedrijf Rotterdam en IBM bouwen slimme, 'connected' haven van de toekomst*. Retrieved from Port of Rotterdam: https://www.portofrotterdam.com/nl/nieuws-en-persberichten/havenbedrijf-rotterdam-en-ibm-bouwen-slimme-connected-haven-van-de-toekomst

PS-Crimson. (2018, February 9). *Public Safety & Crisis Management Service Orchestration*. Retrieved from PS-Crimson: http://www.ps-crimson.com

RainGain. (2018, May). *Rotterdam*. Retrieved from Rain Gain: http://www.raingain.eu/en/rotterdam

Reinders, B. (2018, February 19). NL Smart City Strategy. (M. Heezen, Interviewer)

Rijksinstituut voor Volksgezondheid en Milieu. (2017). *Amsterdam Smart Citizens Lab*. Retrieved from Samen Meten aan Luchtkwaliteit: https://www.samenmetenaanluchtkwaliteit.nl/amsterdam-smart-citizens-lab

Rijksoverheid. (2016, April 1). *Gids Proportionaliteit - 1e herziening*. Retrieved from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/aanbesteden/documenten/richtlijnen/2016/04/01/gids-proportionaliteit-1e-herziening

Rijksoverheid. (2016, March 15). *Meteorologische gegevens, 1990 - 2015*. Retrieved from CLO: http://www.clo.nl/indicatoren/nl000418-meteorologische-gegevens-in--nederland

Rijksoverheid. (2017, July). *Aanbestedingsregels*. Retrieved from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/aanbesteden/aanbestedingsregels

Rijksoverheid. (2018, March 9). *Kabinet onderzoekt maatschappelijke effecten van technologische ontwikkelingen*. Retrieved from Rijksoverheid: https://www.rijksoverheid.nl/actueel/nieuws/2018/03/09/kabinet-onderzoekt-maatschappelijke-effecten-van-technologische-ontwikkelingen

Rijksoverheid. (2018, June 18). *Omgevingswet*. Retrieved from Rijksoverheid: https://www.rijksoverheid.nl/onderwerpen/omgevingswet

Rittel, & Webber. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences*, 155-169.

RTV Rijnmond. (2012, September 5). *Rotterdam experimenteert met 'Verkiezingsapp'*. Retrieved from RTV Rijnmond: https://www.rijnmond.nl/nieuws/92855/Rotterdam-experimenteert-met-Verkiezingsapp

RTV Rijnmond. (2015, June 8). *Lantaarnpaal Heijplaat levert stroom, wifi en toezicht*. Retrieved from RTV Rijnmond: https://www.rijnmond.nl/nieuws/130120/Lantaarnpaal-Heijplaat-levert-stroom-wifi-en-toezicht

RTV Rijnmond. (2017, May 27). *Rotterdam krijgt grootste smart grid van Europa*. Retrieved from RTV Rijnmond: https://www.rijnmond.nl/nieuws/155426/Rotterdam-krijgt-grootste-smart-grid-van-Europa

RTV Rijnmond. (2017, November 21). *Sensoren in Rotterdamse Afvalcontainers*. Retrieved from RTV Rijnmond: https://www.rijnmond.nl/nieuws/161641/Sensoren-in-Rotterdamse-afvalcontainers

RTV Rijnmond. (2018, April 25). *Geluidssensoren moeten Rotterdamse Kruiskade veiliger maken*. Retrieved from RTV Rijnmond: https://www.rijnmond.nl/nieuws/167673/Geluidssensoren-moeten-Rotterdamse-Kruiskade-veiliger-maken

Schmidt, R. (2018, May 3). Projectmanager Smart Cities en Digitale Economie Gemeente Rotterdam. (M. Heezen, Interviewer)

Schot, J., & Rip, A. (1997). The past and future of constructive technology assessment. *Technological Forecasting and Social Change, 54*(2-3), 251-268.

Semiotics Labs. (2018, March 4). *Sensoren Semiotic Labs bij Erasmusbrug*. Retrieved from De Verkeersonderneming: http://www.verkeersonderneming.nl/nieuws/sensoren-semiotic-labs-bij-erasmusbrug/

Smith, M. R., & Marx, L. (1994). In M. R. Smith, & L. Marx, *Does Technology Drive History? The Dilemma of Technological Determinism.* Cambridge, Massachusetts: The MIT Press.

Stadsbeheer Rotterdam. (2015, June 2). *Fietscomfortmetingen voor comfortable fietsen*. Retrieved from Youtube: https://www.youtube.com/watch?time_continue=4&v=LT8f_3HGk0Q

Stedin. (2017, April 10). *Slim elektriciteitsnet in Rotterdam getest in de praktijk*. Retrieved from Stedin: https://www.stedin.net/over-stedin/pers-en-media/persberichten/slim-elektriciteitsnet-in-rotterdam-getest-in-de-praktijk

Stevens, P. (2018, May 11). City Advisors and KPN Smart Cities. (M. Heezen, Interviewer)

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy, 42*(9), 1568-1580.

Taebi, B., Correljé, A., Cuppen, E., Dignum, M., & Pesch, U. (2014). Responsible innovation as an endorsement of public values: the need for interdisciplinary research. *Journal of Responsible Innovation, 1*(1), 118-124.

Talking Traffic. (2018, February 7). *Data Beschikbaar*. Retrieved from Talking Traffic: https://www.talking-traffic.com/nl/talking-traffic/data-beschikbaar

Talking Traffics. (2018, January 5). *Talking Traffics*. Retrieved from Talking Traffics: https://www.talking-traffic.com/nl/

Technopedia. (2018). *Filter Bubble*. Retrieved from Technopedia: https://www.techopedia.com/definition/28556/filter-bubble

Teeffelen, K. v., & Naafs, S. (2017a, December 5). Moeten we wel zo blij zijn met de slimme stad? *TROUW*.

Teeffelen, K. v., & Naafs, S. (2017b, December 5). Niemand controleert big brother. *TROUW*.

Teeffelen, K. v., & Naafs, S. (2017c, December 9). Privacy in een stad vol glurende ogen, kan dat? *TROUW*.

Tranos, E., & Gertner, D. (2012). Smart Networked Cities? *25*(2), 175-190.

Tranos, E., & Gertner, D. (2012). Smart Networked Cities? *Innovation - The European Journal of Social Science Research, 25*(2), 175-190.

TRIPZOOM. (2014, March 24). *TRIPZOOM! Focus op Fietsers*. Retrieved from Youtube: https://www.youtube.com/watch?v=GcHVIxrEEyM; http://www.youtube.com/watch?v=9J_BzysGOJk&feature=youtu.be

United Nations Conference on Housing and Sustainable Urban Development. (2015, May 31). *Habitat III Issue Papers - 21 Smart Cities.* Retrieved from habitat3.org: http://habitat3.org/the-new-urban-agenda/documents/issue-papers/

United Nations Environment Programme. (2004, March). *Urban Issues*. Retrieved from UNEP.or.jp: http://www.unep.or.jp/ietc/Issues/Urban.asp

Veldman, T., & Bondarenko, O. (2018, March 28). VNG realisatie congres. (M. Heezen, Interviewer)

Verhoeven, A. (2015, January 27). *Rotterdam slaat plank mist met wifi-tracking*. Retrieved from SOLV: https://www.solv.nl/weblog/rotterdam-slaat-plank-mis-met-wifi-tracking/20355

Verschuren, P., & Doorewaard, H. (2010). Research Strategies. In P. Verschuren, & H. Doorewaard, *Designing a Research Project* (pp. 178-186). The Hague: Eleven International Publishing.

Vieveen, F. (2018). *Inventarisatie Smart City Initiatieven.* Rotterdam: Gemeente Rotterdam.

Vieveen, F. (2018). *Inventarisatie Smart City Initiatieven.* Rotterdam : Gemeente Rotterdam.

Vieveen, F. (2018, April 9). Projectmanager Digitale Innovatie Gemeente Rotterdam. (M. Heezen, Interviewer)

Vlaskamp, M., Persson, M., & Obbema, F. (2015, April 25). China kent elke burger score toe - ook voor internetgedrag. *De Volkskrant*.

Von Schombergen, R. (2011). Prospects for Technology Assessment in a framework of responsible research and innovation. *In: Dusseldorp, M., Beecroft, R. (Eds.), Tech-nikfolgen Abschätzen Lehren: Bildungspotenziale Transdisziplinärer*.

Vries, M. d. (2018, April 3). *Dataparafraag voor in Coalitieakkoorden*. Retrieved from ibestuur: https://ibestuur.nl/weblog/dataparagraaf-voor-in-coalitieakkoorden

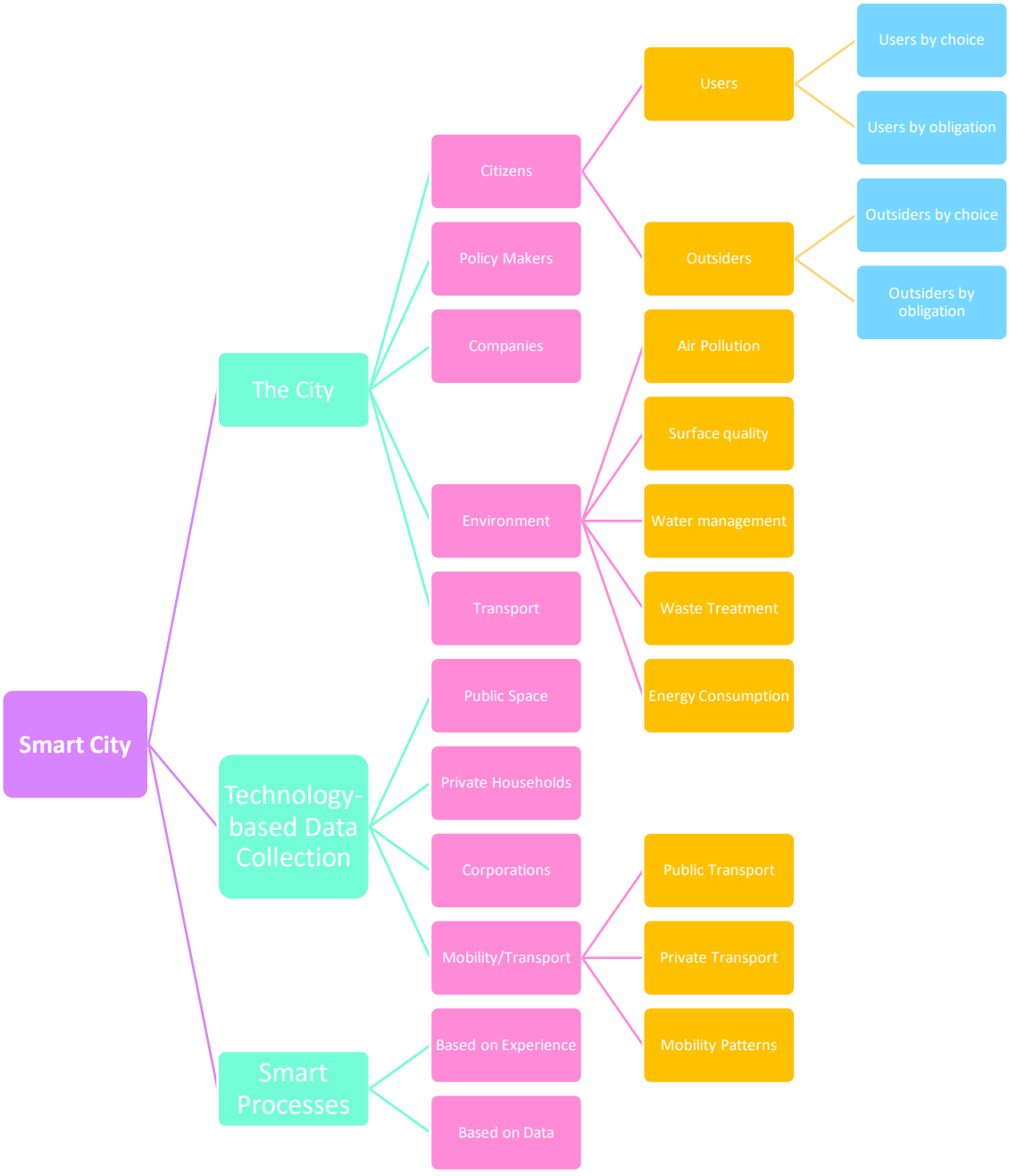
Wesselink, J.-W. (2018, May 31). Future City Meet-up. (M. Heezen, Interviewer)

Zoonen, L. v. (2016). Privacy concerns in smart cities. *Government Information Quarterly 33*, 472-480.

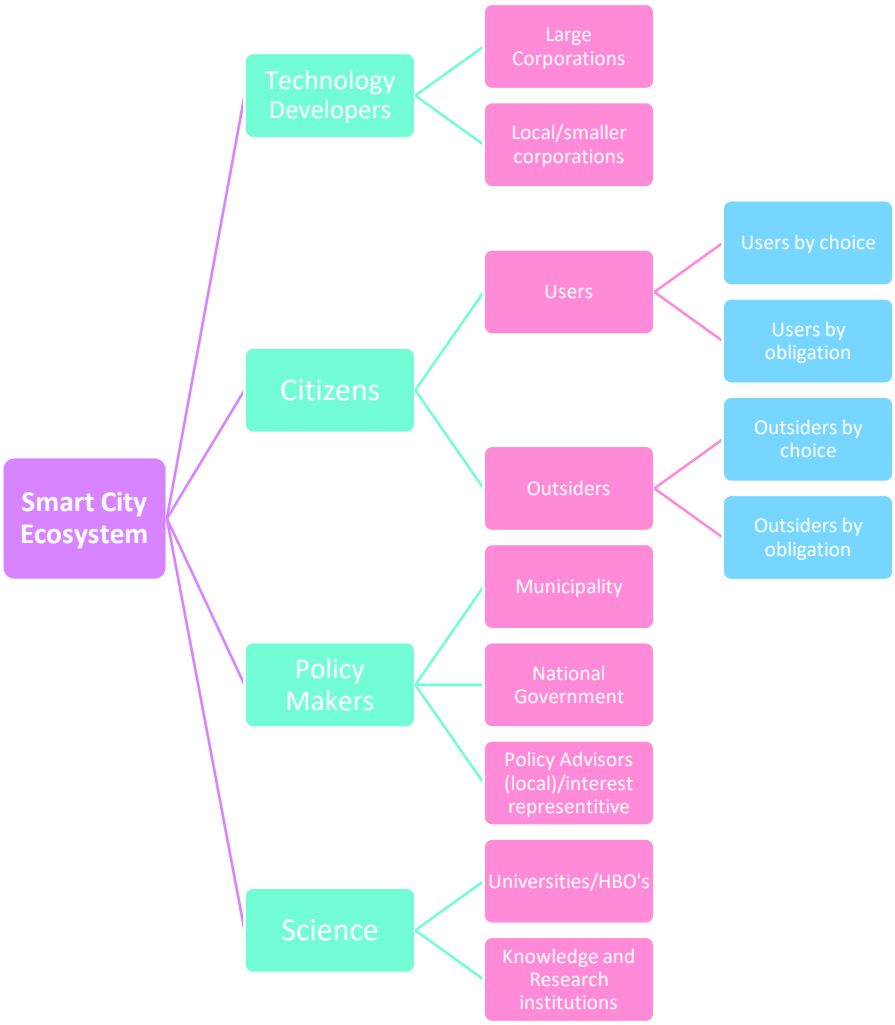
Zoonen, L. v. (2018, April 17). Dean Graduate School Social Sciences and Humanities Erasmus Universiteit. (M. Heezen, Interviewer)

Appendix A: Conceptual Flow Charts

Smart City Conceptual Flow Chart:



Smart City Ecosystem Conceptual Flow Chart:



APPENDIX B: INTERVIEW QUESTIONS AND APPROACH FOR KADASTER PROJECT

GESPREKSLEIDRAAD EXPERTINTERVIEWS SLIMME BINNENSTEDEN

INTRODUCTIE EN KENNISMAKING

De interviewer introduceert zichzelf kort en geeft een toelichting over het onderzoek. Ook legt hij/zij uit op welke manier de informatie uit de interviews gebruikt zal worden. Hij/zij legt uit dat een verslag van het gesprek teruggekoppeld wordt aan de geïnterviewde, evenals publicatie tzt.

- Wat is uw functie? Hoe lang werkt u al bij gemeente X?
- Wat is uw achtergrond? Hoe ben u in de wereld van de Smart Cities gekomen?

GOVERNANCE VAN SMART CITIES

- Onder welke afdeling valt u? Wie zijn er nog meer bezig met Smart Cities? Op welke afdelingen zitten zij?
- Heeft de gemeente behoefte aan meer kennis op het gebied van Smart Cities? Wat voor kennis? Zijn jullie bezig om deze kennis in huis te halen?
- Wie analyseert en bewerkt data in de projecten waar de gemeente bij betrokken is?
- Wat doen jullie met de Urban Data Center? Waar zit deze in het organogram?

SITUATIE GEMEENTE

- Heeft u zicht op welke partijen data verzamelen in de openbare ruimte in uw gemeente? Zo ja, kunt u schetsen welke partijen dat zijn, wat voor data zij verzamelen en waar zij deze voor gebruiken? Dit hoeft geen uitputtende lijst te worden.
- Hoe ervaart u de rol van marktpartijen met betrekking tot dataverzameling in de openbare ruimte? Wat kunnen marktpartijen bieden?
- Heeft de gemeente contact met deze partijen? Maken jullie afspraken?

BELEID GEMEENTE

- Wat meet uw gemeente precies in de openbare ruimte? Hoe en door wie worden deze data verzameld en waar worden ze voor gebruikt?
- Is er al beleid aangepast of zijn er acties ondernomen op basis van inzichten verkregen uit verzamelde data (die dus anders niet zouden zijn gesignaleerd)?
- Wat zijn de ambities en plannen van uw gemeente m.b.t. dataverzameling in de openbare ruimte? Zowel langetermijnvisies als concrete gebruiksmogelijkheden.
- Heeft uw gemeente een register van sensoren in de openbare ruimte? Zo nee, zou dit u waardevol lijken?
- Wie zijn jullie belangrijke samenwerkingspartners in het publieke domein? (VNG, gemeenten, provincie).

WETGEVING

- Welke wettelijke kaders zijn relevant als het gaat om dataverzameling in de openbare ruimte? Hoe anticipeert uw gemeente hierop? (Algemene Verordening Gegevensbescherming)
- Gebruiken jullie de open data principes? Hoe vertalen deze zich naar beleid en naar uitvoering?

BURGERBEWUSTZIJN

- Wat doet uw gemeente om inwoners te informeren over dataverzameling in de openbare ruimte? Hoe en waarover wordt geïnformeerd? Worden inwoners ook betrokken bij of geraadpleegd over dit thema?

SPANNINGSVELDEN

- Welke risico's ziet u als het aankomt op dataverzameling in de openbare ruimte? Hoe probeert uw gemeente deze te ondervangen?
- Waar moeten gemeenten volgens u meer aandacht aan besteden op het terrein van dataverzameling in de openbare ruimte?
- Gebruiken jullie de handreiking van Geonovum?

PLAN VAN AANPAK STRAATINTERVIEWS SLIMME BINNENSTEDEN

INLEIDING

Voor het onderzoek naar de slimme binnensteden dat Platform31 uitvoert in opdracht van het Kadaster en het Ministerie van Binnenlandse zaken gaat zij onder andere de straat op om interviews af te nemen met gebruikers van de openbare ruimte. Het doel van deze interviews is om te achterhalen in hoeverre gebruikers van de openbare ruimte zich bewust zijn van de manieren waarop er data over hen worden verzameld en waar deze data voor worden gebruikt. Ook wil Platform31 middels deze interviews toetsen wat mensen hiervan vinden: maken zij zich bijvoorbeeld zorgen, of zien zij juist kansen?

DE WERKWIJZE:

Het streven is om per stad minstens twintig respondenten te spreken. Omdat er vijf steden deelnemen, zal het totaalaantal respondenten daarom oplopen tot minstens honderd. Hierbij moet worden benadrukt dat Platform31 er niet naar streeft een statistisch representatieve steekproef van gebruikers van de openbare ruimte te onderzoeken. Dit is - gezien de omvang van het project en de beschikbare middelen - niet haalbaar. Wel streeft Platform31 naar diversiteit in haar groep respondenten op het gebied van geslacht en leeftijd. Op die manier zal een dwarsdoorsnede ontstaan van het bewustzijn van gebruikers van de openbare ruimte. Op basis hiervan zal een globale indruk ontstaan van het bewustzijn bij gebruikers van de openbare ruimte.

De interviews zullen worden afgenomen op plaatsen waar daadwerkelijk dataverzameling plaatsvindt. Op die manier kan het onderwerp het makkelijkste geconcretiseerd worden. Deze plekken zullen in de vijf steden uitgekozen worden in samenspraak met de *Smart City Managers* van de betreffende steden, met wie Platform31 ook contact heeft voor de later af te nemen expertinterviews. Aan deze experts zal gevraagd worden welke data op deze specifieke plaats verzameld worden, door wie en hoe. Ook vragen we waar deze data voor gebruikt worden.

De onderzoeker benadert actief voorbijgangers op straat. Omwille van het responspercentage is de indruk die de onderzoeker hierbij maakt van cruciaal belang. Hij moet voor voorbijgangers herkenbaar zijn als onderzoeker – en uitdrukkelijk niet als bijvoorbeeld verkoper. Hij maakt zich daarom direct kenbaar als onderzoeker die werkt namens de overheid. Bij voorkeur is hij ook herkenbaar aan een kledingstuk (jas?) of een badge. Een zichtbare vragenlijst kan bij voorbijgangers de verkeerde indruk wekken en hen ervan weerhouden het gesprek aan te gaan. Eventueel kan de lijst met vragen en antwoorden buiten zicht gehouden worden om het gesprek op een meer natuurlijke wijze aan te kunnen gaan.

DE VRAGEN:

1. Bent u ervan op de hoogte dat er in deze straat gegevens over u worden verzameld?
   Zo niet, maakt de onderzoeker de voorbijganger attent op de wijze waarop er gegevens over hem of haar verzameld worden, wie dit doet en wat er gebeurt met deze data
2. Wat vindt u ervan dat er op deze manier gegevens over u worden verzameld en gebruikt? Hierbij indien mogelijk doorvragen: waar maakt u zich specifiek zorgen over? Of ziet u juist het nut ervan in?
3. Weet u hoe en waar u meer informatie zou kunnen vinden over deze dataverzameling?
4. Vindt u dat er meer zichtbare informatievoorziening omtrent dit thema zou moeten zijn? Welke wijze van informatievoorziening zou u op prijs stellen?
5. Wie is volgens u verantwoordelijk voor deze informatievoorziening?

APPENDIX C: THE ECOSYSTEM OF ROTTERDAM

Before analysing some technology applications in the city of Rotterdam, a brief elaboration on Rotterdam as a municipality, as an innovator, as a collaboration partner and as a Smart City is given in this sub-chapter. Whereas the most occurring characteristics of the Smart City Ecosystem, the role and functions of municipalities and their stance in this development has already been addressed in chapter five, the specifics on the city of Rotterdam will be described without repeating the information provided earlier too much. This information will function as a contextual backdrop for the technology analysis of the cases residing in Rotterdam later on in chapter seven.

C.1: A GENERAL INTRODUCTION ON ROTTERDAM AND ITS MUNICIPALITY:

The city of Rotterdam has a lot of potential in terms of becoming a Smart City due to the political ambition represented in the city, the economic foundation and innovation infrastructure providing solid building blocks, the mentality of the city where 'Make it Happen' is not without reasons their slogan, and a large appeal for visitors and citizens to work, live or spend time in the city. The city should however, in order to really profit from this potential, create coherence between initiatives in the city. The landscape is at the moment very fragmented rather than expressing a clear vision or structure. For this fragmentation issue to be resolved, Smart City Rotterdam should be developed from a clear strategy, a vision from the municipality that will be able to alight all these initiatives and new opportunities to agree with this vision. The communication of this vision is another important element since when the vision is widely known, relevant partners will be able to approach the municipality with initiatives that they know will be relevant. Collaboration within the Smart City Ecosystem is already hard enough, the communication of a game plan and future outlook for the city might stimulate effective cooperation and partnerships that will actually attribute to realizing the (political) ambitions of the municipality (PBLQ, 2015).

There is no concrete starting point for a Smart City. In Rotterdam, the focus was mainly on the connection to market parties and business models that could be formulated around these connections. Technological applications could be viewed as the starting point for development, where The Hague for example is betting on cyber security applications, and Rotterdam on Smart Manufacturing since its historical link to being a city of creators, a place of industry (Boot, 2018). For the municipality of Rotterdam, the Smart City is "a city that dramatically increases the pace at which it improves its sustainability and resilience, by fundamentally improving how it engages society, how it applies collaborative leadership methods, how it works across disciplines and city systems, and how it uses data and integrated technologies, in order to transform services and quality of life to those in and involved with the city (residents, businesses, visitors)." (Bravenboer, Slimme Lichtmast: Inventarisatie- & Adviesdocument - Externe Versie, 2018). This definition is used in the Rotterdam Digital Economy and Smart City framework, where based on 5 pillars, development will be realized on this theme. Of these pillars, one if the Smart City, whereas the other ones are Digital Infrastructure, New Technological Developments, Roadmap Next Economy, and Networks and Ecosystems.

Frank Vieveen, expressed in 2016 that the municipality of Rotterdam was very interested in every initiative that had something to do something with Smart Cities and Big Data, expressing a desire to innovate and become one. In fact, they ended up winning a prize for their innovative policy, which lead to the accidental development of Smart City Rotterdam. This illustrates that the Smart City was not originated from a clearly developed strategy or vision but was a result of the innovative capacity of the city itself. Also, since the Smart City could entail very little or a lot, knowing what your definition of the Smart City is, gives the opportunity to create the strategy or vision around it in order to develop this Smart City further (Binnenlands Bestuur, 2016). The city of Rotterdam already has a lot of potential to offer to innovative parties such as start-ups, however, they could invest more into the development of innovative competencies in their region. Especially, specific attention should be paid to making sure that this innovative capacity is relevant for the development of their Smart City (PBLQ, 2015). In Rotterdam, multiple projects and Smart City initiatives are created in collaboration with other parties, while, the municipality ends up taking most of the responsibility. Without clear communication on the expectations and a

clarification on a desirable role distribution, market parties will likely not take much of the responsibility on them. Rotterdam therefore needs to make better and more comprehensive agreements in which the division of responsibility and tasks could be laid down. In this sense, public debate or a critical stance should be created for fair and realistic analysis of the performance of existing and proposed new projects (PBLQ, 2015).

C.2: The Rotterdam Innovation System

For Rotterdam to develop into a real Smart City there are high hopes and expectations. Due to the connections that the city has with both market parties from various industries, as the connection to a solid knowledge base with universities and universities of applied science in the city itself or in its close proximity, innovation and creation are at the core of the city. Also, the city has a lot of energy, young people, diversity, a nice hands-on mentality and a loyal constituency (PBLQ, 2015). Rotterdam could not be compared to other cities such as Amsterdam which are very different in some ways; like the kind of people living in these cities. There are also very different acute problems that these cities have to deal with, and there are different mentalities with their citizens, businesses and municipalities. These differences might determine the strategy of these cities for their urban development trajectory, which cannot be a question of which is better, but is a question of which choices are made and why (Zoonen, 2018). The municipality experiences some trouble in trying to decide what to engage in, what projects and initiatives to exploit, and how to deal with bottom-up inventions and suggestions (Gebraad, 2018). There are so many of these initiatives in Rotterdam that the municipality experiences difficulty in finding a way to appropriately deal with all this.

The municipality of Rotterdam sees the Smart City not just a nice, futuristic image, but it is also perceived and used as an urban development strategy, where citizens, businesses, the city itself and the connections this Ecosystem has with external actors from various backgrounds, are all important for the trajectory of this development (PBLQ, 2015). The Smart City is a proposed solution to adjusting city management to dealing with transitions, which cannot be planned or predicted, but simply could be dealt with in an agile, flexible, disruptive and innovative way (Kate, 2018). The municipality is looking for ways to create a future-proof basis in terms of infrastructure and governance to support the innovations market parties and scientific partners can come up with. This requires the municipality to adopt new ways of working, due to the dynamics and the unpredictability of the Smart City development trajectory. This could mean that people have to change the way they execute their job, or that their job is not taken over by a smart system (Binnenlands Bestuur, 2016).

It is necessary to work in a multidisciplinary way, since the Smart City is not to be put in any box, it is addressing various problems, requires various expertises and knowledge perspectives, and cannot simply be solved by one department. However, due to naivety of the municipality, the added value of good collaborative effort has not yet been discovered (Bakker & Bal, 2018). They should look out for making choices based on what they know (future cone; simply projecting current views and knowledge onto future times) and should gain knowledge on the possibilities that are out there to be able to go the extra mile (Bravenboer, Trainee Gemeente Rotterdam, 2018). There are several strategies used by the municipality to realise this and Rotterdam is trying to invest in cooperation and collaboration with start-ups. They do this for example by issuing design competitions for specific urban issues, where small start-ups, or individual engineers and designers can work on and present their ideas (Keesman, 2018). This gives these small organisations the opportunity to realise their concepts in the city, since public tenders are too expensive or too big of a risk for them to participate in.

Speaking of monetary issues; the economic crisis, that stroke in 2008, hit a lot of people, organisations and industries. Among them, they hit the municipality of Rotterdam too. This crisis created a culture inside the municipality where attention and budget were paid towards everything that *must* happen to keep the municipality up and running. This does not include innovation. This corporate culture still resides in most parts of the municipality, making it difficult to find time, budget and understanding for the need to innovate and there are only a few people that can afford to do so (Bravenboer, Trainee Gemeente Rotterdam, 2018). While there is a great desire to become future-proof, to digitize, and innovation, the way the municipality is dealing with

budgets might seriously hamper its innovative capacity. While it is true that you have to be strict when it comes to spending public money, there should be some space to manoeuvre, and to create a more modern organisation that allows innovation processes to occur (Kate, 2018). You cannot expect the municipalities to work 100% agile, however, maybe it could be more than nothing at all.

In terms of knowledge and awareness, there is a big gap to be seen between the people that are higher or lower educated, that are technology oriented or are technophobic, people who speak Dutch, people who do not, etc. This gap will only increase when there is one group claiming a growing responsibility for city management practices, be extremely active in participation projects, launching initiatives in the city that will only address one of these groups or specifically leave one out. As a city, you therefor need a clear focus that determines where you will invest your energy in and why (Bravenboer, Trainee Gemeente Rotterdam, 2018). Not just citizens of Rotterdam experience a lack of knowledge, also the municipality itself is missing some crucial information and skills to deal with the Smart City developments (Zoonen, 2018). Whether this is due to the budget cuts made due to the financial crisis, where 'unnecessary' experts were out of a job, or because of the transition character, creating this highly complex and dynamic development trajectory is unclear. However, this is an issue that the municipality should spend more time on in order for them to make good decisions, to raise awareness and to realize a critical stance towards these developments.

C.3: Collaboration, Culture and Learning in the Rotterdam Ecosystem:

Within this subsection, learning, collaboration and culture will be discussed of the municipality of Rotterdam and its corresponding ecosystem. These specific characteristics might explain the success of the Smart City projects and initiatives or they might explain the difficulties they have to overcome while realizing it. These issues and cultural facets might be very comparable to those of other municipalities and ecosystem parties.

C.3.1: Learning in the Municipality:

When trying to find out what will increase a cities, organisations, or individuals learning capacity, you could also reverse the question; What keeps them from learning and being innovative? For the municipality of Rotterdam four issues were brought to attention. First, there is a lack of networking capacity, difficulty in reaching out to others that are bringing the municipality more than just functional contacts. Second, the learning system is not in order where learning occurs in the traditional sense of the word which entails that you learn from your mistakes. Which is an example of passive responsibility, where lessons learnt only occue when things have already happened. The skills needed to learn in an effective and actively responsible way are lacking. These skills entail how to learn skills that are necessary to function well in your job, how to effectively use knowledge from a network, how to reach out to these networks, and how to create effective peer-to-peer constructions. Third, the municipality of Rotterdam has the privilege of having citizens and employees that are very loyal and intrinsically motivated to work for their municipality. Unfortunately, this energy, loyalty and motivation is not used properly. There is too little control over this energy available internally, while it is a very unique situation to have employees this loyal. When more attention will be paid to the ideas and energy of these people, the municipality could create more with less investment. Finally, the organisation structure is not accurately suited for innovation. There are specific systems that could work to realise more innovation and knowledge development in the municipality in a structured way, however, you will have to adopt a network idea and not necessarily an institutional one. The municipality is very good at bureaucratic processes, while they are not that good at networking, building bridges (when using this as a figure of speech – there are in fact people specialised at realising physical bridges in the city) and connect with people from 'the outside' and use their knowledge and capacities (Nijboer, 2018). The municipality has to accept that creation of new knowledge and because of this new knowledge, innovation, is something that might feel dangerous, that could be compared to standing on the edge of a swamp. While you have no idea if it is safe, whether dry ground will be reached at all, but if you just keep standing on the edge, you will never find out. In this metaphor, the municipality should adopt a more active role where they are sending out scouts, who, if they return, will present them with very valuable information

which they should cherish, even if they do not know what to do with this information yet. This also means that in order to keep doing these expeditions you need different people, processes and concepts within the municipal organisation. The process of learning, knowledge creation and innovation will require other types of persons than the institutional practice of the municipality. Which are different processes, with different objectives, however, there should be a place for both of them.

What hampers learning in the ecosystem on the topic of Smart Cities (and many others) is that managers of department directors usually detect a problem and ask their department to solve it. They want basically nothing more than the problem to disappear. However, making a problem disappear or non-existent, is not the same as actually solving the problem at stake (through the eyes of the municipality). This could for example also mean that situations and scenarios get reframed in a way that the issue is no longer a problem, it could mean that the problem definition itself is adjusted to a situation that no longer requires immediate attention, or that problems get explained and backed up by data to downsize this problem (Nijboer, 2018). Formulating a clear problem definition is a challenge, especially due to the difference in perception of the employees working at the municipality. At the more strategic departments people have a more institutional and conceptual thinkers, that try to focus on solving problems such as the energy transition, urbanisation, inclusive communities, etc. While there are also people working at the municipality that focus on the problems of individual citizens, where for example nuisance from construction work in the Karel Doormanstraat is their focus of the day. This also makes that these people have different problem definition, learn differently, and require different skills. If you want these people to connect and to be able to communicate clearly, there should be somebody inside the municipality that could create some overview in terms of a meta level, where the conceptual thinkers on strategic departments tend to stay at macro level, and employees focussing on the individual citizen on micro level, an overarching meta level could connect these two and create situations for them to collaborate, share knowledge and ideas and learn from each other (Nijboer, 2018). This might result in better problem solving and more innovative capacity within the municipal organization.

C.3.2: Collaboration with parties of the Rotterdam Ecosystem:

Rotterdam's approach can be seen as distinctive due to the role of people like Frank Vieveen, who acts as a broker for the Smart City, connecting parties, creating and seeking opportunities, create internal connections with relevant departments or sectors and being the go-to contact for questions and ideas on this topic. This approach might lead to some very interesting results and solutions to problems in a way that is done very differently at other municipalities. The connections made are not just internal but also external. An example is the collaboration between the municipality and KPN who is responsible for realizing the technological infrastructure needed for digital innovations such as the 3G, 4G and LoRa networks available in the city. The intention of this collaboration is beside to create innovation, also to ensure more economic activity in the future, create new jobs and could increase quality of life for its citizens (Binnenlands Bestuur, 2016). This is an example of public private partnerships that can stimulate positive outcomes for both parties involved.

While the collaboration efforts made with KPN for realizing the technological backbone in the city to create and realize these innovations are crucial, it is not the only collaboration that the municipality is involved in. In an attempt to identify all collaborative efforts that the municipality of Rotterdam is involved in in context of the Smart City, a list of 56 collaboration structures have been identified. These collaborations are occurring on several themes, involving public organisations, private organisations, NGO's, citizens, the national government, province South Holland, the European Union, start-ups, foundations specialized in knowledge transfer, collaboration, innovation, or technologies, etc. The themes that the municipality of Rotterdam is mostly collaborating on are (in no particular order): economic growth; Smart grids; energy; sustainability; health; (social and cyber) safety; service development; innovation (stimulating, realising, collective); digital infrastructures; societal challenges; collaboration; entrepreneurship; knowledge transfer; technology promotion; mobility; transparency, ethics and value creation; standardisation; open and Big data; and realising public debate (Vieveen,

Inventarisatie Smart City Initiatieven, 2018). Not all of these collaboration structures and partnerships are as important, some of them are more symbolic than actually attributing to Smart City Rotterdam.

Some important aspects of the Smart City development trajectory are the way the municipality is dealing with the risks and problems involved with this course. For the municipality of Rotterdam most important partners in that domain are the G5 (collaboration structure between the 5 largest municipalities of the Netherlands; Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven), and the NEN (focusing on achieving manageable, good standards for the Smart City). These collaboration efforts are very different in approach and impact in comparison with the efforts focused on achieving innovation that usually involves private parties and start-ups like the collaboration discussed above with KPN. Most important is that these collaborations lead to greater learning capacity which is highly desirable on every theme, and which could seriously be improved for both within the municipality as in collaboration with external parties (Bravenboer, Trainee Gemeente Rotterdam, 2018). It is interesting to see that the collaboration efforts of the municipality are all theme-specific, involving different parties and municipality employees per theme. This could create barriers for integral problem solving and creating an effortless connection between theory and practice.

Another important collaboration structure for the municipality of Rotterdam is the MRDH – Metropoolregio Rotterdam Den Haag. The MRDH is an umbrella organisation that houses 23 municipalities from the region surrounding Rotterdam and The Hague, which does not necessarily have a lot of employees, however has a lot of meeting rooms. The MRDH is the place where cross-fertilisation should take place between municipalities and knowledge institutes such as the universities of Leiden, Delft and Erasmus, business partners and the Innovation Quarter, where ideas are shared, problems can be discussed, and strategic choices are negotiated on. It is an organisation that could help steer in the Ecosystem in a certain direction by addressing important topics in meetings, gathering knowledge, or drafting new policy and frameworks. One of the most influential projects of the MRDH is the Roadmap Next Economy, which is fully focused on future trends and transitions, how these influence our living environment, and how we should adjust policy and practice towards these changes in the landscape such as the higher availability of technology and the focus on innovation to solve complex problems (Boot, 2018; Kate, 2018). The MRDH has in potential a lot of influence, however perceives it as a risk that they might not be effective enough in realizing their ambitions due to the fact that everything that is thought of at the MRDH has to pass local council in the municipality first before it actually will be executed. This could be attributed to a dysfunctional collaboration, or lacking 'closeness' to the municipalities in play, since in an ideal collaboration, you would know what the preferences, requirements and desires are of these municipalities. However, this might then complicate decision-making on the proposed policies and frameworks since you will have to get all 23 municipalities to agree on the interests of some of the municipalities. Maybe the focus of the MRDH should therefore be more on exchanging knowledge and experience, on getting everybody seated around the same table and organize discussions on issues rather than presenting solutions for these issues.

Beside the MRDH, there are other structures of collaboration such as 'Kenniswerkplaats Urban Big Data', which is focused on the sharing of knowledge, means to realize digitalisation and how to involve citizens (Zoonen, 2018). For innovation purposes, cooperation is also facilitated between organisations such as TNO (scientific research organisation on technologies), Rijkswaterstaat (Water management organisation of the state) and the Port of Rotterdam, where a lot of economic activity for the city of Rotterdam is originating. Together with the Port, the municipality is also stimulating innovation via initiatives like the Mobility Lab, where start-ups are challenged to test and create Smart Mobility initiatives in Rotterdam. These pilots are often a win-win sort of situation; start-ups can test and improve their product, making it market ready, the municipality can innovate rather cheap (Keesman, 2018). Also, because of the small size of the projects, the risk of them having very severe negative effects on the city is small. At the same time, this fact might just be the risk the municipality should worry about; thinking small initiatives can do no harm and not assess them critically before implementing them.

Another important theme for collaboration is resilience and cyber security or cyber resilience (Gebraad, 2018; Nierstrasz, 2018). Rotterdam is one of the 100 Resilient Cities, which is a global network of cities that all focus in

one way or another on resilience issues. The Hague is actually also one of these cities, however, there is no competition between the two cities, they are merely focused on getting further ahead in the development of their resilience strategies, which both have different focus points (Gebraad, 2018). An issue that is high on the agenda nowadays for achieving resilience is cyber resilience, how to deal with cyber-attacks, hackers that could totally derail the city, and what can we do to prevent this from happening? These questions are answered by a new collaboration initiative; the cyber report point, where port authority is central in realizing cyber secure initiatives. The goal is to create building blocks that can be applied both in the port as in the city itself, and to develop knowledge and insights on this subject (Nierstrasz, 2018). The collaborative approach of combining the Port with the city, is a reoccurring strategy for the municipality of Rotterdam that has created many fruitful innovations and strategies in the past. In what way the lessons learnt on the subject of cyber security could be translated to city management and the Smart City has yet to be proven.

C.3.3: The culture of the municipality of Rotterdam:

The term Smart City is for the municipality of Rotterdam mainly a marketing term that they use to communicate with external parties and with citizens. Internally they call it transition programs and within these programs they are searching for the smart handling of projects and innovations. Frank Vieveen, who is the project manager of digital innovation, works as a broker between parties, as a link between internal and external parties, between specialists and generalists, between sectors, clusters, industries, and also between external parties themselves. Because of the function Frank fulfils, the Smart City team itself is relatively small and only consists of four or five people that will call themselves to be working on this specific theme. Other municipalities tackle this very differently and work with a big group of people, retrieved from various departments of the government. The reason for the municipality of Rotterdam to not do this is because they want to keep the innovative capacity of these departments instated, and instead want to stimulate innovations to happen from their strategy and the connection they will make to projects, firms, or initiatives. This way, the role that they take on is more of a process facilitator than actually coming up with the Smart City initiatives to be implemented (Vieveen, Projectmanager Digitale Innovatie Gemeente Rotterdam, 2018). It is argued that the focus of the Smart City team might be too much on the technology side. The people working on the realization of the development strategy of the municipality called Next City, and Roadmap Next Economy – the development trajectory set out by the MRDH – are focussing on the way these technologies trickle through the physical aspect of the city, and what its effect on society might be (Kate, 2018). This focus is very different, however very important for realizing a Smart City in a responsible or integral way.

It remains a challenge to create integral solutions due to the fact that departments among themselves have difficulty reaching out to each other and knowing that other people might be relevant for realizing their interests. It often occurs that people work past each other, do not know what other people from their department or sector are up to, and they would not know at all what is happening with their colleagues from another department. This has something to do with the fact that originally the municipality was a combination of separate organisations that all had their own responsibilities, staff and budget. This is now centralized; however, people are still not completely aware of how to find each other and how to communicate (Bakker & Bal, 2018). Another reason for having difficulty in reaching out to each other inside the municipality is due to the enormous differences in background, responsibilities and field of work. For example, lawyers, asset managers and planners often clash due to the fact that they do not speak the same language (figuratively speaking), they have other interests and projects to manage, and will not easily align (Bravenboer, Trainee Gemeente Rotterdam, 2018). Also, employees within the municipalities work in different ways. Some of them are working in programs that handle several programs at once, some of them are fulfilling administrative tasks or perform routine work. This gives employees the incentive to stay within their bubble and not reach out to people with different functions or disciplines (Kate, 2018). When comparing two large departments that are involved in working on the Smart City are ‘Stadsonwikkeling’ and ‘Stadsbeheer’ which basically entails City Development, and City Management. Where City Development is focused on the strategic, emerging, long-term view of the city, City Management is implicating everything that City Development comes up with. This construction is realizing a lot of innovation in

the city; however, they are barely communicating about this. City Development should maybe focus more on spreading the message in order to attract more innovative capacity, and to gain a better image (Keesman, 2018). This might be very typical for the municipality of Rotterdam and its mentality. It is very hands on, and just like the slogan of their local football club Feyenoord states (loosely translated); action speaks louder than words. This might be very different in comparison with other cities like Amsterdam, where they have a very active marketing department that communicates all ambitions and actions that they undertake, even before they have happened (Stevens, 2018).

While there are various reasons to engage in the Smart City development, such as improving the quality of life of citizens, creating a better image as a city, and realizing economic growth and change, the municipality experiences difficulty in making choices in what to engage (Bakker & Bal, 2018; Bravenboer, Trainee Gemeente Rotterdam, 2018). Technicians approach the municipality shouting that they have found the solution, cities do not know what to do with this, which creates situations where municipalities get lured into the trap of these technolgy developers which could lead to very wrong choices in terms of the consequences technology could have in the city, on their image, on the quality of life, and on economic activity (Bakker & Bal, 2018). The reasons to engage in the Smart City, might also be harmed during the actual impelmentation which is to blame on a high level of naivety within the mjnicipality, some sort of fear or shame for dealing iwht digital technologies and a substantial knowledge gap. It is very difficult, especially with a lacking knowledge base, to translate theory into practice, and to create enough awareness to engage in the intiatives that will actually matter. Other reasons for the difficulty experienced in deciding which technologies should be implemented is the fact that we live in very dynamic and changing times, which might make it even more difficult to determine what we might need the coming years. The fear of making the wrong decision is something that might make people not decide at all or to be ignorant about the risks involved (Bakker & Bal, 2018). This ignorance or unawareness of risks could then in turn lead to vendor lock-in situations where the municipality is highly dependent upon its private partner. Also, attention should be paid to which technology standards you engage in since you want that all technology systems are able to commicate and function well together. However, when these standards are not compatible, you might lose the innovations connected to these standards (Bravenboer, Trainee Gemeente Rotterdam, 2018). Which is a waste of time, money and energy and might set back the process of development.

At the municipality of Rotterdam there are several different innovative, or transition related projects ongoing such as the Smart City development, Next City or Next Economy practices, Resilience, and the Roadmap Next Economy. These programs are all realising impact in the city and are all changing current practices at the municipality. What is very interesting to note is the fact that all these teams involved on these innovative projects are very small, consisting of nothing more than 15 people (Bakker & Bal, 2018; Bravenboer, Trainee Gemeente Rotterdam, 2018; Gebraad, 2018; Kate, 2018). And this while these projects are very interesting from a marketing point of view, and from and urban development strategy point of view. How come that Rotterdam is known as being one of the 100 global Resilient Cities, while it actually entails only 15 people working (mostly) part-time on this subject, out of the 11.000 employees that the municipality houses? This is mainly due to the fact that the municipality has the first and foremost responsibility to ensure all city management practices are executed well and sufficient before there is even time or budget that could be invested in other activities. On the other hand, these small teams allow for dynamic and innovative processes that do not have to be fully structured in institutional contexts, which allows them to experiment and move freely. Where it is often a struggle to find a budget for this type of activities, it is much easier when there is a political agenda connected to the project. This struggle to find time and money to engage in these types of projects is not due to the lack of interest or perception of importance. For example, the mayor of Rotterdam is very involved in the resilience project and the Smart City development (Gebraad, 2018). This gives them space to try and see where it goes without too much constraints.

APPENDIX D: CASES OF ROTTERDAM:

In this appendix all thirty-seven cases identified in Rotterdam that fit the research requirements, had ample information available and were 'analysable' despite the time constraints. For each case, the project initiator, collaboration type and partners, type of project, a description of the project, quadrant location in status-quo, argumentation for this location, whether there is a risk for quadrant shifts, what the argumentation is for this shift and the occurring value conflicts, which values are conflicted, and where the quadrant shift is going towards are elaborated on. Other information on the analysis of these cases will be provided in chapter 6.6 in the body of this thesis.

1: RAIN GAIN

Project Initiator:	**EU project Rain Gain**
Collaboration Type:	Public, Private, Scientific (triple Helix)
Collaboration Partners:	Municipality of Rotterdam; TU Delft; Provincie Zuid Holland; Waterschap Hollandse Delta; Hoogheemraadschap Delfland; Hoogheemraadschap van Schieland en Krimpenerwaard; Paris; London; Leuven
Type of project:	Environmental Project
Project Description	The Rotterdam Rain radar measures and predicts very locally the precipitation in the city and the Rijnmond area. This is used for better and more efficient use of pumping stations and water storage facilities to prevent flooding or other disturbances attributed to precipitation. Since the rain radar can also measure and predict snowfall, this data can be used to determine the sprinkle policy for road salt in a more sustainable way. The project is created to research the functioning and use of these types of environmental radars. The tests are also executed in London, Paris and Leuven, and lessons learnt will be shared from 2020 onwards.
Quadrant Status-Quo:	IV
Argumentation for status-quo location:	This project is a project that focuses solely on environmental data (weather conditions) and is therefore considered as impersonal data. The purpose of this project is to create better (and more localized) weather forecasts, and apply this data to for example better, environmentally friendly road salt sprinkling policies. This focus is therefore service based.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The only risk that could occur with this type of project is that when the data collected via the rain radar is used to create an app for inhabitants of Rotterdam, to check whether they should sit on the terrace of a restaurant or to book a table inside, this app will have to be able to detect their current location. When GPS-data is stored or used for other purposes than the intended service (weather prediction), you might say it could touch upon some values that will be slightly pressured such as privacy, when data is used for providing commercial display or nudging practices, it might affect the autonomy of the user.
Conflicted Values:	If value conflicts occur, which is not likely, it will be on the values of privacy and autonomy.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2018); (RainGain, 2018)

2: Pilot Project Havenspoorpad

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Municipality of Rotterdam; ALiS; Luminext; elspec; Philips; Tvilight; Lightwell; and others.
Type of project:	Smart Lighting Project
Project Description	To save energy, a pilot is done with dynamic lighting options that have a basic setting on 10% of the capacity, and when a cyclist is passing by will turn up to a higher percentage. All lampposts have been divided among different private parties that all have the luxury to experiment their technology on 3 lampposts, using the ALiS protocol. By the use of the ALiS protocol, the different suppliers all connect to the same management system, assuring there is no negative effect of employing different suppliers for the same service; light.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	This smart lighting project focuses on acquiring data in terms of movement of cyclists, to determine whether the light should be adjusted or not. This is impersonal information (as long as it is acquired via motion sensors). The purpose of this technology application is for cost reduction for electricity, saving energy, emitting therefore less carbon and other poisonous exhaust for the environment, and it might be for realizing innovation intentions. The effect of these efforts is to offer the service of light, while limiting negative effects for the environment, increasing status for the municipality and reduce costs.
Risk for quadrant shift:	Expecting negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	Because of the involvement of the (many) private parties, that use sensors to detect cyclists, but in a sense could all add extra sensors to this system, there is no overview on what is happening, who is in control. Also, when this pilot is carried out through the rest of the city, it might shift to surveillance or personal data collection. Especially since the sensors that detect whether there is a cyclist might base this not just on motion but could also base this on connecting to their mobile phones. As soon as it involves personal data, and the technology is implemented in a wider scale, the risks are increasingly getting higher, and the shift from service to surveillance purpose could actually happen.
Conflicted Values:	If this negative future scenario becomes reality, it would affect the Privacy and control for the public and would affect Economic values and power relations for the municipality.
Quadrant Shift:	Via Quadrant I to Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2018); (Astrin, 2018); (Films Gemeente rotterdam, 2015)

3: Filling Degree of Waste Containers

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	BBF Holding BV; Roteb Lease
Type of project:	Environmental project; Asset Management Project
Project Description	The trash containers in Rotterdam are equipped with a filling level meter. This way, trash collection can be scheduled in a smart and efficient way, problems can be detected early on, municipality can save money, time and realise CO2 reduction. These trashcans equipped with the filling degree meter are currently located on several test locations throughout the city. The project/pilot will, in case of a success, be widely implemented, allowing for even better and more efficient waste collection.
Quadrant Status-Quo:	IV
Argumentation for status-quo location:	The sensors inside the trash containers are merely measuring whether the container is full, or empty, and how full or how empty it is. It could also detect clogging in the system, in that case a maintenance employee could be sent to this specific container to quickly resolve the issue. The sensor is therefore solely measuring impersonal data, and its purpose is initially to offer a better service to the citizens of Rotterdam who no longer have to deal with overflowing, congested containers. For the municipality it serves the purpose of reducing costs and time therefore also a service purpose.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	When the sensors can be coupled to a personal profile – for example via personalized waste cards, as is happening in several other municipalities – there is a risk of "profiling" individuals, and eventually, using this to adjust taxes accordingly to it. While it might be "fair" in some way, there is a significant loss of privacy for the citizens. In the most negative way, where the shift will be going towards monitoring practices on personal level, this is especially an issue. The most likely scenario is however a shift to a monitoring practice with impersonal data, where aggregated data could be used to create waste management policies on neighbourhood or street area, on which tax for waste management could be based. This might create negative incentives such as walking to another neighbourhood with your trash in order to keep your own expenses low. This might not actually solve any problem, and might create some social problems where justice and privacy is again an issue.
Conflicted Values:	If this negative future scenario becomes reality, it would affect the privacy, power relations and feeling of justice for the public. The information asymmetry the municipality could gain access to could cause these issues.
Quadrant Shift:	Quadrant III (however, shifts also possible towards I and II)
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2018); (Zoonen, 2016); (RTV Rijnmond, 2017)

4: HIGH-SPEED CAMERAS FOR MONITORING LOAD ON ASSETS

Project Initiator:	**Municipality of Rotterdam**
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Asset Management Project
Project Description	The municipality would like to be able to monitor their infrastructures and large civil structures such as bridges and large buildings. The quality and safety of these structures is especially important for the wellbeing and functioning of the city and by being able to detect dynamic load patterns in these structures, policy could be formulated for maintenance, repairs or replacement of these structures. For this purpose, high-speed cameras are used that could detect these dynamic load patterns in the structures.
Quadrant Status-Quo:	IV
Argumentation for status-quo location:	The sensors are in this case represented in high-speed cameras which are detecting load deformations and patterns. This is highly impersonal data. The purpose of this application is mostly service based since it allows for asset managers to be able to do their job better. However, it could also be argued that is monitoring for the functioning and wellbeing of these infrastructures and civil structures.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There is absolutely no value conflict that could occur here. It only enlarges safety, it might in the end decrease maintenance and repair costs, and no one is experiencing negative side effects of the use of these high-speed cameras. A very far-fetched negative effect this technology could have is that it might result in policy changes that only allow certain modes of transportation to enter the city or to cross a certain bridge or road due to the impact of their vehicle (imagine tourist busses or heavy lorries) on these structures. In that case, which is highly unlikely to occur, there could be some value conflicts in terms of economic values and justice (for the operators of buses or private sectors that are dependent upon lorries for deliveries, transportation, for the municipality in terms of reachability of the city (which is a criterium for being an attractive city for citizens, businesses and visitors)).
Conflicted Values:	*If* the highly unlikely scenario plays out as was described above, economic values and justice will be affected for private parties and the municipality.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

5: MULTI MAST

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Multiple private parties
Type of project:	Smart Lighting project
Project Description	Multi mast is a project that wants to assess the possibilities of public private partnerships for using lampposts as commercial outlet, parking solution, communication unit, charging point, etc. There are a lot of application types that are interesting to research when it comes to business models and data acquisition built around the Smart Lamppost. The lamppost itself is a means for innovation in terms of light consumption, as is also illustrated in the second project Havenspoorpad, however, it is also a relatively large and high pole on which you could attach various sensors, charging devices, wifi-routers, solar panels, or commercial screens and pamphlets.
Quadrant Status-Quo:	Centre of all quadrants
Argumentation for status-quo location:	The reason for locating this project at the centre is due to the multi-facetted characteristics of this project. On the one hand it is creating new service opportunities such as efficient electricity usage due to dimming lights when they are not needed, or scanning the street for available parking spots, waste nuisance or other public disturbances so that the municipality could act quick upon these issues. On the other hand, there is no specific information to be found on what types of sensors are used, and whether they also collect data that will not be used for a service purpose but for monitoring the citizens living in this street, passing by or visiting someone in the neighbourhood which could then lead to stigmatization, unfair or unjust treatment, or a loss in autonomy where nudging technologies or commercials may affect your actions or opinion.
Risk for quadrant shift:	Expected negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	This project, with an incentive to combine the function of light with all kinds of private activities creates a high risk of third parties that will exploit this opportunity for solely economic reasons, by adding all types of sensors that will collect personal data for surveillance purposes. By allowing and pursuing these projects in a way without limitations, the risk of pressurizing and conflicting various dearly held values is high.
Conflicted Values:	When and if this scenario becomes reality, value conflicts arise for both the public as for the municipality or other type of government body affected. For the public privacy, autonomy, justice, control, safety and power relations are affected by the implementation of Big Brother's play set created by these private parties. For the municipality issues could arise with safety, control and power relations in terms of the safety and control the public parties could have on the systems and algorithms used in the technology application, and no longer really have influence on the previously strictly publicly owned asset.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Zoonen, 2016); (Naafs, De Muren hebben Sensoren, 2017a)

6: QR-CODED BENCHES

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Application Project; Social Media Project
Project Description	For this project or pilot, city benches are equipped with a QR code that provides the user/'seater' information about the surroundings, and an opportunity to rate the bench via social media or to report a malfunction. This could be historical information on the bench itself, on the surroundings, what they see now, how it used to be, and what the characteristics of the neighbourhood are. Its second purpose, is to provide the municipality and asset managers of information of these surroundings that will provide them with more accurate information of the state of the public space in Rotterdam and might instruct them to undertake action.
Quadrant Status-Quo:	Quadrant I
Argumentation for status-quo location:	Because this project is application-based, it requires people to install an app on their phone before they can access the information, or the service provided via the QR-coded benches. Since this phone is connected to a personal profile and highly personal data, the project has been placed in the top half of the quadrant framework concerning personal data. The idea behind the application is however for it to provide a service aspect in terms of information and improved and more efficient asset management (assuming people actually use this app to report disturbances).
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	This project combines personal data (it only collects data when using your personal information via the use of your phone) for a service purpose that can provide much joy, but when used differently or combined with other data, can be used for surveillance purposes. It is also debatable whether this application uses your location while you are not actively using the app. This data could give the municipality all kinds of information that the app was originally not intended to, and which is not asked by the users of this app. This intention change could create a shift from service to monitoring in a heartbeat. The logging and registering of personal information such as your location, whether you are a citizen that complains a lot (stigmatization), or other information does not only cause a conflict for your privacy, but might possibly also influence the value of justice, power relations and control.
Conflicted Values:	Power relations, Privacy, Control, Justice.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

7: City Traffic

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	City Traffic
Type of project:	Monitoring Project
Project Description	The target of the municipality is to monitor pedestrian flows by means of MAC-addresses. City traffic offers technologies and services that allow the municipality not only to track the amount of people in the city or in a certain street, they can also monitor how many unique people pass by (so they can register whether you are walking by only once, twice or ten times), how often people return to the street, city or shop, how long people stay in this place, which routes they take and the environmental circumstances occuring during their time spent. This is due to the fact that there might be a relation between the weather conditions or time of the year and the level of visitors in the city centre.
Quadrant Status-Quo:	Quadrant II
Argumentation for status-quo location:	According to several legal experts and lawyers, the MAC-address monitoring might not be based on a personal profile, with information on for example your date of birth and your name, however, it is an address that is connected to one specific devise, such as your smart phone. Since people generally always carry their phones around, it is highly connected to them as a person and not just to their anonymous device. This device creates the ability to make highly personalized user profiles by tracking unique visitors, and combining this data with other sources. The purpose of this technology is also obviously not a service. The municipality and shop or restaurant owners of the city centre might benefit from this data for analysis, however, for the people who are the object of registration, there is no added value
Risk for quadrant shift:	Expected negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	A MAC address might not be an address coupled to your personal profile, however, it is a unique code, that only requires little effort to combine with other data to achieve very personal data about your whereabouts, what time you spend in a certain area, and other information as was explained above. The recombination of data is very dangerous and could make the impersonal information of a single device in a certain place, combined with other data sources, into a very private method for analysing every move of an individual. This does not only harm privacy, but this data could also be used for stigmatization, nudging of influencing, and monitoring individuals. Another issue is the fact that citizens are not aware of the fact that they are being followed all around town, there is no transparency and there is no permission.
Conflicted Values:	If and when this scenario becomes reality, the public will experience value conflicts on privacy, justice, control, and autonomy. On the other side there are the municipality and the entrepreneurs in the city who could benefit from this data for whom mostly the values of power relations and economic values are of importance.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Bethlehem, 2017); (Verhoeven, 2015); (City Traffic, 2017); (Bouman, 2016)

8: Beter Benutten – Cyclists

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Dat.mobility and other private partners
Type of project:	Monitoring project; Application project; Mobility project
Project Description	To stimulate cycling in the urban area, the municipality wants to monitor how many cyclists are using certain areas of the city, and where they are going, where they are coming from, what route they choose. They therefore created and application that could be downloaded and used on your smartphone, which tracks your every move. This way, the municipality will get insight in where improvements are required and what might stimulate cyclists to take their bike out for a spin more often.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	The data acquired in this project is generally solely GPS data, which is used for monitoring behaviour of cyclists. This is the way the project is described and presented, and what it intentionally will serve as purpose.
Risk for quadrant shift:	Expected negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The desire to couple measured data and to combine data sources from apps used by certain target groups, individual mobility profiles can be created, which can be used for other purposes than just monitoring cyclists but controlling cyclists or nudging cyclists to change their behaviour. Whether this is for a good cause or not is not the point, it is that autonomy might be hurt by this and people should not be influenced while unaware of it happening and without giving permission to do so. However, there is of course debate about whether the cyclists are choosing to maybe experience the negative effects of the application since it is a very conscious choice to download this application, and thereby agreeing to the fact that you are being monitored. The danger lies in the recombination of data, the shift in intention of data collection, and the lack of transparency in use cases of this data besides solely monitoring the behaviour of cyclists in the city.
Conflicted Values:	If and when this scenario becomes reality, public values that will get conflicted are privacy and autonomy.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (TRIPZOOM, 2014)

9: Use of Public Transportation

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	RET; TLS (TransLinkSystems); Municipality of Rotterdam
Type of project:	Monitoring project; Mobility Project
Project Description	For reaching a political target in the municipality - increased use of public transportation - the municipality wants to use aggregated data from the OV-chipcard to monitor usage. To achieve this target, data acquired from these monitoring practices could be used to formulate new policy, make suitable investments or be the basis of some whitepapers on this subject in terms of policy and public transportation.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	To serve the purpose of getting insight into the use of public transportation, the aggregated OV-chipcard data will be used for the analysis. This aggregated data is therefore not personal but impersonal, however is somewhat close to the border between personal and impersonal data. The purpose of data collection is obviously for monitoring. The municipality uses this data for their own use and insight, and not to create better services for the citizens. At least, not directly based on this data. It might of course occur that new services are developed due to insights created by this data and other sources of information, however, that is not the main goal of this project.
Risk for quadrant shift:	Expected negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	Since OV-chipcard is bound to an individual, individual mobility patterns can be created. This might not happen at the municipality, but this could also happen at the RET. The fact that the RET of TLS is owner of the data, who simply provides the information to the Municipality (anonymized), does not mean that they do not use this same data for other purposes than giving the municipality of Rotterdam insight into their public transportation use throughout the city. This might create power struggles due to information asymmetry and lack of control for the municipality. For the public, issues might arise on the topic of privacy and control due to the fact that they did not give permission on these monitoring practices and because of the lack of transparency on these practices, also do not get the chance to create some sort of opinion on this subject.
Conflicted Values:	When and if this scenario becomes reality, value conflicts for the municipality will arise in terms of power relationships and control. For the public, the issues arise on the values of privacy and control.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

10: SCANNING-CARS FOR LICENSE PLATES

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring project; Mobility project
Project Description	If you want to park in the city, you can register your license plate at a paying point, pre-paying your costs, or you can pay via a parking app where you can add a specific license plate to your account. Scanning cars are then deployed to drive around, while automatically scanning the cars near the location of the scanning-car. This car will then recognize if you have a parking permit registered to the license plate, will know whether you have paid at the paying point somewhere in the neighbourhood, whether you used a pre-pay method or payed via the parking app.
Quadrant Status-Quo:	Quadrant I
Argumentation for status-quo location:	The information the scanning car could retrieve while scanning is personal data due to the fact that it is coupled to the license plate of your car, which tells you who the owner is, where the car is registered, etc. The purpose of data collection is for a service purpose. The use of license plates in parking policy makes it a lot easier for many citizens and visitors of these citizens to park in the city.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The cars that scan the license plates can be used for other information gathering besides data on payment-status of parked cars. The service itself is not necessarily risky, however, the usage of cars with sensors attached to it, can in theory measure a whole lot more than just whether you paid for your parking space. Also, since license plate information is personal, this information might also be used for other applications. The shift in purpose of the cars is (according to information available) not possible due to the fact that they are procured with a certain description, which the municipality perceives as limiting. Ideally, these cars could be deployed more efficiently since they could also register information about the quality of the road, on nuisance in terms of waste management, loitering and environmental measurements of air quality or sound.
Conflicted Values:	The shift towards Quadrant II is not due to a loss in privacy, but for an increase in monitoring practices. Value conflicts arising for citizens are on privacy (due to the personal information enclosed by the license plates) for the general application of scanning cars and the risk of recombination of data. However, the technology developments elaborated on in the previous section create new conflicts in terms of justice, control and power relations.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2018)

11: SENSOR ANALYSIS FOR PARKING SPACE AVAILABILITY

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring project; Mobility project
Project Description	By the use of sensors, a system can identify whether there is availability of parking spaces. These sensors could reduce annoyance and frustration for road users. Research has concluded that one-third of traffic in the city centre is there driving around, trying to find a parking spot. This is undesirable for multiple reasons. The frustration is only one of them, maybe even more important is the pollution caused by these cars, who in turn cause congestion for other cars. This situation is far from ideal. However, these sensors could aid in identifying free and available parking spaces.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The data collected by this sensor is whether a parking space is empty or whether it is not. This is impersonal data. The application of this project is to offer a better service for finding parking space in the city centre. However, there is no real service aspect added to these sensors yet, the aim of this project is to analyse available spaces and directing cars towards these spaces. So, while the application is more a monitoring of parking spaces nowadays, since the objective is to couple this surveillance to a service activity, this project is classified as a service purpose.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	Experimenting with various types of sensors could insinuate that here are also applications of sensor technology that are not necessarily only measuring whether a space is filled, but maybe also, how long cars are parked, what cars are parked, etc. Especially when it is combined with the scanning of license plates, which could be said to be personal information since it is directly linked to some private data such as your home address. The combination of these data sources with others might make it highly personal and could allow for surveillance processes to unfold instead of service processes.
Conflicted Values:	Value conflicts that might arise are privacy and power relations. Additionally, control and safety might also get conflicted.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

12: Rain sensor for cyclists

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Mobility project
Project Description	This sensor is measuring whether it is raining. If it is, cyclists get an advantage towards cars and receive more often a green traffic light than the cars in line for the same crossing. The sensor is somewhat more complex than solely the measurement of rain since it also uses weather predictions for rain to come. When rain is approaching, the traffic lights are also anticipating this by giving cyclists more green light and longer green light for them to be home before it rains. These sensors are not (yet) widely implemented but are used as a pilot to stimulate cycling in the city centre. This could be perceived as a political goal for both realizing a mobility target as well as a sustainability target.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensor is solely measuring whether it is raining or whether rain is about to come. The sensor therefore only collects impersonal data. The purpose of the data collection is for the mere service purpose of regulating traffic in a beneficial way for cyclists.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are no real value conflicts to identify in this case since it does not concern personal data at all, and it might be used for achieving some political goals, however, does not really create any downsides. However, there is one thing that is important to foresee. There are no conflicts because of the fact that there is only one crossroad in Rotterdam using these sensors. This one traffic light where cyclists get beneficial treatment is not something other traffic users could complain about, especially when it is raining, and they are dry and warm inside their cars. However, when this technology is going to be implemented throughout the entire city, it might get problematic and cause entirely different mobility problems; congestion of motor vehicles every time it is raining. Which is about 150 days a year in the Netherlands…
Conflicted Values:	Potential value conflicts in case of wide implementation will happen for the value of justice, where people without the alternative of using a car, are disadvantaged over cyclists. Also, economic values might get conflicted when the use of these sensors lead to a less accessible city, which might hurt businesses and economic development.
Quadrant Shift:	Not applicable.
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Rijksoverheid, 2016); (Halkes, 2015)

13: Comfort measurements for cyclists

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring project; Mobility project
Project Description	In this project, the city management department of the municipality of Rotterdam uses a sensor for the improvement of cycle paths in terms of comfort. This sensor measures the comfort of the cycle paths in the city by means of vibrations and analysis using cameras. This way, road can be repaved or repaired when necessary, and cycling is even more stimulated because of the attractive option citizens and visitors have in Rotterdam using their bicycle instead of other means of transportation.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensor measures merely vibrations when driving on a cycle path, which is giving the municipality information on comfort of cyclists on that particular piece or road or pavement. The other things measured are dents in the road, whether the road is clean and if repairs or maintenance are required. This means that the data collected is impersonal. The application of this data is for a service purpose, however indirect. The data acquired is actually initially monitoring data, however collected for the purpose of improving the situation for cyclists.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	In this case there is no possible value conflict that could occur or a risk of shifting activities in the quadrant framework.
Conflicted Values:	Not applicable
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Stadsbeheer Rotterdam, 2015)

14: COMFORT MEASUREMENTS FOR ROAD USERS

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring project; Mobility project; Application project
Project Description	By the use of an application, that uses GPS data and can show vibrations, you can measure the comfort and state of a road. Comparable to the comfort measurements of project 13, where vibration and visual data is collected on the cycle roads of Rotterdam. A significant difference here is that this data collection on the road quality and comfort is done via an application, which should be installed on a smartphone, and it considers data collected by many road users that use this app.
Quadrant Status-Quo:	Quadrant I
Argumentation for status-quo location:	Vibration data is generally not personal, however, due to the fact that it is connected to a specific GPS location (which is necessary in order for the municipality or road authorities to use for maintenance and repair information) which is generated via a smartphone, the data collected via this application is considered personal data. The purpose of data collection via this application is however intended for the improvement of the roads in order for the drivers to have a higher level of comfort while driving on these roads.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	Because the application uses personal location data, individual profiles can be generated, and data can be used for different purposes than initially intended to. However, since app users choose to use this application, the question rises whether this is a problem, whether they choose to be monitored makes it ok to also use this data for other purposes. This is a difficult topic, while generally speaking it is not allowed to use data for other purposes than intended, since then the individuals who are the object of registration do no longer know what is happening to their personal data, and they did not give explicit permission to use it for any other purpose than initially stated. This could create value conflicts in terms of privacy, control, and justice.
Conflicted Values:	If and when the technology is implemented in the way depicted by the negative future scenario, public values of privacy, control and justice might get conflicted.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

15: ROAD SALT SPRINKLER

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Mobility Project; Asset Management project
Project Description	By the use of GPS data (of the driver of the road salt sprinkler), the sprinkler system adjusts its amount of salt that is distributed on the road, and the width of distribution will get adjusted according to the road the vehicle is currently sprinkling. The municipality uses this technology in times of frost or snow, when road salt is usually distributed equally in each street, which could have negative effects on the environment, and in some situations, the amount of road salt distributed is too much for its own good, and in other situation it might not be sufficient to actually make it safe for the users of the road. For the most efficient and effective distribution of road salt possible, data on the location and situation could aid the sprinkle vehicle in distributing just the right amount. Effects are cost reduction, increased safety in some areas where too little salt was previously distributed, and a better environmental situation.
Quadrant Status-Quo:	Quadrant I and IV
Argumentation for status-quo location:	The reason for this project to be located on the border of quadrant I and IV is due to the fact that the data collected is technically speaking both personal and impersonal. Since it uses the location of the driver, it is connected to this individual, making it personal. However, since all the other data, besides the GPS location, used for the distribution of the road salt is impersonal, it lies somewhere on the border of the quadrants. The purpose of data collection is clearly collected for a service purpose, which has no ways of tricky recombination, not disadvantages for actors in the ecosystem whatsoever.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are not risks available for shifts in the quadrant framework, as well as no risks for value conflicts.
Conflicted Values:	Not applicable
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

16: HEAT CAMERA FOR CYCLISTS

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Mobility Project
Project Description	A heat sensor measures if there are a lot of cyclists waiting for the traffic light or if this is only a small group. This then determines when the traffic light will turn green, and how long it should stay green. This sensor is only active during rush hour. This initiative was realized due to the issues the municipality of Rotterdam experiences with actual congestions of cyclists instead of cars. Also, their ambition to stimulate cycling in the city instead of using a car or other motorized vehicle is aligned with their sustainability and environmental political targets, where they strive for a significant reduction in CO2 exhaust, while even aiming to become CO2-neutral. This means that when you want more people to choose to use their bicycle, that you should ensure that they will get the best possible treatment possible in order to stimulate this.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensor is collecting aggregated data on body temperature of cyclists. This is not personal information and could not be connected to personal data in any way. Also, the purpose of data collection is clearly a service purpose and not a monitoring project. This sensor does not have to store or register anything on the data, it just has to be connected to the traffic light which responds on large amounts of cyclists.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are no real value conflicts to identify in this case since it does not concern personal data at all, and it might be used for achieving some political goals, however, does not really create any downsides. However, there is one thing that is important to foresee. There are no conflicts because of the fact that there is only one crossroad in Rotterdam using these sensors. This one traffic light where cyclists get beneficial treatment is not something other traffic users could complain about. However, when this technology is going to be implemented throughout the entire city, it might get problematic and cause entirely different mobility problems; congestion of motor vehicles during rush hour, which at times already is pretty bad. Whether the environmental benefits are then acknowledgeable is also to be debated.
Conflicted Values:	Potential value conflicts in case of wide implementation will happen for the value of justice, where people without the alternative of using a car, are disadvantaged over cyclists. Also, economic values might get conflicted when the use of these sensors lead to a less accessible city, which might hurt businesses and economic development.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Fietsfan010, 2016); (Benders, 2017)

17: GOBIKE

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public organisation with foundation
Collaboration Partners:	Fietsfan 010
Type of project:	Mobility Project; Application Project
Project Description	The Gobike is a shared bike service on which you can borrow an electric bicycle by logging in with a personal profile, from which the costs are automatically calculated and charged according to use. This bike sharing service will be distributed from some park and ride locations throughout the city. The idea is that people no longer take their cars in all the way to the city centre, but park their car on the outskirts and take a bike in. This will hopefully create less exhaust and congestions due to the cars in the city centre and will therefor provide a mobility solution as well as an environmental one. There are a lot of bike sharing services in play in Rotterdam, also based on the use of an application. The only exception is the NS-bike, which you can borrow using your OV-Chipcard. However, the Go Bike is unique in the sense that it the only shared service bicycle that is electric. This electric element might make it easier for people to take the bike the further distances you will have to travel from these park and ride locations into the city centre, even if you are not as fit or athletic.
Quadrant Status-Quo:	Quadrant I
Argumentation for status-quo location:	The project will be placed in the first quadrant because of the fact that the data gathered is personal due to the fact that it is required through the use of an application, for which you need to be registered with a personal profile that entails all sorts of personal information about you. The purpose of this data collection however is for the delivery of a service; the ability to use a bicycle to transfer from the park and ride to your final destination in a convenient, environmentally and congestion friendly way.
Risk for quadrant shift:	Expected negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	Because of the fact that you log into the application required to use the bicycle with a personal profile, in theory, the data you produce can be used for any type of application, directly linked to you as an individual. As accounts for all application-based bike sharing services, there are many ways to make money; via the time-bound charging fees for using the bike, insurance deposits when bikes get stolen or damaged, but first and foremost; by creating a trackable user database. This database, containing personal information and mobility patterns, is of great commercial value for both marketing purposes and consumer behaviour analysis. The added value will only increase when you combine this information to other data sources, you will have a goldmine. The reasons for engaging in these projects is therefore mostly not really to resolve a mobility issue, but to use the data of your users for commercial and economical gains. This is very risky in terms of privacy of the users, the lack of control we have on this movement from a municipality point of view, the shift in power relations where the bike sharing companies might have much more power over you than you would like to, the information used for marketing purposes could create nudging situations where autonomy of the user might be hampered, and most important values are perceived to be the economic values held by the companies trying to make a profit.
Conflicted Values:	If and when this negative scenario will play out as depicted, the values of privacy, autonomy and power relations will be conflicted for the public and the value of control will also be conflicted for the municipality.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (De Verkeersonderneming, 2017); (Dunn, 2017)

18: Sensors in the Erasmus Bridge

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Simiotic Labs, Rotterdam Mobility Lab, Verkeersonderneming, NS, Rotterdam The Hague Airport, KPN, Innovation Quarter, Municipality of Rotterdam
Type of project:	Mobility project; Application project
Project Description	The sensors in the Erasmus bridge are collecting data on failure of the bridge and can predict when it will need service. If successful, these sensors will be applied in multiple civil installations in the region or even the entire country. These sensors are not only collecting data, they also use various algorithms that allow them to predict failure or errors in the engines that control the bridge.
Quadrant Status-Quo:	IV
Argumentation for status-quo location:	The purpose of this project is a service project, that allows the municipality, when it seems successful, to reduce standard maintenance costs and by preventive maintenance, damages to the bridge will be less large than they usually will be. The identification of errors or the start of small failures are detected much earlier and due to the predictive algorithms, the maintenance and repair activities could be anticipated on. The data collected is in no way related to an individual, therefor it concerns impersonal data and a service purpose, explaining the position in the quadrant framework.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There is no risk to be identified in this case in terms of shifting this technology. It could be argued that the technology could not just be used for service purposes, since it is generally speaking a monitoring activity that is used for a service purpose. Whether the activity of monitoring in this sense should be dominating the purpose of the data collection is debatable. The project could in this line of reasoning also be located in the third quadrant, of surveillance and impersonal data. However, this does not mean that there are higher risks of value conflicts occurring.
Conflicted Values:	There are no value conflicts to identify.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Semiotics Labs, 2018)

19: Talking Traffics

Project Initiator:	Talking Traffics
Collaboration Type:	Public Private Partnership
Collaboration Partners:	De Verkeersonderneming, MRDH, Municipality of Rotterdam, Ministry I&M, BeMobile, Dynniq, Ericsson, KPN, Flitsmeister, KoHartog, Locatienet, Mobiele TV NL, Royal Haskoning DHV, Siemens, Simacan, Swarco, Sweco, Vialis, Ziut, Monotch, vtron, all4elevation, Metropoolregio Amsterdam, Rijkswaterstaat, Goed op Weg, Clean Tech Regio
Type of project:	Monitoring project; Mobility project; Application project
Project Description	By the use of iVRI's (intelligent Traffic Regulation Information systems), that communicate with all sorts of devices such as your smartphone, or navigation system, the flow of traffic will be adjusted to the users, making it more efficient and comfortable. Talking Traffics is a Smart Mobility initiative that country-wide is testing all sorts of applications of their technology, in collaboration with a large amount of both public and private parties. Rotterdam is only one of the 60 cities that are connected to the project. The reasoning behind this project is the fact that congestion is increasingly becoming a bigger issue in the Netherlands and this might pressure our economy. Nowadays, 86% of our citizens is in possession of a smartphone, which might be a building block in the solution for these problems. The project includes an application that could be downloaded onto your phone, which allows you to be connected to traffic lights, road signs, traffic centres and other road users, creating an Internet of Things environment for road users. This application could then aid you in all kinds of ways; it provides information on the allowed driving speed, whether there are accidents or dangerous situation ahead on the road, it could determine if there is priority traffic at a crossroad (such as an ambulance, public transportation or cyclists), it could make traffic lights anticipate traffic that will create a better flow through the city and it aids you to the most affordable, close to your destination, parking spot. Therefore, this application could both enhance efficiency in traffic as safety and comfort.
Quadrant Status-Quo:	Quadrant I
Argumentation for status-quo location:	The placing of the project in the first quadrant is due to the fact that the data collected is connected to an individual mobility or user profile, which makes the data collected in this project personal. The purpose for data collection is however an example of service-based data collection, that could aid road users and logistics companies in various ways to achieve more efficient, comfortable and safer transportation.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	Combining all this collected data on people's whereabouts in the city, individual profiles can be deduced and used for other applications than traffic flow. Users have no choice to be excluded from this analysis. This database, containing personal information and mobility patterns, is of great commercial value for both marketing purposes and consumer behaviour analysis. The added value will only increase when you combine this information to other data sources, you will have a goldmine. The involvement of the large amount of private parties might create the incentive to use this data and experience for different applications. Another important implication is the fact that this technology is supposed to make traffic safer whilst stimulating you to use your phone in traffic.
Conflicted Values:	Privacy, control, autonomy, safety and power relations might get conflicted for the public consisting both of users and non-users of the application.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Platform Beter Benutten, 2016); (Talking Traffic, 2018)

20: Smart electricity Grid Merwevierhavens

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Stedin, Siemens, Lyv Smart Living, Omnetric
Type of project:	Energy Project
Project Description	Due to the fact that in the next years, we should start to rely more and more on sustainable energy resources which such as solar panels and wind turbines, the energy grid will have to deal with different load distributions on the net. This could cause failure of the grid, it could cause oversupply at one moment, and under supply at the other. This could result in many problems, for which the smart grid could offer a solution. The smart grid in this area is used for better alignment between supply and demand of energy systems available. The project is experimenting with the application of such a smart grid in collaboration with both public parties as private parties.
Quadrant Status-Quo:	IV
Argumentation for status-quo location:	The project is only collecting data on grid level, which is not connected to personal data or personal energy use. The only thing that is measured is the way energy is balanced on the grid, how demand and supply could be levelled, not who in this region is using the most. The purpose of this project is to be able to provide stable energy supply for the demand side, which is described as a service. The same system could be used for monitoring fluctuations on the grid, however the reasoning behind the monitoring practices is to offer stability on the grid, which then serves a service purpose
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There is no risk of this technology shifting in any other direction. Also, there are no potential value conflicts occurring. Balancing out supply and demand is beneficial for all parties involved and would even safe money for the state if the grid is able to handle big fluctuations occurring due to the introduction of renewable energy sources. In the end, we all want to create a more sustainable future, for which the smart grid might be an integral part of creating this future. The only risk is that citizens living at the Merwevierhaven could experience nuisance of the testing or construction of the smart grid, who should have access to electricity even when experiments are ongoing.
Conflicted Values:	Not applicable
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (RTV Rijnmond, 2017); (Stedin, 2017)

21: Overflow sensors

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Partners4UrbanWater, I-real BV., Kloens BV
Type of project:	Environmental Project; Asset Management project; Monitoring project
Project Description	With heavy rainfall it is important to be able to adequately measure the water level in the overflow areas to allow for higher water quality and to prevent nuisance due to flooding. This sensor network gives a unique insight into the Rotterdam Sewer system and allows for real time monitoring of the sewer system.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensors enable the municipality to adequately measure water level in overflow areas and the sewer system. This is impersonal data. The reason for data collection is to prevent flooding, therefore offering the service of providing the citizens of Rotterdam with dry feet, even during heavy rainfall, and reduce nuisance and disturbances for water.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are not risks to be identified in this project in terms of shifting in the quadrant framework or in conflicting values. The only possible shift, which is not very likely would be towards the third quadrant if these sensors could also be used to measure personal load on the sewer system and what types of fluids and other material is deposed in the sewer system for a specific household. This would be surveillance, which is used in some parts of Noord-Brabant where issues with drugs-waste were identified due to sensors in the sewer system. This might, however, require different sensors and more sensors on different locations than that are used in this project.
Conflicted Values:	Not applicable. If the shift will be made towards the very extreme scenario as described above, it might hamper privacy, justice and power relations due to the fact that if information on personal load on the system is known, taxes could be adjusted accordingly. This might hurt privacy, the perception of justice and whether this is fair, and struggles in power relations due to information asymmetries.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2018)

22: Underground Sensoring

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Veldmeetdienst and Laboratoriumgroep (VLG), Municipality of Rotterdam
Type of project:	Environmental project; Asset Management project; Monitoring project
Project Description	Rotterdam is known for the availability of water and methods to deal with excess water such as so-called 'water squares', and other resilient approaches to dealing with water nuisance. This all to ensure the safety of the city. Which is also provided by the construction of dykes, flood defence systems, and soil bodies on strategic locations. Once these constructions are built, there is however no way to see whether they are functioning as they should to ensure the safety of the city. Therefore, in this project sensors are placed underground to measure water levels and grain pressure.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	This project is measuring grain pressure and water level, something that you would not describe as personal information. The purpose of the application of sensors and collecting these data is for a service purpose; making sure the city remains safe and resilient.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There is not shifting to be observed. It is however debatable whether the monitoring of several physical aspects underground is surveillance or service. The monitoring itself might not be service oriented, however the purpose of monitoring is.
Conflicted Values:	There are no value conflicts to be identified.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

23: Groundwater level Sensoring

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Environmental Project; Asset Management Project; Monitoring Project
Project Description	The target of this project is to research the possibilities of reliability, scalability and use of LoRa networks for applications such as effective and efficient groundwater level measuring. LoRa networks could be seen as the infrastructure to connect sensors on, which could be used for several purposes. In this case, the focus is on the groundwater level monitoring for achieving resilient policy for water management in the city.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensors in this project are measuring the level of water, which is impersonal data. The purpose for monitoring water level is service related.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There is not shifting to be observed. It is however debatable whether the monitoring of groundwater levels is surveillance or service. The monitoring itself might not be service oriented, however the purpose of monitoring is.
Conflicted Values:	There are no value conflicts to be identified.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

24: Sensored City

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public and Knowledge sector collaboration
Collaboration Partners:	Sensored City Platform
Type of project:	Asset Management Project; Monitoring Project
Project Description	Developing an automated monitoring system that uses sensors to determine the state and safety of housing structures and foundations. These sensors communicate via LoRa network and combine measurement data with existing data from Remote Monitoring systems, and Artificial Intelligence systems that use pattern recognition for predicting scenarios. This project aims at providing better information on housing structures, which is hard to determine other ways. The application of sensors throughout the city could then create the sensored city, where insights for maintenance and repairs could also be derived from this information.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The project measures physical properties of houses and structures carrying these buildings, therefor collecting impersonal information. The purpose of this project is to provide better information and based on this information to create insights which might aid maintenance and repair operations in houses and neighbourhoods. The purpose is therefore service oriented.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The combination of data about the state of someone's house, could have a negative effect on the worth of a house and the desirability factor of prospected buyers. If data is openly available and combined, it might shift toward a surveillance purpose, a service that people use to base choices on, which is severely disadvantageous to home owners. The fact that the data the sensors are actually measure is impersonal, does not mean that it has implications on a personal level. This would especially be an issue when not all houses are equipped with these sensors, which could mean that some houses in your street are of higher value due to the fact that they did not have all sorts of problems identified by these sensors, however, this does not mean that the other houses do not have construction issues. This issue was debated in the ethics of data, where unavailability of data on issues might create the perception that there are not issues. While it might be fair to know about the construction flaws of a house before buying it or living in it, it might feel unjust when citizens are being 'punished' for having these sensors installed, since it could be used for the identification of problems and not really solve anything.
Conflicted Values:	If and when this negative scenario becomes reality, issues in justice are especially important, where the perception of fair treatment is very interesting. This might then in turn impact economic values, power relations and (maybe) privacy.
Quadrant Shift:	Quadrant III
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

25: Vibration Meter Application

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring Project; Application Project
Project Description	To make sure that while there are constructions in the direct surroundings of a house or office building, no damage is done to property and no nuisance is experienced by inhabitants, they developed the vibration meter application. If you live near a construction site, or if there is maintenance being executed in your street, you could download this application and measure nuisance. When nuisance is experienced which could be supported by data proving your right, complaints could be taken more seriously and could be prioritised in terms of levels of vibration and noise nuisance available.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The application measures vibrations, which is impersonal data. The purpose of this application is for the municipality to provide better service towards its citizens, who's complaints will be treated better, quicker, and more adequate. This purpose is therefore a service application.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The only thing that might cause issues is when the citizens are using the application to monitor nuisance during construction and will rely on the data to influence their perception of experienced nuisance. The intention is that when you are experiencing nuisance, you could use the app to prove it. Not the other way around; to use the app to prove that you experience nuisance whilst not actually experiencing anything remarkable.
Conflicted Values:	There are not real value conflicts to be identified. However, in case of misuse of the application, the municipality might experience a conflict in power relations since the citizen is now the party that is in possession of valuable information and can pressure the municipality to act upon this data.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2016)

26: Fireworks Sensoring

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring Project; Safety Project
Project Description	To be able to identify people that cause inconvenience for neighbours with the use of loud fireworks in the period around New Year's Eve, sensors are placed to quickly identify a loud noise, and when these loud noises occur where it originates. This is used to respond quicker to noise-issues and safety issues occurring due to fireworks around New Year's Eve. When there is nuisance in a certain street or neighbourhood, more surveillance will be added here. Also, streets or neighbourhoods where, based on historical data, are a lot of disturbances this time of the year, the sensors are placed, and more surveillance will be around before the sensors are even measuring any noise peaks.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	The reason for measurement is a typical surveillance project. It might be argued that the surveillance is to be able to offer better service, however, the service in this project is the availability of police officers or other public agents that could play a role in controlling the neighbourhood and allowing its safety and reduction in nuisance. This is not really a service in my opinion, but the result of enforcing surveillance practices. The data measured by the sensors is sound of fireworks, which is not directly linked to personal data, therefore measuring impersonal data.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	These sensors could take away privacy and freedom away from people living in this area. While the cause of monitoring is good, it might shift towards the edge of monitoring individuals and influencing individual behaviour by feeling watched (the panopticon approach). Especially when combining the data from the fireworks sensors to other data sources, could create an extensive way of monitoring individuals. Also, when it is not New Year's Eve, but a lovely day in May, are these sensors then removed? Or are they not just measuring noise spikes, but also other things and could they possibly invade privacy by listening to conversations?
Conflicted Values:	The most important value conflicts that might occur are control and justice, where the monitoring practices might be for the greater good and safety of the citizens of Rotterdam, there is no control on what the sensors are measuring, and it might feel very unjust that you get caught because you happen to have a sensor in your street, placed there due to stigmatization, while a few blocks ahead, people are creating just as much disturbance, however, they do not have such a sensor watching over them. Privacy might get conflicted in cases of listening into people's personal conversations.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Ousseur, 2015)

27: Monitoring Maastunnel

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring Project; Environmental Project; Asset Management Project
Project Description	This project is about experimenting with the use of sensors to measure deformation, temperature, humidity, air quality, cleanness of the Maastunnel. The Maastunnel is quite a unique tunnel since it was the first tunnel in the Netherlands realized in 1942. This means that the tunnel is in need of some maintenance and repairs due to its elderdom. To make sure that the physical and environmental properties of the tunnel are allowing for safe and healthy use of the tunnel, these sensors are monitoring these various characteristics.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	This project is measuring impersonal data such as air quality, temperature and humidity. This data is collected mainly for a monitoring purpose since there is not policy of improvement connected to these monitoring practices. However, the results of the monitoring practices could steer new policy or stimulate types of maintenance or repairs needed to allow the tunnel to operate in a safe, efficient and healthy way.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There is no risk for this project shifting towards another quadrant, however, when the monitoring practices are coupled to policy making and are steering actions, the project might shift to quadrant IV since then the focus would be more towards realizing a service purpose than a surveillance purpose.
Conflicted Values:	There are no value conflicts to identify in this project.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Maastunnel, 2017)

28: Drone Inspections of Civil Structures

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring project; Asset Management project
Project Description	Civil structures in the city need to be checked and inspected for disturbances, filth, or maintenance and repairs. This project is about using drones and cameras to analyse whether civil structures are in need of repairs or maintenance, what their current status is, and meanwhile saving a lot of money by using drones, that are easier to manoeuvre and can reach places that are hard to reach.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	The data collection in this project is collecting information about the status of civil structures, which is impersonal information. Also, the objective is to use this data for a surveillance purpose which could guide maintenance or repairs activities and save a lot of money in doing so.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are no shifts to be seen in this project. However, when policy on service activities would be coupled directly to the images, the shift could be made to quadrant IV. Nowadays, it is mostly used for monitoring and surveillance.
Conflicted Values:	There are no value conflicts to identify in this project.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

29: Election day Application

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Unknown or not applicable
Collaboration Partners:	Unknown or not applicable
Type of project:	Monitoring project; Application project
Project Description	During election time, a lot of employees spend hours on counting votes, checking the validity of the voting bills and making sure results are reliable. By the use of the election application it is possible to monitor the election process, assisting employees on that day in the task that they have to carry out, know the statistics of turnout immediately after the closing of the election offices, could be the way for employees to communicate issues or complaints to the general organisation, it could count the number of employees in each office, and it could provide provisional results. The tasks that the application takes on a lot of tedious tasks that require a lot of time and manpower. This way, the hectic chaos that normally occurs during election day, could be reduced to a somewhat more efficient and manageable process.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The application is not collecting any personal data, however it could in theory know who came out to vote easier than a human being would since it automatically registers and saves the data. The number of people showing up for the elections however could also be seen as aggregated data which is not highly personal. The application is clearly developed to serve as a service application, making everyone's day a little easier and more efficient in terms of time and effort.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	This application could in theory collect more personal data, which will not be used to monitor individuals but might in fact be giving incentive to use the application for monitoring. Monitoring and control in this sense are very tightly connected. The data retrieved from these monitoring processes might lead to structural changes for the next elections, where stigmatization could occur based on historical data on turnout, issues or disturbances in certain voting offices, on which policy might be adjusted to. This could lead to hiring less people for the voting offices that do not attract many voters, or to the addition of security in places where previous years were issues.
Conflicted Values:	The slight chance of this scenario turning out as described above could lead to the conflict in the values of human dignity due to job loss and stigmatization.
Quadrant Shift:	Quadrant III
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (RTV Rijnmond, 2012); (Binnenlands Bestuur, 2012)

30: RUGGEDISED

Project Initiator:	EU project RUGGEDISED
Collaboration Type:	Triple Helix collaboration (Public, Scientific, Private collaboration)
Collaboration Partners:	Rotterdam, Umeå, Glasgow, Brno, Parma, Gdansk, TNO, KPN, RET, Future Insight, Eneco, Erasmus Universiteit, Ballast Nedam
Type of project:	Smart Lighting Project; Monitoring Project; Mobility Project; Environmental Project; Asset Management Project; Energy Project; Safety Project
Project Description	This project is a very large one that consists of various projects that all are focused on making a city fit for the future. One of these projects focusses on applying sensors in lampposts for smart lighting application, others create efficient waste management systems by applying sensors in waste containers (filling degree meters). The span of project involved under the RUGGEDISED projects very wide, including smart lighting, monitoring, mobility, environmental, asset management and energy projects. For realizing these projects multiple partners are involved from both the private industry, as the scientific partners and public ones.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	Data in these projects is generally all impersonal data. The purpose of these projects is all in some way related to service, by making the city fit for future, the service could either be expressed by better and more efficient waste management, smart light provision, creating smart mobility solutions for citizens, installing and testing smart grids which are integral to renewable energy solutions. Therefore, the umbrella project which houses several other projects could be assigned to quadrant IV.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The lamppost equipped with sensors has the possible effect of using collected data for personal profiles, commercial interests or for surveillance purposes. This makes might make the lamppost a risky project in collaboration with private parties, which might have different interests at heart. When there are no agreements made beforehand, this might develop into something undesirable. The same accounts for other initiatives, such as the waste management systems which already have been discussed earlier in project 3. Due to the collaboration with private parties, and the experimental nature of these projects, there are certain risks of these projects shifting into quadrant III or even II.
Conflicted Values:	Just as with the other projects that involve smart lighting or filling degree meters, possible value conflicts occurring could affect the privacy, power relations and feeling of justice for the public. The information asymmetry the municipality could gain access to could cause these issues. As for the smart lighting projects involved; when and if this scenario becomes reality, value conflicts arise for both the public as for the municipality. For the public privacy, autonomy, justice, control, safety and power relations are affected by the implementation of Big Brother's play set created by these private parties. For the municipality issues could arise with safety, control and power relations in terms of the safety and control the public parties could have on the systems and algorithms used in the technology application, and no longer really have influence on the previously strictly publicly owned asset.
Quadrant Shift:	Quadrant III (in extreme situations Quadrant II, depending on the specific project)
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2017); (Jonge, 2018)

31: Citizen Science Project

Project Initiator:	DMCR
Collaboration Type:	Citizen Science
Collaboration Partners:	Citizens of Rotterdam (and other cities participating in this project), RIVM, DMCR
Type of project:	Monitoring Project; Environmental Project
Project Description	This project focusses on the testing of cheap(er) sensors for air quality and other environmental measurements, where citizens can achieve a powerful position by expressing concerns about environmental data in their living environment. When, previously, people could complain about the fact that they were concerned about industry in their living environment, or a road with loads of cars, they had no evidence to back up their concerns. Citizen Science projects offers them insight, raises awareness of our environment, and gives the opportunity to take action.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	The information gathered in these projects is most of the time used for surveillance. The data is not directly linked to a specific action of policy. It is however a mechanism that citizens could use to control their government, to back up their complaints and issues in order to be taken seriously. Also, citizen science projects could monitor change in the environment when and the effects of these changes could be measured over time. For example; what is the effect of the maintenance done on the Coolsingel in Rotterdam, which used to be a busy road, which could now no longer be used as before. Is this something to notice in the atmosphere? Does it improve air quality locally? And does it worsen the pollution in other locations since traffic is redirected? These questions could be answered. This is all environmental data therefor it is not personal information.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	While the risk of a quadrant shift is very unlikely for these projects, when used to monitor the behaviour of your neighbour's fire place, it might get personal and effects might be negative. Resolving personal conflicts due to sensor applications is not the intention of the project, therefore a shift might occur, however on very local and personal scale. This means that the shift will probably not happen, however, it could still mean that values get conflicted.
Conflicted Values:	The values that might get conflicted when the citizen science is used for resolving personal feuds, are privacy (your neighbour is monitoring you, your behaviour, without asking or permission), justice (that you happen to have a neighbour with a sensor might make the result of these actions feel unjust doe to the fact that maybe a lot of other people experience the same issues, however do not get taken seriously because of their lack of data), and power relations (people with data could get a powerful position in comparison to citizens that do not monitor, and the relationship with government bodies changes, citizen could suddenly have a powerful position).
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Carton, Smart City Update, 2018); (Loo & Jansen, 2018); (Rijksinstituut voor Volksgezondheid en Milieu, 2017)

32: Buiten Beter Application

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Yucat Mobile Business Solutions
Type of project:	Monitoring Project; Environmental Project; Application Project
Project Description	This application was created to make a system that allows people to register disruptions in the outdoor (public) space. This way, you can communicate disruptions quicker, it automatically ends up with the right person, and it will be more accurately processed by the municipality. This application could increase the level of service they offer to their citizens, who are the most important customers of a municipality. They can also act and operate more efficient due to the fact that the complaints and disturbances are monitored and registered by citizens instead of themselves. When action needs to be taken, the process will be sped up which might save some money in the end.
Quadrant Status-Quo:	Quadrant I
Argumentation for status-quo location:	Since the service runs on an application, which is coupled to an individual who registers disturbances, the data gathered might have impersonal information as a subject (e.g. the tile of this pavement is broken), however is collected in a personal way – via a profile and smartphone. The cause of data collection is for a service purpose, from which citizens could benefit in receiving quicker and more accurate service, and the municipality could increase its efficacy and popularity amongst citizens.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	When the application, connected to your personal profile, is used for this purpose, it might get linked to other data about you, your whereabouts, for other purposes than bettering the service offered by the municipality. Profiling could lead to stigmatization, personalized commercial outings or suggestions provided by the municipality. This is undesirable and might create a shift from the first to the second quadrant, pressurizing values of privacy, power relations and autonomy. Also, the developer and owner of the application might have other intentions than the municipality. The application might be sold as an app to report disturbances in public space in the municipality, however, Yucat might track your location in the background, creating highly personal and commercially valuable user profiles which could be combined with other data sources.
Conflicted Values:	If and when this negative future scenario becomes reality, public values of privacy, power relations and autonomy could get conflicted.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Zoonen, 2016); (Buiten Beter, 2016)

33: LAMPPOST OF THE FUTURE

Project Initiator:	Lightwell
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Municipality of Rotterdam, Lightwell
Type of project:	Smart Lighting project
Project Description	The lamppost in the neighbourhood Rotterdam-Heijplaat offers steer lighting by means of LED lights, it offers wireless internet electricity to charge electric vehicles and it is equipped with multiple sensors. These sensors are amongst other reasons to dim or brighten the lights according to the surrounding conditions. Also, there is a camera attached to the lamppost for surveillance purposes.
Quadrant Status-Quo:	Quadrant III and IV
Argumentation for status-quo location:	The location of this project placed on the border of quadrant III and IV is due to the fact that it combines applications that offer a service, such as charging or internet access, with surveillance purposes by the attachment of a camera. The data collection occurring this project is represented as being impersonal data. Whether this is completely true remains to be debated…
Risk for quadrant shift:	Expected negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	This notion of "all kinds of sensors" in the project description makes me wonder whether these sensors are measuring innocent information about weather conditions or that they might be to represent a certain commercial interest based on personal profiles. This project, with an incentive to combine the function of light with all kinds of private activities creates a high risk of third parties that will exploit this opportunity for solely economic reasons, by adding all types of sensors that will collect personal data for surveillance purposes. By allowing and pursuing these projects in a way without limitations, the risk of pressurizing and conflicting various dearly held values is high.
Conflicted Values:	When and if this scenario becomes reality, value conflicts arise for both the public as for the municipality or other type of government body affected. For the public privacy, autonomy, justice, control, safety and power relations are affected by the implementation of Big Brother's play set created by these private parties. For the municipality issues could arise with safety, control and power relations in terms of the safety and control the public parties could have on the systems and algorithms used in the technology application, and no longer really have influence on the previously strictly publicly owned asset.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Lightwell, 2018); (RTV Rijnmond, 2015)

34: Heatmaps of the City Centre

Project Initiator:	Bureau Binnenstad – Municipality of Rotterdam
Collaboration Type:	Public
Collaboration Partners:	Municipality of Rotterdam – Bureau Binnenstad is an internal organisation with own responsibilities in terms of city centre management
Type of project:	Monitoring Project
Project Description	With sensors tracking GPS data of people in the city centre, they want to create so called heat maps where behaviour and trends of pedestrians in the centre of Rotterdam can be made visible. This data could be used strategically for entrepreneurs in the city centre by for example drawing conclusions on the level of attractiveness of a street. This information could then be used to improve the situation by making the street itself more interesting or nicer to look at. In some cases, this lead to the insight that people simply do not go into a certain area of the city because of the fact that they have to cross the road. This could be made more fun by painting the pedestrian crossing in the colours of the rainbow.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	The project is used for all kinds of applications however is generally a monitoring activity executed by the municipality. The purpose is therefore surveillance rather than service. The data that is collected is derived from the GPS location of mobile phones, however since its representation in heat maps, this is considered aggregated data and therefore impersonal instead of personal.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	The risks that possibly might occur is the fact that the collection of GPS data will give an incentive to also use it for other purposes than simply monitoring the activity in the city. Data could be combined with other data sources, creating personal profiles which are sensitive for value conflicts due to the economic or commercial incentives driving these applications.
Conflicted Values:	Values that might get conflicted due to the GPS data collection for other purposes or for recombination of these data sources for other purposes are privacy (especially since citizens and visitors did not explicitly give permission to be monitored and there is no transparency on the matter), and control (on what happens with this data, what other purposes are shielding behind the surveillance practices).
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Gemeente Rotterdam, 2016)

35: TRAMS COMMUNICATING WITH TRAFFIC LIGHTS

Project Initiator:	MRDH
Collaboration Type:	Public Private Partnership
Collaboration Partners:	Municipality of Rotterdam, Municipality of Delft, Municipality of The Hague, RET; Connecting Mobility
Type of project:	Mobility Project
Project Description	This is a pilot study where the conventional sensor loop in the road surface will be supplemented with Wi-Fi-trackers or sensors that can know the location of the tram earlier on by signing up the tram on this Wi-Fi-connection. This way, traffic lights can communicate with the trams, present them with suggested driving speed, and allow better flow through busy crossroads. This might not only aid the trams to save time and frustration in traffic, but also other road users will benefit from less clogging up of trams since a lot of the time they either cross roads or are driving on roads cars are using as well.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensors who are identifying the trams that are coming and passing, are measuring the mere location and movements of these trams, which is impersonal information. The purpose of the collection of this data is for a service purpose; offering better public transportation for citizens, less congestion in the city centre or at least anticipating on congestion or other disturbances occurring in the city. The means of data collection could also be used for surveillance of these trams, however, this is not the case since monitoring data will be used for a service purpose.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are no risks to be identified for switching quadrants or conflicting values. The only switch it might make is towards the side of surveillance, however, personally I do not think this is information that is interesting enough to monitor in a negative or risky way. Therefore, also no value conflicts are expected in this project.
Conflicted Values:	There are no value conflicts to be identified in this case.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (Connecting Mobility, 2015)

36: WASTE SHARK

Project Initiator:	RDM Rotterdam
Collaboration Type:	Triple Helix collaboration (Public, Private and Scientific partners)
Collaboration Partners:	GenuinEngineering, Havenbedrijf Rotterdam (Port of Rotterdam), Municipality of Rotterdam, RDM Campus
Type of project:	Environmental Project; Asset Management Project
Project Description	The waste shark can sail a route through the port, collecting waste, to make sure waste does not end up clogging the engine systems of the boats passing through the harbour. It uses sensors to steer and detect items. Now the waste shark picks up waste, however it could be adjusted for other purposes like cleaning up oil from the water. These tasks used to be performed by boat on which employees of the municipality would manually scoop out waste from the water, which is a non-efficient way in terms of time and money. This way, the municipality could innovate whilst saving money.
Quadrant Status-Quo:	Quadrant IV
Argumentation for status-quo location:	The sensors on the waste shark collect data on their surroundings in order to navigate themselves in the water. This is impersonal data. The reasons and purpose for data collection are to provide a service for the citizens of the city for keeping their water clean, and for the boat owners, to prevent their motors from clogging. Also, collecting waste from the water could be attributed as a service for the environment, who could severely be damaged by for example plastics in the water.
Risk for quadrant shift:	Not likely
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are no risks to be identified for switching quadrants or conflicting values due to these switches. However, there is of course a risk of people feeling offended or deputed due to the fact that a robot now takes over their job. This could cause value conflicts.
Conflicted Values:	The job loss aspect of the waste shark could cause conflict in terms of human dignity, control and economic values.
Quadrant Shift:	Not applicable
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018)

37: PS – CRIMSON

Project Initiator:	Municipality of Rotterdam
Collaboration Type:	Triple Helix Collaboration (Public, Private and Scientific partners)
Collaboration Partners:	Philips Lighting, ViNotion, Cyclomedia en Technische Universiteit Eindhoven, Municipality of Rotterdam
Type of project:	Safety project; Monitoring project
Project Description	Within the PS CRIMSON project an extra medium (sound sensors) is offered for identifying situation where the dynamic noise thresholds are exceeded. In response, a short sound signal indicates the employees of Camera Surveillance to pay attention to this specific situation. The sound sensors are therefore an additional source of information that could lead to a more effective implementation of camera surveillance, where only the images that are relevant have to be checked. For clarity; the sound sensor is not linked to a camera and functions autonomously and does not record conversations or phone calls from passers-by.
Quadrant Status-Quo:	Quadrant III
Argumentation for status-quo location:	This is a project which has as a purpose to create more efficient and effective surveillance in the city of Rotterdam. The data collected is debatable personal or impersonal. However, the only thing the sound sensor really registers is the decibel level on which the sound happens. When this exceeds a certain threshold, it will trigger camera surveillance to become active. Only from that point onwards the information gathered might be personal. However, up until that moment, the sensor measures theoretically impersonal data.
Risk for quadrant shift:	Plausible negative future scenario
Argumentation for risk of quadrant shifts and Value Conflicts occurring:	There are some risks involved in the application of sound sensors, especially when connected to surveillance cameras. When the incentive of the private parties involved is somewhat sketchy, or when the system gets hacked, actors would have access to highly personal information from private conversations including visual information. In this case, there is a possible shift that could occur from the third to the second quadrant, where surveillance occurs with personal data. This situation might not be highly likely to become reality, however, when these systems are implemented city-wide, the implications could be very big and could conflict a lot of values. What could be especially worrisome is the fact that the PS-Crimson project states to be able to provide better and more services related to combined to public safety such as crowd management, smart lighting control, and this could potentially mean that this technology will have much more power than just measuring sound spikes.
Conflicted Values:	If and when this scenario becomes reality value conflicts would occur on privacy, justice, control, power relations and safety.
Quadrant Shift:	Quadrant II
Sources Used:	(Vieveen, Inventarisatie Smart City Initiatieven, 2018); (PS-Crimson, 2018); (RTV Rijnmond, 2018)

Appendix E: Role-play workshop at the Ministry of Economic Affairs and Climate Policy

In this appendix, the cards used to describe the roles and interests to represent for their role in the case study of a fictional municipality are depicted.

Inwoner van Nooitgedacht:

Context:

Als inwoner van het centrum van gemeente Nooitgedacht heb je zelf veel te maken met de parkeerproblematiek in de stad. Zeker als je terugkomt uit je werk in de spitsuren, rij je vaak in een slinger aan mede-zoekende de wijk door om een plekje te kunnen vinden voor je auto. Het parkeerprobleem veroorzaakt niet alleen veel files en uitstoot, maar vooral veel frustratie! Je maakt je daarnaast ook wel zorgen om de hoeveelheid technologie in jouw directe leefomgeving. Waar zit dit allemaal? Wat betekent dit voor mij?

Belangen:

- Je ziet graag een oplossing voor het parkeerprobleem in de stad.
- Je bent graag op de hoogte en geïnformeerd wat er speelt in de gemeente.
- Je vindt privacy belangrijk en wil graag jouw ding kunnen doen zonder dat je het idee hebt dat je bekeken wordt.
- Je wil een gezonde en veilige leefomgeving voor jou en jouw gezin.
- Je wil tijd (onnodige wacht- en zoektijd) en geld (brandstof) besparen en niet meer belasting betalen om dit probleem op te lossen.

Ambtenaar bij Gemeente Nooitgedacht:

Context:

Gemeente Nooitgedacht heeft een aantal doelstellingen gecommuniceerd met betrekking tot transities die gaande zijn in de stad. Ze willen onder andere innoveren en meer technologie toepassen in de stad om efficiënter te werken, toekomstbestendig te zijn, en geld te besparen. Daarnaast kunnen ze natuurlijk niet achterblijven op de rest van Nederland als het gaat om het verminderen van uitstoot in de stad en hebben ze duurzaamheid hoog in het vaandel staan. Dit moet echter niet ten koste gaan van de toegankelijkheid van de stad en ze willen dat Nooitgedacht niet alleen een plek is van de inwoners, maar ook van bezoekers.

Belangen:

- Het verminderen van uitstoot in de stad in het kader van verduurzaming.
- Toekomstbestendig zijn en meegaan met de tijd.
- Een efficiëntere organisatie worden met behulp van technologie of andere slimme oplossingen.
- Niet onder willen doen aan andere steden en een goed imago behouden dan wel verkrijgen.
- Een goed bereikbare en toegankelijke stad zijn.
- Een stad zijn waar mensen graag wonen en werken.

Sales(wo)man bij Calitech

Context:

Calitech is een technologiebedrijf die de ambitie heeft de zelfontwikkelde technologie door steden over de hele wereld te verspreiden en marktleider te worden op het gebied van Parking Solutions (het domein waar ook onze parkeerapp onder valt), Smart Lighting (het verstrekken van lantaarnpalen uitgerust met sensoren), en Smart Charging (snelle laadsystemen verspreid door de stad om je elektrische voertuig mee op te laden). Om dit doel te verwezenlijken zullen ze verkozen moeten worden boven de andere partijen die soortgelijke technologieën aanbieden en moeten blijven innoveren.

Belangen:

- Calitech Parking Solutions zo snel mogelijk en zo veel mogelijk uitrollen over meerdere steden.
- Imago verbeteren en bekendheid vergroten in deze competitieve markt om zo veel mogelijk klanten te scoren.
- De mogelijkheid krijgen om te kunnen blijven innoveren door ervaring op te doen bij steden.
- Naast het uitrollen van de Parking Solutions, de gemeente ook interesseren in de andere technologieën van Calitech.

Rijksoverheid

Context:

Niet alleen bij Gemeente Nooitgedacht spelen dit type problemen en vraagstukken. Vanuit meerdere hoeken krijgt Rijksoverheid te maken met grote transities zoals de energietransitie en digitalisering. Hier moeten we wat mee! Maar wat?

Of het nu gaat om het ontwikkelen van standaarden, wetgeving, het maken van afspraken met private partijen of om agendavorming; er is behoefte aan hulp en kaders voor partijen als gemeente Nooitgedacht.

Belangen:

- Ondersteunen en/of coördineren van transities binnen de publieke sector.
- Innovatie stimuleren binnen de publieke sector.
- Het waarborgen van belangrijke (publieke dan wel maatschappelijke) waarden als privacy, veiligheid, transparantie en inclusiviteit (dat ieder mee mag en kan doen aan de samenleving).
- Het imago van Nederland in stand houden of verbeteren ten opzichte van andere Westerse of Europese landen.
- Het verspreiden van kennis en inzichten over de typische “pijnpunten” die bij alle gemeenten zullen spelen op het gebied van digitalisering, de energietransitie en andere relevante thema’s.