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Smart Urban Governance in practice:

A case study of Dutch smart city developments.

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Preface

Before you lies my master thesis 'Smart Urban Governance in practice: A case study of Dutch smart city developments.' With this final product of my master Spatial Planning I have researched smart urban governance in smart city developments in The Netherlands. In this research I have looked at the way smart city developments in The Netherlands organise their governance structure, what actors are involved and in what way, what the goals are for these smart cities, and how to achieve them in light of smart urban governance. With this final product a very educational process has come to an end, in which I have learnt a lot about the spatial domain.

I want to express my gratitude towards the people that helped me in this process. In the first place my supervisor Dr. Yanliu Lin, thank you for all your time and effort in providing me of guidance and feedback during this research process. I would also like to thank Stichting Brainport Smart District and its director Edwin Schellekens for giving me the opportunity to do a research internship in this organisation. Also a thank you to Henri Smits for his guidance as my supervisor from SBSD and for helping me to connect with the respondents. Naturally I also want to thank the respondents for providing me with their knowledge and experiences, that has been of great value for my research. Lastly I want to thank my friends and family, for supporting me during this period.

Tom Wilde

Eindhoven, 7 August 2020

Abstract

This research is focussed on how smart urban governance gets put into practice in Dutch smart city developments. Furthermore this research focusses on how these cases deal with citizen participation and how the governance networks have been set up. Many cities have set goals to become a smart city or engage in developments to implement smart solutions to daily live problems. Over the past years smart city approaches have gained momentum in city (and spatial) planning (Kummitha & Crutzen, 2017; Hashem et al. 2016; Jiang, Geertman & Witte, 2019; Lin, 2018). Therefore the time has come to actively study some of these developments. In this research the main case study is Brainport Smart District (BSD) which has the ambitious goal to become the smartest neighbourhood in the world (Rood, 2019). BSD also has a component that has as main focus to develop the data side of this smart city. This is aimed to help with all kinds of questions related to the data component in smart cities, in the line of data governance (Cheong & Chang, 2007). This raises the question how data governance and smart urban governance relate to each other. The main research question therefore is: *"How does smart urban governance contribute to realizing smart city developments and improve the governance processes, resulting in better outcomes and more openness for citizens?"*

In this research three case studies are used to be able to formulate an answer to this question. The main case that is used is Brainport Smart District (BSD). This case is researched by analysing (policy) documents available on this development. Next to this there are also semi structured interviews with actors involved in the development and these interviews are analysed on their contents. Some questions posed to these actors are, what are the goals of smart district, who are the involved actors and what projects are carried out to realise the development. These contents are also used to do a social network analysis of a part of the governance network of BSD, to get a better understanding of the governance network. Two other case studies of smart city developments in the Netherlands are analysed also by utilizing the available (policy) documents of these developments. These cases are the Merwedekanaalzone (Utrecht), a redevelopment of an inner city industrial area into a smart city with a mix of living and working. The other case is Living Lab Scheveningen (The Hague), where a smart city infrastructure is implemented in the seaside part of the city of The Hague.

In two of the three cases an organisational model is used, called the quadruple helix, in which four stakeholder groups have a seat at the table when it comes to the development of a smart city. These groups are: Governments, Private parties, Knowledge institutions and Civil society / local residents. This indicates that citizens get a more prominent role in smart city developments than before. Leading to a flatter, less top-down structure that fits to smart urban governance in the line of how Jiang et al. (2019) view smart urban governance. Furthermore this research showed that there is more focus on using smart technologies for achieving smart cities, rather than thinking about and using data that is facilitating these smart technologies. It became clear that data is a difficult topic and that every actor threats data differently. This means every actor can potentially have a different agenda towards dealing with data. Therefore it is needed to create some sort of data governance to give structure for managing data in urban developments. The topic of data governance is explored actively by BSD, but it appears to be a project that is developed parallel to the other ongoing developments. This means that smart urban governance and data governance are not being matched at the moment. Data governance can definitely have implications on the smart urban governance process of the development, but what these implications are and how it effectively works out could not be concluded from this research alone.

Inhoudsopgave

1. Introduction

Many cities in the world have set themselves goals to become a smart city or engage in developments within the cities that want to implement smart solutions to daily live problems. Over the past years smart city approaches have gained momentum in city (and spatial) planning (Kummitha & Crutzen, 2017; Hashem et al. 2016; Jiang, Geertman & Witte, 2019; Lin, 2018). With the theoretical concept of smart cities becoming closer to implementations in the real world, making for more vibrant examples for society. Like Hashem et al. (2016) say that the several applications of smart environments have contributed in picturing living in such smart environments.

With the implementation of smart cities in the real world, academic attention for the governance of smart cities is also increasing rapidly. Meijer & Bolivar (2016) have already made an effort to structure great parts of the debate about the governance of smart cities. They have come to three basic distinctions of how smart cities features are defined; (1) smart technology, (2) smart people and (3) smart collaboration.

When it comes to governing the processes of creating and establishing smart cities the use of information and communication technologies (ICTs) can contribute to establishing better outcomes and possibly more openness in the governance process (Meijer & Bolivar, 2016). However for this to work it can be argued that traditional Urban Governance does not suffice. In literature the debate continues in a direction that calls for smart urban governance to lead the way for the realisation of smart cities (Jiang et al, 2019). However it is not very clear how this would work out in practices and what the challenges are for these developments with the implementation of smart urban governance to the real world cases. Jiang et al. (2019) propose a specific urban planning perspective on smart governance the earlier mentioned smart urban governance.

It could thus be interesting to reflect on and test their proposed perspectives against a smart city development that is being realised at this moment in the Netherlands. This development is Brainport Smart District (BSD). Brainport Smart District is a smart city development that is being realised in the city of Helmond a neighbouring city of Eindhoven. That is also where the name originates from (Brainport Smart District (BSD), 2020). With the goal formulated as “smartest neighbourhood in the world” and an aim of 1500 houses to be built until 2028 it sounds ambitious. But the alderman of Helmond has made it clear that Brainport Smart District is a living lab in which things may go wrong (Rood, 2019). This is an understanding known by future residents that are cooperating with BSD. According to Mr. Moerkerk who said the following to the New York Times: “I realize we are going to live in an experiment,” “Some ideas might not work out the way we expect.” (Plockova, July 24 2020).

Brainport Smart District (2018a) describes itself as “a smart city that is not the sum of individual components.” What they mean with this is that they have the ambition to design the (Urban) architectural environment in conjunction with new technologies for mobility, health, energy generation and storage, sustainability and circularity in mind, all enabled by ICTs. Furthermore, it is the goal to be a real live testing ground, living lab, for the developments of new systems, processes and services of a smart city. The projects, whether it are housing developments or products and services, that are being realised in the district need to pass a business challenge. Here they are judged on their innovation level before being admitted to realise a project within BSD. According to Mr. Van Berkel in the New York Times, is this a process that does not exist anywhere else in the Netherlands (Plockova, July 24 2020).

Therefore it is interesting to research how Brainport Smart District is operating and developing this smart neighbourhood. And in what way smart urban governance (Jiang et al. 2019) is implemented and made to fit with the challenges that come with the development of a high level smart city like Brainport Smart District. In order to research smart urban governance within the development of Brainport Smart District and what challenges smart city developments create for governance systems in general, the following research question and sub questions are defined:

Research question:
"How does smart urban governance contribute to realizing smart city developments and improve the governance processes, resulting in better outcomes and more openness for citizens?"

Sub-questions:

1. *"What is the local, institutional and spatial context in which Brainport Smart District is realised?"*
2. *"To what extent is collaborative planning implemented in the governance model of Brainport Smart District and what are the effects from this to implementing smart technologies?"*
3. *"How is the data governance organized in Brainport Smart District and what are the challenges of this for smart urban governance?"*
4. *"How does BSD compare itself to the cases of the Merwedekanaalzone and Living lab Scheveningen?"*

The methods used to research how smart urban governance contributes to smart city developments where using three different case studies. One case study, the Brainport Smart District development, as an in depth case study research, with document analysis, semi structured interviews of stakeholders involved with BSD and a social network analysis of the stakeholders involved. The other two case studies, of the Merwedekanaalzone and Living lab Scheveningen, where researched with document analysis and online information about these projects. What came forward from this research is research is that smart urban governance contributes in a positive way to the development of smart cities. It delivers empirical evidence about three smart cities and how they use smart urban governance in realizing smart cities. But is also shines a new light on smart urban governance in a way that there are still things that can be incorporated in smart urban governance. It became clear that data governance is something that is needed for smart cities, only to see that it is set up parallel to the existing smart urban governance network and that there could be a possible mismatch. The matching of data governance with smart urban governance is an area that came forward from this research and that could be further explored.

2. Literature review

In this chapter the general understandings of theories involved with smart urban governance will be discussed and evaluated. In order to come to the best suitable definitions to use in this research which help in formulating answers on what influences of smart urban governance are on smart city developments, and how smart urban governance should function. Also the conceptual framework of expected connections of theories and outcomes will be designed and discussed.

2.1. Urban Governance

To be able to explore what smart urban governance is, it is important to determine what is urban governance in general. Urban governance can be subdivided in the general concept of governance and urban governance, so these two differences will be explored.

2.1.1. Definition of Urban Governance

To come to an definition of governance there are two main idea's to explore. First, according to Jessop (1998), governance has enjoyed a revival but it also turned into a buzzword that in essence can mean anything or nothing. Jessop (1998) describes Governance as multi-scalar and meta-governance, as to which he also refers as the 'organization of self-organization'. The revival of the term governance probably comes back to the need to distinguish between 'governance' and 'government'. Furthermore Jessop (1998)explains that governance refers to the modes and manner of governing. Government refers to the institutions and agents charged with governing. And governing is then the act of governing in itself.

Jessop (1998) depicts that there are in general terms, two closely related, but nested, meanings of governance that can be identified. The first meaning of governance can refer to any mode of coordination of interdependent activities. The three most relevant modes are: the anarchy of exchange, organizational hierarchy, and self-organizing 'heterarchy'. Then the second, more confined meaning, is heterarchy (or self-organization) to which Jessop focuses its article. This includes; self-organizing interpersonal networks, negotiated inter-organizational coordination, and decentred, context-mediated inter-systemic steering. So the pre-eminent mode and manner are shifting from hierarchies and bureaucracy towards self-organising networks or 'heterarchy' (Jessop, 1998).

Second, governance can also be understood as governing with and through networks (Rhodes, 2007). Rhodes (2007) further describes governance as: "Interdependence between organizations. Governance is broader than government, covering non-state actors. Changing the boundaries of the state meant the boundaries between public, private and voluntary sectors became shifting and opaque."(p. 1246) Through which he explains that governance is more than just a government that steers how and what happens. This means that non-state actors are involved in decision making processes, involving stakeholders to participate, like companies, but also communities. Obeng-Odoom (2012) agrees with this notion in saying that governance draws on stakeholders from local, regional, national and international levels, that leads to a diverse way of administering cities. This could lead to creating Public Private partnerships or a focus on bottom-up, citizen led development. The shift and change of boundaries of the state have the consequence that the process of governing gets more vague (Rhodes, 2007).

For this research the understanding of governance by Rhodes (2007) is the best fit, as it sees governance as governing through networks. Networks broader than government, covering non-state actors and combining public and private actors. This corresponds with the way that Brainport Smart District is trying to organize the development of the smart district, by establishing a network in which

all the actors involved in the district are combined and enforce each other to develop the district for the best outcome.

In order to gain further understanding of governance networks in spatial planning and to be able to understand Smart Urban Governance. The logical step to make from governance is to understand how governance works when the spatial component is added, therefore Urban Governance. One of the key differences between governance and urban governance is it that focusses on the processes and actors involved with developments in the spatial context. Obeng-Odoom (2012) says that urban governance refers to partnerships in urban development. Mainly between local governments and other stakeholders, like construction companies, landowners and business leaders. You could say that governance is broader that just the urban government. Urban governance is seeking new ways to be creative with accessing and utilizing resources to build strengths, especially on a local and neighbourhood scale. Resources like local knowledge to help build local institutional capacity, just as stimulating the formation of social capital for these areas. Furthermore citizens empowerment is needed to establish self-generating capacities within communities (Kearns & Paddison, 2000).

According to Peters & Pierre (2012) urban governance can be defined as:

> Urban governance, simply defined, is about the formulation and pursuit of collective goals at the local level of the political system. Unlike traditional accounts of urban politics, governance theory makes no prejudgment about which social actors are most central to the pursuit of collective goals. (p. 3).

Urban governance is thus more focussed upon governments like municipalities and maybe the provincial level in The Netherlands depending on what kind of partnerships are formed. Secondly they mention that it is not always the same actors that have the most central role when it comes to urban governance processes. Peters & Pierre (2012), continue this line with saying that cities are much more embedded in a web of institutional, economic and political constraints that add a certain complexity to how they can govern. And that the city government is not naturally the central actor. To follow this up, Obeng-Odoom (2012) argues that: “the management of cities is not the sole preserve of the government or the private sector, but is the preserve of a wide variety of actors and stakeholders that interact with one another to govern cities.” (p. 206). So the responsibility for the spatial domain lies with more than just one party, no longer only the government or extended to private parties. There are thus more actors that can claim their responsibility in governing cities.

When the responsibility of the spatial domain is distributed to more than just the government it is important for all the actors within urban governance to understand that they have a greater accountability to the public than just ‘market performance indices’, as Obeng-Odoom (2012) says. Market parties come to act in a new sort of domain where they have more responsibilities, like establishing a better outcome for the society and not just their market performance. This is a role that they need to accept and carry with them in the partnerships that get established. Peters & Pierre (2012) add that accountability becomes more tied to performance and less to representation, which is in line with more responsibilities for private parties, on the basis of what they deliver. With this it is almost impossible to not discuss some normative benchmarks that come with urban governance. These are some of the standards of good governance. The effectiveness of the measures, and the accountability have been mentioned before, but governance should also be participative and democratic. However these standards are not unambiguous and must be revaluated in light of the particular urban settings in which they are applied and what actors are involved (Peters & Pierre, 2012).

2.1.2. Collaborative planning and participation

Granier & Kudo (2016) identified that scholars say that citizens engagement and/or participation is a key element to define smart cities, however there is still little research conducted upon this area yet. Therefore citizen participation is a weakness for both actual practices and research. But in the recent decades the trend towards increased citizen participation in policy making and design implementation suggest that this needs to be further developed. Various participatory mechanisms need to allow citizens to take part in these processes (Granier & Kudo, 2016).

In the 1990s market-led development still was the go-to way, however the interest in communicative/collaborative planning grew. With a shift in public debate from representative to deliberative democracy following (Monno & Khakee, 2012). These changes had an influence on turning the ideal of participatory planning, from what was a utopia, into an institutionalized practice. This shift happened in the period that the shift from government to governance in urban policy making processes was occurring. With these complex contexts of multilevel governance, participation has become an important asset in expanding democracy and improving the quality of decision making (Monno & Khakee, 2012).

Collaborative planning is thus one way of viewing participation in planning processes, Arnstein (1969) has defined a scale of varying degrees to which participation could lead to influence. This scale is called the ladder of citizen participation. Arnstein advocates that citizen participation is about citizen power, but it has often been referred to as 'self-help' or 'citizen involvement', which undermine the actual goal of participation (Arnstein, 2019). Therefore citizen participation is a more categorical term for citizen power, it is about the redistribution of power to enable have-not citizens, that get excluded from political and economic processes, to join.

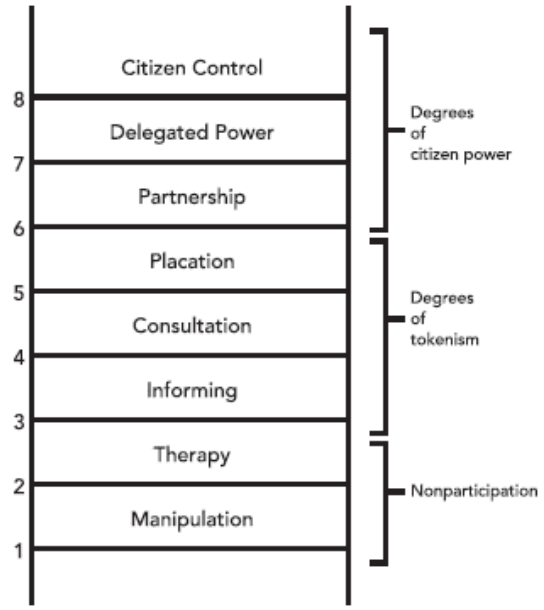


Fig. 2.1: A ladder of citizen participation (Arnstein, 2019)

The ladder describes levels of participation, from nonparticipation up to degrees of citizen power. At the bottom there are manipulation and therapy, these are levels of nonparticipation. What this entails is that the objective is not enabling people to participate. But rather a way of powerholders to educate or even 'cure' participants (Arnstein, 2019). From this level of nonparticipation the ladder goes on to

levels of tokenism, that allows for have-not citizens to listen to plans and have a voice. However this does not mean that these group have the muscle to push through on things they want, because the powerholders are still the deciding party. Monno & Khakee (2012) describe tokenism in their paper as 'legislative-sanctioned participation' which means it is perfunctory, and in the end the outcomes could just be waved away by those in power. These levels on the ladder of participation are; informing, consultation and the last stage of tokenism is placation. Placation is the highest placed because the have-nots are here allowed to advise, which is more than with informing and consultation. The last part over the ladder covers the degrees of citizen power. This part is addressing the increasing decision-making possibilities for citizens. First there are partnerships that enables negotiations and engaging in trade-offs with the traditional powerholding parties. The last two rungs, delegated power and citizen control, are designed to give the have-not citizens the majority of decision-making seats or even full managerial power (Arnstein, 2019). It is important to note that Arnstein's ladder of participation is a simplification, since there are more ways of citizen involvement, but it definitely helps paint the picture of the different gradations in citizen participation. It therefore can be used as a guideline for organisations to better design their participation processes, so that it no longer is just an empty ritual that has little to no effects on the outcomes.

The idea of Collaborative Planning by Healey (1997) was based on a few ideas; first the perception of planning as an interactive process, second as a governance activity, third her focus on planning and policy activities to enhance qualities of places and territories. And last her moral commitment to social justice (Healey, 2003). Later Healey (2008) describes collaborative planning as it is inspired by the ideal of deliberative democracy. With a focus on civic engagement, creating dialogues between the stakeholders with different claims and in the end consensus building. But the sole purpose of collaborative planning is not participation it tries to cover many aspects of the planning process, to which participation is one aspect. The activities undertaken in the planning process take place in a governance network. The engagement of participants in this network shape the sense of the participants of what the governance process is and what they themselves can contribute. This generates ways of thinking and acting that may be carried forward in the development of governance networks (Healey, 2003). However Monno & Khakee (2012) said: "Participation is not just another 'tool' available for the new governance style that characterizes urban policy-making. It is a crucial factor if planning as a state practice is to be maintained and further developed." (p.99). With this statement they want to make clear that governments should not think too lightly over implementing some sorts of participation. Because that could jeopardize how governments could continue to govern and make changes to the way they govern.

2.2. Smart Urban Governance

Smart Urban governance can be explained through combining insights from a couple of other theories. Starting with a short introduction of smart cities and it characteristics, going on in to smart governance and smart urban governance. But also the previous part of this literature review, about urban governance, will be used because it delivers the necessary insight to come to a more complete understanding of smart urban governance.

2.2.1. Concepts of smart urban governance

Smart urban governance is mainly concerned with the governing of smart cities, therefore it will be useful to have some basic understandings of what a smart city is. By looking at some of the definitions of smart cities and its characteristics.

Caragliu, Del Bo and Nijkamp (2011) give the following definition of what a smart city is:

> We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance. (p. 70)

What they mean with this is that smart is defined by investing in not only technological advancements through the use of ICTs. But rather invest in all assets of society, like human and social capital, which in the end establishes a higher quality of live. In order to achieve this Caragliu et al. (2011) say that the process is one of participatory action and engagement.

Next to this understanding of smart cities, Meijer and bolivar (2016) have analysed various papers on smart cities and came to the understanding of three ideal-typical definitions of smart cities. “smart cities as cities using smart technologies (technological focus), smart cities as cities with smart people (human resource focus) and smart cities as cities with smart collaboration (governance focus).” (Meijer & Bolivar, 2016, p. 396).

These ideal-typical definitions of smart cities point to different key components of focus for the city. The first definitions relies heavily on technological advancements to create a better city. The second as Meijer and Bolivar label it themselves is the human resource focus, of the city being smart due to the presences of smart people. And the last definition is the smart city through smart collaboration, like they call it, which has a strong governance focus.

Previously it was mentioned that one understanding of smart cities is a smart city through smart collaboration. This is leaning towards a governance focused explanation of the smart city. So from this point of view is it than that the governance of a smart city also differs from governance, so that a concept of smart governance is needed to explain the governance processes of a smart city. Willke (2007) states that smart governance entails the following: “Smart governance is an abbreviation for the ensemble of principles, factors and capacities that constitute a form of governance able to cope with the conditions and exigencies of the knowledge society.” (Willke, 2007, p. 165)

So the new challenges of the smart cities have also set new challenges for governance principles to be able to govern the smart city. And the concept of smart governance as a new form of governance that entails the ensemble of principles, factors and capacities to be able to guide the processes and actors that are involved in developing smart cities.

Furthermore, making use of ICTs, IoT-technologies and big data analytics are some of the key assets of smart city design. These assets are also able to play an important role in enabling smart governance (Hashem et al. 2016). According to Lin (2018) smart governance is by scholars defined as ICT-bases governance. Which can be seen as a collection of technologies, people, policies, practices, resources, social norms and information that interacts with each other to be of support to city governing activities. Thus in the process of creating smart cities, the tools and assets to establish the smart city, can be beneficial for other purposes. Other purposes like enabling smart governance. Organizations agencies and actors with common grounds can possibly be identified through the use of big data. In order for them to be easier connected which could potentially lead to collaborations among these actors. With these new collaborations new developments can take place to develop cities and countries (Hashem et al. 2016).

Bigdata analytics can in addition be of use to governments in establishing and implementing satisfactory policies, when they can learn through bigdata what the needs of the people are. Or instance in the fields of healthcare, social care, education and others (Hashem et al. 2016). However it could be argued whether these advancements of bigdata analytics are ethically desirable and should thus be pursued in smart cities.

However, others consider smart governance as good practices. In a way that involves citizens in transparent, participative and accountable governance activities (Lin, 2018). In addition to this less technological based definition of smart governance, smart governance refers to participation in decision-making, public and social services, transparent governance and political strategies and perspectives. Smart governance further consists of trades like smart, open and agile governmental institutions combined with stakeholder participation and collaboration on all levels through all branches of governing processes (Lin, 2018).

This all comes back to for types of conceptualisations of smart governance in existing studies. The first is governance of a smart city, the second is smart decision-making processes and the implementation of these decisions, the third is smart administration and the fourth is smart urban collaboration between various actors in the city (Meijer & Bolivar, 2016; Lin 2018).

The model in fig. 2.1 is an adaptation of a model of smart governance by Bolivar and Meijer (2016), in which they included three dimension:

- *Strategies for implementing smart governance (Visions and actions):* an integrated vision/idea and actions (e.g. legislation, policy, etc.) that are needed to transform the organization toward forms of smart governance.
- *Smart governance arrangements:* the use of technology and innovation capacity for collaboration and participation, international coordination, decision-making, and e-administration in connected organizational processes.
- *Outcomes of smart governance:* first order outcomes (changes to government organization), second order outcomes (changes in position of government and other urban actors), and third order outcomes (improvements to the city). (Lin, 2018, p. 802).

Lin (2018) than considered it important that the influence of contextual factors on smart governance should be taken in to account. This led to the implementation of two new dimensions, Context and ICT.

- *Contexts:* is implemented to cover the differences in institutional contexts, like differences in democracy between countries. The other part of the context covers economic social and environmental challenges, that are associated with urbanization and are considered key drives for smart city developments. They have an influence on the smart governance model that is used even so as to the related strategies and actions. Institutional and social context are in planning literature viewed important for their contribution to the innovation capacity.
- *Information and Communication technologies (ICTs):* the existing of ICT infrastructures provide the necessary basic foundations for the implementation of smart governance. ICTs are delivering the technical solutions for smart governance to succeed.

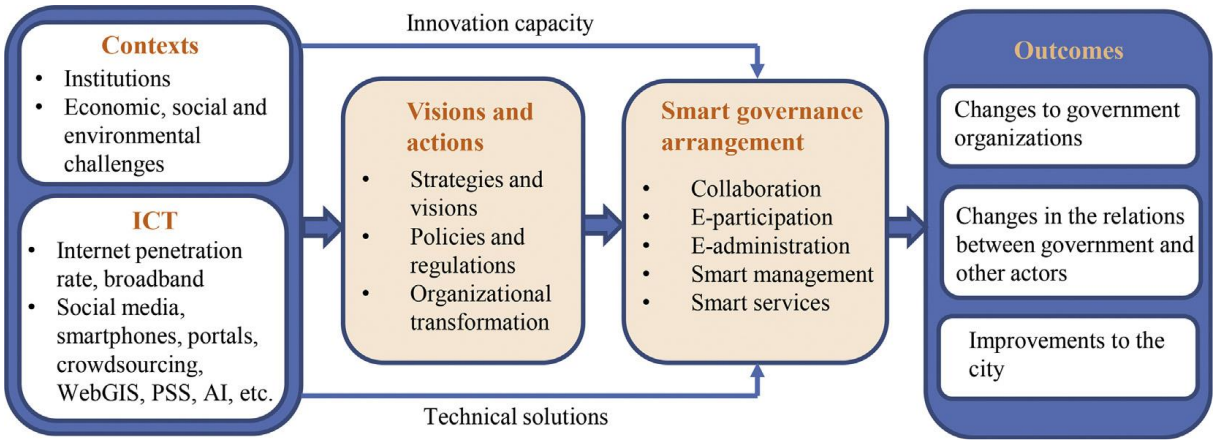


Fig. 2.1. A framework for understanding smart governance in different contexts. (Lin, 2018, p.803).

This model is therefore helpful in understanding different configurations, characteristics and impacts of smart governance. The most important aspects of smart governance are unified in this model, so that it is clear what to look for in the smart governance setup of an organisation.

Smart city governance is something that should be organised in the context of time and space, due to its local institutional and spatial context. Therefore it should also take notice of different forms of cooperation and partnerships involved in the development of smart cities. Thinking of public-private-partnerships and self-governance, as forms to have different stakeholder groups working together, like government, market parties, civil society (citizens) and knowledge institutions. Which could be beneficial in reshaping the spatial urban environment (Jiang et al., 2019). This means that developments take place in productive interactions within and between networks of urban actors, like businesses, citizens and NGO's. Smart urban governance also refers to city governments being able to attract human capital and mobilizing this capital into collaborations between various organized and individual actors, with help of ICTs. There is a focus on utilizing ICTs to improve stakeholder participation and implementing legitimate public policies. Smart city governance or smart urban governance is also a process of thinking about the shift that ICT innovations will cause to the public realm (Edelenbos et al, 2018).

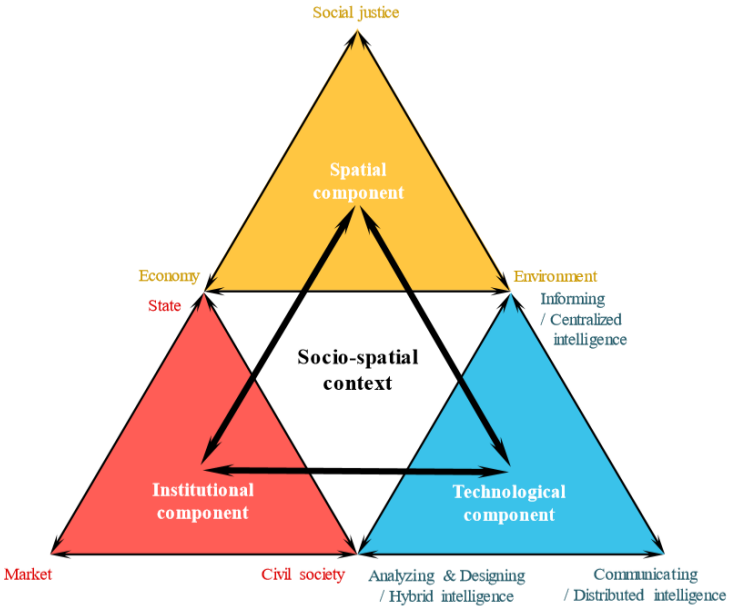


Fig. 2.2: A transformative and integral governance approach to dealing with sustainability challenges in urban space (Jiang et al., 2019).

The figure presented above (fig. 2.2) is a holistic framework based upon the framework of Bolivar and Meijer (2016) and Lin(2018). Jiang et al. (2019) aimed to incorporate contexts, components and purposes.

The framework for smart urban governance developed in this paper comprises the socio-spatial context of urban challenges associated to smart cities, three interlinked components (institutions, technology, urban space) and four sustainability-oriented purposes (economic, political, ecological and cultural). The internal logic of this model suggests 1) a potential relation between the sociospatial context and smart urban governance arrangements, 2) that the potential effect of the socio-spatial context on smart urban governance arrangements relies on the interaction between technology, institution and urban space, 3) that smart urban governance arrangements intends to realize desired purposes, and 4) a feedback effect of smart urban governance purposes (or outcomes) on the socio-spatial context. Based on this, smart urban governance can according to Jiang et al. (2019) be defined as: "a dynamic institutional arrangement, operating within certain socio-spatial contexts, and enabling with the help of smart technologies public participation and stakeholder collaboration to accomplish urban sustainability" (p. 259). It is aiming specifically at the transformative governance of the socio-spatial context of urban challenges associated to smart cities via technological innovations and opening up new possibilities for city transformation. To this end, the meaning of smart urban governance is conceptualized from three dimensions: purposes, components and contexts.

The governance focus of smart cities steers in the direction of an interactive and networked dimension between various stakeholders in the urban domain. The city governments in this regard are increasingly going towards a user-centred view, that treats citizens and other stakeholders as key assets for the development of smart cities (Edelenbos et al, 2018). In order to become smarter, the transformation of city government needs to happen in significant ways to engage with the entire network of actors. From here on it becomes important to identify smart governance capacity, this means identifying and incorporating human capacity and ability, relational capacity and organization capacity to make smart urban governance work (Edelenbos et al, 2018). This is also what Granier & Kudo (2016) noticed in scientific research, that there is a lack of focus on the role of citizens in smart cities. Traditionally it has been neglected and as Granier & Kudo (2016) also state: "both sustainability and citizen participation are not analysed as issues of political struggle and debate but rather as desirables for a 'good society" (p. 67). This good society could be a subtle reference towards engaging in citizen involvements just to please, but not to learn from it or let it have a difference on outcomes.

Hashem et al. (2016) have noted some other limitations to smart urban governance, as they view the collection and analysis of data to be a difficult task in its application. At this moment it is viewed as a limitation of how smart urban governance is able to operate. This can be the result of the development that smart urban governance is going through and that it is not yet reached its full potential. This could be because smart urban governance is still lacking some kind governance aspect specifically designed at towards dealing with data. Data in all kinds of definitions and meanings, problems with data ownership, privacy concerns, data management and storage.

2.2.2. E-participation and planning support systems (PSS)

In the era of city leaders adopting smart city concepts to develop cities across the world, with diverse definitions, goals and approaches of 'smart city'. With these developments in the emerging field of smart cities planning support systems are being developed or applied to help pursue this goal. Therefore it could be said that smart cities and planning support systems are connected according to Geertman et al. (2015). However this relationship has not been examined in great depth jet. Next to this relationship, PSS could poses the ability to form a bridge to society in involving them in the planning process, which could lead to E-participation.

The concept of planning support systems stems from a well-defined field of scholars and professionals starting from the late 80's (Geertman et al., 2015). A definition of PSS is; "geo-information technology-based instruments that are dedicated to supporting those involved in planning in the performance of their specific planning tasks." (Geertman et al., 2015, p.2.). There is a distinction to be made between the field of GIS and PSS, GIS is a general-purpose tool applicable for many spatial problems. But PSS are specifically focused on supporting specific professional planning tasks (Geertman et al., 2015). Zhang et al (2019) follow the same point of view that computer-aided design (CAD) and GIS are explicitly designed for experts, which makes them too difficult for the general public. And that PSS are designed as subsets of geo-information technologies aimed to support those involved in planning to manage plan-related problems.

PSS have in the last decade gone through many technological advancements, however this has not led to utilization by planning institutions. Most organizations lack both the knowledge of and the experience to apply PSS. There are two reasons identified for this underutilization. The first reason is that it is believed that technology implementations takes time and has to tackle several obstacles to be successful. The second reason is the notion that PSS are not sensitive and attuned enough for the specific planning tasks at hand (Pelzer et al, 2015). It could be said that there is then a problem on how the role of PSS is perceived. This problem can partly be attributed to the scientific-analytical view on the role of planning support systems with the emphasis on the support technology itself instead of the added value for the planning practice. Pelzer et al. (2015) make a case for a different perspective towards PSS in spatial planning practice. Leading to a better combined emphasis consisting of scientific-analytic and communicative approaches to planning.

To achieve this, attention needs to go out to a couple of aspects and factors. These aspects consist of 'planning-conceptual' aspects and explanatory factors for planning support. The later needs to include the position of the users and participants but also the political planning context. Another key-factor that is in need of more attention and development is knowledge and information (Pelzer et al, 2015). There is a distinction to be made in two types of information according to Couclelis (2003):

> [There are] two types of information-processing system: the type that is capable of converting the information it receives into knowledge and the type that is not. … The first kind of information-processing system, the kind capable of converting information into knowledge, is we; the GIS is of the second kind. (p. 165)

In this context a definition of knowledge can be needed, Pelzer et al. (2015) translate this in to the following:

> Both the stock of data and information a planning stakeholder possesses, but also the interpretations and appreciations of data and information a planning stakeholder (to a certain extent) *considers to be … correct.* The last part of the definition—*considers to be correct*—is crucial, since it relates to the validity of the knowledge used in planning. (p. 640)

The point they make here is that of the validity of knowledge claims. Rydin (2007) argues that knowledge claims presented by different stakeholders in the planning process need to be tested on their validity, before one acts upon the information presented. It is also important to note that different knowledge claims can coexist without there being any kind of hierarchy assigned to these different claims. It can definitely be the case that these different claims complement each other (Rydin, 2007). From these points a new perspective towards planning support needs to be formulated. Where scientific-analytical ignores the communicative, political and participatory nature of planning practices nowadays. And other planning support roles becoming more important, like tactical, learning and

interactive roles. With this broad perspective of planning support, it becomes important to test the knowledge claims coming from these different aspects (Pelzer et al., 2015).

2.3. Data Governance

The next section is about data governance, this section is incorporated because the smart city is associated with the use of ICTs and the internet of things (for which the input and collection of all sorts of data is important). Through the use of an Urban data platform it is possible to collect and manage data on smart cities and facilitate many of the new facilities that are developed for smart cities. Valid concerns with these bigdata developments are; data gathering, data privacy, data ownership and management. To which something in the form of a governance structure focussed on Bigdata could be a solution.

When smart cities are mentioned big and open data is almost the first thing to follow. But what does that mean? " 'Big data' covers a range of phenomena resulting from the collection, storage, linkage and analysis of various kinds of digital information." (Edelenbos et al., 2018, p. 37). Data can be gather of just any sort of sector and data knows three forms, data is either directed, automated of volunteered. Directed data is data that is produced by actors that use devices to capture data about a person or a location from a surveillance point of view. Automated data is data is produced automatically. Automated through the use of particular digital devices like mobile phones, or software that keeps track of how people use the internet, or registers from public transportation cards. Last there is volunteered data, this type of data is provided by users of for instance social media, most commonly in the form of texts and visuals (Edelenbos et al, 2018). One of the reasons that these types of sources are called 'big' is because of the sheer volume, but that is just one of the characteristics. Other characteristics are typified by the seven V's of Rijmenam (2013), Volume, Velocity, Variety, Veracity, Variability, Visualization and Value.

The second thing that is mentioned about data is 'open', this refers to the possibility that big data is accessible to the public. But this mean that big data is open, however most is not. There are steps being taken to create access to data online from public sectors as a way to promote transparency and data-empowering citizens and civil society. This manly entails data about, demographics, housing, transport from public records that is registered by authorities (Edelenbos et al, 2018). What open data is trying to achieve is making underlying data and also underlying data assets as part of a wider ecosystem available. So that it can be used by external users, whether citizens, software developers, or other businesses, to co-design a great variety of applications (Barns, 2018).

A starting point of the concerns with smart cities comes from the positive connotation of smart cities that they stand for developments that make our lives better and easier thanks to the application of ICTs in urban systems. But the smart city paradigm tends to underestimate the complex governance dilemmas that emerge from the availability of big and open data and smart ICT applications. It could be said that an intriguing paradox arises with smart cities, on one side there is the enormous potential to increase liveability, however on the other hand there is the risk of creating very complex urban governance dynamics (Edelenbos et al, 2018).

To give cities and governments of cities the opportunity to fully utilize all the data that can be accumulated in its public spaces and other urban environments there is a need for a service, call it a platform if you want, that makes this possible. These platforms are referred to as urban data platforms, and examples of these platforms make use of elements form the 'Gov 2.0' or open government movement according to Barns (2018). Where there is a need to go beyond the traditional compliance model where local governments seek to measure the city's performance against targets and regulatory frameworks. Because these earlier measures from 'government as platform' resulted in limited space

for external views or data access and only monitoring of 'performance'. Rather than opening up space that enabled co-development of data services with citizens and software developers. Barns (2018) further advocates that what is interesting to research about urban data platforms isn't necessarily what their abilities are in terms of visualizations and analytics or other services offered by the platforms. But that it is more interesting to reveal the value and uses that there are of urban data by city governments and what this entails for governance systems for cities. There are distinctions to be made between the platforms that have been developed in recent years. There are examples of data showcases (dashboards) initiated by cities but also independent services run by universities, like the University College London's 'CityDashboard'. The independent dashboards are more focussed on understanding the city than on benchmarking performance. A second example are Data services (Datastores and marketplaces) that facilitate the release of government data in open data formats. They differ in that they prioritise the accessibility of government data as an asset or input to be used in wider innovations. The City Data Exchange of the City of Copenhagen is a Datastore and is run by the city in cooperation with tech firm Hitachi. A third example of an urban data platform are Score Cards (CityScore). This type also focusses on monitoring progress and performance against indicators and targets, and are used to track and communicate about the progress of a 20-year planning strategy (Barns, 2018).

The two movements of 'smart ciy 2.0' and government as a platform agenda have emphasized the need to invest in tools and services that support wider access to a range of data assets consisting of government open data, citizen data and private data. That further encourages investments in collaborative developments for digital services with researchers, software developers, citizens and others. Because the dashboards and other platforms that have be designed lack a certain functional scope and miss out on stakeholder engagement (Barns, 2018). Ultimately the added value of an urban data platform should be to support city governments in cultivating partnerships in a landscape of public and private data, citizens, software developers and others. This aim of urban data platforms together with data governance agendas support a more collaborative character for smart urban governance.

Data governance is in this scope important because according to Cheong & Chang (2007, p. 1001) "data governance defines policies and procedures to ensure proactive and effective data management." Furthermore "The adoption of a data governance framework also enables collaboration from various levels of the organisations to manage enterprise-wide data." In this case enterprise-wide can be exchanged for city wide. Cheong & Chang (2007) also discuss who should drive the data governance program, either IT or business officers of a company. They conclude that the quality of the data, whether it is customer or spatial data, is important to secure and that this should be a responsibility of the business. Which means that the data governance program is driven by the business, in this case the city government or provincial or national depending on the scale.

2.4. Conceptual framework

In the conceptual framework the relevant theories on smart urban governance are combined with the societal actors and parties that are involved in smart cities. In this conceptual framework (fig 2.4) the presumed relations of the various key components of smart urban governance are shown. There have been three major different key components identified that are presumed relevant. These components consist of several underlying parts, that influence the key components.

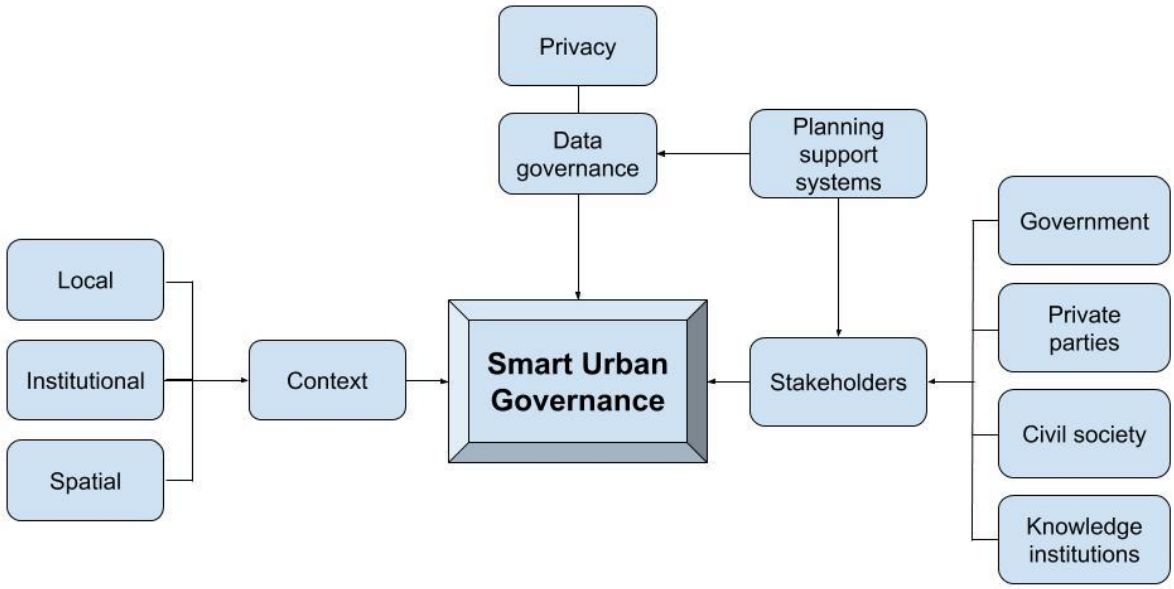


Fig. 2.4: Conceptual framework

The first component is context, with three levels of context (local, institutional and spatial). For smart urban governance to function it is necessary to understand in what context the processes take place. Therefore the distinction between the local, institutional and spatial context need to be made clear and understandable. Context is incorporated by Lin (2018) in the framework to understand smart governance. When the parameters of the context are clearly set out, it is easier to understand the different relationships of actors and how they work with or against each other.

Second are the stakeholders, this covers the actors involved in the development of Brainport Smart District (BSD) (Government, private parties, civil society / local residents and knowledge institutions). This is a key component because in this research the understanding of governance by Rhodes (2007) is used. Who sees governance as governing through networks of actors. A network broader than governments, that covers non-state actors including both public and private actors. Brainport Smart District is keen on creating a network of actors consisting of Government, private parties, civil society and knowledge institutions. This network is involved in decision-making processes and is thus an integral part of the smart urban governance structure of BSD.

Third is Data governance, since smart is associated with the use of ICTs and the internet of things (for which the input and collection of all sorts of data is important). Hashem et al (2016) point out that bigdata analytics can help governments establish and implement satisfactory policies. Because through the use of bigdata that is collected in the city, governments are getting acquainted with the needs of the people in terms of health, social care, education, and so on (Hashem et al. 2016). Within BSD they are working on an Urban data platform, to collect and manage data on the smart district and facilitate

many of the new facilities in the district. A valid concern with gathering data is privacy, this is a concern among every actor of BSD and it is something than can have an influence on the smart urban governance structure of these developments.

Next to these three major components there is one component that interacts with the other components. This is the role of planning support systems (PSS). PSS are mentioned in the framework of Lin (2018) as belonging to the technical solutions that support smart governance. But also in the smart urban governance model of Jiang et al. (2019) the technical component is shown, with several ways to use the technical components. Planning support systems enable these because they can be used as communication tools to the actors of the network. For instances with the creation of an online community where project details will be published to trigger discussions amongst the actors. Or this community can be the starting point of bottom-up initiatives, when future residents find connections upon which they want to collaborate. But PSS can also be used in for instance 3D modelling of the neighbourhood so that future residents can see what is being developed and they can also give direct input to change certain things. This can then be implemented in de 3D model and create a discussion. Next to the use of giving examples of the neighbourhood to future residents. The data gathered on the Urban Data platform can be used to generate big data sets for the 3D modelling of changes to the neighbourhood.

3. Methodology

In this chapter the methods for researching smart urban governance within new smart city developments and living labs will be discussed. First the method of case study research will be introduced and explained with the selection criteria for the case studies. Second, an overview of the general research strategy and the methods and techniques will be discussed, third the methods for data collection and analysis will be introduced. The last part of this chapter is the operationalization of the research question.

3.1. Case study research

Case study research is in the basis a detailed and intensive analysis of a single case (Bryman, 2016, p.60). The case is an object of interest in its own right, mostly associated with a location, like a community or organization. By doing research focussed at multiple cases, of which one is studied extensively. With interviews with actors of this case and a social network analysis of the case, it is possible to cover the complexity of the planning processes that take place in these smart city developments.

3.1.1. Selection of case studies

The research materials used for this research are mainly the case study of Brainport Smart District (BSD) in the municipality of Helmond, The Netherlands.

The case of BSD is selected for this research because the smart city development is highly ambitious on many levels. Their definition of the smart city district that is being developed almost combines the three ideal-typical definitions of Meijer and Bolivar (2016), “smart cities as cities using smart technologies (technological focus), smart cities as cities with smart people (human resource focus) and smart cities as cities with smart collaboration (governance focus).” (p. 396). The first driver of the district is technological advancements, but also to be a place within the Brainport region of Eindhoven for knowledge workers to live. But a major selling point for BSD is the way they want to develop de smart district, this aligns with the last definition of Meijer and Bolivar (2016), cities with smart collaboration (governance focus). BSD wants to develop the district with a quadruple helix type of organization. This means having stakeholders at the decision-making table form the following groups: governments, private parties, knowledge institutions and civil society.

In addition BSD is an interesting case because they have the ambition to create the smartest neighbourhood in the world. They want to achieve this over a time period of 10 years, in which they will have realised 1500 houses and 12 hectares of commercial/industrial spaces. The plan is to realize a portion of the 1500 houses and commercial space every year, and with each year the houses get ‘smarter’. So that when the entire project is finished in 2028 the last houses that have been build are still the best that could have been build.

Another reason to do a case study about Brainport Smart District is because I am in the position to obtain a lot of information about BSD due to the internship that I have with the Brainport Smart District Foundation. Through this internship I am able to have contact with many of the stakeholders involved in the development. And set up semi-structured interviews to gain insights into the connections that these actors have with each other and how the organisation is working as a whole.

In addition to the in depth study of Brainport Smart District (BSD) it will be interesting to compare BSD to some other smart districts that are being developed, these cases are:

- Merwedekanaalzone, Utrecht

The case study of the Merwedekanaalzone in Utrecht is subject of this research because, according to the municipality of Utrecht they started with a design-based experiment called 'Slim City' with the Merwedekanaalzone as first district to cooperate. The initiative is to explore how technology can contribute to better urban development, with the ultimate goal to achieve an urban integrated digital platform. This platform should be able to facilitate all kinds of area data and on which you experience different scenarios of the future, especially for residents to shape their ideas (Slim City, 2020). The development of an urban integrated digital platform has similarities with the development of BSD's urban data platform. It is therefore interesting to compare these case studies later on in the research. Next to these characteristics of what the Merwedekanaalzone wants to accomplish it is important to mention how the area that is being developed is organised, in the way of landownership. The total area that is going to be redeveloped is owned by many stakeholders, it can therefore be quite a challenge to have one shared vision for this project (Janssen, 2018).

- Living lab Scheveningen, The Hague

In The Hague (The Netherlands) they have allocated an area to experiment with 'smart city hubs', this area is known as Living Lab Scheveningen. The main goal of the project is to improve the appeal of this part of the city by making accommodating the technologies in street furniture. The municipality of The Hague wants to test the effects of this smart city infrastructure on municipal processes. But also investigate how they can connect the business community to the infrastructure (The Hage Security Delta [HSD], 2020). In the first stages the municipality is in the lead and operating most of the activities, they will also conduct its own research into social issues and the impact of this innovation on its own processes. In later stages other parties will be able to join, like companies and citizens initiatives. (HSD, 2020).Why the municipality of The Hague chose for Scheveningen to experiment with smart city concepts is because Scheveningen is an area where people live, work and spend their free time. There is a beach with a boulevard, but also a harbour with industry. Living Lab Scheveningen is part of the program Smart City Den Haag, and is the first location in The Hague where smart city is being implemented and researched (Gemeente Den Haag, 2020).

The information about The Merwedekanaalzone and Living Lab Scheveningen will come from online information and documentation about the developments. These sources are best available to obtain the information needed to be able to make a comparison between BSD and these two other cases.

3.2. Methods

To conduct this research the following methods will be used; Literature review, (policy) document analysis and semi-structured interviews. The (policy) document analysis will be used to research all three cases, for BSD the other methods listed will also be used. To research BSD semi-structured interviews will be held and analysed in addition with a social network analysis of the actors involved with the development of BSD, to better understand the social network and make a visualization of the governance network.

The literature review will first be used to establish what is already known about the topic researched here and to guide how to frame the review in order to act as a background for this research and to justify it (Bryman, 2016). Than it will also be logical to write some sort of narrative review to come to the overview of the field of study in this research (Bryman, 2016, p.91). To take these first steps of literature reviewing a bit further for this research it would be interesting to explore a systematic review that reviews literature that adopts explicit procedures (Bryman, 2016, p.98). This is done because Bryman (2016) also mentions that systematic reviews seek to answer the question 'What works'. For

this research the question "*How does smart urban governance contribute to realizing smart city developments and improve the governance processes, better outcomes and more openness for citizens?"* feels similar to what works.

3.2.1. Document analysis

Another part of this research strategy will be to do a document analysis, consisting mainly of policy documents but also documents from the organisation of 'Stichting Brainport Smart District' this is the project office that supervises the development of Brainport Smart District. This is a distinction also made by Bryman (2016) that there is a differences between official documents form the state and official documents from private sources. A way to further explore these documents is doing a discourse analysis like Hajer (2006a) suggests.

Furthermore document analysis was done in order to retrieve the necessary information about the two other cases researched, The Merwedekanaalzone and Living lab Scheveningen (The Hague).

3.2.2. semi-structured interviews

Then this research will be continued with conducting expert interviews with parties involved in the realisation of Brainport Smart District. The strategy of how these interviews will be executed is semi-structured (Bryman, 2016, p.468) in order to give some flexibility to the way of interviewing. Not only for the interview itself but also to evolve the interviews as the research progresses (Bryman, 2016, p.469). For the interviews it is important that representatives from each stakeholder group are spoken to. In order to clarify their role with in the governance network, and the ways they are going to contribute to the realisation of Brainport Smart District. But also to understand how they make use of the smart urban governance implementations for the realisation of this smart city development. An overview of questions asked during the semi-structured interviews can be found in Appendix 2.

To analyse the data from the semi-structured interviews the analysis tool Nvivio will be used. With this tool it is possible to categorise the findings of all the interviews to have a clearer overview of the subjects that came up during the interview. In this way it is easier to combine statements of the different interviewees, in order to process it in the textual analysis in the remainder of this research.

3.2.3. Social network analysis

To assess how the actors function in the development of Brainport Smart District, a social network analysis will be done. With this type of analysis it is possible to examine the relations among actors, how actors are positioned within a network, and how relations are structured into overall network patterns (Prell, Hubacek & Reed, 2009). A social network is a set of socially-relevant nodes that are connected by one or more relations. The units that are connected by the relations of the patterns that are the subject of the study, are nodes or network members. Most commonly these units are persons or organizations. (Marin & Wellman, 2009).

Social network analysis is an extension of current methods of stakeholder analysis, which according to Prell et al. (2009) have some limitations. This mainly addresses the way of how stakeholders are identified and categorized, a subjective assessment of their relative power, influence and legitimacy. These methods often overlook the role that communication networks play in categorizing and understanding the relationships of the stakeholders. These limitations can be overcome by Social network analysis (SNA) (Prell et al. 2009).

An early challenge for a network analysis is defining which nodes to include. One could identify a group which is of interest to them, but knowing which individuals to consider as relevant can be tricky. There are three approaches suggested to deal with this; a position-based approach, an event-based approach

and last a relation-based approach. These approaches do not exclude each other, and are commonly used in combination (Marin &Wellman, 2009).

After identifying network members, the relations between the nodes must be identified. There are four broad categories of relations identified; similarities, social relations, interactions, and flows (Marin & Wellman, 2009).

- Similarities: occur when two nodes share the kinds of attributes frequently studied in variable based approaches, such as demographic characteristics, attitudes, locations, or group memberships.
- Social relations: include kinship or other types of commonly-defined role relations (e.g., friend, student); affective ties, which are based on network members' feelings for one another (e.g., liking, disliking); or cognitive awareness (e.g., knowing).
- Interactions: refer to behaviour-based ties such as speaking with, helping, or inviting into one's home. Interactions usually occur in the context of social relations, and interaction-based and affective-based measures are frequently used as proxies for one another.
- Flows: are relations based on exchanges or transfers between nodes. These may include relations in which resources, information, or influence flow through networks. Like interactions, flowbased relations often occur within other social relations, and researchers frequently assume or study their co-existence. (P.12)

Understanding social relationships askes for more than knowing how to measure some characteristics of networks, like density of their interconnections. Marin & Wellman (2009) have identified some guiding principles of network analysis. The first is; relations, not attributes. Social network analysis draws from the opinion that causation is not located in the individual but in the social structure. Since attributes (like race, gender, or education) are inherently contained within the individual / actor and not between actors. Second is; networks, not groups. It is important to define the boundaries of the network, with keeping in mind that nodes are not treated as belonging only to sets of mutually-exclusive groups. It is an easy oversimplification to say that group members are discretely bounded of mutually exclusive members. Which then makes the importance of differing levels of group membership and cross-cutting ties invisible. When focussing on the networks and not groups, you can examine the strength and nature of connections. And third; relations in a relational context. This means understanding the effect and meaning of a tie between two nodes in a broader pattern of ties withing the network (Marin & Wellman, 2009).

Within social network analysis there are different perspectives and ways to develop theories, formalist theories and structuralist theories. The main focus of formalist theories is describing the mathematical form of social networks. Studying the effects of forms and the causes of these forms. As for structuralist theories have a focus on how patterns of relations can shed light on substantive topics within disciplines (Marin & Wellman, 2009). For this research the perspective of structuralist theories and especially the approach of looking at network causes of phenomenon of interest is the way to proceed.

The chosen dimension for this research is that of a whole network structure, which takes a bird's eye view of a social structure, where al node types of the network are of interest. It comes down to analysing more than one relation, and finally stacking these relations into one single network such as a workplace (Marin & Wellman, 2009). In this research the network of a multi-level partnership between governments, private parties, universities and civil society. Collecting data on multiple types of nodes happens through two-mode network data. Where one mode consists of governments and the other mode of private parties, or the universities involved or civil society as a group.

From the social network analysis a certain classification can be attributed to a network, Borgatti et al. (2009) has defined for categories: transmission, adaptation, binding and exclusion. Each category presents how a particular kind of network can cause particular outcomes. Thinking about the outcomes of networks and what kind of networks are caused by different forces ask for the need to make a connection between sociological concepts onto particular network forms (Marin & Wellman, 2009).

The collection of data can take place through a couple of forms, through observation, from archives and historical materials, or trace observations of electronic communications, or through surveys and interviews. It is important to note that in interviews respondents are asked to report with whom they share relations. This can be done by presenting a list of network members, but sometimes this is not possible when relations are not clear yet. So respondents are asked to recall with whom they share relevant relations. It can also be needed to ask for the characteristics of these relations (Marin & Wellman, 2009).

In the interviews there will be a section focused on gathering information about the social network structure where the respondents are involved in. The questions asked are in line with the following:

With what parties are you in contact with, like governments, private parties, universities, civil society?
How often are you in contact with these parties? Daily, weekly, monthly?
What is the nature of these contacts?
How is the cooperation with these parties?
How is the cooperation within the BSD Foundation? Or, 'How is the cooperation with the BSD foundation going?' Depending on whether the person is directly involved in the foundation of is working with the foundation form one of the private parties or governments or others.

When the data of the network is collected the next step is to analyse the data. This means calculating measures of the properties of network positions, dyads and networks as a whole. This covers the number of relations a node has and the extent to which a node is a bridge to other nodes. Dyads can differ in the strength of their tie: Homophily, the similarity of the two nodes; multiplexity, their content and number of relation types shared; or media multiplexity, the number of communication media used. Networks van also be studied by the way that they are divided into subgraphs. This is the case when networks consist of multiple components. Components are sets of nodes that are tied to one another in a direct or indirect way, but have no direct ties to nodes of other components (Marin & Wellman, 2009).

To perform a social network analysis in this research the software package of UCINET 6 will be used (Borgatti, Everett & Freeman, 2002; Borgatti, 2002). This package is designed to study social networks and whole network data, and also represent the networks visually. UCINET 6 has a variety of network analytical tools, like centrality measures and with NetDraw the social network data can be visualized (Apostolato, 2013).

3.3. Data collection

The methods for data collection mainly come back to gathering scientific literature, gathering policy documents and expert interviews with experts and stakeholders involved with Brainport Smart District. The interviews are focused on gathering data about BSD, what kind of smart city development is it, who are the stakeholders, how do they cooperate, and in what kind of social network structure do they operate, what are their goals and how are they achieved. All the interviews have been carried out

by videocalls with the help of Microsoft Teams, because it was not possible to organize face to face meetings in the period of this research.

For the interviews with experts and stakeholders the following subjects have been part of this research:

Table 3.1: Interviewees for interviews about BSD.

Type of stakeholder	Institution	Who
Government		
1.	Municipality of Helmond	Alderman
2.	Province of North-Brabant	Chief Information Officer
3.	Stichting Brainport Smart District	Director
4.	Stichting Brainport Smart District	Project manager Data line BSD
Private Parties	**Company**	
5.	Henriks Coppelmans	Director of Development & Innovation
6.	Geodan / SBSD	Project manager
7.	Woonconnect	Director/ co-owner
Knowledge institutions		
8.	TU/E	Professor & Chair of Building Sustainability
9.	TU/E	Professor & Chair of Information Systems in the Built Environment (ISBE) group

In total 9 stakeholders of BSD have been interviewed, representatives of governments, private companies developing houses and other projects in BSD and the knowledge institutions since the TU/e was also the initiator of this smart district.

Next to the semi structured interviews a short questionnaire was distributed to future residents that participate in the 40KavelLab. This was done in cooperation with the program manager of the participation line. This makes it easier to get responses from the stakeholder group consisting of (future) residents of this district, and to have a broader more grounded support for the claims of this stakeholder group. The questionnaire was made and distributed with the help of google forms. The sample size of this group were only seven participants. However they belong to the core group of this development and have the most interaction with Stitching BSD. Questions asked in this questionnaire are: questions about their household composition and where they live at the moment. Then followed some questions about characteristic aspects of BSD and how important these characteristics are for the respondents. This is asked on a five point scale from (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree.

I am interested in technology
I think a circular ecosystem is important for the future
I am interested in new forms of mobility
I see benefits from living in a smart neighbourhood like BSD

Then came questions about the process of the 40-KavelLab. Again asked on this five point scale from (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree.

I think it is a positive development that citizens / (future) residents are involved in the development of a new neighbourhood
I feel that there has emerged a real partnership with the 40 Land Lab, between us and future residents (foundation) as BSD developer
The contact with the responsible program managers from BSD is good
How often do you have contact with someone from BSD (program managers or others)?

To analyse the outcomes of this questionnaire the program SPSS will be used. Therefore the categories of the five point scale will be recoded from (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, (5) strongly agree in to: (-2) strongly disagree, (-1) disagree, (0) neutral, (1) agree, (2) strongly agree. This makes it easier to work with the data in SPSS.

3.3.1. Operationalization

As it comes to the operationalisation of the research question and theoretical concepts, on one hand it is expected that, depending on the subjects that are being interviewed, the respondents are largely familiar with how the theoretical concepts are framed. Due to the background of these respondents, and how they deal with the challenges ahead of them. But there is one stakeholder group the citizens (in this research, the participants of the 40-KavelLab) for which it will be important that certain theoretical concepts are operationalised in a way that they become understandable. In order for them to understand the questions asked and to respond in a way that they can make clear how they feel about the process of the project where they are involved with, and how they view the development of BSD.

On the other hand some theoretical concepts need to align with how they are perceived within the case of Brainport Smart District. So here some adjustment might be needed, but it is expected that that can be done without much alteration . A translation from how BSD perceives theoretical concepts in to how these concepts are presented in the academic world.

4. Case Study

4.1. Brainport Smart District

4.1.1. Local, Institutional and Spatial Contexts

In the city of Helmond, that is part of the metropolitan region Eindhoven and Brainport Eindhoven, and with about 90.000 inhabitants it is also the second largest city in this region. A new neighbourhood is being developed, which aims to be a smart city development. This neighbourhood is called Brainport Smart District (BSD). The idea of this initiative is to create a smart city that has a different approach towards smart city developments than is most common in day to day literature and execution. Within Brainport Smart District a smart city is ought to be developed through a different process than is usual, with a much more bottom-up approach than is currently known. Citizen participation is one of the key objectives to realising the city district. Next to the goal of becoming the smartest neighbourhood in the world (BSD, 2019).

At the start of Brainport Smart District seven different program lines were defined as the basis of the project, these program lines are: Circular neighbourhood, Participation, Social and safe neighbourhood, Healthy neighbourhood, Digital neighbourhood, Mobile neighbourhood and a neighbourhood that has energy (BSD, 2018a). In this way BSD wants to have an integrated approach for realising a smart city. Most smart city developments take just one of the aspects that are listed above, and in literature this then also is a smart city. However BSD wants to do more than just smart mobility or smart street lighting. Professor and Chair of Building sustainability of the TU/e (interview May 27 2020) explains how BSD came to live:

> *"For the TU/e I founded the Smart City program, to establish connections between researchers on this subject. Than came the thought to see if it is possible to put this in to practice, so that we can test and follow this real world testing area. This started the search in the province of North-Brabant, because it is convenient for us as Eindhoven based university. Eventually Helmond became the place to develop this district, because the municipality was very keen on cooperating."*

To give substance to the goals and ambitions of BSD, a Quality Book (Q-Book) was made. This Q-Book needs to help with making clear what is innovation and when is a project innovative enough to have a place in BSD. It was not the goal to create a checklist, but it was the goal to create a document that inspires people and companies to be innovative. This Q-Book describes BSD's expectations for the level of innovation of any proposal seeking a place within BSD. It includes ambitions, indicators and specific goals for all program lines as established by the BSD programs. Ambitions mean: "What we want to achieve; the dream; the vision". The indicators mean: "The means to realize the ambition, the subject". And the goals mean: "The tools to achieve this, if possible, with indicative numbers, percentages or levels" (BSD, 2020b).

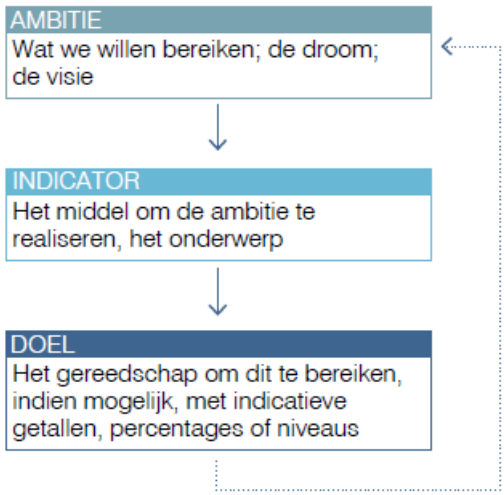


Fig. 4.1: Q-Book framework (BSD, 2020b, p.7)

Brainport Smart District (BSD) proposes that in order to realise the development of the smart district in Helmond a new approach to or even a new form of governance is needed. A new approach that goes further than common planning practices like public private partnerships. BSD has a unique DNA

through an integral and interdisciplinary approach with the goal of testing and implementing the newest developments. What is needed to realise this are the competences and interests of the research and business industry. But also to the role of the end users (residents and companies located in the district) are essential to the success of the project. This leads to a quadruple helix type of organization for the realisation of Brainport Smart District, symbolised in figure 4.2.

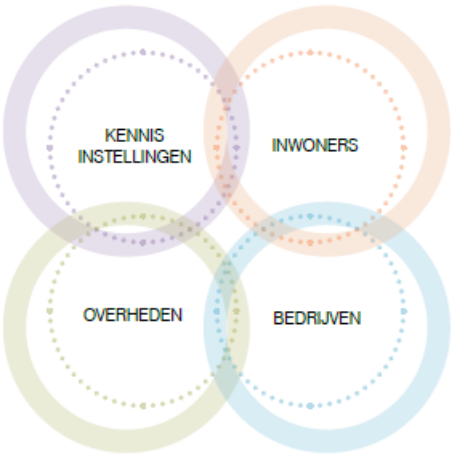


Fig. 4.2: Quadruple Helix, with Governments, Private parties, Knowledge institutions and Civil society / local residents. (BSD, 2020b, p.6)

At the top of the organization there is a governance structure that is common and well proven, this is the Brainport Smart District Foundation (Stichting BSD). But there is also a governance structure that is largely undefined, this is the governance structure that needs to govern the way of dealing with developing the smart city and data handling in the smart district. The idea of BSD was presented to cities in the Province of Brabant by the TU/e in search of an area where the district could be developed. Several cities were interested but the city of Helmond presented the best location, so the TU/e decided to partner with Helmond (interview with director of SBSD, June 6 2020). From here on talks started about how to develop this smart city district, in terms of how to set up the organizational aspect of this development. The ambition was to create an organization were all public partners could participate in, the best fit at this point in time was to set up a foundation (stichting in Dutch) this became Stichting Brainport Smart District. It was advised that the municipality of Helmond should found the foundation, and that they should take care of the statutes and the structure of the governance of the foundation. So that it is much easier for the other parties to participate in that foundation. This means that at this moment there is a board of this foundation consisting of the Alderman of the municipality of Helmond, the director of Brainport Development, the Chair of Building Sustainability of TU/e, rector magnificus of the Tilburg University and the Deputy of spatial environment from the Province of North-Brabant.

Fig. 4.3: Urban blue print of BSD (BSD, 2019, p.6)

When looking at some of the spatial components of BSD it made sense that BSD is being developed in Helmond. The municipality of Helmond offered a plot of land that was part of the zoning plan of the VINEX location of Brandevoort. In fig 4.3 the urban blue print is shown, in the bottom right corner is the already existing part of Brandevoort, the rest is Brainport Smart District. This greenfield is ready to see a development of 1500 houses and 12 hectares of business park. This helped in setting the goal for BSD. The goal for Brainport Smart District is formulated as "smartest neighbourhood in the world" and an aim of 1500 houses to be built until 2028. The alderman of Helmond has made it clear that Brainport Smart District is a living lab in which things may go wrong (Rood, 2019). At this moment in time, no houses have been built yet, the first years were dedicated to defining goals, ambitions and projects to achieve this district. This year there was a shift towards defining an implementation plan, to ensure that by the end of 2020 the first projects and houses are going to be built. Director of SBSD (interview, June 6 2020) said:

> *"this year we finally want to show what we have been working on, and that is only possible by building the first houses, so that is what is going to be aim for in 2020."*

Brainport Smart District (2018b) describes itself as "a smart city that is not the sum of individual components." What they mean with this is that they have the ambition to design the (Urban) architectural environment in conjunction with new technologies for mobility, health, energy generation and storage, sustainability and circularity in mind, all enabled by ICTs. Crossovers between these program lines need to be endorsed just like fig 4.5 is showing. Not one project that has the focus on one of the aspects, but a broader focus on more program lines. Furthermore, it is the goal to be a real live testing ground, living lab, for the developments of new systems, processes and services of a smart city.

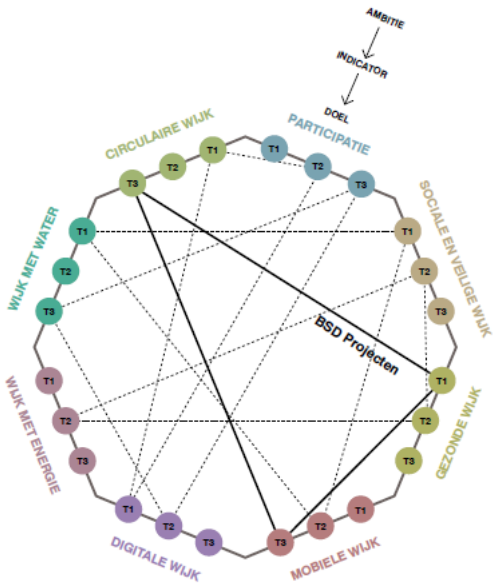
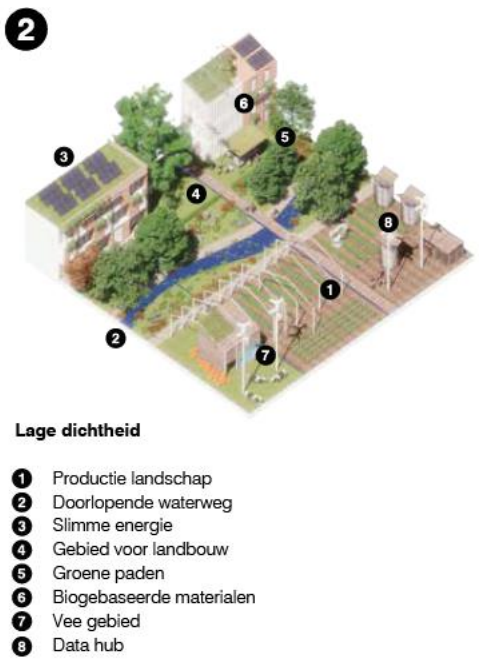


Fig. 4.4: establishing crossover between (BSD, 2020b p.11)

The urban blueprint of BSD is designed to consider distribution of urban networks in various scales, ranging from the regional scale of the whole neighbourhood to a single building unit. The distribution of densities and functions is also important so that it allows for the vision of BSD to be applied in a flexible, on-demand framework. It is tried to organise this in an inherent future proof mechanism that allows for changes and modifications of the plan over time. Following this line of thought, the vision tries to create a mix of programmes across the neighbourhood, for diverse use of the site and shortening the distance between living and working. This is shown in fig 4.5 & 4.6. Ideally this would result into a situation where each urban plot functions as a micro district, which stimulates community bounding. The ambition is also to create a variations in the density distribution of the neighbourhood, in order to create different characters of neighbourhoods. These varieties should offer different activities and lifestyles. Together with the earlier stated ambition the deliver on-demand flexibilities, changes to plans can be made if needed. When looking at the landscape strategy the aim is again to create a mix of landscapes. The ecology is formed by various building blocks to form a richly

composed landscape, with diverse nature reserves, production grounds and living environments. BSD wants to create an interconnection of various components for an integral and collaborative landscape (BSD, 2019).



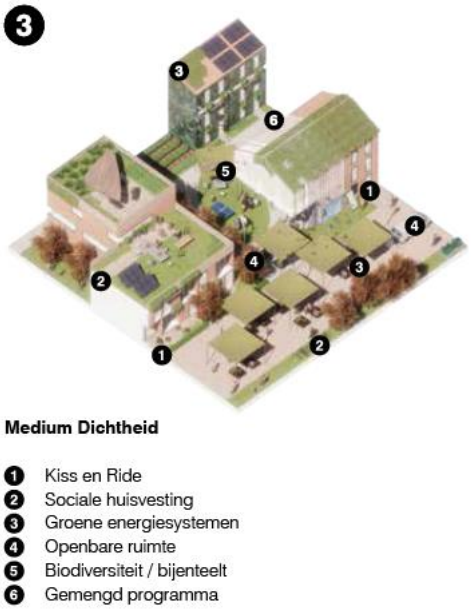


Fig. 4.5: Low density mock-up of BSD (BSD, 2020b, p.94)

Fig. 4.6: Medium density mock-up of BSD (BSD, 2020b, p.95)

4.1.2. Stakeholders

Within the development of Brianport Smart District there are four major stakeholder groups coming from the quadruple helix organisation type. These groups are, governments, private parties, knowledge institutions and civil society (local residents). The government parties involved are, the municipality of Helmond and the Province of North-Brabant. There are two universities involved, Technische Universiteit Eindhoven (TU/e) and Tilburg University. Private parties can get involved with BSD through a business challenge where they can pitch their ventures, and get selected to build, create or contributed to the development of BSD. The stakeholder group of the civil society is harder to grasp, this is mainly because there are no residents of the district yet. However, BSD is trying to give substance to this as concretely as possible by means of various projects, to initiate citizen participation.

Stakeholder relations

The quadruple helix structure of Brainport Smart District results in a complex organisation with different groups of stakeholders involved, and more stakeholders than is seen in more mainstream urban developments. In this case BSD started as a train-of-thought from a professor at the TU/e, and when other participants were found in the Province of North-Brabant, the municipality of Helmond and Brainport Development it became necessary to think about a construction/ organisation in which all these partners could cooperate with each other. As explained earlier this resulted in the foundation 'Stiching Brainport Smart District'. This foundation is a private law entity because that is how a foundation is organised according to Dutch law. However the participants of this foundation are basically public law entities, because the municipality of Helmond, Province of North-Brabant, The TU/e and Tilburg University are all public law entities, the only exception is Brainport Development. Therefore it is necessary that the Stichting BSD operates on many levels as if it were a public law entity. This means that for the tendering procedure, the foundation must follow the tendering procedure that applies to public bodies. All the operations carried out by Stichting BSD are located ate the interface of various legal forms, due to the public partners of this development. As director of SBSD (interview, June 6 2020) said;

> *"That means that we are a special foundation, so essentially private law. But because we are financed under public law, we have to deal with many rules from public law. A tender procedure is the most striking example."*

A second problem of the foundation, is that there is the problem of the administrative or democratic legitimacy of the Stichting Brainport Smart District. The Stichting is the party who is actually developing the district. However for the citizens of Helmond this is a situation that can be unclear to them, because in the public opinion the district is developed by the municipality of Helmond. This comes from the fact that the chairman of the foundation is the alderman of the municipality of Helmond. But officially the municipality could point to the foundation when something goes wrong, because it is an entity of its own. But for the public this is a situation that is unclear, and also a situation of which they can think that it is undesirable and therefore the municipality is still the one party that has the most responsibility.

This al led to the point that the Stichting Brainport Smart District has started research into possibilities to restructure or further develop the organisation to better fit the building phase. The reason why the Stichting is researching this is that with developing the district certain risks, in terms of gains and losses, need to be taken by the developing party. But it is difficult for a foundation to take these risks according to the director of SBSD (interview, June 6 2020). It could be a better fit to create a development company consisting of a limited company and a limited partnership. The limited company should then house the limited companies who are involved with BSD and are going to build the district. And in the limited partnership the public parties of the province and municipality take place. These possibilities are at this moment the subject of research for the Stichting BSD and there are no decision yet on how to continue and maybe change the organisation behind Brainport Smart District. The Stichting BSD felt the need to explore and research the possibilities they have to make changes in their organisational structure in making the step from thinking and designing to actually developing the district. The director of SBSD said that making the connection between being innovative and developing innovative things in BSD and just developing something in the spatial domain is a difficulty coming from the smart city paradigm. Because in the real world so far, it seems difficult to make crossovers between the innovations and spatial developments.

The Stichting BSD has an advisory board that is not integrated in the foundation, this board is called the Quality-team most often referred to as the Q-team. What the Q-team does is they check and

encourages the foundation and its board to do its work as well as possible. In addition, they check and stimulate the projects presented by companies to be developed within BSD. Next to being an advisory board to the Stichting BSD the Q-team is also an advisory board to the College of Mayor and Alderman of the municipality of Helmond. According to the 'Verordening Quality Team Brainport Smart District' the Q-team is an independent advisory board (Gemeente Helmond, 2019). The guiding principles for the Q-team are set in the Quality-book. The Quality-book (Q-book) is written by the Q-team in cooperation with the Stichting BSD, and it is at this point approved by the Q-team, and the board of Stichting BSD. Later the municipality will also approve the Q-book, so that it is uniformly supported and known what the goals are. This Q-book will also be provided to all the companies wanting to collaborate in BSD, so that they can conform with the guidelines. The CIO of the province of North-Brabant (interview, Jun 6 2020) explains the following about the Q-team:

> *"The big question is how do you deal with such a Q-book? Before you know it, it turns into some kind of checklist that you keep next to each project. And if it does not meet these requirements, then it is not allowed. However I think it is a bit more dynamic. At this moment it is a snapshot of what we think is important and there are ambitions, targets linked to. But it may well be that practice shows that we have to adjust the Q-book. Which has been made clear from the beginning that the room to do so is available."*

The Stichting Brainport Smart District can be seen as the main stakeholder in this governance network, through that the Stichting BSD acts as the prominent developing party. The Stichting BSD also consists of several partners that are stakeholders in this development. One of these partners is the TU/e, this can be seen as the founding party as a professor from this university started this project. Next to the Technical University of Eindhoven a second university is part of this development, this is Tilburg University. Together they represent the knowledge institutions in the quadruple helix organisation. At this point the involvement of the Tilburg university is limited to a position in the board of the Stichting BSD and a position in the Q-team. The TU/e is more involved in BSD, next to positions in the Board of the Stichting BSD and a position in the Q-team, some professors are involved with projects that have started, or are closely involved with activities of some of the seven projectlines from BSD. One professor that is closely involved with the Data project line is the Chair of Information Systems in the Built Environment (ISBE) of the TU/e (interview with professor & Chair of ISBE TU/e, May 19 2020). So he has contacts with the project manager and -leader of Stichting BSD, but also with actors that are involved with the development of a PSS system called the Digital-Twin. Within this project there are contacts with the private parties that are developing the PSS, 'Geodan' and 'Woonconnect (de Twee Snoeken)', the Province and the municipality of Helmond. These moments of contact for the chair of ISBE take place in a steering committee, that takes place once every four to six weeks. And sometimes in a smaller committee to discuss subjects in more detail, but these are not regulated in a schedule.

The next stakeholder group involved are the private parties, the private parties are not a member of the foundation. They get involved with BSD through a business challenge, in the business challenge companies have the opportunity to submit an idea or project that they would like to develop in BSD. These projects are then assessed whether they meet the requirements set by BSD in the Quality Book and whether the project adds something to the district that is beneficial and innovative. At this point there have been 4 waves where companies were given the possibility to submit their innovative ideas. From the business challenge a period of intention is started where the company conducts a feasibility study, that in the end needs to receive an approval from the Q-team. When a company receives the approval a collaboration agreement is prepared, so that the company and Stichting BSD can work closely on elaboration of the plans. In preparation of a final implementation agreement that leads to the actual carrying out of the project by the company (interview with Director of Development &

Innovation, May 28 2020). One of the companies, Henriks-Coppelmans, that has been subject to this research has a project called 'Plus-op-de-meter' which aims to build house that produce more energy than they use, in order to store and share the energy with the neighbourhood. Director of Development & Innovation (interview, May 28 2020) adds:

> *"We also score on the program line of circularity with our project. We have a partnership with VDL to use old battery's from their busses, which they cannot refurbish to be put in busses again, but they are suitable to be used in houses to store energy."*

Most of the contacts that Hendriks-Coppelmans has are with the program/project leaders from Stichting BSD, that are from the project lines that fit with the project. So the project line Neighbourhood that has Energy and the project leader that oversees the building of houses. At this moment they have little direct contact with the municipality of Helmond or the province, all the major contact moments are with the project leaders of BSD (interview with Director of Development & Innovation, May 28 2020).

A second project that is subject of this research is the Digital-Twin, this project comes from two companies 'Geodan' and 'Woonconnect (de Twee Snoeken)' and they are building a planning support system, based on a 3D representation of the Smart District. But this project can be seen as a partnership between Sitchting BSD and these two companies. They way that this project is setup, in the sense that it is a partnership, results in a bigger group of actors that are involved in the project and have contact with each other. This is different than with the project of Hendrik-Coppelmans. With this Digital-twin project there is the involvement of the TU/e, the province, the municipality and also the project leaders of the program lines of the Digital neighbourhood and Participation (interview with Project manager Geodan, May 28 2020). The Director of Woonconnect (interview, June 3 2020) says the following about this contacts:

> *"We have a lot of contact with the municipality of Helmond, and next to that we have a work sessions once a month with the partners of this project including the project leader of BSD. But next to this meeting our contacts are mostly with our partner Geodan."*

The last major stakeholder group is the civil society which incorporates the (future) local residents of the neighbourhood. Since there is nothing build in this district yet, there are no local residents at this moment. However Stichting BSD is trying their best to incorporate as many lay people as possible in the project. How they are doing this will be further explained in the next section about participation. At this moment there is one group of people that is involved in the planning process. This is because this group of people is not only very interested living in BSD, but most of all are they interested in building their own house in BSD, this group is known as the 40-KavelLab. This group of people have received a questionnaire to understand how they view the proses thus far and to understand their motives why they want to live in BSD.

Citizen participation

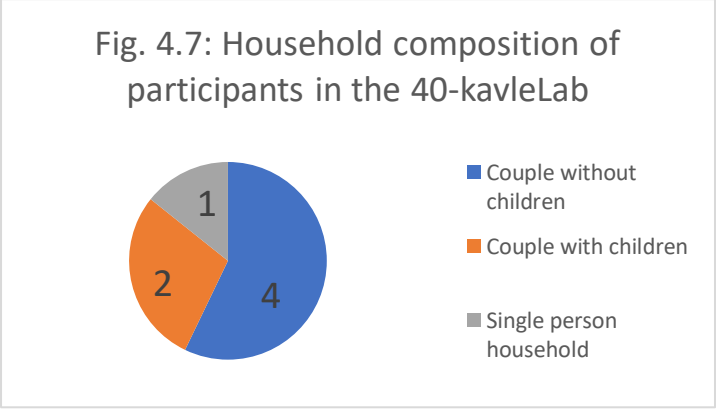
Giving substance to participation of the civil society and (future) local residents happens in this project in several ways. According to the director of SBSD (personal communication, June 6 2020):

> *"A User-council is appointed, with the goal of appointing future residents and people interested in the project. The goal is to finish the project of appointing the User-council by the end of 2020. Another way is the active involvement of citizens in innovative projects. A striking example is the water project, a citizens who is keen on living in BSD someday is involved with the creation and deliberations of the water plan for BSD."*

Next to these projects and means to involve citizens BSD has also a project where citizens are encouraged to be test subjects for building their own houses in BSD, this is called the 40-KavelLAB. Together with BSD the citizens are figuring out what the new rules are and what they mean in real-life practices when it comes to building their own homes. Next to these forms BSD has from the start invested in information nights and markets, and now there is also an only community where information is shared, this is called BrandevoortLAB. On this platform it is also stimulated to share thoughts, active thinking.

With this information BSD is trying to comply with Arnstein's (2019) ladder of participation. BSD wants to deliver on all the major scales to improve citizen participation, by informing and consultation through the BrandevoortLAB, Placation through having citizens involved in projects like the water plan to advise and help create such plans. Partnerships are formed with the 40-KavelLAB where citizens are building their own houses together with help from BSD. And on the highest levels of participation, delegated power & Citizen control, is being worked with the User-council that gets initiated by the end of 2020.

A group of participants of the 40-KavelLab have received a questionnaire to gather some insight as to how they view the process of this project and how they work together with BSD in developing their own homes in this district. Next to why they want to be involved in a project to build their own houses. First of all the respondents were asked what their current place of residence was. Four of the seven respondents live already in the municipality of Helmond and two live in the neighbouring village of Mierlo. Only one respondent is living further away in a town called Thorn in the province of Limburg. In fig 4.7 the household composition of the participants is shown, what can be concluded from this is that couples without children are more interested in participating in this project, than single person households or couples with children.



The characteristics that these participants find the most important, see appendix 1 (Table 1), are the creation of a circular ecosystem everyone scored this characteristic with strongly agree. Next to this the participants think that sustainability in general is important. But also the interest in new forms of mobility is high. These interest align with the characteristics of BSD with the focus from the project lines of Circularity, Energy and Mobility. In Table 2 of appendix 1 the views of the participants on building and living in BSD are represented. All the respondents are keen on building an innovative house in a way that it matches the ambitions of BSD. Next to this the majority of the respondents believe that there are benefits of living in a smart district like BSD. However, when asked about if the ambition of BSD to become the smartest city district in world is realistic the respondents are less positive. Just one respondent agrees with the that it is a realistic ambition.

When asked about the process, see Table 3, the respondents are positive about the developments in the direction of incorporating citizens and setting up partnerships with (future) residents. Next to the

fact that most of them find it pleasant to work with a group of likeminded people that are going to build their own houses in BSD. However, in the process of working with BSD to establish their own homes improvements might be needed. The respondents answered rather negatively to the statement about if the process thus far is pleasant. In Table 4 the views of the respondents their contact with BSD and how they are part of BSD is represented. For all these three points progress is need according to the respondents. The contact with the program managers of BSD scores average negative. For the way that they feel that there is a full-fledged partnership between BSD and the participants in the 40-KavelLab scores even a little lower with only one respondent that is neutral about this statement.

Social network Analysis

To assess how the actors of BSD function in the development, a social network analysis (SNA) was done on a number of actors that represent the four major stakeholder groups. The actors included in the SNA are organizations as well as individuals, as it is interesting to see how many connections an organisation has, and also for some individuals it is interesting to see how many connections have. In table 4.1 the actors of this SNA are represented and to which stakeholder group they belong.

Table 4.1: Actors included in the social network analysis.

Stakeholder group	Actor
Government	Municipality of Helmond
	Alderman (H)
	Projectmanager (H)
	Province of North-Brabant
	Deputy (NB)
	Chief Information officer (NB)
Stichting	Stichting BSD
	Director (SBSD)
	Projectmanager Data (SBSD)
	Projectmanager Participation (SBSD)
	Projectmanager Energy
Indepent Adivsory Board	Q-team
Private parties	Tech company 1 (Geodan)
	Tech company 2 (De Twee snoeken/Woonconnect)
	Building company (Hendriks-Coppelmans)
Knowledge institutions	Technical University Eindhoven (TU/e)
	Tilburg University
Civil society / residents	40KavelLab

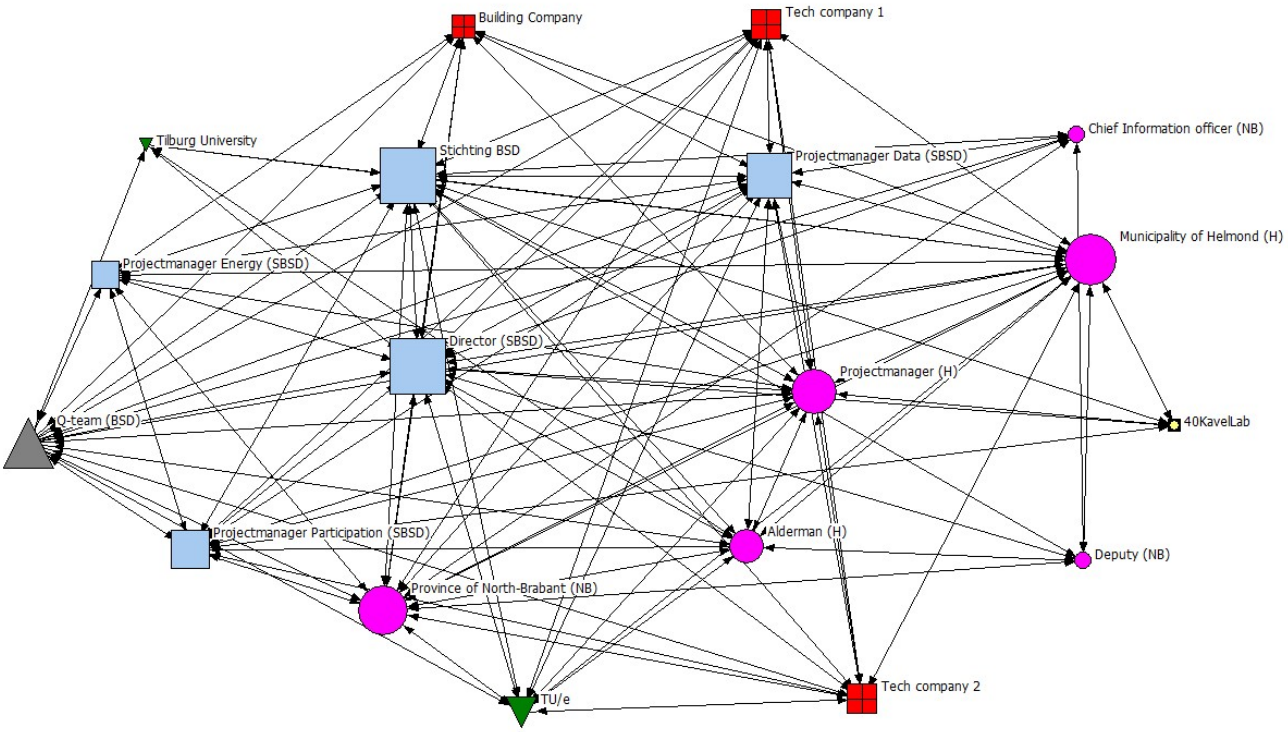


Fig. 4.8: Social Network Structure BSD

In Fig 4.8 the social network structure of BSD is represented, these actors are only a small representation of the total number of actors involved in the development of BSD. However it is helpful in analysing the way BSD is being developed and how the Stichting BSD, governments, private companies and civil society are connected with each other. From this network graph it is possible to obtain data from this network overview by making calculations for the density, closeness, betweenness and degree of centrality. With this information, conclusions can be drawn about the network and how the actors relate to each other.

In this small representation of the network of BSD 18 stakeholders are included, where two actors have the maximum number of ties possible with 17 ties, these actors are the director of SBSD and thus also the Stichting BSD. The Director of BSD is part of many of the different aspects of the development, he functions under the board of Stichting BSD, which gives him ties with the parties that have a seat in this organisation. He also functions as secretary of the Q-team, establishing ties with these people and all the projects that come to present their initiatives for BSD. And of course his ties with al the program managers and project leaders in the Stichting BSD. These actors have the highest degree of centrality and are in the centre of the network, as seen in fig. 4.8.

All of the other actors represented in this network have less ties. The density of this network is 0,65 or 65%, this means that 65% of the actors in this network have talked at least once to the other actors in this network. For instance the program manager Data of BSD, he has contacts with all the partners of the Digital-twin project (municipality, province, the private parties) and almost everyone within Stichting BSD. In the end he comes to 14 ties in this network. Which is still higher than the average ties of 11 per actor.

But it is not the situation that every actor of this network has a connection with each other. In this network there are two actors with only 5 connections to the network, these are the Tilburg University and the 40-KavelLab. The little contact that the participants of the 40-KavelLab have results in the

lesser positive views on their contacts with BSD. They score the contacts with program managers negative and they do not feel as they are fully integrated in the development of BSD, this is also visible in fig 4.6. where the 40-KavelLab is positioned very small and on the side of the network. The little ties of the Tilburg University are also no surprise since their involvement at the moment is limited to their presence in the board of Stichting BSD and a position in the Q-team.

4.1.3. PSS & Data

Brainport Smart District works with program lines that define the subjects that are important for the development of the district. Two of these program lines have direct ties with Planning support systems (PSS) and data, namely the data line and the participation line.

Planning Support Systems (PSS)

From each of these program lines a project started that can be identified as a planning support system, namely the Digital-Twin (Data line) and the BrandevoortLab (Participation line).The Digital-Twin project is a project that is a cooperation of two private parties that work with GIS and BIM systems to make a digital copy of the District. One company delivers the map on which the neighbourhood will be shown and the other company delivers BIM models of the houses and other buildings that are going to be built in the neighbourhood. In the end this should result in a 3D representation of the neighbourhood. The digital-Twin project started with a subsidy granted from the Ministry of the Interior and Kingdom Relations coming from a subsidy budget called 'Innovatie Budget Digitale Overheid' innovation budget for the digital government. This budget is intended to improve digital services to citizens, and BSD has received a subsidy in this context. So the main goal of this project is to create a digital copy of the neighbourhood and the new houses that are going to be built. In order to be of service for future residents and new house owners. They are enabled to make changes to their potential new house in this digital environment, which then tells them if the change are allowed withing the rules and regulations of BSD and can thus be executed. So that they can also apply for a permit more easily afterwards through this system (interview with project manager Geodan / SBSD, May 28 2020). Professor and chair of ISBE TU/e (interview, May 19 2020) further explains that at this moment the project is going to be a proof of concept, where the neighbourhood will be shown in as a digital copy, with 3D models of standardised houses. Because there are no designs available yet of the houses that are going to be built. But it will be possible to see how the tool will be functioning, through the implementation of some of the regulations that will come into effect in the district. Further options like a 'dashboard' on which the effects of certain changes to the house, like adding solar panels or other sustainable solutions, will be shown can be added in later stages of this project. All in an effort to help (future) residents getting grasp on their new houses. One of the key components of the service that Woonconnect delivers to this project is. Getting the residents involved in the process of designing and making personal adjustments to their future houses. The director/co-owner of Woonconnect (interview June 3 2020) further explains about the product:

> *"The core of our tool is to make flexible digital models of houses/buildings with all kinds of calculation software around it in order to calculate the effect of all kinds of scenarios. Which can be done for existing buildings with construction work, but also in this case for new build houses. "*

Furthermore the tool of Woonconnect knows two stages, the first is the planning phase. In this planning phase people are able to roam around freely within the tool in search of the house the want, they can decide which plot in the district they want and then they can try to configure their home the way they want it. The second phases, starts when a person or family actually lives in the house. At this point they have gotten a digital key to their house, so that it is only accessible by the persons that holds the digital key. This gives the homeowners the possibility to share the digital key with, for instance, a

painter when they want to repaint a part of their home, the painter can then prepare a quote without the need to stop by the house (director/co-owner of Woonconnect, interview June 3 2020).

The Digital-Twin as being designed at this moment has thus a main goal to be a service for (future) residents of Brainport Smart District, and not yet the government. As opposed to what happens more often is that such a tool / platform is being developed for government purposes. This can be and probably will be something that this platform can become, but not at this moment in time. This project will be finished in September of 2020, and then all the stakeholders involved with this project want to continue with the development of the Digital-Twin. In order to achieve this, a new subsidy application has already been submitted to the Ministry of the Interior and Kingdom Relations, said project manager of Geodan / SBSD (interview, May 28 2020). In this second phase of the project the goal is to at least have the digital-twin live for a whole year, so that it can run parallel with the development of the district. Than during this year it will become clear where changes are needed based on user requirements and wishes. The TU/e also wants to look at appointing a PDEng (Professional Doctorate in Engineering) to this project to see how this PSS can be further developed and possibly work with the data and results that can be gathered in this second phase (project manager of Geodan / SBSD, interview, May 28 2020; Professor and chair of ISBE TU/e, interview, May 19 2020).

This planning support system that is being developed can't strictly be seen as a PSS that fits to the definition of Geertman et al. (2015, p2): "geo-information technology-based instruments that are dedicated to supporting those involved in planning in the performance of their specific planning tasks." Because this PSS focusses more on the usability by (future) local residents than to be an instrument for planning professionals. However it is still a geo-information based platform. This PSS definitely has the possibility to become a tool that gives further residents the ability to co-design this new district to a certain extent. How and in what way that this will be designed in the Digital-twin is still subject to research in the proof of concept phase says the project manager of Geodan / SBSD (interview, May 28 2020). It is also to be seen how the Digital-Twin can be of service to planning professionals

Next to the Digital-twin project there is another project in BSD that finds itself in the middle of being a PSS and an e-participation tool, this is called the BrandevoortLab. The reason why this is called BrandevoortLab and not BSD, is because BSD is part of the greater neighbourhood of Brandevoort in Helmond and the local residents of this existing neighbourhood are also invited to join this community. The BranevoortLab is in the first place a website where people interested in the development of Brainport Smart District can have interaction with the professionals working on BSD but also with each other. The description of the website says: "The community for pioneers, for innovators, for future thinkers. People who want to think about new technology and smart innovations in Brandevoort" (Brandevoorlab, 2020). Director of SBSD (interview, June 9 2020) described it as follows:

> *"It is a virtual meeting place where people can find information about BSD. And where we invite everyone to think with us about the development, and form opinions about the things that are being developed."*

Data

In smart city developments you cannot escape the subject of data, just like in this smart city. BSD is very aware of this notion as they have create a program line that focusses specifically on this topic. For this program line there is one project which is the main goal, and that is establishing an Urban Data Platform, such a platform has not yet been developed and put in to practice in the Netherlands says Project manager Data (interview, May 1 2020). This urban data platform will function as a cloud service on which all the data will be stored that is accumulated in the BSD area. Data gathered by companies that have projects in the district, with sensors to register all sorts of raw data. In the first stages of BSD

the Stichting BSD will be the one to exploit and keep the urban data platform running. When the urban data platform is up and running and the first residents and companies have settled in the district the idea is that they will jointly form an association of owners, that controls the urban data platform. Alderman of Helmond (interview June 2) explains the following about the urban data platform:

> *"What you see with these developments is that in America the tech companies control these developments, and in China it is the government. And what we in Europe try to do is to search for the middle ground, so not put your faith in the hands of a 'Google' nor solely in the hands of the government."*

The valid concerns of bigdata developments like, privacy, data ownership and management have been acknowledged by BSD. To an extent that there are roughly three major components/projects that are being developed by BSD to tackle these concerns; a data manifest, a data governance board and an ethics board (Project manager Data, interview, May 1 2020; Alderman Helmond, interview, June 2 2020; CIO Province of the North-Brabant, interview, June 5 2020). The data manifest can be seen as a set of playing rules for every actor involved with BSD, from governments and private companies to local residents. In this data manifest rules that are crucial relate to transparency about data that is being gathered, ownership of data, self-management and -determination in terms of what sorts of data of private spaces is shared and to what extent citizens want to be involved. This means also that there should be an 'opt-out' possibility, that every resident has the possibility to say that they no longer want to participate in the sharing of their data and that everything that was known about them should be deleted. To what extent that this is possible is at this point still a bit uncertain according to CIO of the province of North-Brabant (interview, June 5 2020). But this is something that will be closely examined with the appointment of new projects in BSD. However does this point also lead to the realization, by actors involved with BSD, that (future) residents should get guidance about all the things they are saying yes to when they decide upon living in the living lab of BSD. CIO of the Province of North Brabant (interview, June 5 2020), said the following in this regard:

> *"There is of course one specific group that also finds it interesting to live in a development like BSD, but all the more reason to protect them against themselves. Of course you do make that choice yourself. We're not going to pamper them, but we will help them with that process. It's a bit like the people who win the Grand Prize in the lottery. We now also know that it is very difficult to deal with this properly. People are then offered a psychologist as standard to guide them in that process. Maybe we should do that here too. Explain to the people very well what it means to live here, what you are saying yes to, as far as we can see it. Because we cannot foresee all of that yet."*

This point has also been made by the project manager Data from BSD and the Alderman of Helmond.

Another key component of the data line is that the data should be open data, in a way that it is accessible for everyone free of charge (Project manager Data, interview, May 1 2020). The point of what is big and open data is something that Edelenbos et al. (2018) also mentioned, because every development threats this differently. And what kind of data is than openly shared, Edelenbos et al. (2018) mention that most of the time this is limited to demographics or housing details. But in this development al the data gathered in public spaces by any sort of project will in the end become openly available. This should be made accessible through the urban data platform.

These sort of agreements come from the rules set in the data manifest. This data manifest is a stepping stone in developing a data governance structure for BSD. A data governance is something that is being advocated by the Project manager Data of BSD (interview, May 1 2020):

> *"A governance model is needed. In which there is an association of data owners, that together with the council of the municipality of Helmond decides on the exploitation of the urban data platform. And a trusted body that is and independent committee that checks whether the parties that are involved comply to the principles that we have formulated for the handling of data in the data manifest."*

The association of data owners has been mentioned before but it is important to take a closer look, because this means that the control over the data from BSD comes in the hands of all four of the quadruple helix stakeholders. In this regard it is still partially uncertain what the effects will be on business models of private companies, and how they are wanting to cooperate with BSD. This will be something that needs further exploration in research and in practice. Also the trusted body that is mentioned will be realised in the form of the data governance board and the ethics board. The alderman of Helmond (interview, June 2 2020) says:

> *"What I find very important is that we also organize a number of critical no- and against thinkers who help us. Because we do not have a monopoly on wisdom in this regard.*

These boards are thus enabled to think along with the developments that touch the subject of data in the developments of BSD and then form an opinion towards the developments. Where it should be the case that these people are encouraged to have a critical stance towards these developments. That is what is needed according to the alderman, people to are critical but also constructive. Not only for governments but also for private parties.

5. Two other Dutch Smart City case studies

5.1 Merwedekanaalzone, Utrecht (The Netherlands)

5.1.1. Local, Institutional and Spatial contexts

In Utrecht The Merwedekanaalzone is a district that is going to be redeveloped from businesspark into a lively healthy and sustainable district. Next to this transformation this district is also assigned as the first district to be the design experiment of Utrecht's Slim City initiative. This initiative has as its goal to explore how technology can contribute to better urban developments. Also the development of an integrated urban data platform, on which all kinds of district data will become available, next to the ability for residents to experience (future) scenarios of the district (Slim City, 2020). With a specific need to see how design-based experiment develops itself and to explore technology can contribute toward more participation within the urban development process in this area. So that it can serve as a blue print for elsewhere in the city of Utrecht. According to De hoop et al. (2019) an other aim of this project is to encourage business and innovation together with environmentally sustainable neighbourhood.

In the first visions of the Merwedekanaalzone the municipality presented Smart as an absolute necessity to accommodate the city's growing number of inhabitants. The use of smart technologies and in particular smart mobility are seen as the best means to achieved the ambitious goal of constructing 10.000 houses in this district (De Hoop et al., 2019). A striking goal with this ambition is a proposed parking standard of 0.30 parking spaces per house, far lower than is standard at the moment in the Netherlands.

Fig. 5.1: Mock-up of the Merwedekanaalzone, Utrecht. (Merwede, 2020)

Spatially the Merwedekanaalzone is an elongated zone between the large-scale infrastructure of the Europalaan - Superior Den Oudenlaan and the Merwedekanaal (Canal). This area is divided in three sub-areas 4, 5 & 6 and has a surface-area of 65 hectares. The development of this district will be based on the themes of sustainable healthy urbanization that Utrecht uses. These themes are mobility, water, nature and green, Energy, soil, reuse of materials and (spatial) values (Gemeente Utrecht, 2018).

5.1.2. Stakeholders Merwedekanaalzone, Utrecht (The Netherlands)

The most important stakeholders involved in this project are quiet a large number of companies and the municipality of Utrecht who all own parts of the land intended for the development of the Merwedekanaalzone. The companies involved are: AM/Synchroon, Ramphastos, Jansen-De Jong, BPD, Lingotto/3T Vastgoed, G&S Vastgoed/Boelens de Gruyter/Round Hill Capital and Greystar (Gemeente Utrecht, 2020). Because of the high ambitions of the municipality of Utrecht to develop the Merwedekanaalzone in a healthy way it gained interest of other government institutions. Utrecht is working together with Rijkswaterstaat (RWS), water authority Stichtse Rijnlanden, RIVM (National Institute for Public Health and the Environment) (Gemeente Utrecht, 2018).

When developments around The Merwedekanaalzone carried on, broader sets of actors began to question the municipalities obsession to reach their ambitious goals for this district. To the extent that residents from the neighbouring district started a local collective “Stop Manhattan aan de Merwede”. This action group is keen on highlighting the negative effects that the proposed plans have on the larger area surrounding The Merwedekanaalzone. Especially when it comes to the ambitious goals of a very low parking standard, the action group is no believer of the district’s capacity to have an influence on the embedded mobility routines of people (De Hoop et al., 2019).

Citizen participation

The municipality of Utrecht states in their ‘Omgevingsvisie Merwedekanaalzone’ that they want to cooperate with initiators, stakeholders and interested parties like local residents. Working together on the tasks and ambitions for this area for the upcoming 15 years of transformation. In the past years this has already been done for sub-area 5 where land-owners, users and other interested parties came together to think about transforming this sub-area. The municipality is involved with this development as one of the land-owners. In sub-area 6 is a similar process started where individual (land-) owners work together with the municipality and other parties in an attempt to realise (temporary) solutions, like transforming offices into houses. For sub-area 4 the case is a bit different as there is a developer (one company) working together with the municipality to transform this area. But they are involving local-residents and other interested parties in the developments of the plans (Gemeente Utrecht, 2018).

Involving local residents happens mostly through ‘stadsgesprekken’ (city talks), during these city talks the municipality wants to have a fruitful discussion with stakeholders, experts and everyone else that feels involved with the developments. Before these city talks are held, working sessions take place in the area that is the topic of the upcoming city talk, to gather the talking points form the community. This process was held to gather input for the area vision ‘Omgevingsvisie Merwedekanaalzone’, in an attempt to explore opportunities for the area. Another way that the municipality uses to inform citizens is through the website and a digital newsletter (Gemeente Utrecht, 2018)..

5.1.3. PSS & Data Merwedekanaalzone, Utrecht (The Netherlands)

For the Merwedekanaalzone being a smart city is not their main priority but through the Slim City initiative planning support systems and data have been incorporated in the project. Next to the understanding of the municipality of Utrecht that they cannot succeed in their goal of creating a healthy urban living system for the city without some sort of digital ecosystem (Gemeente Utrecht, 2019).

Planning Support Systems (PSS)

In the attempt to research what kind of PSS where available to include citizen in the developments of the Merwedekanaalzone Slim City made an initial exploration in 2017. Three different proof-of-concepts have been made to show in what ways technology could contribute to a more participatory

approach to urban developments (Slim City, 2020). The first is called ‘SpeelRuimte’ this is a 3D world that enables (future) residents and other interested parties to engage in a discussion about their neighbourhood. This 3D world is enriched with information about spaces and places in the neighbourhood that is have become talking points or places with potential to change. This could be the case for cycling routes or parking zones in the neighbourhood that are troublesome, and alterations can be made to these places to see the effects. Which should lead to a lively discussion about these places and spaces, with argumentations that lead to definitive decisions about these places.

The second proof-of-concept is ‘FietsBereik’ this application combines cycling behaviour, travel times and waiting times in one digital 3D environment. It enables residents and visitors of a neighbourhood to experience what the benefits can be of smart technologies and smart interventions in public spaces for a safer cycling experience. On the other hand it is possible for residents to speak out about their preferences for certain scenarios that enables them to contribute to the design of their neighbourhood. The third proof-of-concept is ‘Krasse kavels’ this is a serious game that enables different actors from one neighbourhood to work together in creating a healthy design for the neighbourhood. It is a tool that supports talking to each other and finding out what each other's interests are and to come to mutual agreements. One of the important features is to change roles between the actors that are working together in a way that it stimulates the participants to view the problem form a different point of view.

Data

As mentioned before the municipality of Utrecht is aware of the need of some kind of digital ecosystem. In the ‘Omgevingsvisie’ (2019) the municipality mentions that they are interested in seeing the developments of European DECODE in which the cities of Amsterdam and Barcelona are participating. The municipality is looking forward to the developments of this project and if it will be usable for not only the Merwedekanaalzone but the entire city of Utrecht. DECODE is thus an European funded endeavour to design an urban data platform as a service for the data-centric digital economy. Where data is generated and gathered by citizens, sensor networks and the Internet of Things (IoT) to be available for a broad communal use under the appropriate privacy protections (Decode, 2020a). What decode proposes is that there needs to be an alternative available between on one hand big tech’s control over data and the infrastructure they provide, and on the other hand a state controlled infrastructure that faces challenges like centralisation of power. One way that decode brings forward is to establish a democratic form of data governance, in a platform that enables groups of people to leverage their data’s collective value (Decode, 2020b). Decode (2020b) furthermore explains what is needed to establish data governance for such platforms:

> “These may be built on top of technologies that give people control in the first instance, but provide trustworthy mechanisms to share personal data. In turn, these may give rise to new, democratic data sharing arrangements where people can decide collectively the terms by which data is accessed and used, potentially enabled by new institutions for collective decision-making. These are what we refer to in this report as ‘data commons’.” (p. 10).

Utrecht is thus waiting on developments of third parties and is not engaging in developing their own urban data platform with all the challenges that come with doing so. This is of course a strategy that can be successful and proposes less steps to be taken for the development of Merwedekanaalzone.

5.2 Living lab Scheveningen, The Hague (The Netherlands)

5.2.1. Local, Institutional and Spatial contexts

In 2016 the municipality of The Hague published a program called “Agenda ruimte voor de stad’’ which was the starting point for many redevelopments for the city, including the coastal town of Scheveningen. There have been numerous goals formulated in this plan for the redevelopment of Scheveningen, including ‘smart city labs’ (Gemeente Den Haag, 2016a). The municipality of The Hague chose to start experimenting with smart city concepts in Scheveningen, this is an area where people live, work and spend their free time. There is a beach with a boulevard, but also a harbour with industry. This area is the first area in the city where technologies affiliated with smart city are implemented and researched (Gemeente Den Haag, 2020). To give substance to the developments of a smart city The Hague has also started the programs ‘Smart The Hauge’ and ‘De Kust gezond’. These programs and the city management service of The Hauge came together in Living Lab Scheveningen that enables cooperation’s with private parties. Living Lab Scheveningen is an environment where Public Private Partnerships examine new business models with a focus on smart city services (Van Leeuwen et al., 2018). The developments that take place aren’t strictly focussed on building more houses but are more focussed on redevelopments of the public space and infrastructure.

In the municipality of The Hague there is the drive to create a Smart City Infrastructure, an infrastructure consisting of ‘smart city hubs’ that are WiFi-stations with integrated sensor technologies that are going to be installed in light poles in the public spaces of The Hague, see fig 5.2. Next to creating an infrastructure of sensors that are put in an integrated network it will be researched how Artificial Intelligence (AI) can have useful applications. It will not only be researched if there are applications but also to what extent these applications are desirable (Van Leeuwen et al., 2018). From the Smart The Hague program the goal is to use technology and innovation to tackle societal and economical challenges. The way of working for The Hague is cooperate between governments, private parties knowledge institutions and citizens through co-creation in a quadruple helix. This should help the city in its ability to tackle big transitions in the economical, demographical, sustainable and technological fields (Gemeente Den Haag, 2016b).

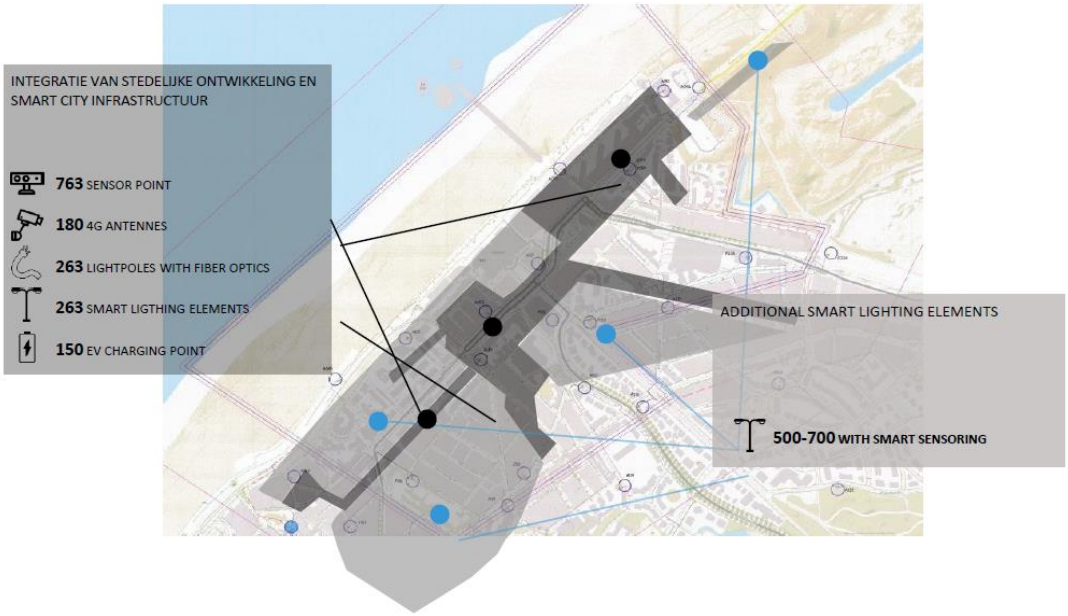


Fig. 5.2: Area in which smart city infrastructure will be implemented (Fraanje, 2020)

Scheveningen is a coastal town that is part of the 11 kilometres of beach that belongs to the municipality of The Hague, Scheveningen is also the most popular one of all the places in these 11 kilometres. The municipality wants to develop Scheveningen through intensifying the tourist program and housing program. The area needs to become a complete, compact and layered tourist centre of the city, with more room for cycling and walking and a less dominating image of cars. But also the redevelopment of landmarks like the pier and the boulevard should improve the image of Scheveningen (Gemeente Den Haag, 2016a). With the redevelopments that are taking place for the program 'De kust gezond' the new infrastructure that is needed for the smart city applications is already being implemented. In this way the redevelopments are taking place as efficiently as possible and is the infrastructure prepared for the smart city applications that are being made. The combined programs of Living Lab Scheveningen should result in the most innovative seaside resort of Europe (Gemeente Den Haag, 2016b).

5.2.2. Stakeholders Living lab Scheveningen, The Hague (The Netherlands)

The stakeholders that are involved in the development of Living Lab Scheveningen (LLS) come again from the four stakeholder groups that are represented in the quadruple helix structure: governments, private parties knowledge institutions and civil society (local residents). The governmental parties involved with this development are, the municipality of The Hague itself naturally but also the metropolitan region of Rotterdam-The Hague and the province of South-Holland (Gemeente Den Haag, 2019). One of the most important private parties that cooperated on the first stages of Living Lab Scheveningen is energy company Eneco. They cooperated with the development of infrastructural specifications, but from here on Eneco will no longer participate as a risk bearing party in this development. Furthermore there are the partners that are connected through Smart The Hague, these are: KPN, Siemens and Stedin. The knowledge institutions that are involved also come from Smart The Hague and these are: Universiteit Leiden, TNO, TU Delft and De Haagse Hogeschool (Gemeente Den Haag, 2016b). Smart The Hague is also part of a number of international initiatives to make cities smarter and liveable, these are Global Smart City & Communities Coalition (this is a global partnership) but also on a European level with City Protocol Society (Gemeente Den Haag, 2016b).

Citizen participation

The last stakeholder group is the civil society and local residents, Smart The Hague (Gemeente Den Haag, 2016b) mentions that local residents should have a central place in this development. This view is based on the notion that there is a risk with new technologies that they are based on supply rather than from the demand of citizens. Municipalities should be urged to create a constant dialogue with residents on various themes and in various stages of the project so that they can participate. Smart The Hague even views their citizens as their most important partner to achieve their goals. Smart people are viewed as critical and the notion is that in the The Hauge area Smart Citizens are greatly represented. Therefore The Hague invests in Human Capital. But the (end-)user is definitely not forgotten in this train of thought. For those citizens that are not yet capable of using all these new technological advancements a free course is available in public libraries. These courses are focused on learning how to use digital communication systems and how to function in a society that is continuously progressing technologically. For citizens that have the abilities to function well in this techno based society initiatives are established to created public added values. This means that they can come up with their own initiatives to start with environmental measurements like air pollution etc. In addition the goal of the quadruple helix cooperation is to work together with all four different stakeholders on projects and that there is a shared responsibility of these projects amongst the stakeholders (Gemeente Den Haag, 2016b).

5.2.3. PSS & Data Living lab Scheveningen, The Hague (The Netherlands)

In terms of Planning Support Systems Living Lab Scheveningen is doing little projects in this field. However on the subject of data governance Smart The Hague and thus Living Lab Scheveningen are more active. A so called Smart City Infrastructure that consist of 'Smart City Hubs' is already partially realised on the boulevard and it surroundings in Scheveningen, that ultimately connects to one Smart City Hub for the whole of Scheveningen. The key concept of this city hub is that it is an openly accessible platform, that gives access to data that can be used to develop new smart solutions for the benefit of the city and its citizens. No longer separated solutions, but a coherent systems on the basis of open-access principles to secure that various parties can develop new technologies (Gemeente Den Haag, 2019). From the first phase of the project it became clear that data gathering and enrichment have enormous economical and societal potential and that it helps with an integrated business case to make the project work. However facilitating of data gathering raises issues about safeguarding privacy. The Hague thinks that through a systematic approach with a bundling of the projects on one open platform and a combination of use-cases this will be better. With the result that data and digital innovations can be combined that lead to new services with economical and societal value (Gemeente Den Haag, 2019).

However these endeavours on its own are interesting it does not seem that Living Lab Scheveningen is actively working on something that can be identified as an Urban data platform like Barns (2018) discusses. The Smart City Hubs are a network of light poles that function as hubs for all kinds of applications of sensors and others. They function in a way that they are gathering data, but at this moment in time of the project it is to unclear how Smart The Hague and Living Lab Scheveningen will continue with this data.

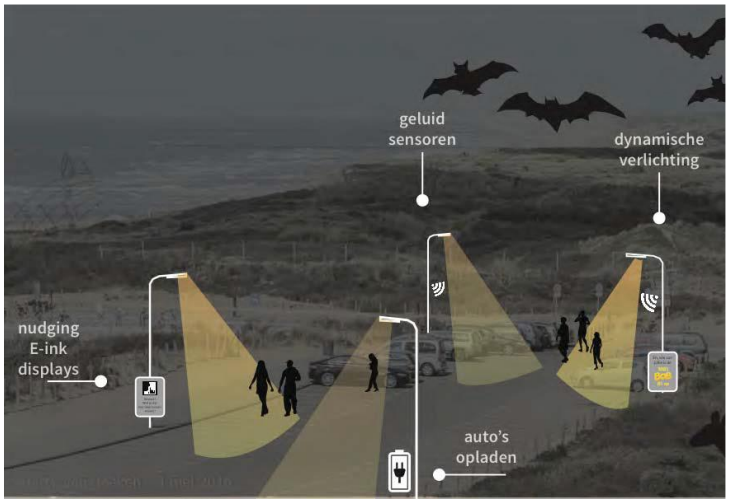


Fig. 5.1: Example of light poles and its functions. Van Leeuwen et al. (2018, p.5)

6. Comparison

Table 6.1: comparison of similarities and differences between the cases.

	BSD	Merwedekanaalzone	LLS
6.1 Context			
Local	BSD will is realised in the municipality of Helmond with 90.000 inhabitants and is part of Brainport Eindhoven (metropolitan region).	Merwedekanaalzone is an area in the municipality of Utrecht with 350.000 inhabitants.	LLS is being developed in Scheveningen which belongs to the municipality of The Hague with 545.000 inhabitants.
Institutional	Started as an Idea of the TU/e, a consortium of actors was gathered around the municipality of Helmond. Not started from a municipal smart city program.	This development is part of a municipal program aimed at smart city developments.	This development is part of a municipal program aimed at smart city developments.
Spatial	BSD is a greenfield development that is going to be an entire neighbourhood with mixed functions. Where everything that is built has a smart component to it. Aims for an integrated development of many different aspects. At least seven.	This is a redevelopment of an inner city district that is a former industrial area. It is going to be a mixed neighbourhood. Aims to be smart through a few different aspects, mobility is one of the main.	This is not a redevelopment of houses but more a development to change the public space in Scheveningen, through implementing a smart city infrastructure and not much else.
6.2 Stakeholders			
Relations	Four major stakeholder groups from the quadruple helix. Government, private parties, knowledge institutions and citizens.	Only three major stakeholders explicitly noted. Government, private parties and citizens.	Four major stakeholder groups from the quadruple helix. Government, private parties, knowledge institutions and citizens.
Citizen participation	Incorporated through many projects on all levels of Arnstein's ladder (2019).	This project reaches the level of consultation.	In this project the level of placation is reached, but the goal for The Hague is to reach delegated power. But it is not clear how this is established.
6.3 PSS & Data			
PSS	Two major projects, an e-participation platform and a Digital-twin of the neighbourhood that enables citizens to co-design.	Research was done in the direction of three different PSS, all three where proof-of-concepts.	Nothing known.
Data	Actively developing an urban data platform. And exploring how to design a data governance.	Not actively developing an urban data platform. Looking at other developments with data governance included.	Establishing a network of 'smart city hubs' that could be turned into an urban data platform, but still unsure.

In table 6.1 a schematic summary is depicted of the similarities and differences of the three case studies. In the remainder of this chapter the points made in this table will be discussed and explained in more detail to receive a better understanding of the differences and similarities.

6.1 Local, institutional, spatial contexts

Brainport Smart District is being developed in the city of Helmond that is part of the metroplotian region of Eindhoven in North-Brabant, this region is also referred to as Brainport Eindhoven. With 90.000 inhabitants Helmond is the second city in this region. The development of the Merwedekanaalzone takes place in the municipality of Utrecht that with 350.000 inhabitants is the largest city and also capital of the province of Utrecht. Living Lab Scheveningen is a development in the eponymous city district Scheveningen of The Hague and has about 55.000 inhabitants. The Hague is the capital of the province of South-Holland and has 545.000 inhabitants.

The smart city developments of Brainport Smart District (Helmond) and Merwedekanaalzone (Utrecht) are housing projects that embrace smart city believes and initiatives. Merwedekanaalzone is a redevelopment of an inner city district that was mostly industrial and in the past few years became more residential, so with this redevelopment an even more diverse lively healthy and sustainable district will be realised. The goal is to explore how technology can contribute to better urban developemnts. Brainport Smart District on the other hand is a typical greenfield development that was originally intended to become a second extension of the VINEX location of Brandevoort. But this typical greenfield development became a smart city development when the TU/e was in search of a municipality to cooperate with for the realisation of a real world testing area for smart cities. This development will also become a district that will be studied by the TU/e. There is definitely a difference in size of the developments between BSD and Merwedekanaalzone in terms of how many houses are being built, BSD only wants to develop 1.500 houses and 12 hectares of Business park. Merwedekanaalzone has the ambition to construct 10.000 houses, but with a much higher density than BSD. Living Lab Scheveningen (LLS) is a different project because this project is in the first place not a project to build even more houses in coastal town of Scheveningen. It is more a project designed to redevelop and invest in the public spaces of Scheveningen and the seaside / boulevard by implementing smart city infrastructure and smart city applications.

The smart city developments of LLS and Merwedekanaalzone are products of municipal programs designed to study and develop their smart city programs for the municipalities, Smart The Hague and Slim City Utrecht. These developments are thus products of municipal policies where the local governments of the municipalities are in the lead. From here on they started the search to establish collaborations with in the first place the provincial governments, for LLS the province of South-Holland and for the Merwedekanaalzone the province of Utrecht. Thereafter collaborations with regional and other governmental parties like the metropolitan region of Rotterdam-The Hague for LLS or Rijkswaterstaat and the RIVM for the Merwedekanaalzone. But also collaborations with private parties where established, in the case of the Merwedekanaalzone this was inevitable because of the many different landowners in this district. For example a lot of real estate developers own properties in this district. LLS sought private parties to help with the development of the smart city infrastructure. Smart The Hague also has partnerships with knowledge institutions like Universiteit Leiden and TU Delft.

BSD is a product of the TU/e that came up with the idea to build a smart neighbourhood. That lead to the search in the Brainport region of Eindhoven / the province of North-Brabant to find an area where they could establish the smart city development. So the start was different to the start of the Merwedekanaalzone and Living Lab Scheveningen. But once the area for the development was selected and thus the municipality of Helmond was selected they became the main stakeholder together with the province of North-Brabant. Frome here on the Stichting BSD became the leading

party, in which the TU/e Brainport Development, the municipality of Helmond, the province of North-Brabant and the University Tilburg are represented in the board of this foundation.

The way of realising smart cities is different for all three of the developments. LLS wants to approach the smart city through implementing a smart city infrastructure that is a network of light poles with smart technologies that can be attached to these poles. This results in to a change of function of the light poles, they have no longer a singular function but function as points in a smart city infrastructure. Merwedekanaalzone bases the developments on the sustainable healthy urbanization themes of Utrecht, these are: mobility, water, nature and green, Energy, soil, reuse of materials and (spatial) values (Gemeente Utrecht, 2018). The most striking goal of Merwedekanaalzone is a very low proposed parking standard of 0.3 parking spaces per house in this area. This can only be realised if the focus of this development is predominantly on smart mobility. BSD wants to approach the realisation of a smart city differently, BSD aims at a more integrated way of realising the smart city. BSD does this with the implementation of seven different program lines: Circular neighbourhood, Participation, Social and safe neighbourhood, Healthy neighbourhood, Digital neighbourhood, Mobile neighbourhood and a neighbourhood that has energy (BSD, 2018a). BSD wants to go further than just one of these aspects, as opposed to LLS with just the smart city infrastructure as major component. And Merwedekanaalzone that is incorporating more than LLS but in still in a different way than BSD.

6.2 Stakeholders

In all three cases the four major stakeholder groups of the quadruple helix organisation type that BSD uses are represented. LLS even uses the same classification of the quadruple helix for their way of incorporating the stakeholders in the development. The Merwedekanaalzone does not do so, and the knowledge institutions are not as explicitly mentioned in the documents that have been consulted. There are differences between the developments as to how partnerships between all of the groups are initiated and established. To begin with the governments, as stated before LLS and Merwedekanaalzone both find their origin in municipal policies and endeavours to research how the smart city paradigm can be of benefit to their cities. This also means that these municipal governments are in the lead of finding suitable partners to kick-start their projects. Living Lab Scheveningen sought partnerships with the province of South-Holland and the metropolitan region of Rotterdam-The Hague (Gemeente Den Haag, 2019). The municipality of Utrecht gained itself interest from governmental institutions that wanted to work together with Utrecht in the developments of this smart district. These institutions are, Rijkswaterstaat (RWS), water authority Stichtse Rijnlanden, RIVM (National Institute for Public Health and the Environment) (Gemeente Utrecht, 2018).

As far as private partnerships go, in the case of the Merwedekanaalzone, Utrecht immediately was confronted with the problem of land ownership in this district. The ownership of the land is divided between the municipality and many private landowners all most all of them are real estate developers. Therefore the municipality needed to form partnerships with these companies to be able to proceed with the goal of transforming this district in to a smart district. For Living Lab Scheveningen the case is different, because The Hague mainly wants to transform public spaces, and therefore has to deal less with private landowners.

Citizen Participation

It is beneficial to take a closer look to how these three cases deal with citizens (civil society), this stakeholder group was always a known stakeholder but to what extent this group got incorporated into the planning process has been varying. Though in the changing landscape of smart urban governance it is becoming a stakeholder group to actively incorporate. Because this group is viewed as an integrated part of being a smart city, with smart people and smart collaborations, according to Meijer & Bolivar (2016). The two cases of BSD and LLS have opted to use an organisational approach

called the quadruple helix that incorporates citizens (civil society) as a partner of the organisation to establish spatial developments. In the case of the Merwedekanaalzone the municipality of Utrecht did not specifically mention a quadruple helix organisation for this development. This however does not mean that the citizens are forgotten in this development. The municipality made it clear in the 'Omgevingsvisie Merwedekanaalzone' that they want to cooperate with local residents. Most interaction thus far has been through working sessions in in the neighbourhood and through 'Stadsgesprekken' city talks. Next to these initiatives there is also a website with information and a digital newsletter that interested parties can subscribe to.

The municipality of The Hague is going a bit further with their initiatives towards citizen participation, their view is that smart citizens are needed. Despite that The Hague has many of them there are citizens that struggle with the every progressing technological advancements. For these citizens free course are available in public libraries so that they will be able to use digital communication systems and how to function in this changing 'smart' society. (Gemeente Den Haag, 2016b). Furthermore the goal for The Hauge is to create a shared responsibility amongst the quadruple helix partners, this means that citizens need to be able to come to positions where they can take such responsibilities. How The Hague is doing this is not clear at this point in the research.

Just like Living Lab Scheveningen, BSD is working in a quadruple helix system where citizens are incorporated in the development. There will be a user-council consisting of future residents and people that are interested in the project to give input and feedback on the developments. BSD is also trying to initiate active involvement of citizens in innovative projects. Where the citizens get involved in the creation processes and deliberation process of the projects. A project that goes further than participating in the creation of various projects, is the 40-KavelLab project. In this project a group of citizens is going to be building their own houses in BSD and is working together with BSD in figuring out what the new rules and regulations are withing BSD and what they mean for real-life practices. This projects is already sometime underway and although the participants are positive about building their own innovative homes in BSD, it also noticeable from the survey that the process could still be improved in some areas. When certain changes could be made to the process and the participants feel a greater sense of belong to BSD the project could become even better. Next to all these examples BSD also initiated an only community platform called the BrandevoortLab. On this platform information is shared from BSD but also from the community itself. Discussion boards can be started and it is stimulated to share your thoughts on the projects of BSD.

It is clear that citizen participation can be done in various ways, with different outcomes and one can work better than the other. But what determines the success of each way is difficult to say because every citizen group can be wanting something else from these processes. However it is important to see that various levels of participation are initiated by all of the three cases. BSD is the case that achieves the most of degrees of participation when you compare it to the ladder of Arnstein (2019). Since BSD is working on the User-council that will enable citizens to have a voice on the highest level of delegated power & citizen control.

6.3 PSS & Data

With smart cities automatically the association is made with the use of ICTs and the Internet of Things just like the collection of data. For smart cities it is needed to collect data in one place or on one platform so that all sorts of data can be used for data analysis. To manage the data from urban areas something called an Urban data platform is the tool that is most mentioned. How the three cases intend to use data and such platforms will be discussed further on. First the focus is on planning support systems.

Planning Support Systems

Next to collecting and managing data, ICTs and the Internet of Things can creat something else that is useful for smart cities, these are Planning Support Systems. It can be a tool for planning professionals but it can also be used to bridge the gap to society in getting citizens involved in the planning process. The way that these cases make use of PSS and data in their developments will be discussed next. For LLS there is nothing known about whether PSS have been used or will be used, therefore this cannot be discussed.

For the case of Merwedekanaalzone the municipality of Utrecht explored three different PSS proof-of-concepts that came together through the Slim City initiative of the municipality. The first is called 'SpeelRuimte' this is a 3D world that enables (future) residents and other interested parties to engage in a discussion about their neighbourhood. This 3D world is enriched with information about spaces and places in the neighbourhood that is have become talking points or places with potential to change. The second is 'FietsBereik' this is a 3D environment that combines cycling behaviour with travel times and waiting times. From here on it enables residents and visitors of a neighbourhood to experience what the benefits can be of smart technologies and smart interventions in public spaces for a safer cycling experience. The third proof-of-concept is a serious game called 'Krasse Kavels' which enables different actors from one neighbourhood to work together in creating a healthy design for the neighbourhood. It is a tool that supports talking to each other and finding out what each other's interests are and to come to mutual agreements.

Brainport Smart District has two sorts of planning support systems at this moment, one is the BrandevoortLab and one is the Digital-Twin which is a proof-of-concept. The BrandevoortLab is an online platform for the community that is interested in the development of BSD. The description of the website of BrandevoortLab says it in this way: "The community for pioneers, for innovators, for future thinkers. People who want to think about new technology and smart innovations in Brandevoort" (Brandevoortlab, 2020). It is a virtual meeting place where people can find information about BSD, and where citizens are invited to think about the developments together with BSD and be critical towards the ideas. In order to come to better results for BSD according to the Director of SBSD (interview, June 9 2020). The other PSS, the Digital-twin, is at this moment still a proof-of-concept just like the three examples of Utrecht. However the goal is to put the Digital-twin in to practices after the first stage is finished in September 2020. This PSS is a 3D representation of Brainport Smart District, through using GIS and BIM systems, so that a digital copy is created. The functionalities of the Digital-twin are in the first place aimed at the future residents of BSD. They are enabled to see how the district is going to look like and from here on it is also possible to select plots intended for houses or houses that have already been displayed. So that the future residents can virtually make changes to the houses based on their own wishes, the program then tells them automatically if these changes are allowed withing the rules and regulations of BSD. Later on it will be possible to file for permits with the municipality through this system (Director/co-owner of Woonconnect, interview June 3 2020). In this stage the Digital-twin is mostly designed to service (future) residents of BSD and not yet the government. The parties involved with this project are keen on continuing the development of the Digital-twin after the presentation of the proof-of-concept in September 2020. In this second phase the goal is to have the digital-twin live for a whole year, so that it can be a digital representation of the developments. But also to be able to make changes based on user experiences, requirements and wishes.

Furthermore the options to add some kind of dashboard to the system will be looked at, first of all for the individual houses, but possibly for the entire district. So that it will be possible to monitor all kinds of data. In essence is the digital-twin already a kind of Urban data platform says the project manager

of Geodan / SBSD (interview, May 28 2020). Therefore the project manager of the Digital-twin and the project manager of the data line form BSD are looking at the possibilities to make a connection between the digital-twin and the urban data platform that will be designed for BSD. But the way that this will be executed is till up for debate, depending of wishes and requirements of various actors. Next to the fact that this project needs additional funding from a second subsidy application that has been submitted to the Ministry of the Interior and Kingdom Relations, before it will be possible to continue looking at these possibilities.

Data

For smart cities in general data has become an essential aspect. Collecting data about urban areas and making it available in one place or on one platform to be used for data analysis is what it is mostly about. All three of the developments are aware of this data aspect for their city and are exploring ways to deal with data. Giving cities the tools to fully utilize all the data that can be accumulated in its public spaces and other urban environments is what urban data platforms can do. According to Barns (2018) these platforms use elements of the open government movement, where there is a need to go beyond the traditional compliance model where local governments seek to measure the city's performance against targets and regulatory frameworks. Because these earlier measures from 'government as platform' resulted in limited space for external views or data access and only monitoring of 'performance'. Rather than opening up space that enabled co-development of data services with citizens and software developers to fully utilize the data that is gathered.

The municipality of Utrecht is for the development of the Merwedekanaalzone aware that some kind of digital ecosystem is needed. Whoever they are not actively working on the development of such a platform by themselves. The municipality is in this regard following the developments of the Europeans DECODE program. In this program the cities of Amsterdam and Barcelona are involved as test areas for the development of an urban data platform as a service for the data-centric digital economy. When this platform is successful the municipality is looking to implement it not only for the Merwedekanaalzone but for the entire city. The goal of Decode is to create a platform, where data is generated and gathered by citizens, sensor networks and the Internet of Things (IoT) to be available for a broad communal use under the appropriate privacy protections (Decode, 2020a). Furthermore Decode is researching what is needed to establish data governance for urban data platforms. The basis as seen by Decode at this moment is; to build a platform on top of technologies that give people control in the first place, next to providing a trustworthy mechanism to share personal data with. Creating room for establishing new democratic data sharing arrangements where people can decide collectively on which terms data is accessible and can be used. Leading potentially to the creation of new institutions for collective decision making (Decode, 2020a). These developments sound promising and the municipality of Utrecht is thus waiting what comes out of this process and how to put it in to practices when it is ready.

With Living Lab Scheveningen the municipality of The Hague has a different approach. In the first place they are establishing a Smart City Infrastructure (SCI) consisting of 'Smart City Hubs', these smart city hubs are light poles that function as a hub for all sorts of technological purposes. The key concept of this SCI is that is in an openly accessible platform that gives access to the hubs and enables initiatives to collect data in the public spaces. The data that is gathered on this platform is also openly accessible to create smart solutions for the city and its citizens. The Hague thinks that through a systematic approach with a bundling of the projects on one open platform and a combination of use-cases issues with the safeguarding of privacy will be tackled. Resulting in new services with economical and societal value for the citizens and the city as a whole (Gemeente Den Haag, 2019). But to what extent this

platform complies with the definition of Barns (2018) is still a bit uncertain how this initiative will into a digital ecosystem, that is a true urban data platform.

Coming to the case of Brainport Smart District it was clear from the start of this development that an Urban Data Platform needed to be developed, it is also one of the main targets formulated for the Data program line. This urban data platform should function as a cloud service on which all data gathered in BSD will be stored. Data gathered in the public space by sensors, whether by public institutions or private companies, but also data from all different projects that are going to be developed in BSD. BSD also thought about who is responsible for the exploitation of this platform and what is desirable in this regard. The project manager of the Data line (interview, may 1 20202) explained that during the development of BSD the Stichting BSD will take on this responsibility. With the goal to transfer this task for a major part to the residents and companies that are going to be living and working in this district. This will become an association of owners that controls the urban data platform. To further tackle problems arising with this goal three major projects are in execution. A data manifest is being composed, second a data governance board will be installed and third an ethics board will be installed. The data manifest will set the playing rules for every actor withing BSD, rules for transparency about data that is being gathered, ownership of data, self-management and self-determination in terms of what sorts of data of private spaces is shared and to what extent citizens want to be involved in the sharing of data. With the ethics board BSD wants to have a group of people that think about, whether or not it is desirable to allow certain projects that are going to be implemented. Are these projects securing enough that they will comply with the playing rules from the data manifest. But also about whether or not it is desirable that certain data will be gathered in this district. And when that is allowed that this is openly accessible and that the communication about what the projects are doing is adequate.

7. Discussion, conclusion and recommendations

7.1 Discussion

This research set out to have a closer look on smart urban governance and in what way it contributes to the realization of smart city developments. Is it improving the governance process, and is it leading to better outcomes and more openness for citizens? With the governance of smart cities three basic distinctions are known according to Meijer & Bolivar (2016); (1) smart technology, (2) smart people and (3) smart collaboration. Smart cities also are very much data driven, how to manage data in this context is also a challenging task, most of the times data management is referred to as data governance (Cheong & Chang, 2007). It could be the case that data governance is something that should be considered to be an active part of smart urban governance. To be able to research smart urban governance and data governance in practice, three case studies in The Netherlands have been subject to this research. In The Netherlands there are quite some cities that are exploring the smart city paradigm and how it can be of use for their city in becoming more liveable. The case of Brainport Smart District (Helmond, The Netherlands) was the most extensively researched case. The cases of The Merwedekanaalzone (Utrecht, The Netherlands) and Living Lab Scheveningen (The Hague, The Netherlands) have been less extensively examined.

Smart urban governance stems from governance which covers a network based structure consisting of a government or governments that work with non-state actors combining the public and private sectors. In this research the understanding of governance by Rhodes (2007) is used, since it sees governance as governing through networks that are broader than state actors. Governance can be applied to all sorts of government processes that benefit from a network of public and private actors that work together to achieve something. In urban governance this is focussed on developments in the spatial context (Obeng-Odoom, 2012). Smart urban governance goes beyond the spatial context that is needed for the development of smart cities. Therefore it should also take notice of different forms of cooperation and partnerships involved in the development of smart cities. Thinking of public-private-partnerships and self-governance, as forms to have different stakeholder groups working together, like government, market parties, civil society (citizens) and knowledge institutions. This could be beneficial in reshaping the spatial urban environment (Jiang et al., 2019). This leads to the following definition of Jiang et al. (2019): “a dynamic institutional arrangement, operating within certain socio-spatial contexts, and enabling with the help of smart technologies public participation and stakeholder collaboration to accomplish urban sustainability” (p.259). In this context it is important for smart city developments to actively involve citizens in the design process through collaborative planning and citizen participation. Monno & Khakee (2012) say that Participation is not just another ‘tool’ for the governance process, but that it is essential if planning as a state practice is to be maintained and further developed. With this it is made clear that citizen participation is valuable for the way a project is governed and that is crucial for governments to change the way new developments should be approached. Involving citizens in smart city developments can be quite a task, however planning support systems (PSS) and e-participation could be the answer in this pursuit of creating a technological smart city. These ICT based solutions can make it easier for citizens to get a grasp and give input on the developments that are going to take place. This is supported by the broader perspective that knowledge claims can come from different perspectives and that they can complement to planning support (Pelzer et al., 2015).

The main question that this research is looking to answer is: *“How does smart urban governance contribute to realizing smart city developments and improve the governance processes, resulting in better outcomes and more openness for citizens?”*

First it was needed to get a grasp on the local, institutional and spatial context of BSD, with analysing the social network that is BSD. BSD is a smart district of 1500 houses that is being developed in the city of Helmond, which is part of the Brainport region of Eindhoven (metropolitan region). The district began with an idea from a professor of the TU/e that wanted to build a real life testing ground for smart city technologies. This resulted in the decision to repurpose a greenfield development of a VINEX-location of Brandevoort in Helmond, into a smart city development called Brainport Smart District. A foundation was started Stichting Brainport Smart District, in which public actors took a seating. These actors are: the municipality of Helmond and the Province of North-Brabant, two universities; Technische Universiteit Eindhoven (TU/e) and Tilburg University and lastly Brainport development. The Stichting BSD has an advisory board that advises on the goals and ambitions of BSD and to what extent projects meet these requirements. This is needed because BSD is in search for partnerships with private parties and others that are going to develop houses, a small section of business park and various other parts of the district. They can enrol into a business challenge where they can pitch their project in order to be allowed to cooperate in the development of BSD.

The collaborative approach and citizen participation is an asset of smart urban governance that can be implemented with smart technologies. This is incorporated in the development of BSD through active advocacy of citizen participation. From the start it was made clear that citizens should have a role in the development of BSD, this happened when the project line participation was incorporated into the plans. From this program line BSD tries to comply with Arnstein's (2019) ladder of participation. BSD wants to deliver on all the major scales to improve citizen participation, by informing and consultation through the BrandevoortLAB, Placation through having citizens involved in innovative plans to advise and create together with the professionals. Partnerships are formed with the 40-KavelLAB where citizens are building their own houses together with help from BSD. On the highest levels of participation, delegated power & Citizen control, is being worked on with the User-council that gets initiated by the end of 2020. Next to these projects there is also a planning support system that is being developed, called the Digital-twin. This 3D representation of the district will enable future residents to see what the district is going to look like and choose a location where they want to live. They can change the house in this Digital-twin to fit their imagination and when rules and regulations are being violated by the changes made this will be made clear in the program.

Since smart cities are often data driven the aspect of data governance may have implications on smart urban governance in BSD. It was clear from the start of the development of BSD that an Urban Data Platform needed to be developed, it is also one of the main targets formulated for the Data program line. This urban data platform should function as a cloud service on which all data gathered in BSD will be stored, and can be openly accessed. To tackle the problems that arise with gathering, storing and using data from an urban area three major projects are in execution. A data manifest is being composed, second a data governance board will be installed and third an ethics board will be installed. These projects should guarantee that the data is secure, anonymous, but openly accessible and can be used for the development of smart solutions for the city. The actors of BSD already came to the realization that correctly handling this part of a smart city is a challenge and that it has implication on how to govern this development. Further defining how a data governance improves the development is being worked on in BSD, and collaboration from all actors involved is needed like Cheong & Chang (2007) suggest.

To put the smart city development of BSD in perspective it was interesting to compare BSD to other cases in The Netherlands. BSD, the Mewerdekanaalzone and LLS have definitely similarities among them. However from the comparison of the three it can be concluded that Brainport Smart District is different in the way the project started with the partnership of the TU/e and the other quadruple helix

stakeholders, with the municipality of Helmond and the province of North-Brabant as most important stakeholders. The other two case originated from the municipal smart city programs, they have a more government led approach. When it comes to collaborative planning in these cases all three try to give this their best interpretation. Although BSD and The Hague go further than Utrecht. Utrecht did research different planning support systems, but is not using them in the development and in involving citizens. The same is noticeable in for dealing with the data aspect, Utrecht is following developments but not yet acting upon, BSD is doing the most in this regard. Overall it can be concluded that BSD is trying to achieve more on all the levels that make a smart city than the other two cases. But that does not mean that the other two are less valuable developments, BSD is just trying to create a more integrated smart city. Where Merwedekanaalzone and LLS have focussed more on one or just a couple of aspects.

7.2 Conclusion

Looking at smart urban governance and in what way it contributes to the realization of smart city developments, this research shows that the governance process in terms of citizen participation has progressed. All three of the cases are showing their efforts to comply to high standards that can be linked to Arnstein's ladder of participation (2019). This can be linked to the way that two of the cases have the quadruple helix in mind that makes the citizens one of the stakeholders in the network of actors. In a way that there are projects that are being driven by citizens, that are going to build their own houses in BSD. Or that they get active involvement in innovative projects where they work together with private parties and governments. BSD also created a governance network in which the main actor is Stichting BSD which is not the government that is in the lead, the government is one of the partners in this foundation. This creates an organization that is flatter, and less top-down in the way it works, with the partners from the quadruple helix. This network is setup in a way that Rhodes (2007) sees governance, broader that state actors. Next to that it is a dynamic institutional arrangement that operates in certain socio-spatial context, and uses smart technologies to achieve urban sustainability, according to Jiang et al. (2019).

However this research showed that smart urban governance at this moment is more focussed on using smart technologies to achieve a smart city, rather than thinking about data that is facilitating smart technologies. In all three of the cases the influence of data is substantial and all three of the cases are in some way thinking about designing a data governance to manage this aspect as Cheong & Chang (2007) suggest. The presence of data in every development that takes place in a smart city changes something to the dynamics of the network in which the actors are involved. Every actor wants something else from the data that is generated or gathered by them. Like private parties who's initiative or developments gathers data, or citizens whose house is generating data, or the government that gathers data in public spaces through sensors. Every actor that is involved thinks differently about what needs to happen with these accumulations of data. Which becomes clear when these actors want to develop a smart city in this case. BSD is working on data governance, but it appears to be a project that is developed parallel to the other ongoing developments. Which means that smart urban governance and data governance are not being matched at the moment. With a possible mismatch waiting to happen, with implications for the smart urban governance process of the development. What these implications are and how this works out could not be concluded from this research alone, because the data governance of BSD is not yet in place and the developments are still on going. However it will be helpful for smart city developments to set up a clear data governance that matches and is part of the smart urban governance network. This will be beneficial for the realization of many smart city developments.

It can therefore be argued that data governance is something that should be studied closer to explore what the implications are for spatial developments. Next to seeing if it can be beneficial to incorporate data governance in the smart urban governance theory. So that the practice of developing smart cities can evolve even further, resulting in better outcomes of more liveable and sustainable cities. Where citizens are satisfied with how all of the smart technologies have been implemented. Future research could thus focus on the relationship of data governance and smart urban governance. This can be done by exploring more case studies of smart city developments. Next to cases from the European model, a mix of cases that are driven from the state practice and driven from tech companies. This will give a better view on the positions of governments and companies concerned with data, and what they want to achieve with data. In this research the European model was depicted, and here all the actors came together in one network, which sometimes could make it difficult to see what the intensions are from each actor. Since the actors are not always willing to be completely open up about their motives. This also means that interviews with actors from all of the stakeholder groups can be very helpful in uncovering the motives their motives. This will potentially lead to a better understanding of whether or not data governance incorporated in smart urban governance will be a good thing.

7.3 Recommendations

This research has been carried out by analysing policy documents of municipalities involved in smart city developments. The results of this research also lead to some recommendations towards policy makers to improve the implementation of smart cities. The way that citizens are incorporated in to the governance systems of the developments is important, citizens want to feel involved when it comes to these new developments. It is therefore important to strive for many different ways of involving citizens and giving them opportunities to cooperate in projects. Their understanding of what is taking place will grow and their input is valuable in regards of what can be implemented regarding new smart technologies.

To establish improvements regarding the implementation of smart cities, it is needed to get actively involved in researching data governance for smart city developments. This can help in setting rules and regulations and clear boundaries of what is permissible in these new cities, interns of data. But also for the implementations of smart technologies, because smart technologies often use and collect data, but what happens with that data is most of the times unclear. With data governance it will be possible to discuss these issues and come to a general consensus of what is permissible in these new urban spaces. Especially when all stakeholder groups presented in this research, governments, private parties, knowledge institutions and civil society/local residents are being involved in this process of establishing data governance.

8. Reflection

In this research the main focus was on the case study of Brainport Smart District since the actors where available to me, due to the internship I had with Brainport Smart District. This could have led to the situation in which the information about BSD was much more detailed and better representable than for the other two cases. Next time this could have a different approach in finding more cases in which the accessibility of the actors for interviews is better organised. That will lead to a more balanced case study research. However the used methods of case studies fit with the subject of smart urban governance and how it is put in to practice in various smart city developments. Also the social network analysis method is helpful in getting a better understanding of the governance network that is being researched. But for following research it will be best if this is done on a larger scale with even more actors to incorporate in the social network analysis. The size of how the analysis is performed in this research may have caused a slightly distorted image of the network. On the other hand the interviews on which this analysis was based showed that these actors had these contacts, with mutual agreement.

Also the questionnaire to get some input from the participants in the 40-KavelLab had a very small sample size. In this research it has not been of influence because it was more about receiving some input from these participants as to how they view the process thus far. The decision was made to do this through a questionnaire, because it was more suitable than to set up interviews with these participants. However for following research this is something to be noted when there is the desire to perform statistical analysis that the sample size needs to be substantially bigger.

Something else that potentially has had influence on this research is the early stages that each of these cases are in, in the period that this research had been conducted. All developments have been recently started two to four years ago and the developments are still on going. This also means that the outcomes of the developments cannot yet be fully assessed. In the case of BSD there are no local residents yet, only future residents and this group is rather small. These are the participants of the 40-KavelLab.

One last thing that is important to mention is the language differentiation between how the interviews were executed and how the contents are displayed in the research. The interviews were executed in Dutch and in order for the contents to be used in the research they had to be translated in to English by me. This could potentially have led to some nuances that might miss in this representation of the contents.

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Appendix 1: Tables from spss analysis

Table 1: Importance of BSD characteristics.

Statistics						
		Ik ben geïnteresseerd in technologie	Ik vind duurzaamheid belangrijk	Ik vind een circulair ecosysteem belangrijk voor de toekomst	Ik vind zelf/ lokaal opgewekte groene energie belangrijk	Ik ben geïnteresseerd in nieuwe vormen van mobiliteit
N	Valid	7	7	7	7	7
	Missing	0	0	0	0	0
Mean		1,14	1,86	2,00	1,43	1,57
Median		1,00	2,00	2,00	2,00	2,00
Mode		2	2	2	2	2
Minimum		0	1	2	0	0
Maximum		2	2	2	2	2

Table 1.1: Ik ben geïnteresseerd in technologie					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	2	28,6	28,6	28,6
	1	2	28,6	28,6	57,1
	2	3	42,9	42,9	100,0
	Total	7	100,0	100,0	

Table 1.2: Ik vind duurzaamheid belangrijk					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	14,3	14,3	14,3
	2	6	85,7	85,7	100,0
	Total	7	100,0	100,0	

Table 1.3: Ik vind een circulair ecosysteem belangrijk voor de toekomst					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	7	100,0	100,0	100,0

Table 1.4: Ik vind zelf/ lokaal opgewekte groene energie belangrijk					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	14,3	14,3	14,3
	1	2	28,6	28,6	42,9
	2	4	57,1	57,1	100,0
	Total	7	100,0	100,0	

Table 1.5: Ik ben geïnteresseerd in nieuwe vormen van mobiliteit					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	14,3	14,3	14,3
	1	1	14,3	14,3	28,6
	2	5	71,4	71,4	100,0
	Total	7	100,0	100,0	

Table 2: Views on building and living in BSD.

Statistics				
		Ik wil graag een huis bouwen dat innovatief is en daarom ook past in deze wijk	Ik zie voordelen aan het wonen in een slimme wijk zoals BSD	Ik vind de ambitie van BSD om de slimste wijk van de wereld te worden realistisch
N	Valid	7	7	7
	Missing	0	0	0
Mean		1,71	1,57	-,57
Median		2,00	2,00	,00
Mode		2	2	0
Minimum		1	0	-2
Maximum		2	2	1

Table 2.1: Ik wil graag een huis bouwen dat innovatief is en daarom ook past in deze wijk					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	28,6	28,6	28,6
	2	5	71,4	71,4	100,0
	Total	7	100,0	100,0	

Table 2.2: Ik zie voordelen aan het wonen in een slimme wijk zoals BSD					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	14,3	14,3	14,3
	1	1	14,3	14,3	28,6
	2	5	71,4	71,4	100,0
	Total	7	100,0	100,0	

Table 2.3: Ik vind de ambitie van BSD om de slimste wijk van de wereld te worden realistisch					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	2	28,6	28,6	28,6
	-1	1	14,3	14,3	42,9
	0	3	42,9	42,9	85,7
	1	1	14,3	14,3	100,0
	Total	7	100,0	100,0	

Table 3: Citizen participation process.

Statistics				
		Ik vind het een positieve ontwikkeling dat burgers / (toekomstige) bewoners betrokken worden bij de ontwikkeling van een nieuwe wijk	Ik vind het proces van het 40 Kavel-Lab prettig werken om mijn eigen woning te realiseren in BSD	Ik vind het prettig dat wij met een groep mensen samen werken die allemaal hun eigen woning gaan realiseren in BSD
N	Valid	7	7	7
	Missing	0	0	0
Mean		1,57	-1,00	1,29
Median		2,00	-1,00	1,00
Mode		2	-2	1[a]
Minimum		1	-2	0
Maximum		2	1	2
a. Multiple modes exist. The smallest value is shown				

3.1: Ik vind het een positieve ontwikkeling dat burgers / (toekomstige) bewoners betrokken worden bij de ontwikkeling van een nieuwe wijk					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	42,9	42,9	42,9
	2	4	57,1	57,1	100,0
	Total	7	100,0	100,0	

3.2: Ik vind het proces van het 40 Kavel-Lab prettig werken om mijn eigen woning te realiseren in BSD					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	3	42,9	42,9	42,9
	-1	2	28,6	28,6	71,4
	0	1	14,3	14,3	85,7
	1	1	14,3	14,3	100,0
	Total	7	100,0	100,0	

3.3: Ik vind het prettig dat wij met een groep mensen samen werken die allemaal hun eigen woning gaan realiseren in BSD					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	1	14,3	14,3	14,3
	1	3	42,9	42,9	57,1
	2	3	42,9	42,9	100,0
	Total	7	100,0	100,0	

Table 4: Contact with BSD and being an integral part of BSD.

Statistics				
		Het contact met de verantwoordelijke programma managers bij BSD is goed	Ik heb het gevoel dat er een volwaardig partnerschap is ontstaan met het 40 Kavel-Lab, tussen ons als toekomstige bewoners en (stichting) BSD als ontwikkelaar	Ik heb het gevoel dat het 40 Kavel-Lab integraal onderdeel is van BSD
N	Valid	7	7	7
	Missing	0	0	0
Mean		-,86	-1,29	-,71
Median		-1,00	-1,00	-1,00
Mode		-1	-2[a]	-1[a]
Minimum		-2	-2	-2
Maximum		0	0	0
a. Multiple modes exist. The smallest value is shown				

4.1: Het contact met de verantwoordelijke programma managers bij BSD is goed					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	14,3	14,3	14,3
	-1	4	57,1	57,1	71,4
	0	2	28,6	28,6	100,0
	Total	7	100,0	100,0	

4.2: Ik heb het gevoel dat er een volwaardig partnerschap is ontstaan met het 40 Kavel-Lab, tussen ons als toekomstige bewoners en (stichting) BSD als ontwikkelaar					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	3	42,9	42,9	42,9
	-1	3	42,9	42,9	85,7
	0	1	14,3	14,3	100,0
	Total	7	100,0	100,0	

4.3: Ik heb het gevoel dat het 40 Kavel-Lab integraal onderdeel is van BSD					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-2	1	14,3	14,3	14,3
	-1	3	42,9	42,9	57,1
	0	3	42,9	42,9	100,0
	Total	7	100,0	100,0	

Appendix 2: interview questions.

Tabel 2.1: Overview of questions to ask during the semi-structured interviews.

General questions
Can you please introduce yourself and what your relation is to BSD?
Could you describe BSD to me?
What is the goal of BSD?
Who is developping BSD?
What is the meaning of the different project lines of BSD for the development? Are these essential for a smart city?
With who form the following stakeholder categories do you have contact: Government, private parties, universities and civil society?
How often do you have contact with these parties/persons? Daily, weekly, monthly?
Government
What is the role of your institution for BSD?
What is your role, or are your responsibilities and interests? Are there any possible conflicts of interest?
What is the goal of your institution for BSD?
How is the general cooperation with all the parties going?
What is the goal of the Urban Data Platform?
How do you see data governance in line with BSD?
Private parties
What does your company do for BSD, what do you develop or produce?
What is your role, or are your responsibilities and interests for/with? Are there any possible conflicts of interest?
How do you cooperate with BSD?
Who do you cooperate with for the development of BSD? And how is different to other projects you are involved with?
How is the general cooperation with all the parties going?
Knowledge institutes
How is the university involved with the development of BSD?
Are there tasks or projects that the university carries out for BSD?
How is the general cooperation with all the parties going?
What are the responsibilities and interests of the university? Are there any possible conflicts of interest?
What is the goal of the Urban Data Platform?
What can you tell me about data governance, and the things BSD does on this subject?