

Master's Thesis Internship – master Sustainable Business and Innovation

Shared agendas or problematic partners?

Perspectives of quadruple helix actors on public value creation in smart cities



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SUMMARY

This research considers that the main purpose of a smart city is the creation of public value, which requires smart governance strategies. However, some critical urban planning literature considers a neoliberal perspective when regarding smart cities. This perspective warns that private actors may become too dominant in the public domain of cities. It is possible then that cities will turn into “corporate” instead of “smart” cities, which will influence public value creation in a negative way. Alternatively, there are authors who state that the neoliberal interpretation explains a smart city mostly through discursive critiques. This results in an urgent need to examine the smart city as it actually exists, and to understand how viewpoints on public value creation among quadruple helix actors differ. Therefore, this research addressed the following research question:

Research question

How do quadruple helix actors view public value creation through smart governance strategies in Dutch smart cities?

To answer this question, this research performed a Q-methodological study. The Q-methodology was chosen because it is both a qualitative and quantitative method that enables the discovery of different viewpoints of people on different subjects – in this case, public value creation through smart governance strategies.

This research identified three perspectives. Perspective 1 implies a bottom-up approach in smart governance strategies. It highlights the role of citizens by suggesting that smart cities is mainly about active citizens who set up smart city projects themselves. Perspectives 2 and 3 highlight a top-down approach. This top-down orientation is most prominent in smart governance strategies of *collaboration* and *integral vision* where perspective 2 sees the national government as key actor while perspective 3 views local governments should be key actors.

In identifying which public value matters in smart cities, all three perspectives highlight some aspects of the economic dimension of TBL, but mostly in an adverse way. There are also nuances. Perspective 1 highlights that every TBL dimension is equally important. Perspective 2 stresses the social inclusivity of a smart city, while perspective 3 sees “energy” as an important opportunity in smart cities.

Based on this research, the identified perspectives revealed that the economic and corporate view is not as present as some critical urban literature may state. In addition, all three identified perspectives mainly emphasise collaboration processes in smart cities, which reveals that quadruple helix actors in Dutch smart cities view public value creation mostly through the smart governance strategy of *collaboration*.

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1 INTRODUCTION

Today more than half of the world's population lives in urban areas, and this proportion is expected to increase to three quarters by 2050 (Alawadhi et al., 2012; Chourabi et al., 2012). As a consequence, city governments face a wide range of challenges, from producing wealth and innovation to creating health and sustainability in urban environments. Cities need to be green and safe, but also vibrant; and vibrancy is associated with a complex assemblage of different stakeholders with competing objectives and values (Landry, 2006; Chourabi et al., 2012; Meijer & Bolívar, 2016).

In response, the concept of the “smart city” has been proposed as a solution to meet these urban challenges (Alawadhi et al., 2012). The literature about the smart city concept is rich but fragmented (Tranos & Gertner, 2012; De Wijs et al., 2016), resulting in a lack of one uniform and consistent definition (Chourabi et al., 2012). Taking a more social approach to defining smart cities, scholars with a public administration background suggest that the main purpose of smart cities is the creation of public value. In general, public value creation aims to obtain collectively desired social outcomes. For smart cities, these outcomes are related to the improvement of better quality of life for citizens (Castelnovo et al., 2016; Meijer et al., 2016), which requires smart governance (Albino et al., 2015; Meijer et al., 2016).

Smart governance has not been uniformly defined yet. Some scholars emphasise political participation, while others focus more on the collecting of public management data by sensors or sensor networks (Bolívar & Meijer, 2016). After several research publications on smart governance, Meijer et al. (2016, p. 648) define smart governance as managing and implementing policies to improve citizens' quality of life by leveraging ICTs and institutions, and by actively involving and collaborating with stakeholders. In order to realise this smart governance they identify five smart governance strategies, namely *integrated vision*, *legislation*, *technology/ICT*, *policy* and *collaboration*. Collaboration in particular, plays a vital role in public value creation since collaboration is a key component in accomplishing public goals (Hui & Huyllar, 2010; Morse, 2010; Bolívar & Meijer, 2016; Castelnovo, 2016). In most smart city projects collaboration is considered through a quadruple helix approach for which different spheres of actors are involved (knowledge institutes, private, public and citizen actors) (Verheggen, 2017). The challenge, therefore, is to utilise a policy approach in which several actors cooperate to obtain public value (Hui & Huyllar, 2010; Morse, 2010).

The need for such a policy approach in smart cities is also seen in the Netherlands. Recently, several Dutch cities, companies and scientists have helped to realise the Dutch Smart City Strategy (*NL Smart City Strategie*), in which the Dutch G5 cities (Amsterdam, The Hague, Utrecht, Rotterdam and Eindhoven) see themselves as frontrunners in the achievement of becoming smart cities. In order to achieve this, however, they stress the need for cooperation between the national government and themselves. Collaboration in most Dutch smart city projects are also considered through the quadruple helix approach. However, the organisation of these projects is often fragmented, with actors remaining in their own social spheres (Verheggen, 2017). A recent report of the National Smart City Strategy (2017) has therefore

argued that cross-sectoral collaboration is necessary, across institutional scales (regional, national and international) and between cities, businesses, scientists, citizens and the national government.

One of the variables which influences successful collaboration is power balances between the actors. This can be understood as a situation where actors can participate on equal footing with other actors (Ansell & Gash, 2008). However, research reveals that in many collaboration processes power imbalances are a common problem (Lester & Reckhow, 2013), which also influence the role of actors in public value creation. This theme is also present in the critical urban planning literature on smart cities, in particular in relation to the role of private actors. Vanolo (2013), for instance, has stated that private actors may become too dominant in the public domain of cities, and that large companies use the smart city concept as a strategic tool for gaining a dominant position in this domain (ibid; Söderström et al., 2014). Hollands (2015) argues that business involvement in moulding the smart city is mainly through large ICT and property development companies, which results in a more neoliberal and less citizen-centred form of smart city governance.

Though much of the urban planning literature is critical, it does acknowledge that the neoliberal interpretation of a smart city is complex and nonlinear, and that this interpretation has been concerned with explaining smart cities mostly through discursive critiques (Luque-Ayala & Marvin, 2015; Söderström et al., 2014). There is an urgent need to analyse the smart city as it actually exists (Shelton et al., 2015) and to understand how viewpoints on public value creation among the quadruple helix actors differ. This kind of research is lacking in scientific literature (Meijer & Bolívar, 2016). Therefore this research will fill the gap between scientific literature and practice by addressing the following research question:

Research question

How do quadruple helix actors view public value creation through smart governance strategies in Dutch smart cities?

In order to answer the research question, this research makes use of Q-methodology, which is explained further in the method section. The conceptual framework section elaborates on the issue of public value creation in smart cities and how this can be obtained through smart governance. It also provides a review of critical urban studies about power imbalances among the quadruple helix actors in smart cities. The results are presented after the method section, followed by conclusion, discussion and finally recommendations.

Social relevance

The research is partly conducted for the Ministry of Infrastructure and the Environment in the Netherlands, which highlights the social relevance of this research. As already mentioned, several Dutch cities, companies and scientists have helped to realise the Dutch Smart City Strategy which argued that cross-sectoral collaboration is necessary, across institutional scales (regional, national and international) and between cities, businesses, scientists, citizens and the national government. However, the design of this cross-sectoral collaboration is still at the beginning phase whereby there is indistinctness about how these developments will progress in society. Therefore the Ministry aims to determine how it should position itself regarding cooperation in smart city projects. Hence, the outcomes of this research are used to provide recommendations for the Ministry.

2 CONCEPTUAL FRAMEWORK

This research draws on concepts and theories from various literatures, most of which are based on public administration and urban governance studies. In this section, an overview of these literatures is given. The section ends with a conceptual model.

2.1 Defining smart cities

The concept of smart cities captures the idea of the creation of new relations between technology and society (Meijer et al., 2016). One uniform and consistent definition of smart cities is lacking (Chourabi et al., 2012), but increasing numbers of authors emphasise a broader perspective on the term smart cities (Castelnovo et al., 2016; Meijer et al., 2016; Niaros, 2016), advocating the separation of the concept into many features and dimensions (Castelnovo et al., 2016). For example, the study of De Wijs et al. (2016) sought a definition of the smart city concept. It suggested that the concept consists of four components: technology, sustainability, human and social capital, and governance. In terms of *technology*, the emphasis is on the contribution of ICT to the planning and management of cities. In this way, it refers to an urban environment where ‘pervasive’ or ‘ubiquitous’ computing has introduced a range of digital devices for sensing, monitoring and managing the city. The *sustainability* component relates to long-term human impacts on the environment. The third component, *human and social capital*, emphasises that a smart city needs creative and educated people to sustain a knowledge economy and create a climate suitable for an emerging creative class that is a fundamental asset for smart cities (Castelnovo et al., 2016). The last component, *governance*, can be encountered as the process of interaction and decision making among public, private and civil society actors involved in collective issues (De Wijs et al., 2016; Geertman & De Klerk, 2016). Combining these four components De Wijs et al. (2016) aim to take a broader perspective on the smart city concept in accordance with the definition given by Caragliu, Del Bo and Nijkamp (2011, p. 70):

“The smart city can be defined as a city where 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.”

In addition, Meijer & Bolívar (2016, p. 7) elaborate on this definition by defining the ‘smartness’ in a city. They state that a city can neither be qualified as ‘smart’ nor ‘stupid’, but could be analysed in terms of its structural and cultural characteristics in these four domains. Therefore the authors define the smartness of a city as:

“Its ability to attract human capital and to mobilize this human capital in collaborations between the various (organised and individual) actors through the use of information and communication technologies.”

To make these collaborations between the various actors successful, there should be a power balance between the actors meaning that actors can participate on equal footing with other actors (Ansell & Gash, 2008). However, in many collaboration practises power is not equally distributed (Lester & Reckhow, 2013). This is also identified in the smart city literature, with private actors seen as becoming too dominant.

Hollands (2015) states that the most prominent instances of business involvement in shaping the smart city are where large ICT and property development corporations have had almost total control in building and designing whole entities. This is in line with Söderström et al.'s (2014) suggestion that, on the surface, the dominant smart cities' narrative relating to business is about creating efficient and sustainable cities to meet urban challenges and create public value, but that underneath the companies see the smart city concept as a tool for gaining a dominant position in a huge market. The authors describe it metaphorically as a situation where big companies, such as Siemens and Cisco, aim to be the electrician and plumber, and IBM their choreographer and superintendent (IBM is the current market leader in the business of smart urban technologies). However, critical scholars are increasingly focusing on the claims being made by corporate smart city initiatives, while Luque-Ayala & Marvin (2015) argue that within the corporate sector there is significant uncertainty about how "smart" in smart cities might be developed, what role it should play in corporate strategy and what its potential benefits and profitability are in an urban context? In this sense, the focus should be on the relationships through which the smart city actually exists, has been produced, and on the territories in which the idea has taken root and effected change (Shelton et al., 2015).

2.2 Defining public value creation

Taking the broader definition of Meijer & Bolívar (2016) about smart cities into consideration, scholars with a public administration background argue that the outcome of smart cities is new public value (Meijer et al., 2016). Depending on the specific context and problems to be solved, generating public value within a smart city strategy could mean many different things (ibid).

In general, however, public value refers to whatever is undertaken and produced by agencies utilising public resources (their inputs, outputs and outcomes) in their efforts to achieve collectively desired social outcomes (Moore, 2013). The wealth of published research about public value has made for a varied academic field. There has been a notable diversity of ideas about what the most important elements of public value-creation are. Still, one widely used theoretical approach comes from Meynhardt (2017), who suggests that public value comes into being when people perceive positive contributions to what they regard as society, societal order or social values. He distinguishes four value dimensions, one of which is hedonistic-aesthetic value. This is, in essence, about maximising pleasure and minimising displeasure, and it relates to broader ideas of quality of life (Gemeinwohl, 2017). Therefore this research sees public value as improving the quality of life for urban citizens.

Considerations about quality of life feature significantly in the smart city literature. All smart city initiatives ultimately aim to improve quality of life for citizens and other urban stakeholders (Castelnovo et al., 2016). In this sense, quality of life relates to urban sustainability since it is about providing a healthy, satisfying and enjoyable life for all urban residents, in the present and the future (Maclaren, 1996). The essence of urban sustainability is captured in the Triple Bottom Line, hereafter called TBL, accounting framework (ibid; Savitz & Weber, 2006), which incorporates three dimensions of performance to measure social, environmental and economic sustainability (Elkington, 1994). Many business and non-profit organisations have adopted this framework to evaluate their performance, and a similar approach has gained currency with governments at different institutional levels (Hall, 2011). In this research, it is suggested that the combination of the three dimensions of the TBL, therefore, represents the creation of public value in smart cities – but smart governance is needed for its realisation (Albino et al., 2015; Meijer et al., 2016).

2.3 Defining smart governance

The fragmentation in literature about smart cities is reproduced in the concept of smart city governance (Meijer & Bolívar, 2015). The term “governance” itself is already one of the most frequently used in social science (Ansell & Torfing, 2016). It has, over time, accumulated many different meanings, resulting in a term that is notoriously slippery (Jessop, 1998; Ansell & Torfing, 2016). Governance has generally been interpreted according to a “good governance” or a “neoliberal” normative model. In the latter, the normative emphasis has been on moving away from state-centric models of governance, and towards a leaner state. The focus in this case is on policies promoting deregulation and privatisation, since neoliberal models present the market as the most appropriate or efficient institutional framework for allocating goods and services in society. By contrast, the good governance model presents the state as a key player and a central hub of governance arrangements. Its focus is on involving non-state actors in processes of rule formation, procedural and substantive decision making, resource allocation, and service delivery (Gupta et al., 2015). Whether governance is approached from the good governance or neoliberal model, in general governance is about the administration of society and the economy through collective action and in accordance with common goals (Meuleman, 2008).

A relatively new form is “smart governance”. It is identified as managing and implementing policies to improve citizens’ quality of life by leveraging ICTs and institutions, and by actively involving and collaborating with stakeholders (Meijer, et al., 2016 p. 648). Bolívar & Meijer (2016) and Castelnovo et al. (2016) have aimed to assess public value in relation to smart cities and smart governance. Their foci differ, but both studies stress that smart governance is multidimensional in the generation of public value (Meijer et al., 2016). Castelnovo et al. (2016) identify elements of a smart city governance assessment framework, which is based on the public value management approach. The framework starts with citizens’ needs and institutional settings which drive the decision making process in ensuring the optimal allocation of resources for public value services. These services are generated in the

creation of public value outcome (Castelnovo et al., 2016), which relates to what Bolívar & Meijer (2016) have identified as smart governance strategies.

The smart governance strategies help to realise smart governance. In total Bolívar & Meijer (2016) identify five strategies: integral vision, legislation, technology/ICT, policy and collaboration. An integral vision of the city is the guiding idea, and this is translated in legal, technological/ICT, policy, and collaborative actions. The next table (table 1) describes each strategy in short.

Smart governance strategies	Description
Integral vision	Integral vision for a smart city which can coordinate the many different components that comprise the smart city
Legislation	Consists of two parts: <ul style="list-style-type: none"> • Creating a new legislation framework about responsibility, openness, transparency, and access to public data • Regulations that government agencies may impose on what, how, where, and why citizens are able to influence the governance of their cities
Technology/ICT	Consisting of three parts: <ul style="list-style-type: none"> • Development of information infrastructure that underpins the city through distributed computing and networks available to everyone with devices that can access such infrastructure • Collection of all sorts of data and information concerning public management by sensor or sensor networks • Support of technologies and models of services in smart cities
Policy	Policies to promote smart city initiatives oriented toward strengthening innovation systems
Collaboration	The activity of coordinating communications in order to achieve collective goals through collaboration

Table 1. Short explanation smart governance strategies (Bolívar & Meijer, 2016, p. 10-11)

2.4 Conceptual model

Based on the literature review, a conceptual model can be visualised as follows:

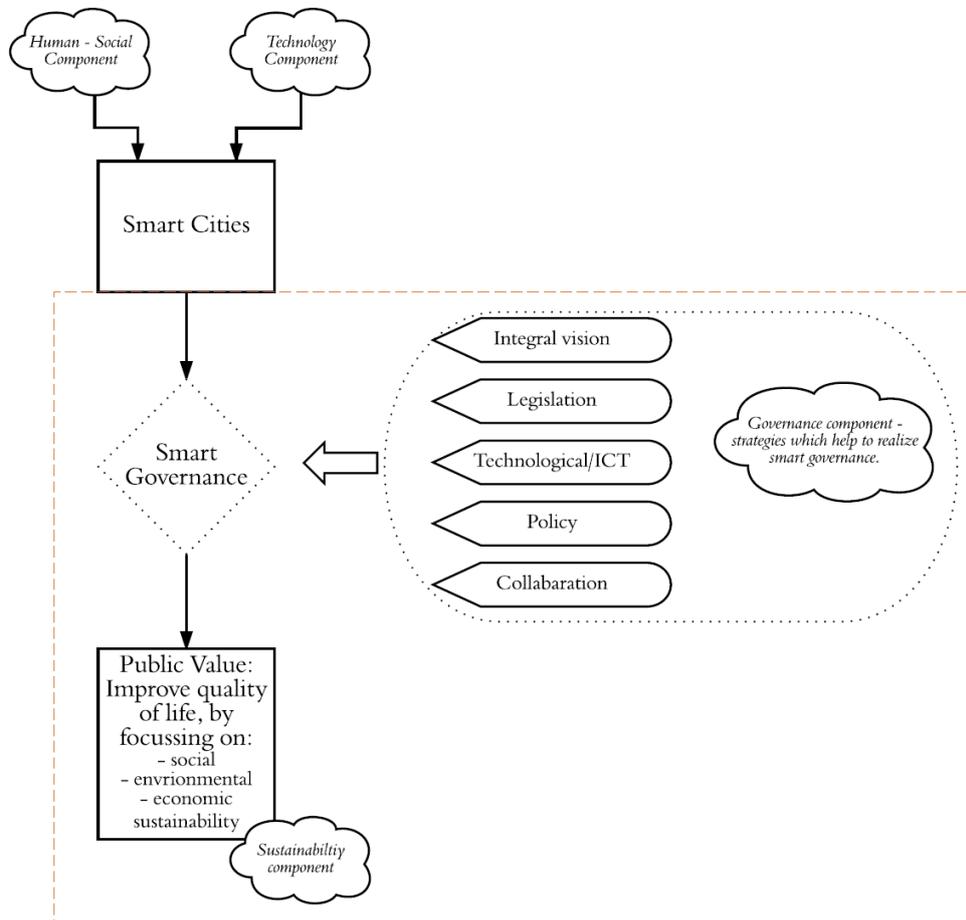


Figure 1. Conceptual model

Looking at the figure above, the four components identified by De Wijs et al. (2016) can be included in the process of public value creation in smart cities. The *technology* and *human-social capital* components can both be seen as main drivers to reach the main objective of smart cities – the *sustainability* component – which is creating public value by improving the quality of life. However, in order to realise public value, the contribution of smart governance is required: the *governance* component. The process of public value creation through smart governance consists of smart governance five strategies. The stippled orange line represents the unit of analysis which is distinguished into two parts: public value creation through smart governance (in conceptual framework under governance component) and determination of which public values matters in smart cities to improve the quality of life (in conceptual framework under sustainability component).

3 METHODOLOGY

3.1 Studying existing smart cities using the Q-methodology

To study the smart city as it exists and determine different views of quadruple helix actors on public value creation through smart governance strategies in Dutch smart cities, this research has performed a Q-methodological study. The existence of different viewpoints implies subjectivity, equivalent to individual personal impressions and opinions (Akhtar-Danesh et al., 2008). To analyse subjectivity in a scientific study, the concourse theory of communication proposes the Q-methodology. Q-methodology originated in the work of William Stephenson (1902-1989), trained in both physics and psychology (McKeown & Thomas, 2013, p. 10). As Barry and Proops (1999, p. 337) state:

“Q-methodology is a qualitative, but statistical approach that enables discovery of a variety of discourses concerning how individuals understand their behaviour, and how they understand the social and environmental worlds in which they live.”

In this sense, this methodology combines qualitative and quantitative methods to investigate the subjective views of those directly involved in a topic, allowing participants to express their viewpoints by arranging items (typically statements related to the topic) into a sorting grid. The key to this approach is to consider data in terms of an individual's entire pattern of responses, and therefore identify shared views (Coogan & Herrington, 2011; Eden et al., 2005). This sorting behaviour (Q-sorts) is then analysed through *factor analyses*, by which participants with similar views can be grouped into *factors* (Watts & Stenner, 2005).

Ultimately, Q-methodology is composed of two aspects: Q-sort and inverted factor analyses (Baker, 2013). The Q-sort is the qualitative part of the methodology. The Q-sort entails, first, the Q-set, which is the collection of heterogeneous items that participants sort. The Q-set is comprised of a variety of statements, each with a different assertion on a chosen topic. Another important aspect of the Q-sort involves the participant group or P-set. There are no strict rules governing the number of participants which can vary according to the context of the research (Watts & Stenner, 2005). The overall configurations produced by the respondents in the Q-sort are intercorrelated in the inverted factor analysis which is the quantitative part of the Q-methodology.

The second part of the Q-methodology, the factor analysis, reveals similarities between respondents' sorting (Coogan & Herrington, 2001). In this research, the factor analysis is conducted using the free program PQMethod 2.11, specifically designed for Q-methodology and recommended by several scholars (Previte, 2007; Coogan & Herrington, 2011; Dziopa & Ahern, 2011).

3.2 Application of Q-methodology

3.2.1 Q-sample

The process of making the statements resulted in a final set of 39 statements, in accordance with the general guidelines for conducting a Q-methodological study. Watts & Stenner (2005) state that the exact size of the Q-set is dictated by the subject matter itself. The final 39 statements were tested in two pilot interviews to make sure the statements were clear, the interview could be performed in one hour, and to ensure the statement set covered the entire discourse as thoroughly as possible. The formulated statements are presented in Appendix A.

In making the Q-set, a structured sample process was chosen by which statements are intentionally selected to cover a range of existing theories and topics (Steelman & Maguire, 1999). The statements made in this research are based on the conceptual framework established in section 2 where the unit of analysis is distinguished into two parts: smart governance strategies and determination of which public values matter. Therefore, statements 1–15, and 29–39 are statements which examine public value creation through smart governance strategies. The statements are divided in groups. Each group represents one of the five smart governance strategies. For example, one of the five strategies is *policy* for which statements 7–14 exemplifies this strategy. Textbox 1 gives an example how this is presented in Appendix A.

Strategy policy: policy for promoting smart city initiatives

- Statement 7: To realise a smart city, policy for promoting smart city initiatives is necessary
- Statement 8: The central government should take the lead in making policy for promoting smart city initiatives
- Statement 9: The local governments should take the lead in making policy for promoting smart city initiatives

Textbox 1. Example statements public value creation through smart governance strategies in Appendix A

In addition, when possible, a distinction is made about which actor (public: national or local¹; private; or citizen) should take the lead in the smart governance strategies. This since the research is partly conducted for the Ministry of Infrastructure and the Environment in the Netherlands.

¹ The Dutch government administration is ranked in 3 levels. First there is the central government, which is responsible for nation-wide policy. The central government is followed by provincial authorities, and form the link between local governments (municipalities) and the central government. The local governments focus on all matters relating to their own jurisdiction such as management of public spaces and environmental aspects (Netherlands Enterprise Agency, 2017).

Statements 15–28 are the public value statements. These statements are based on the document Smart City Index Master Indicators (2014) conducted by the Smart City Council. This council describes itself as a neutral advisor to council cities about the transformative power of smart technologies (SCC, 2016). In Appendix A, the public value statements are divided under the three TBL dimensions (social, environmental, and economic). For example, textbox 2 shows statements 15–19 as presented in Appendix A, which represents the economic dimension.

TBL dimension: Economic

- Statement 15: A smart city is all about economic development
- Statement 16: A smart city is about creating a high gross regional product and low unemployment rate (economic dimension).

Textbox 2. Example public value statements in Appendix A

3.2.2 P-set

The P-set describes the respondents participating in the Q-study. The aim of this research is to obtain the viewpoints of quadruple helix actors on public value creation through smart governance strategies. Therefore, as it specifically concerns the viewpoints of the quadruple helix actors, a strategic sampling of the participants was chosen (Watts & Stenner, 2005).

The initial P-set consisted of 20 respondents, of which the goal was to include five representatives from each quadruple helix sphere (knowledge institutions, private, public, and citizen actors). However, ultimately this was not possible. Moreover, one interview with a public respondent could not be included as the Q-sorting was interrupted due to an unexpected meeting. Therefore, the P-set includes 19 respondents, four from knowledge institutions, four citizens, five private, and six public actors. This is a reasonable break down as the Q-methodology does not require a large number of participants. Moreover, a larger P-set is not beneficial in a Q-study because the methodology operates on the assumption of finite diversity. This means that a researcher investigates the similarity and diversity of patterns across individuals for which there exist only a limited number of opinions within a particular discourse domain (Cools et al., 2009). This typically results in two to four viewpoints on a subject wherein the P-set should include 8–30 respondents (Van Exel & de Graaf, 2005).

Most selected respondents of the P-set (12 respondents) contributed to the Dutch Smart City Strategy and as such the sample includes several quadruple helix actors. Moreover, this process ensures that respondents were familiar with the smart city concept. However, to create more variation in the P-set sample, respondents who were not involved in the Dutch Smart City Strategy, but who were still familiar with the smart city subject, were also chosen (7 respondents). More detailed information about the P-set can be found in Appendix B.

3.2.3 Q-sorting

For the Q-sorting, respondents were asked to arrange statements cards (printed on separate and numbered cards) into three piles according to agreement, disagreement, and neutrality. From these three piles, respondents were then asked to arrange the statements in a more sophisticated pattern: a fixed quasi-normal distribution (see figure 2).

Figure 2 demonstrates that the distribution dictates the number of items that can be assigned to each ranking position (Coogan et al., 2009) and is related to a *forced distribution*. In this research, five elements were required at each of the extremes (-4, -3 and +3, +4), while seven were required at the neutral point of zero. When respondents felt strongly about a statement, they placed it at the relevant extreme of the grid to indicate strong agreement or disagreement. Respondents had to arrange the statements they felt more ambivalent about in the central portion of the grid (Baker, 2013). This final sorting took roughly 5–10 minutes. In total, the interview took about 60 minutes.

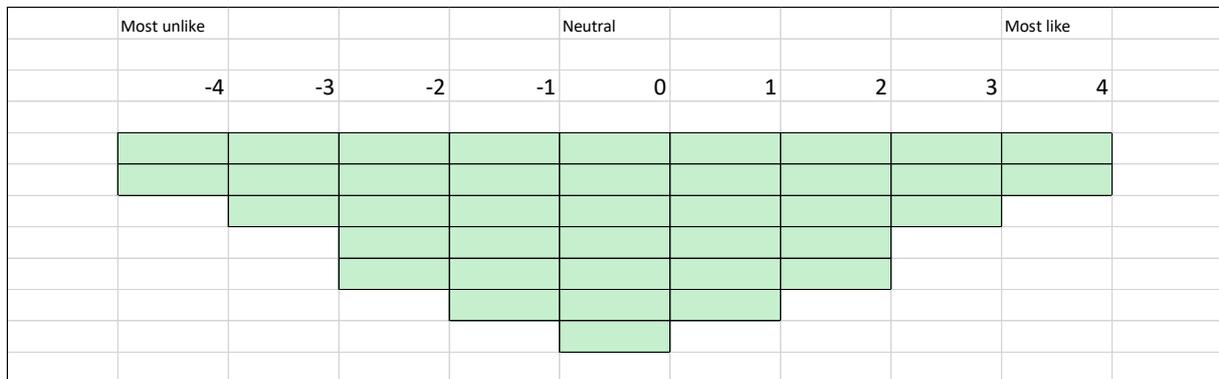


Figure 2. Fixed quasi-normal distribution for 39 statements

To aid interpretation of results, respondents were asked to explain their placement for every statement. Their answers were both noted and recorded. After the interview the notes and records were transcribed in Excel.

3.2.4 Data analysis

For the data analysis, the initial sorting of all respondents was imported into PQMethod 2.11. Using Pearson's r correlation, all 19 Q-sorts were correlated. This correlation resulted in a correlation matrix which provided information about differences and similarities in how respondents arranged their Q-sorts.

After entering the sorts, the correlation matrix was subject to a factor analysis (Valenta & Wigger, 1997) for which principal components analysis (PCA) was performed. Principal components analysis is a factor extraction method (Akhtar-Danesh et al., 2008) used to find patterns in data of high dimensions, or, as for Q-methodology, grouping similar views into factors (Smith, 2002). An individual's positive loading on a factor indicates his or her shared

subjectivity with others on that factors. In many cases, three to four factors can be identified, thus three to four different viewpoints on the subject.

In Q-methodology, interpretations are based on examining and comparing factor scores. These scores show the level of agreement/disagreement among statements within each identified factor. However, to come to the factor scores, the factors needed to be rotated first. Thereby a varimax rotation was executed since PCA with varimax is the most common routine employed (Brown, 2004). Varimax is an orthogonal rotation technique that minimizes the error and maximizes the factor loadings. Second, each factor loading was controlled for the weighting for which a composite Q-sort was uncovered for each of the factors. A composite Q-sort, also known as conceptual best-fit Q-sort, reflect an overall Q-sample for the respondents who loaded on the factor in total (Brown, 2004; Dziopa & Ahern, 2011). The composite Q-sort summarises the viewpoints of all persons loading on any identified factor.

3.2.5 Data interpretation

In this research the top and bottom columns (representing most extreme placed statements) of the conceptual best-fit Q-sorts are used for interpretive purposes. The comments made by respondents about the statements are used to aid interpretation of the viewpoints clustered in the factors.

4 RESULTS

This section discusses the results of the data analysis. First, a table with respondents' factor loadings is shown which presents three identified factors. Second, respondents' factor loadings are followed by an interpretation of the factor scores for which every perspective is described using statements placed at the extremes of every conceptual best-fit Q-sort.

4.1 Correlation matrix subjected to factor analysis

The Q-factor analysis revealed three dominant factors, meaning that there are three dominant views on public value creation through smart governance strategies in Dutch smart cities. Table 2 shows, for every factor, the corresponding factor loadings of every respondent. Factor loadings which scores > 0.45 (bold and indicated with X) are significant, meaning that these respondents represent a shared value pattern for that specific factor. Respondent 10 has two significant factor loadings and is therefore not considered in the statistic results of the Q-analysis (Valenta & Wigger, 1997). The X indicates for which factor the respondents are loaded.

Respondents	Factor loadings		
	1	2	3
1 - private actor	0.1332	0.5840X	0.2647
2 - public actor	0.7126X	-0.4037	0.1421
3 - citizen actor	0.2390	0.5412X	0.3181
4 - public actor	-0.1162	0.1191	0.6327X
5 - citizen actor	0.6161X	-0.0863	0.0836
6 - private actor	-0.0748	0.6342X	-0.0833
7 - knowledge institution actor	0.5468	-0.0481	0.5819X
8 - citizen actor	0.7234X	0.3468	0.1608
9 - public actor	0.4895X	0.3538	-0.0373
10 - private actor	0.5576	0.3077	-0.5241
11 - public actor	0.7793X	0.1042	0.1156
12 - knowledge institution actor	0.7191X	0.1350	0.1940
13 - public actor	0.3739	0.4252	0.5811X
14 - knowledge institution actor	0.6529X	0.2028	-0.0546
15 - knowledge institution actor	-0.0269	0.7123X	0.0645
16 - citizen actor	0.5645X	-0.2870	0.3173
17 - private actor	0.3914	0.2766	0.5306X
18 - public actor	0.4946X	0.1116	-0.0244
19 - private actor	0.4354	0.5013X	0.0891

Table 2. Factor loadings respondents

Each factor represents a unique perspective (Ramlo et al., 2008). Therefore, the factors are hereafter called and considered as perspectives. To determine these unique perspectives on public value creation through smart governance strategies in smart cities, each perspective is interpreted using the statements which have the highest (+3, +4) and lowest (-4, -3) grid-position of the conceptual best-fit Q-sort for every perspective (statements placed at the extreme) (Akhtar-Danesh et al., 2008; Coogan & Herrington, 2009). These grid positions are of particular interest since they represent the most likes and dislikes of the respondents loaded onto one perspective (Zabala, 2014), and reveal, as such, a dominant value pattern (Dijkema, 2016).

The following section discusses all three perspectives. Each perspective description is divided into public value creation through smart governance strategies (statements 1–15 and 29–39) and a determination of which public values matters in smart cities according to the respondents (statements 15–28). This distinction is made following the conceptual framework presented in section 2. In both these divisions, a table is presented concerning the statements positioned at the extreme. Every table is complemented by a smart governance strategy or TBL dimension column indicating the concerning strategy or TBL dimension.

4.2 Interpretation perspectives

In this section it is aimed to find the common approach between the statements placed at the extremes of the conceptual best-fit Q-sorts, which summarises each perspective in essence. This is followed by an in-depth analysis with personal comments of the respondents concerning their most extreme rankings, and are presented in italics. The personal comments are used to endorse each perspective summary.

4.2.1 Perspective 1: citizen oriented, highlighting that all TBL dimensions are equally important

4.2.1.1 Public value creation through smart governance strategies – perspective 1

No.	Statement	Grid position	Smart governance strategy
33	A smart city can never exist without a <i>level playing field</i> among the quadruple helix actors	+4	Collaboration
1	Clear rules (legislation) about data and privacy are essential in a smart city	+3	Legislation
10	A smart city is mainly about citizens who set up smart city projects and initiatives by themselves	+3	Policy

No.	Statement	Grid position	Smart governance strategy
37	Collaboration among the quadruple helix actors is only for knowledge exchange	-3	Collaboration
4	New technologies and innovations can take place faster if governments impose fewer rules	-3	Legislation
8	The national government should make policies for promoting smart city initiatives and projects	-3	Policy
12	Private actors should be central in smart city initiatives and projects	-4	Policy

Table 3. Statements placed at the extreme on public value creation through smart governance strategies – perspective 1

For perspective 1, table 3 shows the statements placed at the extreme on public value creation through smart governance strategies. With regards to smart governance strategy of *policy*, perspective 1 shows a strong disagreement that the national government should make policies for promoting smart city projects. Within these projects, private actors should not be central, and perspective 1 actually implies that the focus has to be on citizens who set up smart city projects themselves. Considering smart governance strategies related to *collaboration*, perspective 1 implies that a *level playing field*² is essential, and that collaboration is not only for knowledge exchange. In addition, perspective 1 strongly agrees that clear rules about data and privacy are essential, and that a decline of rules (based on legislation) will not hinder the development of new technologies and innovations (both part of smart governance strategy of *legislation*). The strong opinions regarding smart governance strategies of *collaboration* and *policy* in particular, implies a bottom-up approach³ coming from citizens. Therefore, perspective 1 can be summarised as:

Summary perspective 1 (PVC⁴)

“A bottom-up approach, mainly in the smart governance strategies of collaboration and policy – citizen orientation.”

Perspective 1 is defined by nine respondents for which every quadruple helix actor is represented, except for private actors (table 2).

² *Level playing field*: a situation in which every actor has a fair and equal chance of success.

³ Top-down/bottom-up approaches. The term bottom-up and top-down are used in several scientific disciplines, and in interviews, most respondents used these terms too. In this research, the two terms are related to the urban movements of smart cities. The urban bottom-up approach is understood as a heterogeneous collection of people and groups that collaborate within cities in various types of communities (Niederer & Priester, 2016). The top-down approach is understood as governmentally driven by which policy-makers create policies to steer smart city projects (Robinson, 2016).

⁴ PVC: Public Value Creation (through smart governance strategies)

Personal comments and quotes of respondents

The bottom-up approach is characterised by a strong disagreement with the suggestion that the national government should make policies to promote smart city initiatives and projects [8, -3]. In addition, it highlights that private actors should not be central in smart city projects and initiatives [12, -4]. These two strong opinions suggest that there should not be a prominent role for both the central government and private actors. However, due to strong agreements concerning active citizens who set up smart city projects and initiatives themselves [10, +3], perspective 1 actually suggests that citizens have to take a central role in smart city projects.

[statement 10] – *“A real smart city should be inviting to their citizens in such a way that people get inspired and feel excited to start their own projects.” (respondent 8 – citizen actor)*

[statement 10] – *“I think it is important that active citizens will be involved in smart city projects and initiatives. At this moment, I think it is too much top-down, while I think in smart city projects, attention should also go to active citizens and therefore be more bottom-up.” (respondent 12 – knowledge institution actor)*

However, some respondents have more nuanced or even critical attitudes towards the active role of citizens. They respond well to the idea of involving citizens, but they think citizenship alone is not enough.

[statement 10] – *“I am not sure here. I think you need more than simply active citizens. For example, a good digital infrastructure is essential. If you do not have that, active citizens will not go far.” (respondent 11 – public actor)*

[statement 10] – *“If a smart city is mainly about active citizens who set projects by themselves, then you get very moderate projects. To make smart city projects successful, you need substantial knowledge and experience.” (respondent 9 – public actor)*

Respondents of perspective 1 also strongly disagree with statement 37 suggesting that collaboration among quadruple helix actors is solely for knowledge exchange [37, -3]. Respondents suggested that with this collaboration, experiences (including mistakes) should be exchanged and can result in concrete actions. In addition, perspective 1 also entails a strong agreement with the notion that a smart city can never exist without a *level playing field* among quadruple helix actors [33, +4]. This suggestion endorses a bottom-up, citizen-oriented approach as some respondents specifically state that within this field, the demands of citizens should be central.

[statement 33] – *“I totally agree with statement 33. Of course, equal influence among actors is not possible since it also depends on the subject. But when we think about how we want to organise our city, for example, we have to keep in mind that we do it for the citizens. Therefore, we have to think about how we can improve the quality of life for our citizens.”* (respondent 16 – citizen actor)

Next to its orientation around citizens, perspective 1 highlights a strong disagreement with the idea that new technologies and innovations take place faster if governments impose fewer regulations [4, -3]. This statement can relate to an ‘economic-business’ view of smart city development as companies like to have a certain leeway to promote innovation (Ahmed, 1998). However, in respondents’ personal comments to statement 4, they did not specifically refer to private actors’ influence on smart city developments. Rather, they discussed the way these rules can be used.

[statement 4] – *“Complete nonsense! There is clear empirical evidence that this is not always the case. It is not the number of rules which hinders innovation, but a lack of knowledge as to how to use these rules in their field.”* (respondent 14 – knowledge institution actor)

[statement 4] – *“Disagree, nonsense! That is sheer laziness. You can interpret these rules in many ways, whereby much more is possible than one would initially think. So, there should not be fewer rules, but there should better communication about these rules.”* (respondent 11 – public actor)

Finally, perspective 1 also highlights that clear rules about data and privacy are essential in smart cities. These are necessary to protect citizens and keep personal data private [1, +3].

[statement 1] – *“Totally agree. In the whole privacy debate, it is essential to gain citizens’ confidence. Therefore, you have to make clear rules about data and privacy.”* (respondent 9 – public actor)

[statement 1] – *“I agree totally! Within the topic of data and privacy, it is the government’s duty to protect their citizens. Before you know, algorithms will decide how to organise public space.”* (respondent 16 – citizen actor)

4.2.1.2 Public values – perspective 1

No.	Statement	Grid position	TBL dimension
28	In a smart city, all three dimensions (social, environmental, and economic) are equally important	+4	All three
17	In a smart city, it is essential there are a high number of technological and innovative start-ups (economic dimension)	+3	Economic

No.	Statement	Grid position	TBL dimension
19	A smart city is all about city branding (economic dimension)	-4	Economic

Table 4. Public value statements placed at the extreme – perspective 1

Table 4 shows that perspective 1 considers public value in smart city as a situation where all three dimensions of TBL are treated equally. Additionally, there are strong opinions on the statements concerning some aspects of the economic dimension. Perspective 1 strongly disagrees with the notion that a smart city is only for city branding, but it does view a high number of technological and innovative start-ups as essential. Therefore, perspective 1 on public value in smart cities can be summarised:

<u>Summary perspective 1 (PV⁵)</u>	
<i>“Public value is characterised by an emphasis on some aspects of the economic dimension of TBL. However, every TBL dimension remains equally important.”</i>	

Personal comments and quotes of respondents

Perspective 1 stresses that all three dimensions of TBL (social, environmental, and economic) are equally important [28, +4]. Respondents remarks often suggested that this equality is also context depend, and that it is especially important that the dimensions are considered in relation to each other.

[statement 28] – *“All dimensions are important and they are connected. They have to be in balance. However, you also have to look at the local context of the city. If you have a city with a lot of social challenges, it is logic attention goes more to the social dimension than to the economic dimension, so to say.”* (respondent 8 – citizen actor)

[statement 28] – *“We have to go to a circular economy where all three dimensions are in balance. Only in that way you can create a sustainable world.”* (respondent 16 – citizen actor)

⁵ PV: Public Values

Moreover, perspective 1 is also characterised by a strong disagreement with the idea that smart cities are about city branding (economic dimension) [19, -4]. Some respondents stressed that this is not the case, while others added that it should, in fact, be the other way around.

[statement 19] – *“Disagree. It should actually contribute to solving social issues. Therefore, it is not about how you can sell your city, but how you can improve the quality of life for your citizens.” (respondent 12 – knowledge institution actor)*

[statement 19] – *“I definitely do not agree. I would say that city branding is important for a smart city. So, the other way around.” (respondent 16 – citizen actor)*

[statement 19] – *“No, I would say the other way: City branding is important for a smart city.” (respondent 2 – public actor)*

Given this strong disagreement, it is interesting that perspective 1 entails strong agreement with the idea that technological and innovative start-ups are important in smart cities [17, +3] because statement 17 is also about the economic dimension. However, this agreement is not based on strong economic reasons. Most respondents do not see the presence of start-ups as a strong economic driver, but more as a catalyst for new innovative ideas and products.

[statement 17] – *“They are the ones with new ideas!” (respondent 18 – public actor)*

[statement 17] – *“Totally agree! Start-ups are essential. They bring innovation and give energy.” (respondent 16 – citizen actor)*

4.2.2 Perspective 2: national government oriented, highlighting the social inclusivity in a smart city

4.2.2.1 Public value creation through smart governance strategies – perspective 2

No.	Statement	Grid position	Smart governance strategy
6	To make smart cities successful, governments need to invest in a digital infrastructure	+4	Technology/ICT
30	To scale up smart city initiatives, the national government should take the lead on making an integral smart city vision	+4	Integral vision
38	Collaboration among quadruple helix actors needs to result in concrete policy	+3	Collaboration
34	It is up to the national government to bring actors together for collaboration in smart city initiatives	+3	Collaboration
33	A smart city can never exist without a <i>level playing field</i> among quadruple helix actors	+3	Collaboration

No.	Statement	Grid position	Smart governance strategy
10	A smart city is mainly about citizens who set up smart city projects and initiatives themselves	-3	Policy
37	Collaboration among the quadruple helix actors is only necessary for knowledge exchange	-3	Collaboration
32	Private actors should take the lead in making an integral smart city vision	-4	Integral vision

Table 5. Statements placed at the extreme on public value through smart governance strategies – perspective 2

For perspective 2, table 5 shows the statements placed at the extreme on public value creation through smart governance strategies. In smart governance strategies of *collaboration* and *integral vision*, perspective 2 highlights a strong emphasis on the role of the national government. Respondents suggest that the national government should take the lead in making an integral smart city vision, and bringing actors together in collaborative processes for smart city developments. In addition, the focus in smart city projects should not be on active citizens who set up smart city projects by themselves (smart governance strategy *policy*). Though the national government is seen as a key actor, a level playing field is essential. In addition, perspective 2 also suggests that collaboration among the quadruple helix actors should result in concrete policy. At last, perspective 2 highlights the idea that it is important for governments to invest in digital infrastructure (smart governance strategy *technology/ICT*). In particular the strong positive opinions regarding smart governance strategies of *collaboration* and *integral vision* implies a top-down approach with the national government as key actor. Therefore, perspective 2 can be summarised as:

Summary perspective 2 (PVC)

“A top-down approach, mainly in the smart governance strategies of collaboration and integral vision – the national government as key actor.”

Perspective 2 is defined by five respondents for which every quadruple helix actor is represented, except for public actors (table 2).

Personal comments and quotes of respondents

In perspective 1, most respondents strongly agree that a smart city is mainly about active citizens who set up smart city projects themselves (statement 10). However, respondents within perspective 2 do not agree [10, -3], and endorse a top-down approach:

[statement 10] – *“A bottom-up approach is relevant, but it is not the only factor. There is a certain limit with active citizens. I have seen too many times, that ambitious communities with beautiful experiments fail because they did not have the capacity to scale up their projects. That is a shame. Therefore both public and private actors should support (financially) these active citizens.”* (respondent 3 – citizen actor)

[statement 10] – *“No, that is too restrictive. You want to respond to active citizens, but someone need to coordinate that. You cannot expect that this will come from the projects of the active citizens. The active citizens are just a small part.”* (respondent 15 – citizen actor)

Though a *level playing field* is essential [33, +3], perspective 2 is characterised by an emphasis on the national government as a key actor in smart governance, especially within collaborative processes and integral smart city vision. This can be seen in strong agreement with the notion that the national government should take the lead in making an integral smart city vision [30, +4]. This can also be seen in the idea that is up to the national government to bring actors together for collaboration in smart city initiatives [34, +3].

[statement 30] – *“Yes, I completely agree with statement 30. The national government should definitely take the lead.”* (respondent 3 – public actor)

[statement 34] – *“It is up to the national government to bring actors together? Yes, I do think so. The national government should contribute to this since I think municipal boundaries are too restrictive for smart city projects.”* (respondent 19 – private actor)

The top-down view on smart city developments is also characterised by strong agreement with the idea that governments need to invest in a digital infrastructure [6, +4]. Specifically, respondents within perspective 2 see it as the national government’s duty to invest. Respondent 3 describes this opinion as follows:

[statement 6] – *“The national government is a public actor. We, as a society, decided that public actors have to take care of public services, and digital infrastructure is one of them.”* (respondent 3 – citizen actor)

Digital infrastructure, as a broad term, can be interpreted in many ways. Respondents within perspective 2 also interpret digital infrastructure broadly, admitting it is both about physical elements (e.g. fiberglass, WiFi-hotspots) and elements of governance (e.g. data management). Respondent 19 conceptualizes this as follows:

[statement 6] – *“The national government should take care of the physical parts of the digital infrastructure (such as connectivity), but then you should also think about the governance part. For example, how are we going to manage our data? So, the national government should invest in both (physical and governance).”* (respondent 19 – private actor)

As with perspective 1, those within perspective 2 also disagree with the idea that collaboration among the quadruple helix actors is only necessary for knowledge exchange [37, -3].

Perspective 2 even highlights that this collaboration should result in concrete policy [38, +3].

[statement 38] – *“No, only knowledge exchange is not enough. Therefore, I agree with statement 38. I think it is important that the national government really take the lead in this.”* (respondent 19 – private actor)

Also, as in perspective 1, perspective 2 represents strong dissatisfaction with the central role of private actors in smart city developments, though for perspective 2, this is related to an integral smart city vision [32, -4].

4.2.2.2 Public values – perspective 2

No.	Statement	Grid position	TBL dimension
16	A smart city is about creating a high gross regional product and low unemployment rate (economic dimension)	-3	Economic
25	A smart city is mainly supported by a well-educated population (social dimension)	-4	Social

Table 6. Public value statements placed at the extreme – perspective 2

Table 6 shows that public value in smart cities in perspective 2 entails a more social approach given that a smart city is not only supported by well-educated people. This social approach is strengthened by strong negative opinions about the economic view on smart city initiatives. This is due to strong disagreement with the notion that a smart city should create a high gross regional product and low unemployment rate. Therefore, public value in smart cities in perspective 2 can be summarised as:

Summary perspective 2 (PV)

“Public value is characterised by an emphasis on some aspects of the social and economic dimensions of TBL, with special attention on the social inclusivity of a smart city.”

Personal comments and quotes of respondents

Thus, perspective 2 takes a social approach to considering public value in smart cities. This is endorsed by strong disagreement with the idea that a smart city is mainly supported by a well-educated population [25, -4]. Most respondents stated that this can be observed in smart cities, but felt that this development should not be maintained, rather, a smart city is a city for everybody.

[statement 25] – “Disagree, everybody has smart ideas. Maybe this is what you can observe, but if a smart city only depends on well-educated people, then it will be a dead end soon. A smart city is for everybody.” (respondent 3 – public actor)

[statement 25] – “Well, that is not how it should be. I think you need the knowledge of the well-educated people, but still the public support should come from everybody.” (respondent 15 – citizen actor)

This strong opinion is complemented by disagreement with the position that smart cities primarily concern creating a high gross regional product and low unemployment rate [16, -3].

4.2.3 Perspective 3: local governments oriented, highlighting the environmental opportunities in a smart cities

4.2.3.1 Public value creation through smart governance strategies – perspective 3

No.	Statement	Grid position	Smart governance strategy
35	Local governments should bring actors together for collaboration in smart city initiatives	+4	Collaboration
31	It is up to the local governments to make an integral vision for a smart city	+4	Integral vision
13	In project management of smart city projects, the focus should be on results (e.g. on time, within budget)	+3	Policy
6	To make a smart city successful, governments need to invest in digital infrastructure	+3	Technology/ICT

No.	Statement	Grid position	Smart governance strategy
30	To scale up smart city initiatives, the national government should take the lead for making an integral smart city vision	-3	Integral vision
14	Within smart city projects, preconditions should be set. A clear set of achievements is not necessary	-3	Policy
37	Collaboration among the quadruple helix actors is only necessary for knowledge exchange	-4	Collaboration

Table 7. Statements placed at the extreme on public value through smart governance strategies – perspective 3

For perspective 3, table 7 shows the statements placed at the extreme on public value through smart governance strategies. Like perspective 2, perspective 3 also highlights strong opinions about smart governance strategies of *collaboration* and *integral vision*. However, instead of

the national government, local governments should initiate the collaboration processes and an integral smart city vision. In addition, as in the other two perspectives, collaboration is not only for knowledge exchange. This perspective still suggests a top-down approach in smart governance strategies, but with local governments as the key actors in smart governance. Furthermore, perspective 3 implies that governments must also invest in digital infrastructure (smart governance strategy *technology/ICT*), and that clear achievements are necessary in smart city projects (smart governance strategy *policy*). In particular the strong opinions regarding smart governance strategies of *collaboration* and *integral vision* implies a top-down approach, but with local governments as key actor. Therefore, perspective 3 can be summarised as:

Summary perspective 3 (PVC)

“A top-down approach, mainly in the smart governance strategies of collaboration and integral vision - local governments as key actors.”

Perspective 3 is defined by four respondents for which every quadruple helix actor is represented, except for citizen actors (table 2).

Personal comments and quotes of respondents

The top-down approach is defined by strong agreement with the idea that local governments should bring quadruple helix actors together for collaboration on smart city projects [35, +4]. Additionally, it is not the national government, but the local governments who should make an integral vision for a smart city [31, +4] [30, -3].

[statement 35] - *“I think the local government should do this. They know the local situation and local stakeholders. I think the national government can bring together local governments and help them to scale up smart city projects.”* (respondent 13 – public actor)

It is interesting to see that while there is strong agreement with the notion that the national government should make an integral smart city vision, respondents here feel that the national government should be involved, but in the background. Respondents 17 and 13 phrase this as follows:

[statement 30] – *“I would say that the national government should act as a partner, but in a facilitating way. Facilitating through financial support and by bringing different stakeholders together.”* (respondent 17 – private actor)

[statement 30] – *“It can help, but I am not sure it is necessary. Maybe the national government has to make an integral vision about smart cities, but not a very extensive one. It is more that the national government can facilitate this integral vision. I expect to see more from local governments, but the national government can still play a role.”* (respondent 13 – public actor)

As with the other factors, respondents within perspective 3 feel that collaboration is not only for knowledge exchange [37, -4]. The respondents did not strongly agree with statement 38, which suggests that collaboration among quadruple helix actors should result in concrete policy, though they suggested it should result in concrete actions and not only knowledge exchange.

[statement 37] – *“Well, no. It should be more than knowledge exchange. Together you can also build, make things concrete.”* (respondent 7 – knowledge institution actor)

[statement 37] – *“No, it also about concrete actions.”* (respondent 17 – private actor)

Perspective 3 sees the local government as an important actor in collaborative processes for smart cities, and therefore as a key actor in smart city initiatives. Within this perspective, there is also strong agreement with statement 6 [6, +3]. Due to the emphasise on local governments’ actions, it is reasonable to suggest that respondents in this perspective would agree that these investments should come mainly from the local government. For example, respondent 17 states:

[statement 6] – *“Agree. I believe that in order to realise a digital infrastructure, local governments should invest in order to make a more uniform surrounding.”* (respondent 17 – private actor)

However, not all respondents within this perspective are explicit about local governmental investments in digital infrastructure. Respondent 7 suggests that these investments are the responsibility of the national government, while respondent 13 is unclear who should invest.

[statement 6] – *“Investments should be done by both private and public actors for which the national government should take care about the non-profit.”* (respondent 7 – knowledge institution actor)

[statement 6] – *“Within digital infrastructure investments, it is still a question as to who is going to invest, or who should also invest.”* (respondent 13 – public actor)

At the least, perspective 3 highlights that within smart city projects, the focus should be on realizing results. Therefore, a clear form of achievement is necessary [13, +3] [14,-3]

[statement 13] – *“Yes please, because I think people just talk too much. It is too much about intentions instead of results.”* (respondent 7 – knowledge institution actor)

4.2.3.2 Public values – perspective 3

No.	Statement	Grid position	TBL dimension
22	Within a smart city, a ‘smart energy network’ is essential	+3	Environmental

No.	Statement	Grid position	TBL dimension
15	A smart city is all about economic development	-3	Economic
19	A smart city is all about city branding	-4	Economic

Table 8. Statements placed at the extreme on public value identification – perspective 3

Table 8 shows that in perspective 3, public value in smart cities entails an environmental approach due to strong agreement with the notion that a ‘smart energy network’ is essential in a smart city. Compared to the other two perspectives, perspective 3 presents the strongest dissatisfaction with a corporate view of smart cities given disagreements with the idea that a smart city primarily concerns economic development and city branding. Therefore, public value in smart cities in perspective 3 can be summarised as:

<u>Summary perspective 3 (PV)</u>
<i>“Public value is characterised by an emphasis on some aspects of the environmental and economic dimensions of TBL, with special attention on the environmental energy opportunities in smart cities.”</i>

Personal comments and quotes of respondents

Perspective 3 takes an environmental approach to considering public value in smart cities. Specifically, this approach is oriented around energy. This can be seen in strong agreement with the idea that a ‘smart energy network’ is essential in smart cities. Some respondents within perspective 3 see energy as inextricably bound up with smart cities:

[statement 22] – *“This is extremely important since you can couple energy with many things: think of climate, mobility, citizen initiatives (collective energy buying). With energy, you can actually connect all three dimensions (social, environmental, and economic).” (respondent 7 – knowledge institution actor)*

Strong opinions about the ‘smart energy network’ are complemented by strong disagreement with the idea that smart cities primarily concern economic development [15, -3] and city branding [19, -4]. This highlights dissatisfaction with a corporate approach to smart cities. Respondent 17 conceptualizes this as follows:

[statement 15] – “No, this is possible, but it should not be all about economic development. I think that in the past we focused too much on economic instead of sustainable development. I believe that with good governance we should look to how we can strengthen these three dimensions.” (respondent 17 – private actor)

[statement 19] – “If you only do it for city branding, you should definitely not do it!” (respondent 17 – private actor)

4.2.4 Results in short

From the above identified perspectives, it is clear that perspective 1 implies a bottom-up approach in smart governance strategies. It highlights the role of citizens by suggesting that smart cities is mainly about active citizens who set up smart city projects themselves. It also emphasizes on smart governance strategy of *legislation* for which it strongly agrees that clear rules about data and privacy are essential, and that a decline of rules (based on legislation) will not hinder the development of new technologies and innovations. Comparing perspective 1 with both perspectives 2 and 3, the latter two highlight a top-down approach. This top-down orientation is most prominent in strategies of *collaboration* and *integral vision* where perspective 2 implies that the national government should take the lead and perspective 3 views this should be local governments.

Interesting to see is that in identifying which public value matters in smart cities, all three perspectives reveal strong disagreements for one or two statements which are part of the economic dimension of TBL. There are also differences. Perspective 1 highlights that every TBL dimension is equally important while perspective 2 stresses the social inclusivity of a smart city, and perspective 3 sees “energy” as an important opportunity in smart cities.

5 CONCLUSION

This research began by considering that the main purpose of a smart city is the creation of public value, which concerns obtaining collectively desired social outcomes to improve quality of life for urban citizens, the achievement of which requires smart governance. To realise this smart governance, five smart governance strategies have been identified, and *collaboration* is one of them. In many collaboration processes though, power is not equally distributed. This point is also acknowledged in urban planning literature on smart cities for which several authors state that private actors may become too dominant in the public domain of cities. This influence public value in a negative way. After a short overview of different authors involved in the critical urban literature debate on smart cities, it became clear that there is an urgent need to examine the smart city as it actually exists, and to understand how viewpoints on public value creation among quadruple helix actors differ. Therefore, this research addressed the following research question:

Research question

How do quadruple helix actors view public value creation through smart governance strategies in Dutch smart cities?

To answer this question, this research performed a Q-methodological study, which identified three perspectives on how the quadruple helix actors view public value creation through smart governance strategies. Each perspective characterisation was divided regarding how the quadruple helix actors view public value creation through smart governance strategies, and how they view which public values matters in smart cities. In essence, each perspective is summarised in table 9.

Perspectives	Public value through smart governance strategies	Public values
<p>Perspective 1:</p> <p><i>Citizen oriented, highlighting that all TBL dimensions are equally important</i></p>	<p><i>“A bottom-up approach, mainly in the smart governance strategies of collaboration and policy – citizen orientation.”</i></p>	<p><i>“Public value is characterised by an emphasis on some aspects of the economic dimension of TBL. However, every TBL dimension remains equally important.”</i></p>
<p>Perspective 2:</p> <p><i>National government oriented, highlighting the social inclusivity in a smart city</i></p>	<p><i>“A top-down approach, mainly in the smart governance strategies of collaboration and integral vision – the national government as key actor.”</i></p>	<p><i>“Public value is characterised by an emphasis on some aspects of the social and economic dimensions of TBL, with special attention on the social inclusivity of a smart city.”</i></p>
<p>Perspective 3:</p> <p><i>Local governments oriented, highlighting the energy opportunities in smart cities</i></p>	<p><i>“A top-down approach, mainly in the smart governance strategies of collaboration and integral vision – local governments as a key actors.”</i></p>	<p><i>“Public value is characterised by an emphasis on some aspects of the environmental and economic dimensions of TBL, with special attention on the environmental energy opportunities in smart cities.”</i></p>

Table 9. Summary of all three perspectives

First, considering division public value creation through smart governance strategies. All three perspectives mainly emphasise the smart governance strategy of *collaboration*, both in a consensus and distinguishing way. Regarding consensus, all three perspectives agree that a level playing field in a collaboration process is essential, and that collaboration must result in concrete actions. However, there are also clear differences between the perspectives concerning how to approach smart governance strategies (bottom-up versus top-down) which relates to how these statements are distinguished from each other. Perspective 1 implies a bottom-up approach coming from citizens, suggesting that the focus must be on the citizens who establish smart city projects. Perspectives 2 and 3 both highlight a top-down approach. The difference between these two perspectives is based on who is the key actor in bringing these actors together for smart city collaboration. Perspective 2 suggests the national government, while perspective 3 believes this should be local governments.

Second, considering public values in smart cities. All three perspectives emphasise certain aspects of the economic TBL dimension, but in a strong negative way. This can be interpreted as that the focus in public value creation in a smart city should not only be on economic development. However, there are also some nuances. Perspective 1 strongly agrees that every TBL dimension is equally important. In perspective 2 there is more emphasis on the social inclusivity of a smart city, while perspective 3 focusses more on the environmental opportunities in a smart city.

In short, this research addressed the critical urban literature debate stating that power in collaboration processes in smart city projects may not be equally distributed, meaning that private actors can become too dominant. All three identified perspectives mainly emphasise collaboration processes in smart cities, which reveals that quadruple helix actors in Dutch smart cities view public value creation mostly through the smart governance strategy of *collaboration*. However, the difference between the perspectives is not so much related to power imbalances, but more on how to approach these collaborations (bottom-up versus top-down). In addition, the identified perspectives revealed that this economic and corporate view is not as present as some critical literature may state.

6 DISCUSSION

This section is divided into two parts. First, it discusses the chosen geographical scope. This is followed by a critical examination of the three main challenges of Q-methodology related to this research.

6.1 Discussing geographical scope

This research considered public value creation in Dutch smart cities. The geographical scope of Dutch cities was chosen because several cities in the Netherlands consider themselves frontrunners in becoming smart cities. However, it is possible this geographical scope influences the conclusions of this research.

This study argued that the difference between the three identified perspectives is related to how to approach collaboration in smart city projects (bottom-up versus top-down). Furthermore, economic and corporate views of smart cities are not as present as some critical literature states. However, regarding corporate views, this relative absence can partly be related to Dutch policy decision-making processes. In these processes, the Netherlands is characterised by its *polder model*, which emphasises a strong desire for consensus, in which it is important that all parties are heard. This can automatically mean that economic parties have less influence in the decision-making and collaboration processes. Consequently, this can indulge the corporate view on smart cities. It is possible that cities in a country like China reveal more economically driven smart cities, due to China's rapidly changing urban governance towards a more market-orientated economy (Wu, 2002). Therefore, further research needs to be aware of the possible influences of the geographical scope.

6.2 Discussing Q-methodology

In Q-methodology literature, the items that have generated the most debate are related to the process of developing statements, the generalisability of results, and the subjectivity when analysing the results (Eden et al., 2005; Simons, 2013). The next section discusses those three items in relation to the Q-study in this research.

6.2.1 Q-statements: how do you know enough is enough?

One of the first stages in Q-methodology is to develop a set of statements representing the sum of discourse on the research topic (in this case public value creation in smart cities through smart governance strategies). Within this stage, one important question is how to decide when you have sufficient statements that cover the entire research topic discourse. Several authors suggest treating developing statements as an exercise, such as a grounded theory analysis of quantitative data. This means stopping when the saturation point is achieved (Glaser et al., 1968; Eden et al., 2005; Simons, 2013). This point is reached when statements begin to repeat, rather than adding new elements. The saturation point is reached in

this research. Initially, the first Q-set in this research consisted of approximately 60 statements. However, after discussing these statements with the supervisor of this research and two pilot interviews, it became clear that several statements repeated themselves, therefore the Q-set was reduced to 39 statements. In addition, it was important not to make the Q-set too extensive, since the Q-sorting process is an intensive process for respondents. Though most respondents find doing Q-sorts interesting (due perhaps to the “game-like” effect of sorting cards) (Webler et al., 2003; Eden et al., 2005), too many statements can counter this open and positive feeling.

6.2.2 Generalisability

Some arguments related to this topic state that results from a Q-study cannot be generalised due to a small P-set (Eden et al., 2005). This argument also applies to this research since the P-set consists of only 19 respondents. However, Q-methodology transfers perspectives about an idea, rather than to a population, for which it is particularly helpful for producing a more nuanced understanding of certain subjects or debates (Leggette & Redwine, 2016; Previte et al., 2007). In Q-methodology, the numerical distribution among study respondents are not the prime issue; generalisations are based on the validity and theoretical implications of identified opinions (Valenta & Wigger, 1997). Thus, it is important that the P-set is diverse, so that all perspectives are represented (Leggette & Redwine, 2016).

To make the P-set as diverse as possible, the P-set of this research consisted of different quadruple helix actors. These types of actors were appropriated since this research aimed to identify the viewpoints of quadruple helix actors on public value creation through smart governance strategies. However, the citizens’ views of quadruple helix actors may represent a limitation, since actual citizens involved in certain smart city projects are not presented. This could affect the conclusions of this research. Maybe when actual citizens were interviewed, another extra perspective could be identified. For example, one perspective in which there is neither a strong emphasis on one of the five smart governance strategies or dimensions on TBL. This since still many people in society are not aware of the smart city concept (Cooper, 2016).

The apparent lack of citizen viewpoints is mitigated, however, by engaging four citizen-oriented NGO’s, and one citizen-oriented start-up. Nevertheless, further research should include the citizen view of the quadruple helix actors by investigating a population of citizens involved in smart city projects.

6.2.3 Subjectivity when analysing Q-sorts

Finally, another debatable area of Q-methodology is analysing Q-sorts, especially the processes of identifying the number of perspectives (factors) and characterising these perspectives are vulnerable to subjectivity. This since each perspective description is based on the researches own judgement. For both characterising and identifying the number of perspectives, a common approach in Q-methodology is to use the statements at the extremes

of the grid in a ‘best-fit’ Q-sort for each perspective (Eden et al., 2005). This approach is also taken in this research.

In this research, three perspectives on public value creation through smart governance strategies are identified. However, there is a subtle difference between perspective 2 and perspective 3. In the data analysis, the PQMethod program also identified correlations between factor scores (correlation between perspectives). It revealed some agreement between perspective 2 and perspective 3 due to a correlation coefficient of 0.51. It is possible that other researchers may think this coefficient is too high, and prefer to derive two perspectives (the correlation coefficient would then be 0.34). This research also tested the correlation coefficient between two perspectives (which would result in only two perspectives), and it showed a correlation coefficient of 0.34. However, based on the statements placed at the extremes of the conceptual best-fit Q-sorts of the perspectives, it was decided not to do so. This is because both tables 5 and 7 from the results section reveal that in perspective 2 there is a strong preference for the national government as key actor, while in perspective 3 this is not the case.

In addition, to limit the subjectivity in the labelling process, textual data (i.e. respondents’ personal comments for every statement) are used to remain as near as possible to the respondents’ opinions. This, however, revealed that, within the best-fit, Q-sort respondents do not fully agree with each other. For example, the best-fit Q-sort of perspective 1 demonstrates a strong agreement that a smart city mainly concerns active citizens who set up smart city projects by themselves. However, not all respondents from perspective 1 fully agree with this statement. Respondent 11 stated that you need more than active citizens alone. These opinions are found in the personal Q-sort of respondent 11, in which statement 10 is positioned in grid position 0. Hence, to propose a higher level of confidence for analysing Q-sort results, further research should focus on an analytic approach that secures more reliable results in a Q-study. This is done by a bootstrap re-sampling approach in the Q factor analysis⁶ computed by Zabala and Pascual (2016).

Zabala and Pascual (2016) aimed in their research to contribute to Q-methodology by proving a novel implementation of the bootstrap in Q. The bootstrap approach provides a deeper and more accurate understanding of data, and of the robustness in analysing Q-sorts, which increases confidence in the results. The approach quantifies the level of confidence associated with each statement, and the Q-sorts for each of the perspectives. This information may nuance, and, in some cases, change the interpretation of perspectives with respect to an interpretation based on the standard results (Zabala & Pascual, 2016, p. 11-12).

⁶ Bootstrapping is a statistical technique. It consists of drawing resamples from the original sample multiple times, and each of these resamples is analysed. A resample consists of a set of observations in which some observations from the original samples may be repeated, and others may be absent (Zabala & Pascual, 2016, p. 6).

7 RECOMMENDATIONS

7.1 Academic literature

This research addressed the critical urban literature debate that power in collaboration processes in smart city projects may not be equally distributed. This can result in private actors becoming too dominant in smart city developments. However, this research demonstrates that the issue is not so much related to power imbalances, but is more concerned with how these collaborations are approached (bottom-up versus top-down), and that the economic and corporate views are not as present as some critical literature states. Nevertheless, the results of this Q-study cannot be generalised, but they do open new perspectives on how to consider smart cities. This research can therefore be considered preliminary research. It is therefore recommended that additional research be conducted to determine whether one of the perspectives is more dominant in society, whether there are more perspectives, and whether these perspectives differ between countries.

7.2 Policy

This research was partly conducted for the Ministry of Infrastructure and the Environment. The Ministry aims to determine how it should position itself regarding smart city developments. The research identified three perspectives on public value creation through smart governance strategies, which helps to provide recommendations for the Ministry. First, the Ministry should be aware of the existence of these different perspectives on public value creation in smart cities. When the Ministry uses one of the perspectives to guide smart city policy, it should bear in mind the two other perspectives also. Thus, making smart city policy requires caution.

All three perspectives emphasise the smart governance strategy of *collaboration*, which involves different roles for the Ministry in each perspective. In one of the perspectives (perspective 2), the national government is identified as a key actor in these collaboration processes. The Ministry is the representative of the national government, therefore if the Ministry wishes to become a key actor in these collaboration processes, it is recommended that it considers three aspects. Hence, the Ministry, as a key actor, must:

- Actively bring together the quadruple helix actors in smart city projects. Within this collaboration, it is essential the Ministry secures two things:
 - First, it must assure ‘coming together for collaboration’ leads not to a situation in which people only talk. It is essential that when the actors come together concrete actions on how to set smart city projects follow.
 - Second, the Ministry must secure a *level playing field* so that every actor feels equally represented.

- Take the lead on making an integral smart city vision. This vision should focus on the different components that comprise the smart city.
- Invest in a digital infrastructure to make smart city projects successful. What is important here is to consider a digital infrastructure not only of physical elements (e.g. fibreglass, WiFi hotspots), but also about elements of governance (e.g. data management).

Another possibility is having local governments as key actors in collaboration processes in smart city projects. Local governments must perform similar actions as when the Ministry acts as a key actor. However, when local governments become key actors, the Ministry should continue to play an important role towards the realisation of a digital infrastructure, which it should support in financially.

It is also possible that neither the Ministry nor local governments act as key actors. If this is the case then there is a citizen orientation, in which citizens set up smart city projects by themselves. This could suggest that both the Ministry and local governments leave the process entirely to the citizens. However, there is a strong emphasis on legislation in smart cities; therefore, it is essential that governments (local or national) consider clear rules (based on legislation) regarding data and privacy. These are necessary to protect citizens and guard personal data private, which is considered the government's duty to protect their citizens.

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APPENDIX A – Q-set

Strategy: legislation

1. Duidelijke regels over data en privacy zijn essentieel in een smart city.
2. Binnen smart city ontwikkelingen moet de Rijksoverheid met bindende regels (wetten) komen over de verantwoordelijkheid en transparantie van publieke data. Een handreiking alleen is niet voldoende.
3. Het is aan de gemeenten om regels te maken over de verantwoordelijkheid en transparantie van publieke data in smart cities.
4. Nieuwe technologieën en innovaties in smart cities komen sneller op gang als de Rijksoverheid en gemeenten minder regels opleggen.

Strategy: technology/ICTs

5. Het is essentieel dat nieuwe technologieën, innovatie en data de stadsbewoners het gevoel geven dat zij daadwerkelijk in een ‘smart city’ leven.
6. Om smart city projecten van de grond te laten komen, moeten overheden actief investeren in een digitale infrastructuur.

Strategy: policy

7. Om een smart city te realiseren, is het noodzakelijk dat beleid wordt gemaakt om smart city initiatieven en projecten te promoten.
8. Het is aan de Rijksoverheid om beleid te maken voor de promotie van smart city initiatieven en projecten.
9. Het is aan de gemeenten om beleid te maken voor de promotie van smart city initiatieven en projecten.
10. In een smart city draait het vooral om actieve bewoners die zelf smart city projecten en initiatieven opzetten.
11. In smart city initiatieven en projecten moeten de burgers altijd centraal staan.
12. In smart city initiatieven en projecten moeten de private partijen altijd centraal staan.
13. In smart city projecten moet de nadruk liggen op het realiseren van resultaten (bijv. op tijd, binnen budget, volgens afspraak)
14. In smart city projecten moeten doelen (randvoorwaarden) worden opgesteld. Een duidelijke vorm van prestatie is hierbij niet noodzakelijk.

Subtheme – public values: economic dimension of TBL

15. De focus van smart city initiatieven moet vooral liggen op economische groei.
16. Het is van belang dat een smart city resulteert in een hoog Bruto Regionaal Product (BRP) en een laag werkloosheidspercentage.
17. In een smart city is het van belang dat er een hoog aantal start-ups aanwezig zijn georiënteerd op technologie en innovatie.

18. In een smart city is het van belang dat er een hoog aantal multinationals aanwezig zijn georiënteerd op technologie en innovatie aanwezig zijn.
19. Een smart city is vooral belangrijk voor *city branding*.

Subtheme – public values: environmental dimension of TBL

20. Een smart city is voornamelijk een stad met een hoge milieukwaliteit en een gezonde leefomgeving.
21. Technologie en innovatie in een smart city is vooral belangrijk om milieuproblemen aan te pakken (o.a. minder CO₂-uitstoot, ‘slimmer omgaan met energie’)
22. In een smart city is een slim energienetwerk cruciaal.
23. Een klimaatadaptatiestrategie kan niet ontbreken in een smart city

Subtheme – public values: social dimension of TBL

24. Smart city initiatieven moeten voornamelijk resulteren in een betere sociale leefomgeving (bijv. lage inkomensongelijkheid, lage criminaliteit).
25. Een smart city wordt vooral gedragen door een hoogopgeleide stedelijke bevolking.
26. Een smart city betekent ook dat er sprake is van een groot aandeel aan *shared economy* (bijv. Uber, Car2Go, AirBnB)
27. Voor smart city ontwikkelingen is het belangrijk dat mbo's, hogescholen en universiteiten studies aanbieden gerelateerd aan technologie en innovatie
28. In een smart city zijn alle drie de dimensies (sociaal, milieu en economie) even belangrijk.

Strategy: integral vision

29. Elke sector met een eigen smart city visie hindert de implementatie van smart city strategieën. Een integrale visie over de sectoren heen is daardoor noodzakelijk.
30. Opschaling van smart city initiatieven kan alleen plaatsvinden als de Rijksoverheid de leiding neemt in het opstellen van een integrale visie omtrent smart city ontwikkelingen.
31. Het is aan de gemeenten om een integrale visie over smart cities op te stellen.
32. In het opstellen van een integrale visie over smart cities kunnen bedrijven het beste de leiding nemen.

Strategy: collaboration

33. Een smart city kan nooit gerealiseerd worden zonder samenwerking op een gelijk speelveld tussen stedelijke actoren (publiek, privaat, onderwijsinstellingen, burgers).
34. Het is de taak van de Rijksoverheid om samenwerkende partijen in smart city ontwikkelingen bij elkaar te brengen.
35. Gemeenten moeten samenwerkende partijen in smart city ontwikkelingen bij elkaar brengen.
36. Het is aan de maatschappelijke organisaties om stedelijke actoren bij elkaar te brengen voor de samenwerking in smart city ontwikkelingen.
37. De samenwerking tussen de stedelijke actoren is alleen nodig voor kennisuitwisseling.
38. De samenwerking tussen stedelijke actoren moet leiden tot concreet beleid omtrent smart cities.
39. Het samenwerkingsproces moet open en transparant zijn. Iedereen mag meedoen, waarbij de grootte van de groep niet uitmaakt.

APPENDIX B – P-set (due to privacy not included)