

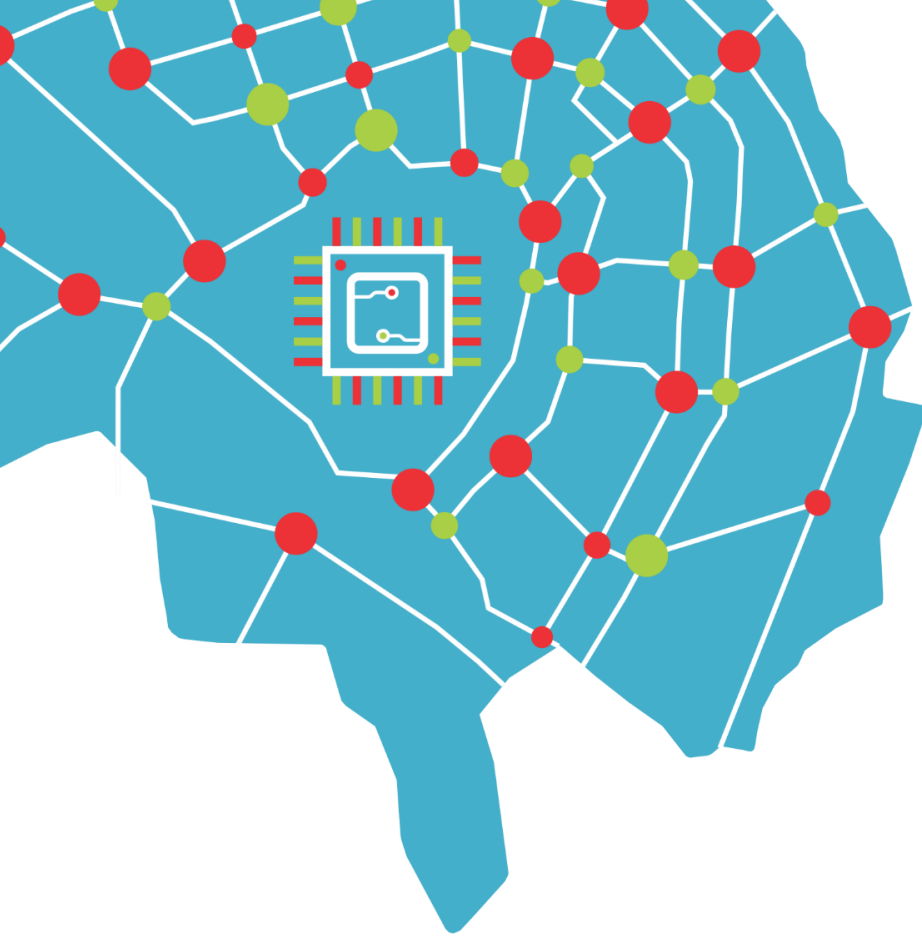
MSc Thesis Report

The Interaction between Non-Government-based Smart City Projects and Government-based Environmental Management The Case of Amsterdam

Zulfikar Dinar Wahidayat Putra



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The Interaction between Non-Government-based Smart City Projects and Government-based Environmental Management The Case of Amsterdam

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Supervisor : dr.ir. W.G.M. van der Knaap

Author : Zulfikar Dinar Wahidayat Putra

Reg no. 930724992210

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Land Use Planning Group
Wageningen University and Research
Droevendaalsesteeg 3
6708 PB Wageningen
The Netherlands

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ABSTRACT

As a new concept, “smart city” is adopted in the cities as one of the urban development strategies to overcome urban challenges. However, as each city has their established environmental management strategies, there is a lack of understanding about the interaction between non-government-based smart city projects and government-based urban environmental management. To better understand the interaction, this research investigates aspects which contribute to the interaction, Amsterdam is used as a case to study this. Based on the coding analysis of the interview and document transcripts, this study reveals that there are two levels of interaction between smart city projects and environmental management, namely institutional interaction (level 1) and projects interaction (level 2). An institution has to have a reason first as a prerequisite to begin an interaction process at the second level, and an interaction at the second level cannot start if there is no interaction between institutions. This study also shows that two aspects from the smart governance category, namely collective intelligence and flexible government, seem to be a basic foundation which contributes to this interaction in an open system governance model under a transactive planning approach.

Key words: Non-government-based Smart City Projects, Government-based Environmental Management, Interaction Process, Interaction Building

SUMMARY

One of the urbanization trends is the rapid increase of urban population which cause several urban challenges. At the same time, there is also a rapid growth of Information and Communication Technology which is used by the urban people to facilitate their life in the city. Understanding the potencies, most city governments adopt various Information and Communication Technologies to cope with the urban environmental challenges which evoke a “smart city” approach. However, there is less knowledge about the interaction between “smart city” concept and urban environmental management, as one of the fields in urban planning discourse. In the current situation, there are non-governmental parties that implement various smart city projects while the governmental parties execute their established agendas and policies. Both parties are alike eager to cope with environmental challenges in the city. Amsterdam seems an ideal case to study the interaction between non-government-based smart city projects and government-based environmental management because the city applies a citizen-oriented strategy in their smart city operationalization. So, on the one hand, the non-governmental parties can initiate and test their smart city projects in the city, but on the other hand, the government can execute their environmental agendas and policies.

This study aims to investigate the interaction between the non-government-based smart city projects and government-based environmental management by analyzing aspects which contribute to the interaction using Amsterdam as a case. A general research question was formulated to achieve this aim, as follows: *What kind of aspects do contribute to the interaction between the non-government-based smart city projects and government-based environmental management in Amsterdam?* A literature study on three key concepts, namely smart city, urban environmental management, and interaction, provided a theoretical understanding towards the smart city and environmental management aspects and interaction prerequisites, in which a conceptual framework was built. Based on the literature, there are 64 aspects in 7 categories of smart city, 13 aspects in 3 categories of environmental management, and 5 prerequisites in 3 categories of interaction prerequisites.

Then the aspects of the smart city and environmental management and its interaction were analyzed in the case of Amsterdam. There are 7 interview and 12 document transcripts analyzed by using coding method to reveal the smart city and environmental management aspects and interaction processes which lead to the analysis of aspects which contribute to the interaction processes. The results show that there are 43 smart city and 17 environmental management aspects gathered and two interaction processes identified from Amsterdam case. The aspects consist of new aspects identified from the field work and aspects from the literature, which is divided into two groups, namely relevant and less relevant aspects.

This study shows several findings within the smart city and urban environmental management concept. In smart city concept, first, “ordinary” citizens can be involved in the smart city projects development by using a co-creation platform under a public-private-people-partnership (P-P-P-P) scheme. Second, in a smart city, citizens can also organize themselves and take the role as “sensor”, “processor”, and “decision taker” to overcome urban challenges. Third, the quality and level of education and capacity in a smart city are necessary to build a collective intelligence which could contribute to the enhancement of the problem-solving capacity of the community and make an efficient city government. Finally, a smart

city uses not only technological but also non-technological resources to increase the citizen quality of life through a multi-dimensional approach and collaboration among partners.

In urban environmental management concept, the definition of each category was revisited. First, an advisory is also about assisting the citizens to make an environmental policy or projects successfully implemented. Second, economic or fiscal is also about give room for investment from the grant, loan, and aid to implement an environmental project which profitable and useful in the future which can change the behavior of people in a long-term basis. Finally, regulatory can also indirectly steer the people to do or not to do something related to the environment through regulatory objectives which become a common guideline for people to do something towards the environment.

Another finding is related to the interaction. This study reveals that the interaction between the non-government-based smart city projects and government-based environmental management in Amsterdam cannot be generalized into one interaction process. It depends on the occasions and activities which exist between the interactions. Regarding the interaction itself, two variables have interaction if only they have a bidirectional direction. If two variables only have a one-sided or no direction to each other, it cannot be seen as an interaction.

Based on the identified interaction processes, this study reveals that there are two levels of interaction between smart city projects and urban environmental management, namely institutional interaction (level 1) and projects interaction (level 2). An institution has to have a reason first as a prerequisite to begin an interaction process at the second level, and an interaction at the second level cannot start if there is no interaction between institutions.

It also reveals that in the projects interaction, two aspects from smart governance category, namely collective intelligence and flexible government, seem to be a basic foundation for building the interaction processes which can bridge the smart city projects as a “self-organized” project and the environmental management as a governmental procedure. The emerging of these aspects in the middle of an interaction process is based on an “interaction building”. So, in the Amsterdam case, collective intelligence and flexible government under the category of smart governance become key aspects to start the interaction between the non-government-based smart city projects and government-based environmental management.

Additionally, in an open system governance model and under the transactive planning approach, smart city, as a concept, links to urban planning, in the part of the governance and project arrangements. Based on these findings, the Amsterdam Smart City and Amsterdam Municipality are recommended to (1) Develop an integrated grand vision about the smart city projects among the programme partners of Amsterdam Smart City to maximize and take benefits from the “work together” interaction process (2) Make an obligatory consideration from the smart city projects to the agendas of the Municipality to accelerate the process in achieving the government’s agendas (3) Assist the smart city projects in the testing and validating process to make the projects in line with related regulations and legally implemented in Amsterdam.

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Teteken Tekun Bakale Tekan
- javanese proverb



The one who stands on persistence will achieve his goal
- javanese proverb



CHAPTER 1

INTRODUCTION

- 1.1. Research Background
- 1.2. Problem Description
- 1.3. Preliminary Research Objective and Questions
- 1.4. Relevance of the Research
- 1.5. Structure of the Report

CHAPTER 1. INTRODUCTION

This report presents findings around the interaction between non-government-based smart city projects (smart city projects) and government-based environmental management (environmental management) based on the case of Amsterdam. The first chapter will provide information about the research background (1.1) followed by the problem description which is based on a scientific and societal problem (1.2). Then based on that, a research objective and questions are generated (1.3). After that, this chapter will also provide the relevance of this study to the urban planning discourse (1.4). Finally, it will be ended by providing information about the outline of this report (1.5).

1.1. Research Background

One of the urbanization trends is a rapid increase of the urban population. It makes cities facing complex issues, especially around urban management, such as transportation, wastes, energy, and socio-economic development (Akaslan, 2017; Ojo et al., 2016; Nam and Padro, 2011). Specifically, the increasing number of people in a city causes several urban environmental issues, such as the increasing amount of solid waste and wastewater, a limited amount of drinking water, and the rising of CO₂ emissions. Cities must use more advance environmental management to deal with these complex issues.

At the same time, there is a rapid development of Information and Communication Technologies that urban people are using to make their life easier in the city (Liu et al., 2017; Cocchia, 2014). Information and Communication Technologies become a tool for people in the city to satisfy their information and communication needs effectively and efficiently. It becomes a more important tool for urban citizens.

Understanding the potency and importance of Information and Communication Technology, many governments adopt particular technologies to cope with the more complex urban challenges to improve the citizen quality of life (Ojo et al., 2016). Governments see that Information and Communication Technologies provide them a quicker way to manage urban environment effectively and efficiently. That evokes a “smart city” which turn out to be more widespread concept after the European Union launched Europe 2020 Strategy in 2010, as it stimulated governments to use the smart city concept as one of key development pathways (Cocchia, 2014).

Most people see a “smart city” as the adoption of Information and Communication Technologies by various stakeholders in the city to deal with urban issues (Dameri, 2017). Two elements can be identified in the smart city concept, namely Information and Communication Technology and stakeholder. Information and Communication Technology is the pivotal element in developing a smart city project, because it is the basic foundation to enable related aspects in the city to become smart. A stakeholder is the main actor to use the Information and Communication Technology in a smart city project. It refers to citizens, communities, and institutions (government and private company) who want to be involved in related smart city projects. Dameri (2017) also stated that the interaction among stakeholders by using Information and Communication Technology is the essential part of a smart city concept.

However, most of the smart city projects do not consider the urban planning practice in the city (Alizadeh, 2017; Bolici and Mora, 2015; Angelidou, 2015). Most governments apply the smart city concept as an independent strategy to cope with several issues in their city. So, most of them do not consider the coherence between smart city projects and urban planning practice in their city. It becomes interesting when the government applies a citizen-oriented strategy in their operationalization of smart city concept,

in which non-governmental parties can initiate and organize a smart city project. Meanwhile both non-governmental initiatives and governmental policies or agendas have to support each other somehow. Furthermore, a discussion towards the non-technological aspect of the smart city based on citizen-oriented strategy also become a new field to be explored, because most of the implemented smart city projects emphasize more on the Information and Communication Technology aspect (Akaslan et al., 2017; Cocchia, 2014).

An example comes from Amsterdam which uses a web-based open platform to increase collaboration among citizens and organizations in solving a specific environmental problem in the city, with the key purpose to reduce greenhouse gas emissions (Windén et al., 2016). Amsterdam Smart City is built based on the initiative between the Amsterdam Municipality (the Municipality and Amsterdam Economic Board), companies (KPN and Liander), knowledge institution (University of Applied Science Amsterdam), and NGO (Waag Society and Pakhuis de Zwijger). They focus on the citizen-oriented strategies in its operationalization to increase the awareness of citizens (Dameri, 2017). Thus, all projects in Amsterdam Smart City platform come from the collaboration among citizens, communities, and related companies. Dameri (2017) also stated that non-technological smart city projects give a significant contribution to the citizens of Amsterdam. Most of the projects in the platform is adopting a problem-based solving approach in addressing environmental problems. But, Amsterdam Municipality also has strategies for addressing environmental problems which are represented in their policies and agendas. In that sense, there is an unclear linkage between projects in Amsterdam Smart City platform and environmental management of Amsterdam. It is an interesting phenomenon to be further looked into.

1.2. Problem Description

Since the booming of smart city concept, so far, most of the scholars are more focusing on the technological aspect and make it as the central focus of smart city concept (Akaslan et al., 2017; Cocchia, 2014). Consequently, there is a gap between “smart city” and the “city” context, which is related to the urban planning discourse that needs further investigation (Ojo et al., 2016). Several scholars also suggested that there is a need to investigate the linkage between smart city projects implementation and urban planning practice (Angelidou, 2015; Bolici and Mora, 2015; Yigitcanlar, 2015). That kind of research can provide useful knowledge on how to solve challenging problems in the city by understanding the coherence between citizen initiatives and established regulations. It also gives understanding on how to regenerate urban areas using resources from Information and Communication Technologies without only focusing on the smart city project itself but also its outcome for the urban planning practice in the city (Bolici and Mora, 2015). It also contributes to the societal problems on how to solve urban issues by creating a linkage between the non-government-based projects and the Municipality’s agendas and policies. Additionally, by investigating the linkage, a scheme of the interaction between smart city project and urban planning practice can be made.

Anthopoulos and Vakali (2012) have researched the interrelation between the smart city concept and urban planning. They analyzed the meeting point between general smart city aspects (user, service, infrastructure, and data layer) and urban planning aspects (quality, viability timeline, capacity, and history and landscape) based on the European Regional Cohesion Policy as can be seen in table 1. Their finding shows that there is a two-way relationship between the aspects of smart city and urban planning which

is represented in figure 1 and 2. They stated that the development of a smart city project has to align with urban planning aspects, whereas urban planning practice has to respect and capitalize smart city projects.

Table 1. General Smart City and Urban Planning Aspects (Anthopoulos and Vakali, 2012)

| Smart City Aspects | Urban Planning Aspects |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| User Layer All e-services used by end-users and stakeholders of smart city (i.e.: mobile apps, web platform, and control center) Service Layer Particular services offered by smart city (i.e.: intelligent public transport system and e-government) Infrastructure Layer Related facilities, networks, and technologies to support the services (i.e.: network infrastructures and server) Data Layer Presents all related data and information to support the service (i.e.: database) | Quality Focus on environmental protection of a city and has attributed in regional planning framework Viability Timeline Cover the sustainability aspect in which timeline is an essential value for the aspect Capacity Concern on the natural and human resources capitalization History and Landscape Embrace various planning and implementation of the government which concerns about historical and landscape sites |

Looking at the smart city aspects, it reveals that Anthopoulos and Vakali (2012) refer to the smart city as a system of electronic services in the city. It means that, they only discuss the smart city concept based on the technological perspective, both the hardware and software. Meanwhile, the urban planning aspects refer to the aspects that affect the built environment, users, and the social-economic condition in the city. They concluded that all of their smart city aspects relate to all urban planning aspects, and vice versa.

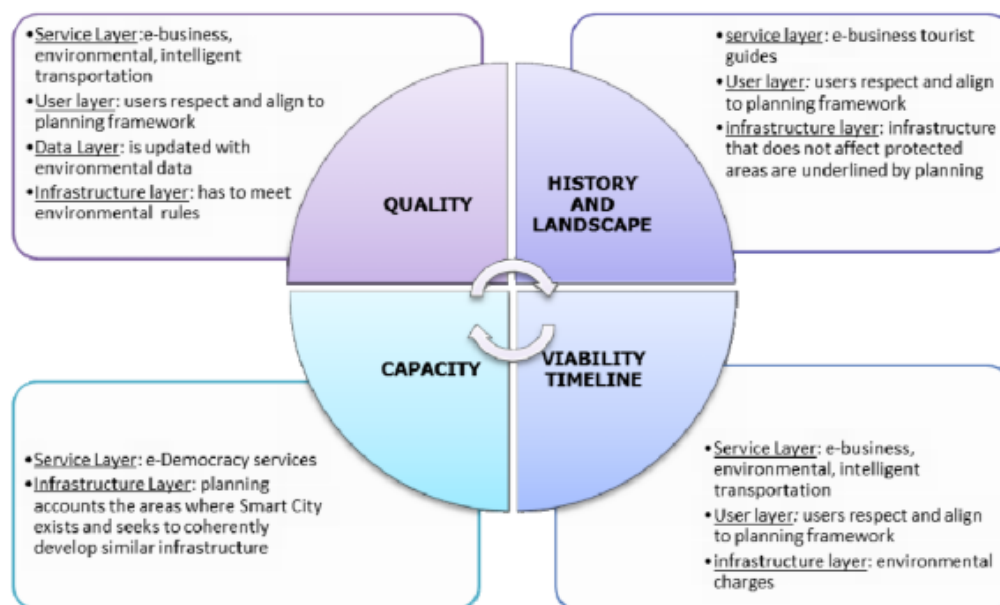


Figure 1. Smart City Interrelation to Urban Planning
(Source: Anthopoulos and Vakali, 2012)

Regarding the smart city concept interrelation to urban planning (see Figure 1), all smart city aspects, somehow, meet urban planning aspects. User layers are influenced by urban planning aspects because the end users and stakeholders have to respect and align with the planning frameworks. For example, an intelligent transport center has to arrange their public transport routes based on the related planning policies to respect the environmental quality and be integrated with land uses in the city. Infrastructure layer also meets all urban planning aspects because it has to align with planning rules and respect the environmental or protected areas. For example, network cables for intelligent transport system have to align with the infrastructure planning policy and should not harm other infrastructures and protected green spaces. Different products of service layers align with different planning aspects, such as intelligent transport system. It contributes to the quality and viability timeline aspects because its development can reduce CO₂ emissions. Finally, data layers align with all planning aspects because each element has to have updated data to analyze its current condition and issue.

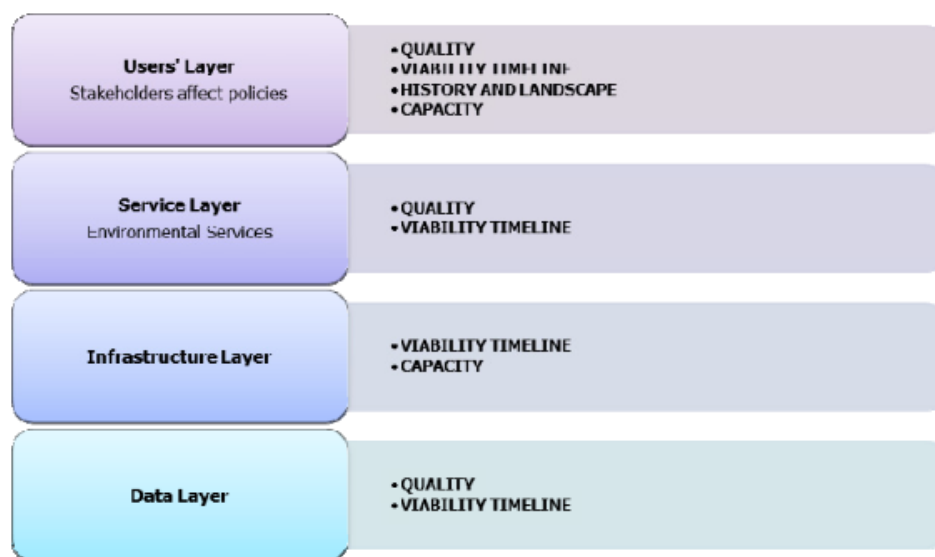


Figure 2. Urban Planning Interrelation to Smart City
(Source: Anthopoulos and Vakali, 2012)

Regarding the urban planning interrelation to smart city concept (see Figure 2), in the data layer, all public data which have been gathered through sensors or other technologies can be used to manage the environment sustainably without ignoring the public privacy. It means that, quality and viability timeline aspects explore the data layers and use it for its purposes. Therefore, the aspects interrelate with the data layers of smart city. The same case also applied to the infrastructure layer. The quality and capacity aspects have to accommodate the development of smart city infrastructures, such as broadband networks and intelligent transport system loops. When a planner develops environmental protection zone, they have to also considering the need for smart city infrastructures. The government also need to consider the capacity of natural and human resources in the development of smart city infrastructures.

However, Anthopoulos and Vakali (2012) elaborate the interrelation between government-based smart city project and urban planning practice only from the technological perspective. There is no elaboration about the interrelation between a “smart city” and “urban planning” in a specific case. As Kuyper (2016) stated that there is no single-fit framework in designing a smart city strategy because every

city has a unique way to solve urban problems. That also applies to urban planning practice, each city has a different framework and aspects to formulate an urban plan. Therefore, there is a need to analyze the linkage between smart city projects and urban planning practice in a specific case study (Bolic and Mora, 2015; Komninos, 2014). In line with that, Ojo et al. (2016) suggested that research on a concrete smart city case will give more contribution to the smart city research domain.

So, there is still a gap regarding the link between non-government-based smart city projects and government-based urban planning practice in a specific case. The problem is that on the one hand, citizens are working on the smart city projects but on the other hand the Municipality is also practicing urban planning (Sabri et al., 2015). Efforts in both of them will influence the urban development, whereas there is an unclear linkage between non-government-based smart city projects and government-based urban planning practice.

1.3. Preliminary Research Objective and Questions

Based on the problem description, as urban planning is a broad discourse, I only focus on the urban environmental management as one of the fields in the discourse. So, this study aims to investigate the interaction between non-government-based smart city projects and government-based environmental management in a city by analyzing aspects which contribute to the interaction. The non-government-based smart city projects mean that the project was firstly initiated by non-governmental parties even though in the middle of the development process, governmental parties can be involved. Meanwhile, the government-based urban environmental management means related environmental management efforts in the urban area that are conducted by governmental parties which provide instruments to manage the environment. To achieve the objective, this study comes up with general and specific questions as follows:

- **Preliminary General research question:**

What kind of aspects do contribute to the interaction between the “non-government-based smart city projects” and “government-based urban environmental management”?

- **Related Specific research question:**

- a. What kind of aspects does the “non-government-based smart city projects” have?
- b. What kind of aspects does the “government-based urban environmental management” have?
- c. How do the “non-government-based smart city projects” and “government-based urban environmental management” interact with each other?

1.4. Relevance of the Research

The relevance of this study to the urban planning discourse is to provide knowledge about the linkage between the smart city, as an emerging concept, and the “city” context, which is related to the urban planning discourse. As, urban planning is a broad discourse which may include land use, transportation, infrastructures, and also environment, this study tries to contribute to urban planning discourse by only focusing on the environmental management in an urban area. The environment is one of key elements in an urban area which may influence the urban conditions (spatial, social, economy, and environment). Knowledge about the interaction between the smart city projects and environmental management can fulfill the knowledge gap between the smart city concept and urban planning discourse, specifically in the urban environmental management field. Providing a clear interaction will help to understand the linkage

between the smart city as an emerging concept and urban environmental management as a field in urban planning discourse.

1.5. Structure of the Report

This report consists of six chapters, namely introduction, theory, research design, results, discussion, and conclusion. The introduction contains the description of a research problem which leads to the preliminary research objective and questions. To understand the concepts emerged from the research objective, a chapter about theory description is needed. It leads to the second chapter about theory used in this study. The theory chapter contains a literature review on the three key concepts used in this study, namely smart city, urban environmental management, and interaction. The elaboration of those concepts will be used to build a conceptual framework for this study. Then, to conduct a research based on the conceptual framework, there has to be an elaboration on research design, in chapter three. Findings from the field will be elaborated in the fourth chapter, namely results. Chapter fifth will elaborate a discussion of the results. The discussion contains my interpretation towards the results to answer the research questions followed by several important discussions. That chapter will be structured based on the research questions. Finally, the sixth chapter is a conclusion which contains the prominent findings of this study, reflection upon the implementation of this study, and recommendations.





CHAPTER 2

THEORY

- 2.1. Smart City Concept
- 2.2. Urban Environmental Management
- 2.3. Interaction
- 2.4. Conceptual Framework

CHAPTER 2. THEORY

Since this study has to develop a framework based on the theories or concepts mentioned in the research objective, it therefore uses three key concepts, namely smart city, urban environmental management, and interaction. Each concept will be elaborated in the following sub sections. At the end of this chapter, a conceptual framework will be built as a guideline for this study.

2.1. Smart City Concept

So far, there is still lack of consensus about the smart city concept (Dameri, 2017). The nature of “smart city” came from a local approach which means that smart city is an initiative of various actors in a city who have their interest and objective in building a smart city project. Therefore, every city government has a working definition to understand a “smart city” which reveals that smart city is a context-dependence rather than a standardized concept. It leads to the immaturity of smart city theory, because there is not yet a single conceptual framework of a smart city concept that is being used in smart city project implementation.

However, this study needs to elaborate the smart city concept to identify aspects which contribute to the smart city project development which will be used to develop a conceptual framework. Firstly, this study has to define a “smart city” to frame its operationalization. Secondly, this study needs to analyze related smart city frameworks to extract various aspects of smart city, and adopt it to the conceptual framework of this study. Additionally, this study has to elaborate smart city categories to categorize aspects of smart city projects. The result of this section is a conclusion on smart city aspects which is divided into seven smart city categories.

2.1.1. Smart City Definitions

As mentioned before, the conception of a smart city is based on each city context (Kuyper, 2016). There are various smart city definitions to explain its conception. A smart city definition is necessary to give a frame for this study. This study needs to inventory related smart city definitions based on the most used definitions as can be seen in table 2. The keyword in each definition is indicated in bold as a clue to summarize the definitions.

Table 2. Smart City Definitions (based on Dameri, 2017) (keyword in bold)

| Defintion | Reference |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| “A city that monitors and integrates conditions of all of its critical infrastructures , including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens” | Hall (2000) |
| “A Smart City is a city well performing built on the ‘smart’ combination of endowments and activities of self-deciseive, independent and aware citizens ” | Giffinger et al. (2007) |
| “Smart city is defined by IBM as the use of information and communication technology to sense, analyze and integrate the key information of core systems in running cities” | IBM (2010) |
| “Concept of a Smart City where citizens, objects, utilities, etc., connect in a seamless manner using ubiquitous technologies , so as to significantly enhance the living experience in 21st century urban environments” | Northstream (2010) |

| Defintion | Reference |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| "A city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance " | Caragliu et al. (2011) |
| "Smart City is the product of Digital City combined with the Internet of Things " | Su et al. (2011) |
| "Smart City is a city in which it can combine technologies as diverse as water recycling, advanced energy grids and mobile communications in order to reduce environmental impact and to offer its citizens better lives" | Setis-EU (2012) |
| "A smart city is a well-defined geographical area , in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a well-defined pool of subjects, able to state the rules and policy for the city government and development" | Dameri (2013) |
| Smart city is the collaboration among policy, citizens, research, and private partners as an ecosystem facilitate idea exchange and innovation by using media, ICT, and open big data | Baccarne et al. (2014) |
| "Smart city is the implementation of multi-dimensional approach which consists of four different approach, namely smart machines and informed organizations, partnerships and collaborations, learning and adaptation, and investing for the future " | Ching and Ferreira (2015) |
| "A Smart City is an integrated system in which human and social capital interact , using technology-based solutions. It aims to efficiently achieve sustainable and resilient development and a high quality of life on the basis of a multistakeholder, Municipality based partnership." | Monzon (2015) based on ASCIMER's working definition |
| "Smart city is the utilization of ICT and innovation by cities (new, existing or districts), as a means to sustain in economic, social and environmental terms and to address several challenges dealing with six (6) categories (people, economy, governance, mobility, environment and living)" | Anthopoulos (2017) |

Based on the above definitions, it can be summarized that a smart city is a city which uses Information and Communication Technologies to increase the citizens quality of life by sensing, analyzing, and integrating information through a multi-dimensional approach and collaboration among policy, citizens, research, and private partners in six categories (people, economy, governance, mobility, environment and living). This study uses the definition to give a general understanding of the meaning of smart city concept for this study.

2.1.2. Smart City Frameworks

A conceptual framework for this study will be identified based on the various frameworks from previous researches. However, this study only uses a smart city framework which is relevant to the research objective. The frameworks are useful to understand the aspects which contribute to the smart city project development. There are four frameworks which will be elaborated in this section which are from Nam and Padro (2011), Chourabi et al. (2012), Mosannenzadeh and Vettorato (2014), and Fernandez-Anes and Velazques-Romera (2015).

a. Framework Developed by Nam and Padro (2011)

Nam and Padro (2011) suggested three core elements of a smart city, namely technology, human, and institutional (see Figure 3). The combination of these elements make a city becoming “smart”. From the technology elements, there are five aspects which have to be fulfilled, namely physical infrastructure; digital networks; smart, mobile, and virtual technologies. Physical infrastructure refers to the use of various hardware, software, and networks of Information and Communication Technology. Digital networks refer to the application of service-oriented information system (web-based platform) which are applied both inside and outside of governmental sectors. Smart technologies refer to the integration of interface facilities (website, monitors, and dashboard), control system (local operators), and database resources (data server), which more looks like a control center to monitor the condition of a city. Mobile and virtual technologies refer to the use of network utilities (fiber optics and Wi-Fi networks) and public hotspot through mobile gadgets.

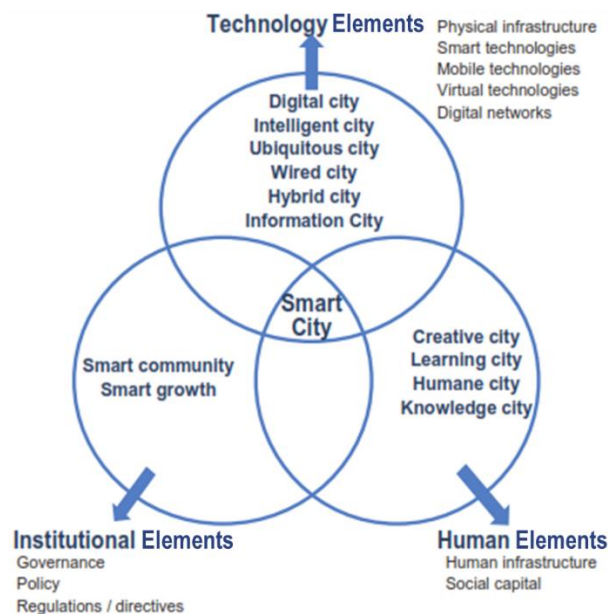


Figure 3. Smart City Fundamental Elements
(Source: adapted from Nam and Padro, 2011)

Regarding the human elements, there are two aspects required, namely human infrastructure and social capital. Human infrastructure refers to the rate of creativity, social learning, and education of people in the city. Social capital refers to the social inclusion, soft infrastructures (knowledge networks, voluntary organization, and crime rate), and the cultural diversity.

Regarding the institutional elements, there is just an aspect, namely governance (policy or regulation). Governance refers to the support of government and their policy towards smart city projects. It emphasizes on the spirit of citizen-centric, which means that every decision is based on the citizen needs and priorities.

b. Framework Developed by Chourabi et al. (2012)

Chourabi et al. (2012) offered a framework to explain the relationship and influence among elements in the smart city project (see figure 4). The framework is developed based on the framework developed by Nam and Padro (2011).

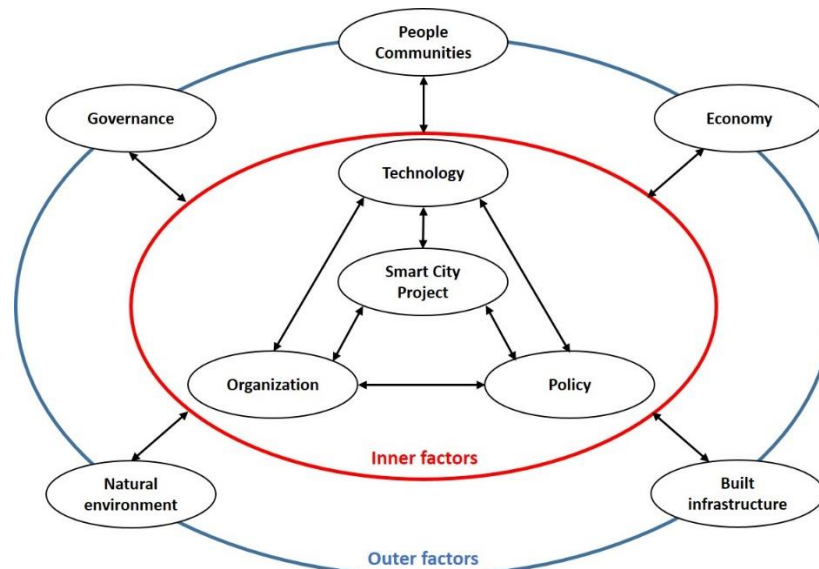


Figure 4. Smart City Project Framework
(Source: adapted from Chourabi et al., 2012)

Chourabi et al. (2012) stated that each element in the framework has a two-way impact on a smart city project, whether it is influencing or influenced by other elements. There are two different levels of influence in the framework, the outer (blue circle) and inner level (red circle) (see Figure 4). The outer level contains people and communities, economy, built infrastructure, natural environment, and governance. While the inner level contains technology, organization, and policy.

Regarding the outer level, people and communities are an important element in a smart city project, because the project has to accommodate the need of the people. According to the analysis conducted by Chourabi et al. (2012), there are seven aspects related to people and communities, namely digital divides, information and community gatekeepers, participation and partnership, communication, education, quality of life, and accessibility. The economy element is generated by economic competitiveness of the project which has six aspects, namely innovation, entrepreneurship, trademarks, productivity, flexibility of labor market, and integration of labor in national and international market. Then the built infrastructure refers to the availability and performance of Information and Technology Infrastructure which has three general aspects. It contains Information and Technology Infrastructure (wireless networks and service-oriented information system), security and privacy (accessibility, threat of virus and hackers, privacy of personal data), and operational cost (cost of development, installation, operation, maintenance, data security, IT experts, and training). Natural environment refers to the implication of a smart city project to nature and built infrastructures. It has two aspects, namely protection of natural resources and related infrastructures (sewage, waterways, and green spaces). Finally, governance refers to the rate of citizen participation and public private partnership. It has eight aspects, namely collaboration, leadership and champion, participation and partnership, communication, data-exchange, service and application integration, accountability, and transparency.

Regarding the inner level, technology is a key element for smart city projects which has two general aspects, namely IT skills and organizational (cross-sectoral cooperation and coordination, IT management, politics, cultural issues). Organization refers to the institution that coordinates the smart

city project, which has six aspects, namely project size, manager's attitude and behavior, organizational diversity, goals and project alignment, similar goals, and flexibility to change. Finally, the policy refers to the political structure and related regulations which are influenced the smart city project. It has two general aspects, namely political structure (city government, council, and major) and legal and regulation.

c. Framework Developed by Mosannenzadeh and Vettorato (2014)

Mosannenzadeh and Vettorato (2014) suggested a more comprehensive framework by integrating four rings in developing a smart city project based on the necessities of smart city project development (yellow ring), main categories in smart city project development (blue ring), main stakeholders involved (green ring), and the way to create a smart city (purple box) (see Figure 5).

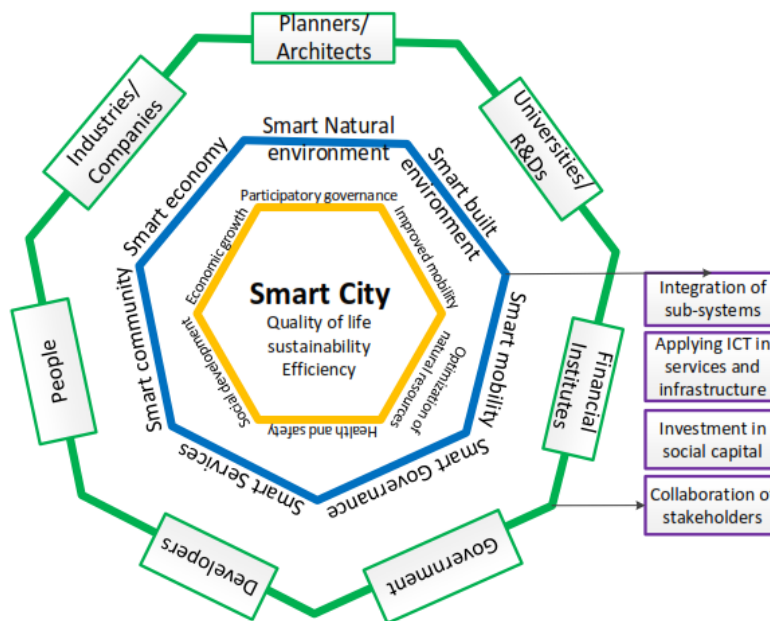


Figure 5. Framework to Define Smart City
(Source: Mosannenzadeh and Vettorato, 2014)

In the yellow ring, it is necessary to develop a smart city project to deal with urban challenges by improving the participatory governance, mobility, natural resources, health and safety, social development, and economic growth. In the blue ring, a smart city could be built based on the integration of seven categories, namely smart natural environment, built environment, mobility, governance, services, community, and economy. But the name of each category can be changed based on the need of analysis. In the green ring, collaboration among stakeholders is required in a smart city project development, such as between planners/architect, university/research and development agency, financial institutions, government, developers, people, and industries/companies. The collaboration among stakeholders by integrating seven categories of smart city and investment on social capital could address the urban challenges to create a sustainable and efficient city with high quality of life.

d. Framework Developed by Fernandez-Anes and Velazques-Romera (2015)

Fernandez-Anes and Velazques-Romera (2015) redefined the definition of smart city from Harrison et al. (2010) by developing a conceptual framework (see Figure 6). They stated that a smart city

is the integration of physical, IT, social, and business elements to achieve a collective intelligence within a city. It means that a city is smart when each element mentioned can be used simultaneously to address several urban challenges. Therefore a city uses collective intelligence when dealing with the challenges.

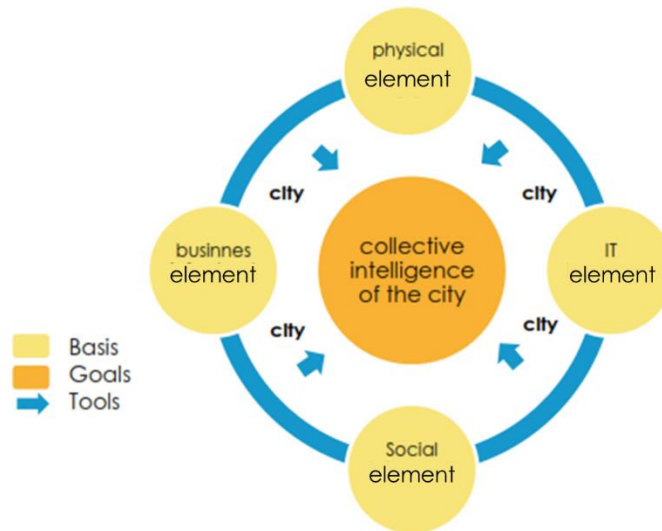


Figure 6. Smart City Definition Framework
(Source: Fernandez-Anes and Velazques-Romera, 2015)

e. Concluding Remark

Based on the above elaboration, it seems that each scholar suggests a different approach to frame a smart city concept. I extracted smart city aspects provided from each framework. It gives broader insight about aspects that can be used for this study and will be structured in section 2.1.4. I also selected the framework from Fernandez-Anes and Velazques-Romera (2015) and Mosannenzadeh and Vettorato (2014) as a material to build a conceptual framework. Four basic elements in the framework of Fernandez-Anes and Velazques-Romera (2015) can be specifically elaborated by using framework of Mosannenzadeh and Vettorato (2014). Physical and IT infrastructure seems to touch the built and ICT infrastructures, social infrastructure seems to touch the investment in social capital, business infrastructure is represented by the stakeholders collaboration, and integration of all infrastructures seem to touch the integration of sub-systems which leads to a collective intelligence. The adoption of the frameworks to the conceptual frameworks of this study will be elaborated in section 2.4.

2.1.3. Smart City Categories

The next step is to determine smart city categories that can be used in this study. A smart city category refers to the related fields of activity that are characterized by the term of smart city (Giffinger et al., 2007). This study adopts the smart city category from Dubey and Sharma (2017) which redefine the smart city category based on Giffinger et al. (2007), which are the most used categories in various researches. These redefined smart city categories are used to get the most updated condition regarding the smart city aspects in each category. In the smart city category developed by Giffinger et al. (2007), Dubey and Sharma (2017) added a new category that is education and capacity building. They added it because currently, education and capacity is necessary to build a successful smart city project. Each category has

different aspects (see Table 3) in which aspects in each category are used to assess the smartness of a city, therefore some of the aspects may be unsuitable when it is used to assess a specific smart city project.

Table 3. Smart City Categories and Aspects (Dubey and Sharma, 2017)

| No | Smart City Category | Aspects |
|----|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Smart Economy | <ul style="list-style-type: none"> - Innovative spirit - New opportunity (entrepreneurship) - Economic image & trademarks - Economic growth (productivity) - Flexibility of labor market - Collaboration at national and international level - Capability to transform - Development of ICT facilities - Safe and reliable transport systems |
| 2 | Smart People | <ul style="list-style-type: none"> - Level of qualification - Affinity for lifelong learning - Social and ethnic plurality - Creativity - Participation and coordination in development process |
| 3 | Smart Governance | <ul style="list-style-type: none"> - Participation in decision-making - Public and social services - Transparent governance - Political strategies and perspectives |
| 4 | Smart Mobility | <ul style="list-style-type: none"> - Local accessibility - (Inter-)national accessibility - Availability of ICT-infrastructure - Sustainable, innovative and safe transport systems |
| 5 | Smart Environment | <ul style="list-style-type: none"> - Natural conditions of resource - Environmental pollution (air, water, soil, waste, etc.) - Environmental protection - Sustainable resource management |
| 6 | Smart Living | <ul style="list-style-type: none"> - Cultural facilities - Health conditions - Individual safety - Housing quality - Education facilities - Touristic attractivity - Social cohesion |
| 7 | Education and Capacity | <ul style="list-style-type: none"> - Students per inhabitant - Satisfaction with accessibility and quality of educational system - Awareness of citizens to use the latest green and innovative technologies - Participatory approach to community and society for overall national development |

2.1.4. Conclusion: Smart City Aspects

Based on the identification of the smart city definitions, categories, and frameworks, this study tries to come up with aspects that contribute to a smart city project development. The aspects are categorized based on the smart city categories to be more structured. The selected aspects are in table 4.

Table 4. List of Smart City Aspects and Categories

| Categories | Smart City Aspects | | | | |
|------------------------|------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Nam and Padro, 2011 | Chourabi et al., 2012 | Mosannenzadeh and Vettorato, 2014 | Fernandez-Anes and Velazques-Romera, 2015 | Dubey and Sharma, 2017 (adapted from Giffinger et al., 2007) |
| Smart Economy | Mobile technologies | Innovation; Wireless networks; Cost of development, installation, operation, and maintenance; Cost of data security; Cost of IT experts and training; Accountability; Entrepreneurship spirit; Flexibility of labor market; Integration of labor in national and international market | ICT infrastructures and services | - | Innovative spirit; New opportunity (entrepreneurship); Economic image & trademarks; Economic growth (productivity); Flexibility of labor market; Collaboration at national and international level; Capability to transform; Development of ICT facilities; Safe and reliable transport systems |
| Smart People | Citizen-centric; Creativity; Social inclusion; Cultural diversity; Social learning | IT skills; Digital divides; Information and community gatekeepers | Social capital | - | Level of qualification; Affinity for lifelong learning; Social and ethnic plurality; Creativity; Participation and coordination in development process |
| Smart Governance | Digital network; Interface facility; Control system; Database resources | Participation and partnership; Collaboration; Leadership; Service-oriented information system; Data-exchange; Transparency; Accessibility; Data security and privacy; Communication | Stakeholders collaboration | Collective intelligence; IT infrastructure | Participation in decision-making; Public and social services; Transparent governance; Political strategies and perspectives |
| Smart Mobility | - | - | - | - | Local accessibility; (Inter-)national accessibility; ICT-infrastructure; Sustainable, innovative and safe transport systems |
| Smart Environment | - | - | - | - | Natural conditions of resource; Environmental pollution; Environmental protection; Sustainable resource management |
| Smart Living | - | - | - | - | Cultural facilities; Health conditions; Individual safety; Housing quality; Education facilities; Touristic attractivity; Social cohesion |
| Education and Capacity | Knowledge networks | Education rate | - | - | Students per inhabitant; Satisfaction with educational system; Awareness of citizens; Participatory approach |

2.2. Urban Environmental Management

Due to the broad field of urban planning, this study will only focus on the environmental management aspects of a city. The pressure to the environment in the city increases since the high flow of urbanization and climate change (Tyrväinen et al., 2013; Samat and Harun, 2012; Moussiopoulos et al., 2010). Conducting a study about smart city projects and its relation to the urban environmental management seems necessary. The term of urban environmental management refers to the environmental management efforts in an urban area.

There is no universal definition of environmental management (Barrow, 2006). The concept is very broad and diverse which stands on anthropology and ecological discourse. An anthropologist defines environmental management as the latest consideration after human development objectives have been set (Redclift, 1985 in Barrow, 2006). An ecologist defines nature as the highest priority in a development process.

This study needs to elaborate the urban environmental management concept to identify the aspects of environmental management which will be used to build a conceptual framework. Firstly, this study has to define the environmental management to frame the operationalization. Secondly, this study needs to analyze aspects which contribute to the environmental management efforts.

2.2.1. Environmental Management Definitions

There are various environmental management definitions to explain its conception. This study elaborates related definitions of urban environmental management as can be seen in table 5. The keyword in each definition is indicated in bold as a clue to summarize the definition. However, I could not find relevant literature about the urban environmental management concept after 2006. This study, therefore, uses Barrow (2006) as a reference in explaining the concept. A reflection upon this will be further elaborated in chapter 5.

Table 5. Environmental Management Definitions (Barrow, 2006) (keyword in bold)

| Definition | Reference |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| "The process of allocating natural and artificial resources so as to make optimum use of the environment in satisfying basic human needs at the minimum, and more if possible, on a sustainable basis" | Jolly, 1978 |
| "Environmental management cannot hope to master all of the issues and environmental components it has to deal with. Rather, the environmental manager's job is to study and try to control processes in order to reach particular objectives" | Royston, 1978 |
| "Environmental management – a generic description of a process undertaken by systems-oriented professionals with a natural science, social science, or, less commonly, an engineering, law or design background, tackling problems of the human altered environment on an interdisciplinary basis from a quantitative and/or futuristic viewpoint " | Dorney, 1989 |
| "Management of the environmental performance of organizations, bodies and companies " | Sharratt, 1995 |
| "The control of all human activities which have a significant impact upon the environment " | Barrow, 2006 |
| "An approach which goes beyond natural resources management to encompass the political and social as well as the natural environment, it is concerned with questions of value and distribution , with the nature of regulatory mechanisms and with interpersonal, geographic and intergenerational equity " | R. Clarke, 2006 in Barrow, 2006 |

| Definition | Reference |
|---------------------------------------------------------------------------------------------|----------------------------------|
| "Formulation of environmentally sound development strategies" | Barrow, 2006 |
| "An interface between scientific endeavor and policy development and implementation" | S. Macgill, 2006 in Barrow, 2006 |

Based on the above definitions, it can be summarized that environmental management is a process of controlling human activities which have impacts on the environment by formulating related development strategies and policies to balance the use of environment and the needs of human. This study uses the definition to give an understanding about the meaning of environmental management.

2.2.2. Environmental Management Categories and Aspects

According to Barrow (2006), environmental managers aim to balance the supply of natural resources and its demand. They have to do three things to make a balance condition in the environment, namely identify goals, assess whether the goal is achievable, and develop and implement necessary means to do things that are possible. In doing that, environmental managers have to deal with various sectors related to environmental management, namely ecology, economics, law, politics, citizens, and also challenges towards sustainable development. The focus of environmental management is on the implementation, monitoring, and auditing (Hillary, 1995 in Barrow, 2006). It means that environmental management focuses on the practical efforts and deal with environmental issues in the field.

Environmental management aims to modify and drive the activities and behavior of the people or organizations. According to Barrow (2006), an environmental management effort applies three general categories to intervene the activities and behavior of people towards environment, namely advisory, economic or fiscal, and regulatory. Advisory focuses more on the spreading of related environmental knowledge or policy to gain the awareness of people. Economic or fiscal focuses more on the use of economic policy instruments to steer the behavior of people by using economical instruments when dealing with environmental issues. Finally, regulatory focuses more on the ruling the people to do or not to do something related to the environment. Each category has its aspects to execute the environmental management as is shown in Table 6.

Table 6. Environmental Management Categories and Aspects (Barrow, 2006)

| No | Categories | Aspects |
|----|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Advisory | <ul style="list-style-type: none"> - Education - Demonstration - Media - Advice |
| 2 | Economic or Fiscal | <ul style="list-style-type: none"> - Taxation - Grants, loans, aid - Subsidies - Quotas or trade agreements |
| 3 | Regulatory | <ul style="list-style-type: none"> - Standards and laws - Restrictions and monitoring - Licensing - Zoning |

2.3. Interaction

Since this study focus on the interaction between smart city and environmental management aspects, a definition of interaction has to be developed. Several definitions of interaction are listed and analyzed first to give a clear meaning for this study towards the term of interaction. Various definitions about interaction are presented in table 7. The keyword in each definition indicated in bold as a clue to summarize the interaction definition and prerequisites.

Table 7. Definitions of Interaction (keyword in bold)

| Definition | Reference |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| "an occasion when two or more people or things communicate with or react to each other " | dictionary.cambridge.org, 2017 |
| <ul style="list-style-type: none"> - "Reciprocal action or influence" - "Communication or direct involvement with someone or something" - "A particular way in which matter, fields, and atomic and subatomic particles affect one another" | en.oxforddictionaries.com, 2017 |
| <ul style="list-style-type: none"> - "the activity of being with and talking to other people, and the way that people react to each other" - "the process by which different things affect each other or change each other" | Macmillandictionary.com, 2017 |
| <ul style="list-style-type: none"> - "mutual or reciprocal action or influence" - "the action or influence of things on one another" | merriam-webster.com, 2017 |
| <ul style="list-style-type: none"> - "reciprocal action, effect, or influence" - "a mutual or reciprocal action or influence" - "the direct effect that one kind of particle has on another, in particular, in inducing the emission or absorption of one particle by another" - "the mathematical expression that specifies the nature and strength of this effect" | dictionary.com, 2017 |
| <ul style="list-style-type: none"> - "a mutual or reciprocal action; interacting" - "the transfer of energy between elementary particles or between an elementary particle and a field or between fields; mediated by gauge bosons" | vocabulary.com, 2017 |

Based on the above definitions, for this study, I define interaction as an activity or occasion of two or more variables in a particular way which has either direct or indirect reciprocal action, effect, or influence to one another. There are at least two requirements of interaction, namely an activity or occasion of more than one variable and it has direct or indirect mutual action, effect, or influence to one another. The definitions also present keywords which can be listed as prerequisites of interaction (see Table 8).

Table 8. Interaction Prerequisites

| No | Category | Prerequisites |
|----|-----------|---------------------------------------------------------------------------------------------------------|
| 1 | Variables | <ul style="list-style-type: none"> - Two or more variables - Mediation variable |
| 2 | Process | <ul style="list-style-type: none"> - Occasion - Reciprocal activities |
| 3 | Effects | <ul style="list-style-type: none"> - Reaction form |

Table 8 presents three categories of interaction, namely variables, process, and effects in which each category has its prerequisites. First, the variables category consists of two prerequisites, namely two or more and mediation variable, which represents the number of variables and form of intermediary variable. Second, the process category consists of two prerequisites, namely occasion and reciprocal

activities, which represents the form of occasion and reciprocal activities between the variables. Third, the effects category consists of a prerequisite, namely reaction form, which represents the form of reaction after the variables affecting each other in an occasion and reciprocal activity. Variables which do not have fulfill one of the prerequisites is considered as a “no interaction” variable.

The interaction process between variables can be represented by using a path diagram. Steiger (2009) stated that a path diagram is useful to show the interconnection between two variables by using arrows which represent the type of interconnection between the variables (see Figure 7). Based on Steiger (2009) a path diagram has to include variables (represented in a box or oval), arrows (lines with arrowhead) or wires (lines with no arrowhead) or slings (lines with two arrowheads). Arrows indicate a direct or linear relationship between variables (a one-sided direction), while wires and slings indicate an indirect or dynamic relationship (a bidirectional direction). Furthermore, Steiger (2009) also stated that a path diagram is not always a tool for presenting a causal relationship between two variables. But it can also be interpreted as a representation of the interaction between two variables, even if the variables do not have a causal relationship. I will use a path diagram to represent the interaction process between smart city projects and environmental management.

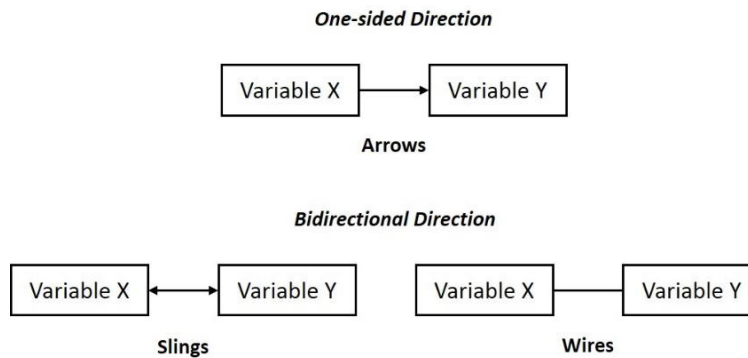


Figure 7. Representation Models of Interaction
(Source: Steiger, 2009)

2.4. Conceptual Framework

After defining the aspects of the smart city and environmental management, and the interaction prerequisites, the next step is to develop the conceptual framework. It is developed by drawing the interaction between the aspects of the smart city and environmental management based on its process flow. Categories and aspects of smart city and environmental management is positioned in each side of the process. In the smart city part, the framework from Fernandez-Anes and Velazques-Romera (2015) and Mosannenzadeh and Vettorato (2014) are merged in it. From Mosannenzadeh and Vettorato (2014), the yellow ring is represented in the smart city process flow as “necessity of smart city projects”; the blue ring is represented by the seven smart city categories which consists of several aspects; the green ring is represented by the active citizens, community, organization, provate company, and Municipality as the stakeholders. From Fernandez-Anes and Velazques-Romera (2015), four basic elements are represented in the whole process flow as a way to develop a smart city. In the environmental management part, three categories of environmental management with their aspects are structured based on the process flow. The interaction prerequisites aspects are also represented based on the theory. The conceptual framework can be seen in figure 8.

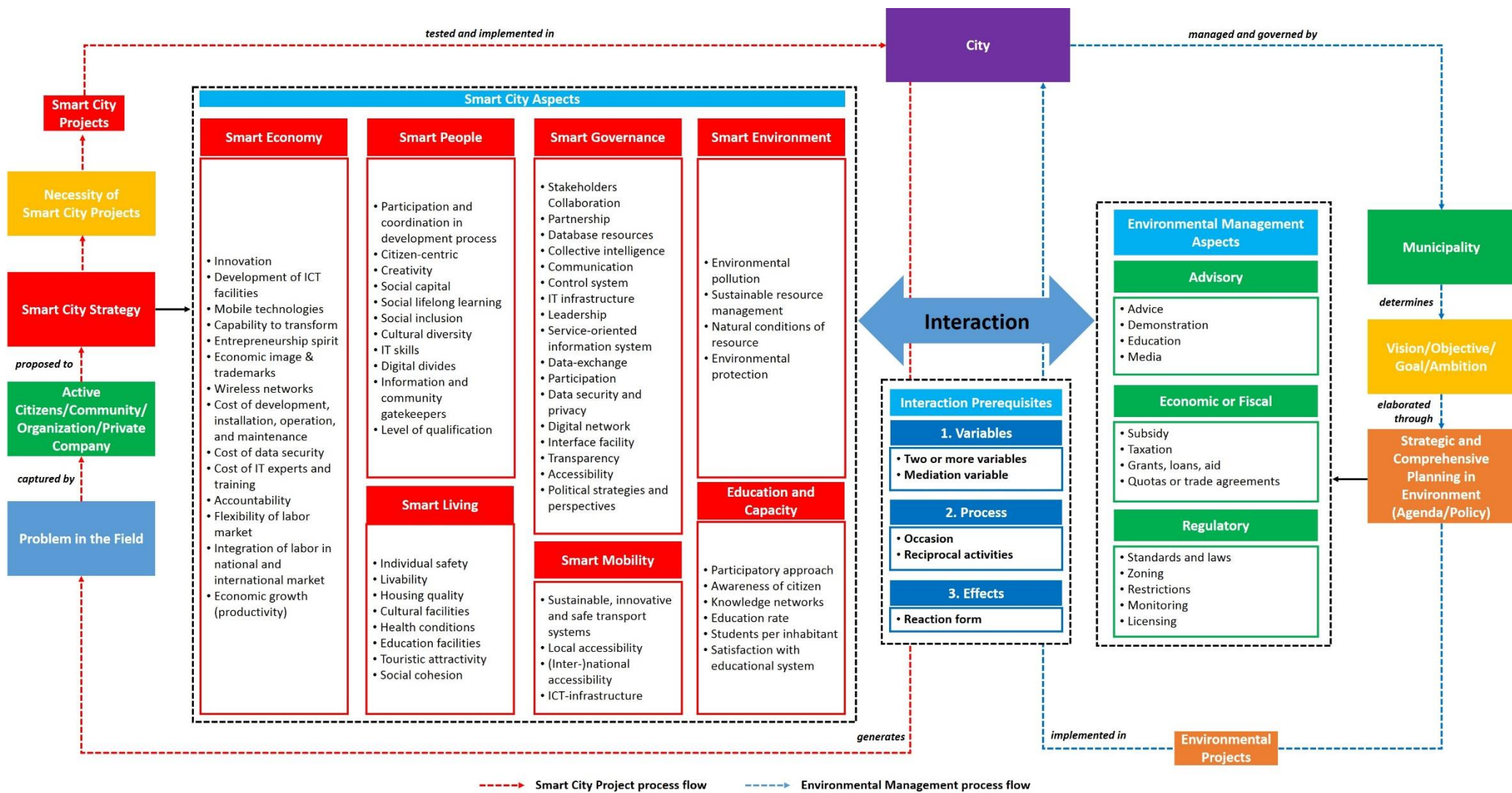


Figure 8. Conceptual framework





CHAPTER 3

RESEARCH DESIGN

- 3.1. Research Philosophies
- 3.2. Research Approach
- 3.3. Research Strategy, Choice, and Time Horizon
- 3.4. Redefined Research Objective and Questions
- 3.5. Research Techniques and Procedures

CHAPTER 3. RESEARCH DESIGN

To investigate the research questions, this study arrange a research design. This chapter elaborates the research design used in this study by using a research onion developed by Saunders et al. (2009) to have a clear understanding of the whole structure of a research design. The following sections will elaborate each “slice of the onion”, starting from the outermost layer.

3.1. Research Philosophies

An overview towards research design used is elaborated, as it influences the way this study is conducted and develop evidences towards the research findings. In elaborating the design, this study uses the research onion scheme developed by Saunders et al. (2009) (see figure 9). The following sections will be structured based on each “slice of the onion” starting from the philosophies layer.

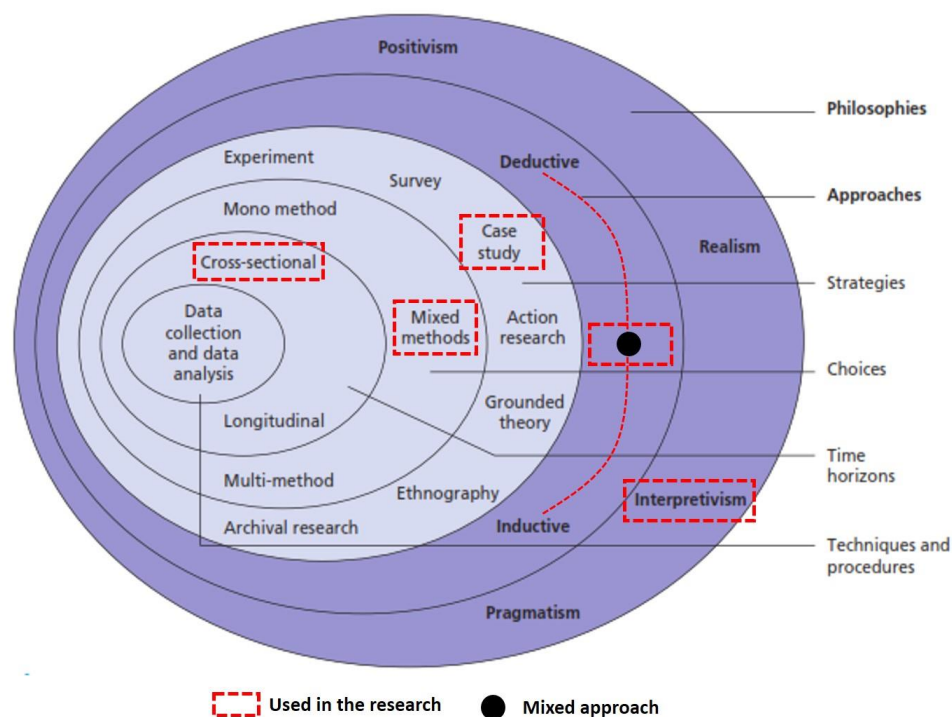


Figure 9. Research Onion
(Source: Saunders, et al., 2009)

The research onion has four major philosophies which usually underlie research, namely positivism, realism, interpretivism, and pragmatism. Each philosophy has a different way of looking at a phenomenon in the world (see Appendix A to know the difference between each philosophy). Reflecting to the research objective, this study wants to answer the interaction between the smart city projects and environmental management in a particular city. As Dameri (2017) stated that a smart city is a context-dependent concept, it has to be analyzed in a particular situation. The view towards the situation cannot be generalized because each situation has a different meaning to be analyzed further. Besides, this study wants to investigate the interaction in a particular case to understand the interaction deeply. That thinking leads me to investigate the interaction between smart city projects and environmental management through

the lens of interpretivist, because the researcher can interpret a socially constructed meaning in the interaction between the two variables.

The characteristic of smart city as a context-dependent concept can be understood by making meaning of it in a particular context of time and place. As Schwartz-shea and Yanov (2012) stated that interpretive research focuses on the meaning-making by being in a setting, then making sense of it and the contextuality (the circumstances that form the setting which can be understood by making sense of it). Furthermore, Saunders et al. (2009) stated that an interpretivist would argue that the insight inside a social phenomenon is too rich to be simplified through a generalized law-like principles. This study also will not be conducted based on a generalized law-like principles, but it will be conducted based on the contextuality of phenomenon based on the information gathered from social actors.

Looking into more detail, according to Schwartz-shea and Yanov (2012), interpretive research is research which has an orientation as a meaning-making based on the contextual knowledge which tries to explain a phenomenon from the behavior and experience of social actors. The characteristic of interpretive research can be seen in table 9.

Table 9. The Characteristics of Interpretive Research
(adapted from Schwartz-shea and Yanov, 2012) (keyword in bold)

| Characteristics | Description |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Research Orientation | <ul style="list-style-type: none"> - Meaning-making orientation - Contextuality (in re. knowledge) - Hermeneutic–phenomenological sensibility: explanatory description (answering “why?”) - constitutive causality |
| Design Attitude | <ul style="list-style-type: none"> - Abductive logic of inquiry: iterative, recursive, starting from surprise/ inductive logic as precursor puzzle/tension deriving from expectations vs. lived experiences - Prior knowledge, expectations (experiential, theoretical) - Dynamic flexibility in implementation of design as learning occurs - Participants = agents with valued local knowledge; researchers as informants; researchers experts in processes of inquiry - Research as “world-making” |
| Getting going | <ul style="list-style-type: none"> - Educated provisional sense-making; start with prior knowledge > the hermeneutic circle-spiral (understanding the whole is by understanding the parts; understanding the parts are helped by understanding the whole > as circle repeated, the understanding expands becoming a spiral) - Investigating - Access questions; choices of settings, actors, archives, documents (relational turn in field research; ethical and power dimensions; active learning in the field) |
| In the field of archives | <ul style="list-style-type: none"> - Mapping for exposure and intertextuality - Bottom-up, in situ concept development (learning) - Exploration of concepts in ordinary language, local knowledge terms - Revise design as needed (flexibility of the design as learning occurs in the field) |
| Analysis of evidence | <ul style="list-style-type: none"> - Hermeneutic sensibility: coherence, logic of argumentation |
| Evaluative standards | <ul style="list-style-type: none"> - Trustworthiness - Systematicity - Reflexivity, transparency; engagement with positionality |

The characteristic of interpretive research influences the design of this study. According to Schwartz-shea and Yanov (2012), there are four concerns of interpretive research which has to be followed in the design of this study. Firstly, the flexibility of the design, it means this study has to revise the prior research elements, such as a conceptual framework, research question, and methodology if those elements are unhelpful when used in the field. Secondly, no intervene to the sources, it means that the researcher cannot intervene the sources, such as the interviewees and documents. Thirdly, a reiterative process in the field, which means that the researcher has to investigate the phenomenon by repeating the knowledge gathered from the field. It can be done by always developing the understanding towards the knowledge gathered in the field. Finally, this study may be supported by a thick description to contextualize the meaning of a phenomenon in the field.

3.2. Research Approach

The second “slice” of the onion is the research approach. According to Creswell (2009), the determination of the research approach is based on the research problem. The problem in this study is that the linkage between non-government-based smart city project and government-based urban planning practice in a specific case is still unclear. Based on that, qualitative research is useful to explore the linkage. Additionally, qualitative research is exploratory in which the researcher explore the phenomenon deeply to gain related knowledge.

Furthermore, this study will use a deductive and inductive approach in its design, as Saunders et al. (2009) stated that it is possible to combine deductive and inductive approach. A deductive approach is a research approach by developing a theoretical framework and hypothesis to be tested in the field. It includes the operationalization of the concept used in the research question and generalization of findings. An inductive approach is a research approach by generating knowledge from the field to develop a theory. It includes an understanding of the nature of the research problem in the field and formulation of the findings to be a theory. Based on that, for this study, I developed a conceptual framework to give an understanding about the prior knowledge regarding the aspects of smart city and urban environmental management, and how these theories are being used in the field. However, this study does not develop a hypothesis.

3.3. Research Strategy, Choice, and Time Horizon

The third, fourth, and fifth “slice” of the research onion is research strategy, choice, and time horizon. Based on the objective, this study wants to investigate a specific case on the smart city projects and environmental management in a particular city. Yin (2003) stated that a case study is a suitable strategy when a researcher wants to investigate a contemporary case with no manipulation towards the relevant behaviors. A case study is an investigation strategy to deeply explore a program, event, process, or individuals which is bounded in time and activity by using variety of data collection methods in a period to gather detailed information (Creswell, 2009). Based on the definition, a case study strategy has at least three important elements, namely a specific contemporary object to be investigated (program, event, process, or individuals), the object is bounded in time and activity, and it allows the researcher to use a variety of data collection methods. Based on the research strategy used, a choice of mixed methods and cross-sectional time horizon will be best suited for this study. This study will be conducted by using various method at one moment in time, not in a series of time.

This study use embedded single-case study which means that this study only use one case but there are two unit analyses in it, namely smart city projects and urban environmental management. A single-case study is selected because this study wants to confirm related smart city and urban environmental management aspects from the theoretical perspective to a particular case. As Yin (2003) stated that the rationales for selecting a single-case study are the research wants to confirm the theories and has a unique case which will be explored.

Therefore, this study needs to elaborate the three elements of case study strategy. Firstly, this study has to select the study area and case by developing several criteria. Secondly, this study has to elaborate the form of data collection, analysis, and interpretation in the investigation. Finally, this study tries to determine related procedures and strategies to check the data accuracy.

3.3.1. Study Area Selection

Based on the general objective and research approach used, this study needs a specific area and case to deeply explore the interaction between smart city project and urban environmental management in a particular context and situation. Therefore, this study has to choose a city which has implemented a smart city programme. One of the fast-movement smart city strategies is in European cities, after the European Union launched the Europe 2020 Strategy in 2010 which stimulates governments to adopt smart city concept as key development pathways (Cocchia, 2014). Because of this policy strategy, many European cities try to implement a smart city concept to, mostly, achieve environmental objectives. The Europe 2020 strategy focuses on the environmental issues, such as CO₂ and Greenhouse gas emissions in a city. Therefore, European cities seems the most suitable possible study areas. Criteria are used to choose a city based on the city characteristics, smart city strategy, and urban environmental management efforts developed in it as can be seen in table 10.

Table 10. Criteria for the City Selection

| Number Code | Description |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | European city¹ (there is agenda towards smart city strategy in Europe 2020 policy document which more focuses on the environmental aspects) |
| 2 | European-large city (more than 500,000 inhabitants)² (represent the most rapid growth of urbanization and urban development) |
| 3 | Established smart city strategy (the city has related smart city strategy as their agenda or policy and it has been implemented at least for five years) |
| 4 | Most of smart city projects are initiated by non-governmental parties (the smart city projects/initiatives are initiated by the citizens, communities, organization, or private company) |
| 5 | Technology is not the core aspect in the smart city operationalization (the city use technology but not as the central aspect of its smart city strategy and end-goals) |
| 6 | Environmental management efforts (the city has environmental management efforts by using advisory, economic scheme, and regulatory/control) |

¹ Strategy towards a smart city is represented in Europe 2020 strategy document as three main priorities, namely smart, sustainable, and inclusive growth

² The categorization is based on Dijkstra and Poelman, 2012 and United Nations, 2016

Regarding the criteria, first, the city has to be a European Union city, as it develops smart city projects based on the Europe 2020 policy. Besides, most of the European cities are using smart city concept to deal with environmental issues. Second, the city has to be a European-large city, because of the large cities experience rapid urbanization and urban development, and also high environmental pressure (Moussiopoulos et al., 2010; Samat and Harun, 2012; Tyrväinen et al., 2013). It seems the best type of city to be investigated. Third, the city has to have a smart city agenda or policy, because this represents that the city already have a clear vision towards its smart city operationalization. Additionally, the smart city strategy has been implemented at least for five years, because that seems an appropriate timeline in which most of the smart city strategies must have been implemented. Fourth, the city has to have most of the smart city projects that are not initiated by governmental actors, but by citizens, communities, organizations, or private companies in the city. This study wants to focus on how non-governmental initiatives in smart city interact with the environmental management practiced by the government. Fifth, the city creates its smart city strategy where people and institutional aspects are the core of its operationalization, not only the technological aspect. Finally, the city has to have environmental management efforts, such as an advisory media, an environmental economic instrument, and regulation on the environment. This study wants to analyze the link between smart city projects and environmental management efforts of the city.

Based on the above criteria, I make an inventory of the cities which satisfy those criteria. The inventory is based on literature review by taking European-large cities which have implemented a smart city concept as can be seen in table 11. Afterwards, the smart city strategy and environmental management of each city are analyzed based on the criteria from table 10. Then one of the cities which satisfy the criteria the most, is selected.

Table 11. List of the Possible Cities (sorted from the most fulfilled criteria)
(The assessment of criteria fulfilled uses numbers from Table 10)

| No | City | Criteria Fulfilled |
|----|------------|--------------------|
| 1 | Amsterdam | all |
| 2 | Copenhagen | 1, 2, 3, 5, 6 |
| 3 | Madrid | 1, 2, 4, 5, 6 |
| 4 | Helsinki | 1, 2, 3, 6 |
| 5 | Vienna | 1, 2, 3, 6 |
| 6 | Dublin | 1, 2, 3, 6 |
| 7 | Milan | 1, 2, 3, 6 |
| 8 | Barcelona | 1, 2, 3, 6 |
| 9 | Rotterdam | 1, 2, 4, 6 |
| 10 | Lisbon | 1, 2, 4, 6 |
| 11 | Berlin | 1, 2, 6 |
| 12 | Hamburg | 1, 2, 6 |
| 13 | Budapest | 1, 2, 6 |
| 14 | Stockholm | 1, 2, 6 |

Table 11 shows that Amsterdam is the only city that meets all the criteria. Amsterdam has already started a smart city strategy in 2009, supported by European Regional Policy 2011. It has a clear shared vision in developing smart city. The Amsterdam Smart City has been established in 2009, thus it has already organized smart city projects for eight years. The operationalization of the Amsterdam Smart City

is also based on the citizen-oriented in which most projects are initiated by citizens, communities, or private companies. It also emphasizes the multi-stakeholders collaboration in developing smart city projects based on its themes. Therefore, technology does not have the central role in it, as Dameri (2017) stated that there are projects in Amsterdam Smart City platform that do not use technology but their role in reaching Amsterdam Smart City objective is significant. Furthermore, Amsterdam city has related environmental management efforts that come from the Municipality policies (a reflection upon this will be provided in section 6.2.1), such as “Sustainable Amsterdam 2015-2018”, “Green Agenda 2015-2018”, “Amsterdam in 2020”, and “Amsterdam Structural Vision 2040”. Based on that, it seems reasonable for this study to select Amsterdam as the study area.

So, the specific research problem of this study is that, on the one hand, Amsterdam Smart City is operationalized based on the citizen-based approach and focusing on problem-based solving (Windén et al., 2016). On the other hand, the city practices environmental management based on several strategic policies and agendas which are focusing on a systematic long-term plan. Amsterdam Smart City might support the Amsterdam environmental management practice to pursue the city’s environmental objectives, and vice versa, but the linkage between them is still vague.

3.3.2. Case Orientation

After selecting the city as a study area, the next step is to investigate the smart city strategy and environmental management in Amsterdam. The investigation aims to give more understanding on the operationalization of Amsterdam Smart City, then select related projects to be further investigated in this study. The selected projects are based on the interviewee statements when they gave an example of the smart city project initiated by the non-governmental parties in Amsterdam. Based on the interview, there are two smart city projects which are analyzed further, namely “100.000 Energy-neutral Homes” and “Logistic Hub Amsterdam”. The investigation of Amsterdam environmental management aims to give more understanding on the Amsterdam environmental management efforts and objectives which are represented in their related environmental management agendas and policies.

3.3.2.1. Amsterdam Smart City

Regarding the Amsterdam Smart City, according to Dameri (2017), Amsterdam Smart City is the first and successful smart city strategy that becomes a precedent and good practice for other cities. Furthermore, Amsterdam created a platform called “Amsterdam Smart City” which has a unique smart city strategy. The platform is organised by four main partner categories as can be seen in figure 10, namely governments, companies, knowledge institutions, and NGO. It declares that technology is not the central point of the platform, while most of the scholars and also cities in the world focus more on technology as a central elements for their smart city strategies (Windén et al., 2016).

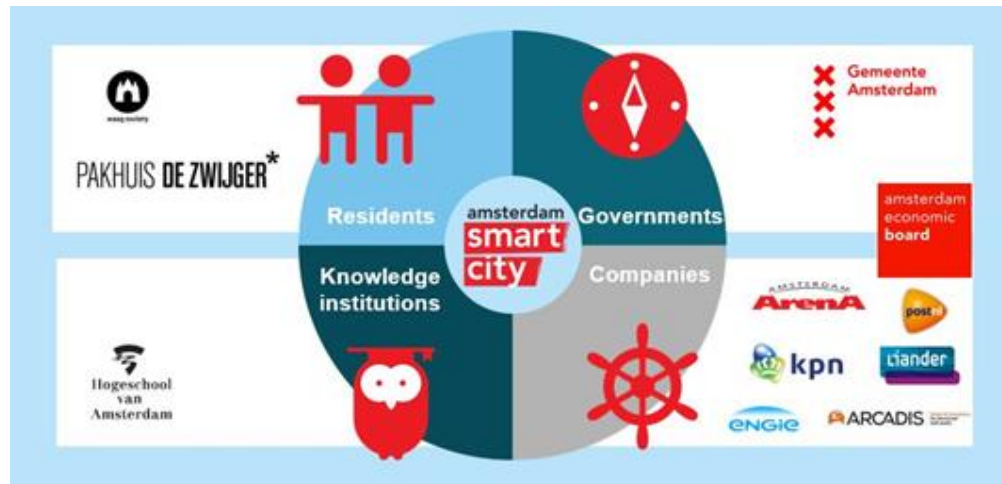


Figure 10. Amsterdam Smart City Platform Organization
(Source: Amsterdamsmartcity.com, 2017b)

Amsterdam Smart City platform aims to look for solutions for better use of natural resources and reducing greenhouse gas emissions through collaboration among citizens and organizations by using a web-based open platform (Dameri, 2017; Amsterdam Smart City, 2017b). To achieve that objective, Amsterdam Smart City focuses on six themes, namely infrastructure and technology; energy, water, and waste; mobility; circular city; governance and education; citizens and living. Thus, every citizen, community, and private company can initiate a project related to one or more of those themes.

Amsterdam Smart City platform also has its definition on a smart city concept. It defined smart city as follows:

“Smart city is all about the total sum of innovative technology, behavioral change and sustainable economic investments. By bringing partners together and setting up small local projects, it creates opportunities for these initiatives to be tested.” (Amsterdam Smart City, 2011: p.7)

Based on the definition, the operationalization of smart city in Amsterdam is more on the creation of small local projects by using or creating innovative technology, generate behavioral change, and under a sustainable economic investment. The creation of a small local project is conducted by collaborating all parties, such as Municipality, organization, private company, community, and also inhabitants. All parties can conduct their projects in a collaboration ecosystem, then they can test it directly in the city. By doing so, the strategy of Amsterdam Smart City is “learning by doing”. They want to make the city as a living lab, where different projects can be tested and scaled up. The overall operationalization of Amsterdam Smart City is based on four pillars as can be seen in figure 11.



Figure 11. Amsterdam Smart City Pillars
(Source: Amsterdam Smart City, 2011)

The first pillar is the collective approach which means that every project conducted in Amsterdam Smart City is based on the cooperation of all relevant parties to achieve viable results. It also emphasizes the higher involvement of the end-users to achieve a successful project. Secondly, innovation and awareness are required for each project. Therefore, the project has to not only have an innovative technology but also need to bring behavioral change to the end users in its implementation. The third pillar is knowledge dissemination which refers to the knowledge exchange among stakeholders by sharing experiences through several occasions. Finally, the project has to be economically viable to give a bigger chance for upscaling, because they do not only want to implement the project in Amsterdam but also replicate it in other cities.

From 2009 until 2017, there are 230 projects conducted on all themes of Amsterdam Smart City. Most of the projects are focusing on the environmental-related objectives, such as reducing greenhouse gas and CO₂ emissions, using renewable energy, and applying circular resources. Each project has its indicator for its development stage, namely idea, concept, implementation, and evaluation. However, Amsterdam Smart City more concentrates its efforts on the energy, mobility, and circular city themes (Winden et al., 2016).

Based on the definition and operationalization pillars, it reveals that Amsterdam Smart City is more an active citizenship-based problem solving strategy, in which every person can propose a different idea to solve a particular problem in Amsterdam. Its form is a platform for developing various smart city projects. It more focuses its activity on the facilitation of various parties to collaborate in small scale project. It also becomes an accelerator of small scale project development and implementation.

3.3.2.2. Selected Examples of Smart City Project

Based on the interview, there are three projects which emerged from the interviewee statements, namely “100.000 Energy-neutral Homes”, “Logistic Hub Amsterdam”, and “City Sense”. The “City Sense” project is a new project which is initiated in October 2017, therefore it cannot give a lesson yet in its implementation. So, there are only two smart city projects which are further analyzed to be an example of the non-government-based smart city projects in this study.

a. 100.000 Energy-neutral Homes (Energy Project Theme)

“100.000 Energy-neutral Homes” project is one of ambitious projects initiated by Alliander, a company which becomes one of Amsterdam Smart City program partners, in collaboration with Amsterdam Smart City and Arcadis Company. The project that was developed in 2016 aims to modify a building into an energy neutral building by involving the residents and home owners to collaborate in developing the design. Specifically, it focuses on the development of an alternative home insulation design and gets rid of the use of gas in a house. Therefore, the house will be free of fossil fuel. Based on that, this project is included in the energy theme in the Amsterdam Smart City platform. Although it is an energy project, it also touches on other aspects to achieve their objective, such as collaboration with the residents and home owners, creating more social inclusion in developing an alternative home energy design, and opening opportunity to a labor market for the residents.

After one year running, this project is still at the initiation phase because there are several constraints emerged when Alliander tries to implement it, such as the overlap of partners with the Amsterdam Municipality, the difficulty to look for the houses, and lack of housing material and infrastructure data. Although the project is still at the initiation phase, it gives a representation of a smart city project which is still in progress with several lessons which can be learned.

b. Logistic Hub Amsterdam (Mobility Project Theme)

“Logistic Hub Amsterdam” is a project initiated by the Amsterdam University of Applied Science in collaboration with Amsterdam University and several logistic partners. It started in 2014 by developing research about the Amsterdam logistics transportation at the Amsterdam University of Applied Science. It aims to reduce the number of logistic trips that enter the center of Amsterdam city by creating a logistic hub in the last mile of the logistic distribution. There are several logistic hubs developed and spread all across the Amsterdam urban area. The universities gathered several suppliers to join the hub and started to supply goods to the universities and other institutions, like the Municipality. So, all goods from different companies are compiled and distributed from the hub by using electrified vehicles to the demander in the center of Amsterdam city. With that, the number of vehicles which enter the Amsterdam city center will be less, and therefore less congestion in the city. Besides, the amount of CO₂ emission from the diesel trucks can be reduced, because the hubs use electrified vehicles. As it has been implemented from 2014/2015, there are several lessons which can be learned from the project.

3.3.2.3. Environmental Management of Amsterdam

Regarding the Amsterdam environmental management, the central aim of Amsterdam city development is to be economically strong and environmentally sustainable (Amsterdam Municipality, 2011). To achieve that objective, in the long term, Amsterdam urban development focuses on seven development directions, namely intensification of land use; coherent public transport network; high quality of public space; greenery and water; space transformation; renewable energy; and waterfront. The Amsterdam Municipality also created several thematic agendas to pursue their objectives, especially for environmental management. The list of the analyzed environmental-related documents can be seen in Appendix B.

Amsterdam environmental management is classified as regulation and control. The Municipality also seems to have a long-term and short-term planning agenda or policy to achieve their environmental objectives. The investigation of Amsterdam environmental management gives this study more

understanding about the kind of environmental management efforts conducted by the Municipality. This study uses the listed agenda and policy as a foundation to analyze the interaction between smart city projects and environmental management of Amsterdam.

3.4. Redefined Research Objective and Questions

After determining the study area and examining the smart city projects and environmental management in the context of Amsterdam, I redefined the research objective and questions. It is necessary because the previous research objective and questions are still general and do not include the conceptual framework and context of Amsterdam as the study area.

This study aims to investigate the interaction between the non-government-based smart city projects and government-based environmental management by analyzing aspects which contribute to the interaction using Amsterdam case. To achieve the objective, I have to identify the kind of smart city and environmental management aspects in Amsterdam. Then align it with the framework used in this study to compare the aspects gathered from Amsterdam with the literature. After that, I will identify the interaction process between aspects of non-government-based smart city projects and government-based urban environmental management. Therefore the research questions are redefined as follows:

- **General research question:**

What kind of aspects do contribute to the interaction between the non-government-based smart city projects and government-based environmental management in Amsterdam?

- **Specific research question:**

1. What kind of aspects does the non-government-based smart city projects have in Amsterdam based on the seven smart city categories?
2. How does the non-government-based smart city project aspects of Amsterdam align with the general smart city aspects based on the seven smart city categories?
3. What kind of aspects does the government-based environmental management have in Amsterdam based on the three environmental management categories?
4. How does the government-based environmental management aspects of Amsterdam align with the general environmental management aspects based on the three environmental management categories?
5. How do the non-government-based smart city project and government-based environmental management interact with each other in Amsterdam?

3.5. Research Techniques and Procedures

So far, based on the research onion (see also figure 9), this study is conducted through the lens of interpretivist by using a mixed approach (combining deductive and inductive approach), a case study strategy, with a cross-sectional time horizon. All of the “slices” have been discussed in the previous sections. The last “slice” of the research onion is determining techniques and procedures which will be used to collect and analyze data and also to evaluate the evidence based on the data analysis. Additionally, the following sections also present the execution of the data collection and analysis method. According to Creswell (2009), research techniques and procedures should contain three major elements, namely the form of data collection, analysis, and interpretation evaluation. The interpretation evaluation will be discussed in section 6.2.1 as a reflection.

3.5.1. Data Collection Methods

Based on the principle of case study strategy, this study use following data collection methods.

a. Document Analysis

Document analysis aims to collect information about the context of the case. This study collects information from environmental-related policy and agenda documents of Amsterdam to inventory the environmental management instruments implemented and stakeholders involved in Amsterdam. Besides, this study also gathers information from related Amsterdam Smart City official documents to holistically derive knowledge about the Amsterdam Smart City development. The document analysis can give important information for this study to determine the specific aspects on the smart city projects, and environmental management in Amsterdam.

b. Interviews

Semi-structured interviews is conducted to collect information about the interaction of smart city to environmental management aspects, and vice versa to find answer on the research questions. The target is stakeholders involved in the smart city project development and environmental management efforts.

3.5.2. The Execution of Data Collection

The data collection process focused on three parts, namely the smart city project, environmental management, and the interaction between them. The execution of each data collection method is as follows.

a. Document Analysis

The document analysis can be divided into two categories, namely smart city project and environmental management documents. Each document was coded (see Appendix B) to be represented in the results (in chapter 4). Firstly, the smart city project documents gathered for this study are based on the interviewee statement. Most of the project leaders suggested me to refer to the overview description of the project on the Amsterdam Smart City website. However, there was one person from the Chief Technology Office (CTO) who gave an official document of the project even though it was a summary of a meeting result with their stakeholders. The Amsterdam Smart City gave a frequently asked question document to me to give related information about the platform. Based on that, there are three smart city projects-related documents gathered.

Secondly, the environmental management documents gathered for this study are based on the self-investigations on the environmental-related policy documents which are currently active in Amsterdam and document(s) mentioned by the interviewees which may influence the smart city projects. Based on that, there were 12 official documents gathered to be further analyzed (see Appendix B). One of the documents was not provided by the Amsterdam Municipality but the Ministry of Infrastructure and Environmental, the Netherlands which described the comparison of environmental policies to reduce CO₂ emissions in various European cities as one of the cities is Amsterdam. However, this study just analyzed the content of the documents which are related to the policies and smart city projects of Amsterdam.

b. Interviews

The interview process was based on formulated questions to guide the interview topic (see Appendix C). The interview questions are based on the conceptual framework and specific research question 1, 3, and 5, which can be divided into three parts, namely smart city project, environmental management, and the interaction between them. The interview questions in each part were formulated with the purpose to gather information which can guide me to answer the research questions. All interviewees were asked the same question in each interview session. However, when conducting the interview, not all questions were asked, because sometimes the interviewee has already explained a topic that indirectly answers several prepared interview questions. There were also new questions emerged to follow up the interviewee's explanation about a topic. The follow up questions were emerged differently in each interview, because it depends on the explanation of the interviewees. That is also in line with the interview method used in this study, which is a semi-structured interview.

There were seven people interviewed for this study from the end of October 2017 until the beginning of January 2018. Three people from the Chief Technology Office Amsterdam Municipality, two from Amsterdam University of Applied Science (one interviewee is project leader of "Logistic Hub Amsterdam"), one from Alliander company (project leader of "100.000 Energy-neutral Homes"), and one from the Amsterdam Institute for Advanced Metropolitan Solution. They represent different stakeholders in the field of smart city projects and environmental management in Amsterdam based on the program partners scheme presented by the Amsterdam Smart City (see Figure 10). In the results (chapter 4), the interviewee will be coded based on their position in an institution (see Appendix D).

Regarding the chronology, in the beginning, I targeted the Amsterdam Smart City platform to gather information related to smart city projects and Amsterdam Municipality to gather information related to environmental management. There was a fine contact with the Amsterdam Municipality in conducting the interview session, therefore there are three people from the Municipality who were interviewed. However, they were from the same department in the Municipality, namely the Chief Technology Office. I had already contacted the people from other departments, such as the chief urban planning and urban designer, but they cannot be interviewed because of the following reasons. The chief urban planning denied to be interviewed because he did not know at all about the smart city projects in Amsterdam, whereas the urban designer was too busy to have an interview session with me. I did not have further access to the other departments in the Municipality. But, people from the Municipality always referred me to the Chief Technology Office department to be asked further about the topic, because they are a program partner from the Municipality to the Amsterdam Smart City.

Regarding the interviewee from the Amsterdam Smart City, the community manager and the communication and engagement officer were not able to have an interview session with me because they were too busy. However, the communication and engagement officer could be contacted by phone and indicated that the Amsterdam Smart City is not a part of Amsterdam Municipality, therefore they are not able to answer the environmental management part of the interview. Then to have perspectives from the Amsterdam Smart City platform, I tried to contact the four main partners of the platform. From that, I was able to gather information from the Chief Technology Office Amsterdam Municipality (government) in which there were three people interviewed from the department, namely the Chief Technology Officer (the CTO), a project manager at CTO which is also the project coordinator of the "City Sense" project, and an officer at CTO. The CTO has a role as the program partner of Amsterdam Smart City from the

government side. They also have a role as a technology seeker which also collaborate with companies. Therefore, their perspective is based on the market and technological side. However, the CTO becomes a key interviewee since they are the head of steering committee for the Amsterdam Smart City consortium. I also interviewed project manager of a smart city project from Alliander (company), and smart city academy manager from Amsterdam University of Applied Science (knowledge institution). The company and knowledge institution are also a program partner of Amsterdam Smart City. Their role as a program partner is developing their project by using the Amsterdam Smart City as a sharing platform. However, their perspective on the smart city project is different. Alliander, as a company, develops smart city projects based on the business perspective sides. The knowledge institution develops smart city projects to both implement their researches and contribute to the community. Therefore, they shared their information within the interview based on their role and perspective towards the current situation of smart city projects and environmental management in Amsterdam. The interviewee role and relationship can be seen in Figure 12.

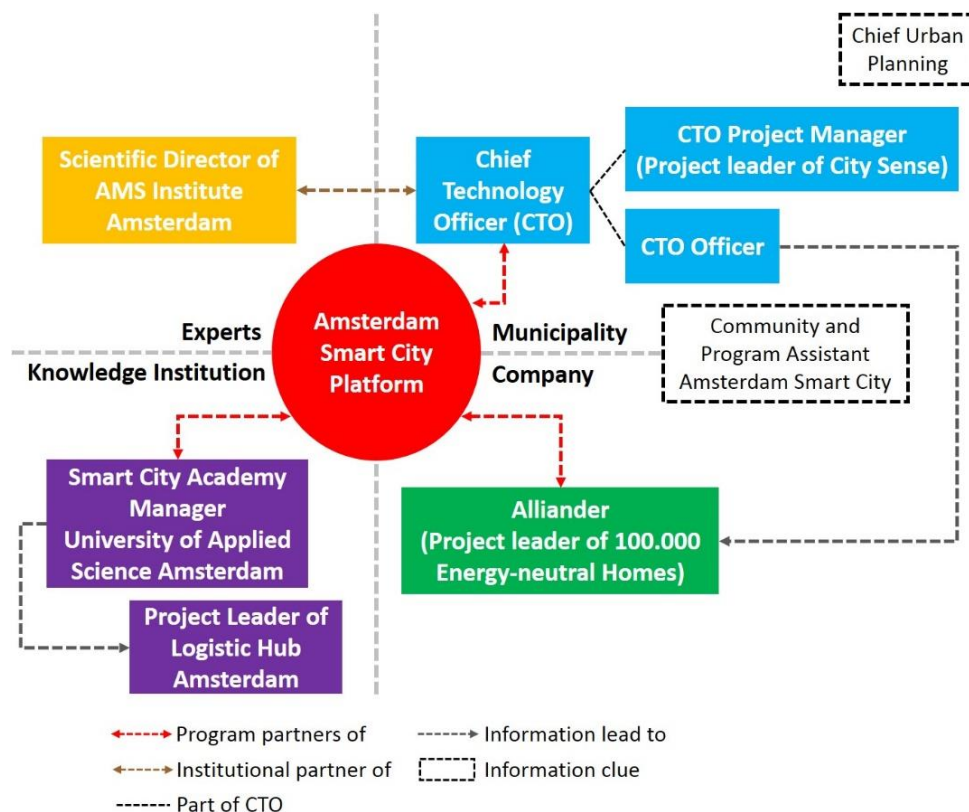


Figure 12. The Relationship among Interviewees

I was not able to have an interview session with the partners from NGO, namely Waag Society and Pakhuis de Zwijger, because of the following reasons. The people from the Waag Society did not reply my email, while people from the Pakhuis de Zwijger stated in their email that their work is not related to the smart city, so that they did not want to be interviewed. Therefore, I did not get any perspectives from that partner category. However, to handle the missing perspective from the NGO, I tried to contact the Amsterdam Institute for Advanced Metropolitan Solution, as a non-governmental party and research community in Amsterdam, to give their perspective. The scientific director of the community was able to

be interviewed. The research community has a role as the provider of researches on the technological development. Therefore, their perspective is based on the technological side of a smart city project. However, the scientific director also gave information about the institutional interactions between the Amsterdam Smart City and Municipality. So, a broad perspective was able to be gathered from various stakeholders in the field of smart city project and environmental management.

Furthermore, I was also able to have an interview session with the project leader whose projects were mentioned in the interviews. There were three project leaders interviewed, namely project leader of “100.000 Energy-neutral Homes”, “Logistic Hub Amsterdam”, and “City Sense”. However, the “City Sense” project just started in October 2017, so it cannot represent the smart city project implemented in Amsterdam. Therefore, this study only takes into account the other two smart city projects as an example of smart city projects going on in Amsterdam. Based on the projects, two themes emerge, namely energy and mobility, which will be a focused theme for the analysis of this study. The summary of data collection execution can be seen in Appendix E.

The data collection only for specific research question 1, 3, and 5 because this study just needs information gathered from the field to answer the questions. Then information gathered are further analyzed to answer the specific research question 2 and 4. Then the general research question will be answered based on the answers from all specific research questions.

3.5.3. Data Analysis Method and Execution

The analysis of this study adopted a scheme from Creswell (2009). It contains six steps in analyzing the data, namely organizing and preparing data, reading through all data, coding the data, generating theme and description, interrelating themes and descriptions, and interpreting the meaning of themes and descriptions.

The first step is that I organized and prepared the data for analysis which contains four activities, namely scanning materials (interview and document transcript), typing up interview notes, transcribing interviews, and sorting the data based on the source. The activity was always done after the interview sessions and document gathering.

The second step is that I read through all organized data which aims to get a general sense of the information gathered from the interviewees and documents to reflect on the overall meaning. Several activities were done to get the general sense, namely identification of general idea and also overall depth and use of the information. This activity at this stage also includes summary writing towards the general idea of the data.

The third step is that I coded the data to start analyzing the raw data from both document and interview transcripts. According to Creswell (2009), coding is a process of organizing the data materials into segments of text to develop a general meaning of each segment. It contains eight steps as can be seen in figure 13 (Tesch, 1990 in Creswell, 2009). Firstly, I get a sense of the transcripts by reading all of it, then write some ideas which come up when reading it. Secondly, I pick one document or interview transcript which is at the top of the pile. Thirdly, I make a list of all topics based on the conceptual framework. Then cluster the topics into each category based on the conceptual framework. Fourthly, I make an abbreviation of the topics in codes and write it next to the segment of the text (in the document or interview transcript). Fifthly, I find the most descriptive wording for the topics and turn it into categories, then group the topic which relates to each other by drawing lines between them. Sixth, I

finalize and sort the codes based on the category. Seventh, I start the preliminary analysis by assembling the data material into category. Lastly, I review all codes and recoded the data if it is necessary to control the quality of the coding result for the analysis phase. The coding resulted in topics and quotations in description related to the research question based on my interpretation.

Additionally, this study used a deductive-inductive coding, which means that firstly the codes are predetermined based on the conceptual framework, previous coding dictionary, previous research, or interview guideline (Stuckey, 2015). For this study, the codes were developed from the conceptual framework by picking aspects from the smart city and environmental management categories. However, this study also includes important new smart city and environmental management aspects which do not exist in the predetermined codes. All of the coding processes were done by using Atlas.ti 7 software.

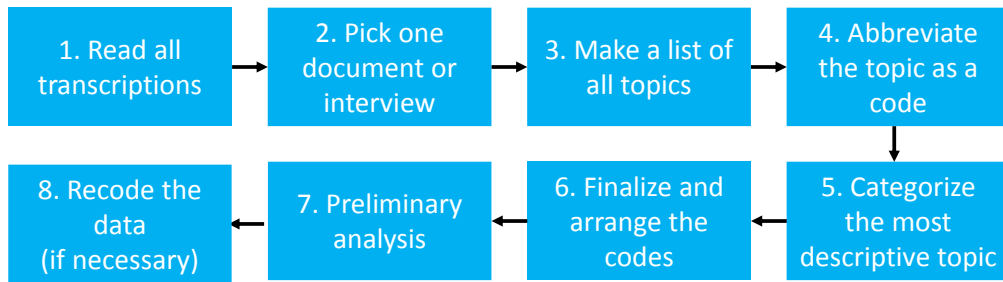


Figure 13. Coding Steps
(Source: based on Tesch, 1990 in Creswell, 2009)

The coding names were developed based on the conceptual framework. Therefore, the code used categories of smart city projects and environmental management and also the interaction to make the grouping process easier for next step. Thus, there were eleven codes for grouping as can be seen in table 12. Each code represents the variable and category based on the conceptual framework.

Table 12. Code Formulation

| Variable | Category | Code | Code Formulation |
|--------------------------|------------------------|----------------|-----------------------------------|
| Smart City Projects | Smart Economy | SEc | "Category": "Aspect" |
| | Smart People | SP | |
| | Smart Living | SL | |
| | Smart Governance | SG | |
| | Smart Mobility | SM | |
| | Smart Environment | SE | |
| | Education and Capacity | SC EC | |
| Environmental Management | Advisory | EM: Advisory | "Variable": "Category" - "Aspect" |
| | Economic or fiscal | EM: Economic | |
| | Regulatory | EM: Regulatory | |
| Interaction | - | INT | "Variable": "Aspect" |

I read transcripts and picked a sentence or line of statement to be coded based on two things. First, it is based on one of words in the sentence or line of statement which refers to an aspect, whether it has been stated in the conceptual framework or a new aspect. Second, it is based on the contextual meaning of the sentence or line of statement which refers to an aspect. Therefore, the generated codes

are not only from the words stated in the transcript but also the contextual meaning of sentence or line of the statement.

The fourth step is that I generated theme and description based on the coding process. The theme refers to the categorization of the coding results. It can be used for the major findings of the research by presenting multiple perspectives of the respondents supported with several quotations and other evidence (Creswell, 2009). The description refers to the detail information about people, places, or events in the setting (Creswell, 2009). In this stage, a thick description strategy was used to write a broad and detail perspective and narrative from various respondents and documents. Therefore, there is strong evidence when developing the research results. That is in line with the fifth step which is interrelating themes and descriptions by developing a narrative passage. It tells about the chronology of an event and detail explanation about the themes by representing a qualitative explanation about the gathered information and supported by several figures, schemes, tables, or other graphics to explain the analysis results easily.

The last step is that I interpreted the meaning of themes and descriptions by generating the lessons which can be found in it. The lessons were developed by both taking personal interpretation and comparison between the data analysis results and information from literature or theories. Regarding the personal interpretation, the researcher developed it based on the cultural background and experiences (Creswell, 2009). In the comparison between the data and literature or theories, the researcher suggests whether the findings confirm the previous literature/theories or not (Creswell, 2009). Additionally, the researcher also developed new questions which need to be answered in the future research.

The overall process of this study can be seen in Figure 14.

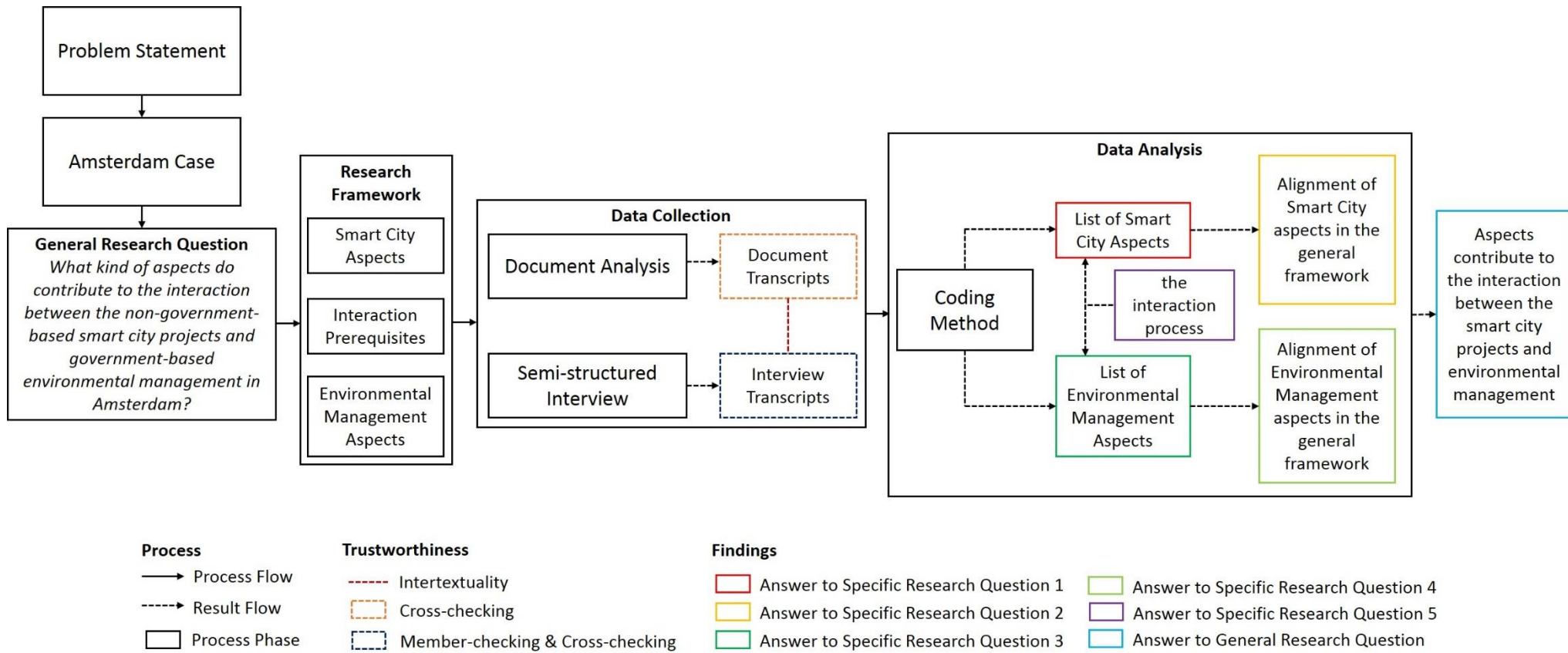


Figure 14. Research Process





CHAPTER 4

RESULTS

- 4.1. Smart City Aspects of Amsterdam
- 4.2. Environmental Management Aspects of Amsterdam
- 4.3. The Interaction Process between Smart City Projects and Environmental Management in Amsterdam

CHAPTER 4. RESULTS

This section will present the results of interview and document transcripts analysis. The structure of this section will follow the specific research questions 1, 3, and 5 which were the focus of the data collection. Information gathered based on those questions are further analyzed to answer the specific research question 2 and 4, and the general research question which will be discussed in chapter 5.

This section will discuss smart city aspects of Amsterdam (4.1), environmental management aspects of Amsterdam (4.2), and the interaction process between smart city projects and environmental management in Amsterdam (4.3). Moreover, this section also presents an analysis towards aspects and interactions which emerged from the coding analysis of statements from the interviewees and documents. The elaboration on the results will be based on an “intertextuality” strategy in which the evidence is based on various statements from the interview and document transcripts (see Appendix H).

There is also a table in each category representing the total number of mentioned aspects in an interview or document transcripts which give a clear the proportion of the results. Additionally, a table also represents the frequency of an interviewee's and document statement on each aspect as can be seen in Appendix F and G. That table helps to consider the relevance of an aspect, especially if an aspect was only stated in either an interview or a document. It was done by analyzing the frequency mentioned of an aspect in either interview or document based on the “relevance threshold” (see Figure 15) which will be discussed in the next paragraph. The elaboration and order of each aspect will be based on the categories in the conceptual framework. Aspects emerged from the transcripts will be marked and discussed in each sections.

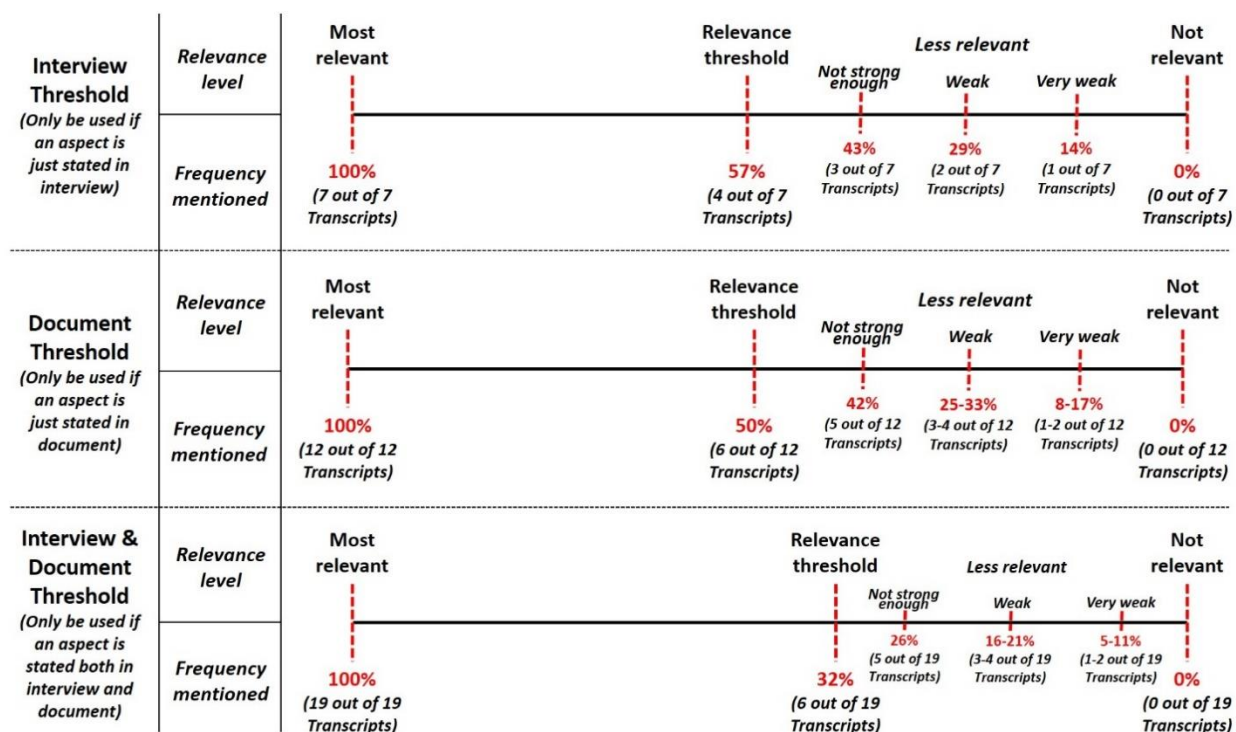


Figure 15. Relevance Thresholds

Regarding the selection of relevant aspects in each category, a “relevance threshold” was used to make a clear judgement on the number or percentage of frequency mentioned (see Figure 15). The threshold is applied for analysis in smart city aspects, environmental management aspects, and the interaction between them.

Based on figure 15, the threshold is divided over three groups, namely interview, document, and combined sources which has a different threshold value. An aspect which only comes from interview transcript will be less relevant if it consists of less than four out of seven transcripts (more than one-half of total interview transcripts). More than half of different interview statements seem to be better in representing the accuracy of the statement. An aspect which only comes from document transcript will be less relevant if it consists of less than six out of twelve transcripts (one-half of total document transcripts). Most documents analyzed in this study came from the Amsterdam Municipality, therefore, there might be several ideas which are not implemented yet in Amsterdam, and it will be labelled as “wishful thinking”. To take into account that possibility, there have to be at least half of different documents state about the same ideas to better represent the accuracy of the statement. If half of the documents stated about an aspect but each of them has different themes and focuses, it is included as a “less relevant aspect”, because then the statement is not robust enough. Finally, if source of an aspect is a combination between interview and document, it will be less relevant if it consists of less than 32% of the total percentage (6 out of 19 transcripts). An equal source from the interview and document can confirm the accuracy of the statement to each other (intertextuality strategy). But if the combination of the number of frequency mentioned is not equal enough, such as 1:5 or 5:1, the aspect will be still considered as less relevant (as “not strong enough”). A less relevant aspect is divided into three level to differ the level of less relevance among the aspects that are included in this range, namely “not strong enough”, “weak”, and “very weak”.

4.1. Smart City Aspects of Amsterdam

Information related to the smart city aspects of Amsterdam is based on the coded document and interview transcripts. In this section, the results will be elaborated based on the seven categories of smart city adopted in the conceptual framework, namely, smart economy, smart people, smart living, smart governance, smart mobility, smart environment, and education and capacity, in which each category has several aspects as can be seen in Figure 16. This study used the aspects in each category to be a guideline for generating the codes. Several new aspects also emerged from the interview and document transcripts. The alignment of new aspects to the conceptual framework will be discussed in chapter 5. The following sections will elaborate the result on the smart city aspects gathered from Amsterdam in each smart city category.

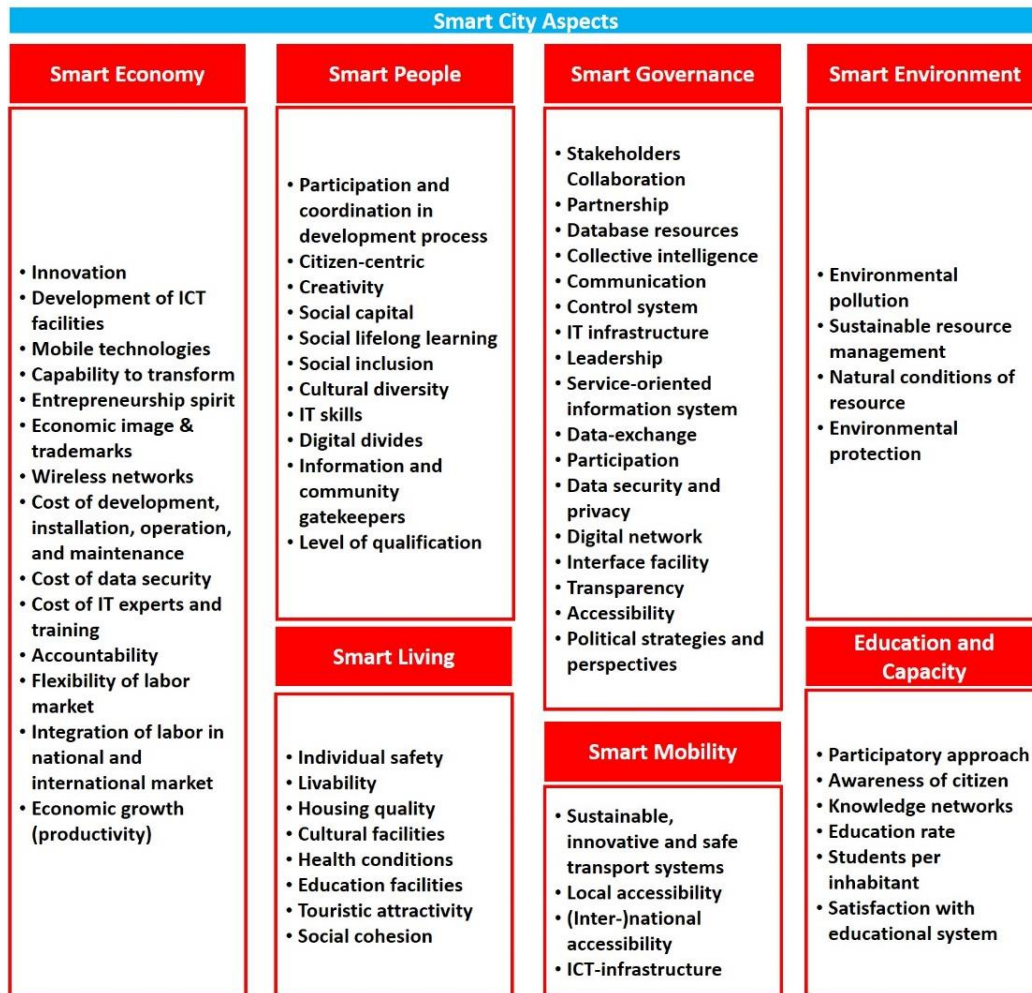


Figure 16. Smart City Categories and Aspects based on the Conceptual Framework

4.1.1. Smart Economy

Based on the coding analysis, nine aspects emerged on the category of smart economy (see Table 13).

Table 13. Smart Economy Aspects of Amsterdam

| Smart Economy Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|-------------------------------|---------------------------------------|------------------------------------|-----------------------------------------|------------------|
| | Interviewees (out of 7 interviews) | Documents (out of 12 documents) | | |
| Innovation | 2 | 5 | 7 | 37% |
| Development of ICT facilities | 1 | 4 | 5 | 26% |
| Mobile technologies | 1 | 4 | 5 | 26% |
| Capability to transform | 2 | 2 | 4 | 21% |
| Entrepreneurship spirit | 2 | 2 | 4 | 21% |
| Economic image & trademarks | 1 | 0 | 1 | 5% |
| Cost of innovation process | 2 | 0 | 2 | 11% |
| Innovation platform | 1 | 1 | 2 | 11% |
| Cost agreement | 0 | 1 | 1 | 5% |

New Aspect
 Relevant Aspect
 Less Relevant Aspect:
 Not Strong Enough
 Weak
 Very Weak

Table 13 shows three new aspects that are emerged from the interview and document transcripts, namely cost of innovation process, innovation platform, and cost agreement. However, those aspects are less relevant because its total number of frequency mentioned is under the relevance threshold. The cost of innovation process cannot be merged with other aspects which have “cost” label in the conceptual framework because the cost of innovation process does not only cover the technical and human resources spending, but also all other spendings when a smart city project is conducted, such as a fund for an innovation platform institution and investment. The innovation platform cannot be merged with the innovation aspect because the innovation platform does not focus on the innovation itself, but more on the institution which is organizing various innovations. The cost agreement cannot be merged with other aspects because it contains a specific method on arranging an agreement between smart city project actors regarding cost.

The most mentioned aspect is innovation which is represented in 7 out of 19 transcripts. As the total percentage is above the relevance threshold, it is considered as a relevant aspect in the smart economy category. The less mentioned aspects are the cost of agreement and economic image & trademarks that is only mentioned once either in an interview or a document. It seems that those aspects are less relevant and “very weak” to represent the development of smart city projects in Amsterdam.

Another point is that there are eight aspects from the literature which were not found in the transcripts, namely wireless networks; cost of development, installation, operation, and maintenance; cost of data security; cost of IT experts and training; accountability; flexibility of labor market; integration of labor in national and international market; economic growth (productivity). It seems that those aspects are not relevant in the development of smart city projects in Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper description.

4.1.1.1. Innovation

Innovation was mentioned by two interviewees and in five documents. It is the only aspect that is relevant in the smart economy category. The statement from documents contain “wishful thinking”, but it is confirmed by two different interviewees. One of the documents stated the innovation aspect as follows (see Appendix H for more supporting statements):

“[...] Smart Grids – innovative technologies to manage the power grid –connect demand and supply in more efficient way at the local level.” (D1)

From the documents, it reveals that most of innovation aspects focus on the energy, circular economy, and mobility project themes. As it was derived from the official documents of the Amsterdam Municipality, it also reveals that the innovation aspect has been adopted by the Municipality in various themes. Statements from the interviewee P1 add the context of the innovation aspect in Amsterdam as follows:

“[...] they have a smart city initiative, so in the city, and innovation district, of course. But in general, the city context as the focus (for innovation).” (P1)

This statement clarifies the spatial context of the innovation projects in Amsterdam, because he indicates that the innovation process can be initiated everywhere in Amsterdam to be tested and

validated. There are smart city projects which are initiated at a district or building scale to test a project. Then the project leader can upscale or replicate it either in other areas in Amsterdam or other cities.

4.1.1.2. Development of ICT Facilities

Development of ICT facilities was mentioned only by one interviewee and in four documents. Since the total percentage of the frequency mentioned is under the relevance threshold value, it is considered as a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam. In this aspect, most statement from the documents stated different ideas about the development of ICT facilities and each statement is “wishful thinking”. Only one interviewee confirms the development of ICT facilities, but it is in a different theme (see Appendix H for the supporting statements).

Based on statement of the documents, most of the development of ICT facilities focus on the mobility project theme. It reveals the mobility development of Amsterdam is optimized by the development of ICT facilities. It is in line with the document D8, as Amsterdam has large ICT sectors, the city can test and apply related ICT facilities in the mobility projects or other project themes. However, most ideas in the statement are not implemented yet. But, this aspect exists in the energy project theme, as one interviewee stated that the Amsterdam Municipality has developed energy display in the neighborhood which is an example of ICT facilities.

4.1.1.3. Mobile Technologies

Mobile technologies was mentioned only by one interviewee and in four documents. Since the total percentage of the frequency mentioned is under the relevance threshold value, it is considered as a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam. In this aspect, all statements from the documents stated different ideas about the mobile technologies and three statements are “wishful thinking”. Only one statement from a document stated a reality about mobile technology by improving mobility using data sources from apps which is in line with the statement of the interviewee (see Appendix H for the supporting statements).

Based on statement from the documents and interview, it reveals that mobile technologies was found in the mobility project themes, specifically in the digital mobility assistant through mobile apps. It is in line with the previous aspect and reveals that mobile technologies is a supporting aspect for development of ICT facilities aspect in the mobility project theme in Amsterdam.

4.1.1.4. Capability to Transform

Capability to transform was mentioned by two interviewees and in two documents. Since the total percentage of the frequency mentioned is under the relevance threshold value, it is considered as a less relevant aspect and “weak” to represent smart city projects in Amsterdam. In this aspect, all statements from the documents contain “wishful thinking”. Only one statement from interviewee P6 represents the reality of capability to transform (see Appendix H for the supporting statements).

Based on statement from the documents and interviews, it seems that the statements confirm each other regarding the process of transformation as an element in the capability to transform. The interviewee P6 was giving prove that Amsterdam is capable to transform in the energy project theme by taking the process in several years. The support from business sector helps the transformation process to happen. It is also in line with the document D7 which declares that the Municipality has an agenda to convert all vehicles in the city to be electrified in the future. It seems that, on the one hand, Amsterdam

has their agenda to transform, on the other hand, they have proven their capability to transform from one to another situation through the support from business sector. But that is only in the energy project theme.

4.1.1.5. *Entrepreneurship Spirit*

Entrepreneurship spirit was mentioned by two interviewees and in two documents. Since the total percentage of the frequency mentioned is under the relevance threshold value, it is considered as a less relevant aspect and “weak” to represent smart city projects in Amsterdam. Statement from documents can be considered as reality because the two documents represent the real condition of entrepreneurship spirit which is also confirmed by two different interviewees (see Appendix H for the supporting statements)

Statements from documents and interviews are supporting each other. Amsterdam has start-up residence as an incubator to emerge new businesses. The businesses which emerged from the start-up can contribute to the implementation of smart city projects in Amsterdam. In that perspective, Amsterdam has their entrepreneurship spirit. It is in line with a statement in the document which declared that entrepreneurship is one of the Amsterdam’s DNA.

4.1.1.6. *Economic Image & Trademarks*

Economic image & trademarks is one of the less relevant aspects and “very weak” to represent smart city projects in Amsterdam, because it was only stated in one interview. However I included it in smart economy category because this aspect represents the other use of Amsterdam Smart City platform itself, which is as a smart city image and trademarks of Amsterdam, as an interviewee stated:

“The community [...] it’s online and offline, it’s to bridge for Amsterdam network internationally. You could kind of see it like marketing communication, what smart city does in this community.” (P3)

This statement reveals that the Amsterdam Smart City becomes a marketing communication to build a smart city network. The platform also strengthen the image and trademarks of Amsterdam as a smart city.

4.1.1.7. *Cost of Innovation Process*

The cost of innovation process is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it was only mentioned by two interviewees (see Appendix H for the supporting statements). The statements came from the interviewee P3 and P4 who are the project leader of a smart city project which is currently going on in Amsterdam. Besides, they also represent the program partners from the non-governmental parties. It seems that, the cost of innovation process were only taken into account by the smart city project actors, because it is not mentioned both in the interviewees and official documents from the Municipality.

4.1.1.8. *Innovation Platform*

The innovation platform was mentioned in one interview and one document. It represents that this aspect is one of the less relevant aspects and “very weak” to represent smart city projects in

Amsterdam, because it is under the value of relevance threshold. The interviewee stated this aspect as follows:

“[...] also develop this platform for testing all kind of new technology online-offline platforms.” (P5)

This statement reveals that the form the innovation platform is multiple. The innovation platform can be formed both online and offline to accommodate the smart city projects development. Each form of platform has different role but complement each other. The online platform has a role as a connector and information exchanger, whereas the offline platform has a role to facilitate the workshops and annual meetings.

4.1.1.9. Cost Agreement

Cost agreement is one of the less relevant aspects and “very weak” to represent smart city projects in Amsterdam, because it was only stated once in the document, namely the “Logistic Hub Amsterdam”. However the statement represents a reality, in which there is an agreement between actors regarding logistical cost. The referred statement is as follows:

“[...] smart redistribution of costs between the suppliers and the two educational institutions, the total costs will be no higher than they were previously.” (D12)

This statement is a fine example for smart economy category, because cost is one of important elements in the smart city project development. Cost agreement is one aspect in driving the economic elements in the smart city project.

4.1.1.10. Concluding Remark

All in all, it can be concluded that smart economy category of Amsterdam has nine aspects including three new aspects. However, the new aspects are less relevant in this category. The most mentioned aspect in this category is innovation which is represented by 37% of the total number of interview and document transcripts. It is marked as the only relevant aspect for this category. Aspects which are under the value of relevance thresholds are development of ICT facilities, mobile technologies, capability to transform, entrepreneurship spirit, economic image & trademarks, cost of innovation process, innovation platform, and cost agreement which is represented by either less than 32% of the total number of transcripts, unequal combination of the number of frequency mentioned, or less than the interview or document relevance threshold. Those less relevant aspects are divided into three levels, namely “not strong enough”, “weak”, and “very weak”. Moreover, there are three aspects which have a large “wishful thinking” level from the document transcripts, namely development of ICT facilities, mobile technologies, and capability to transform. It has to be noticed that several ideas in each aspect might not be implemented yet.

4.1.2. Smart People

Based on the coding analysis, 5 out of 11 aspects emerge on the category of smart people with no new aspects (see Table 14).

Table 14. Smart People Aspects of Amsterdam

| Smart People Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|-------------------------------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Participation and coordination in development process | 4 | 2 | 6 | 32% |
| Citizen-centric | 4 | 1 | 5 | 26% |
| Creativity | 1 | 1 | 2 | 11% |
| Social capital | 2 | 0 | 2 | 11% |
| Social lifelong learning | 1 | 0 | 1 | 5% |

Relevant Aspect Less Relevant Aspect:
 Not Strong Enough Weak Very Weak

Table 14 shows no new aspects that are mentioned in the interview and document transcripts. All statements only refer to the aspects which are in the literature. Most statements in the transcripts represented the same idea with aspects provided in the framework. Regarding the result, the most mentioned aspect is the participation and coordination in development process which is represented in 6 out of 19 transcripts. It is considered as the most relevant aspect in the smart people category. The less mentioned aspect is social lifelong learning that is only mentioned once in an interview. It seems that the aspect is less relevant and “very weak” to represent the development of smart city projects in Amsterdam.

Another point is that there are six aspects from the literature which were not found in the transcripts, namely social inclusion, cultural diversity, IT skills, digital divides, information and community gatekeepers, and level of qualification. It seems that those aspects are not relevant in the development of smart city projects in Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper description.

4.1.2.1. Participation and Coordination in Development Process

Participation and coordination in development process was mentioned by four interviewees and in two documents. It is the only relevant aspect in smart people category. In this aspect, all statements from the documents contain “wishful thinking”. But statements from the interviewees confirm the implementation of this aspect. One of the documents stated this aspect as follows (see Appendix H for more supporting statements):

“We must move from treating citizens as recipients of services [...] to be citizens as participants in the co-creation of improved quality of life.” (D11)

This statement reveals that participation and coordination emerge in the smart city project development process through a co-creation. Co-creation is a participation platform in which it focuses on the citizen as the user to take an active role in the project development process (Business Dictionary, 2017). A statement from the interviewees confirms this aspect as follows:

“[...] it’s called citizen’s evening, they can look up the models or the drawings, and they can give their reaction. [...] in that way there’s some form of dialogue and they (the Municipality)

can also adjust their plan by listening to the citizens and what their need are. [...] we (the Chief Technology Office) also include the citizens, and we always do that in the co-creation (platform)." (P5)

This statement clarifies the use of co-creation model in the smart city projects development in Amsterdam. The Municipality uses the co-creation model to develop a smart city project together with the citizens. According to interviewee P1, the participation of the citizens in the development process is one of the important aspects which led Amsterdam winning an innovation award. It seems that the participation and coordination in the development process is represented in Amsterdam through the co-creation platform. The "wishful thinking" from the documents are confirmed by all interviewees.

4.1.2.2. Citizen-centric

The citizen-centric aspect is frequently mentioned in four interviews and one document. Since the total percentage of the frequency mentioned is under the relevance threshold value, it is considered as a less relevant aspect and "not strong enough" to represent smart city projects in Amsterdam. An example of statement which refers to this aspect is as follows (see Appendix H for more supporting statements):

"[...] it is a platform for people to put in an idea, and then we put it on the map. What does it mean into the years, what the experiment is needed to validate if this is true or possible, and what do we have to do to make it happen." (P6)

Based on the statements from the interviews and document, it reveals that Amsterdam focuses their work on the citizen needs and goals. As stated by interviewee P5 and P6, the Municipality focuses on citizen needs, besides they also facilitate ideas from the citizens to cope with the need of specific people in the city.

4.1.2.3. Creativity

Creativity was only mentioned in one interview and one document (see Appendix H for the statements). Therefore, it is under the threshold value and "very weak" to represent smart city projects in Amsterdam. Based on the statement from the interview and document, creativity emerges in Amsterdam because the people of Amsterdam are creative citizens. But it seems that creativity is less mentioned because actors in the city might think that this aspect is a common thing in a smart city project development of Amsterdam.

4.1.2.4. Social Capital

Social capital was mentioned by two interviewees which refer to the social capital to develop a smart city project (see Appendix H for the statements). It is considered as a less relevant aspect and "weak" to represent smart city projects in Amsterdam. The interviewees' statement reveal that social capital can help a smart city project through the organization of communities in a certain area where the project will be initiated.

4.1.2.5. Social lifelong learning

Social lifelong learning is considered as a less relevant aspect and "very weak" to represent smart city projects in Amsterdam, because it was only stated once by the interviewees (see Appendix H for a statement). The interviewee's statement reveals that citizens have a social lifelong learning by putting,

experimenting, and testing their idea in which they learn about new lessons in that process. Citizens also capable to accept innovative projects in Amsterdam.

4.1.2.6. Concluding Remark

All in all, it can be concluded that the smart people category of Amsterdam has five aspects in which no new aspects emerge. The most mentioned aspect in this category is participation and coordination in development process which is represented by 32% of the total number of interview and document transcripts. It becomes the only relevant aspect in this category. Aspects which are under the value of relevance threshold are citizen-centric, creativity, social capital, and social lifelong learning which is represented by either less than 32% of the total number of transcripts or less than the interview or document relevance threshold. Those less relevant aspects are divided into three levels, namely “not strong enough”, “weak”, and “very weak”.

4.1.3. Smart Living

Based on the coding analysis, three aspects emerge on the category of smart living (see Table 15).

Table 15. Smart Living Aspects of Amsterdam

| Smart Living Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|----------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Individual safety | 2 | 2 | 4 | 21% |
| Housing quality | 1 | 1 | 2 | 11% |
| Livability | 2 | 1 | 3 | 16% |

New Aspect Less Relevant Aspect:
 Weak Very Weak

Table 15 shows a new aspect that is emerged from the interview and document transcripts, namely livability. However, the aspect is less relevant as its total percentage is under the relevance threshold value. The livability cannot be merged with aspects in the conceptual framework because the Municipality make it as a goal in developing related “living” projects.

Regarding the result, all of the aspects in this category is under the relevance threshold value which reveal that most smart city projects in Amsterdam less consider the aspects of smart living. Another point is that there are five aspects from the literature which were not found in the transcripts, namely cultural facilities, health conditions, education facilities, touristic attractivity, and social cohesion. It seems that those aspects are not relevant in the development of smart city projects in Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper elaboration.

4.1.3.1. Individual Safety

Individual safety was found in two interviews and two documents which reveal that it is a less relevant aspect and “weak” to represent smart city projects in Amsterdam. One of the documents stated this aspect as follows (see Appendix H for more supporting statements):

“Main safety challenges focus on dark and silent spots in the city. [...] we discussed the feeling of safety according to crime rates and how stereotyping the area with obvious safety measures will not help.” (D11)

From the document statements, it reveals that the individual safety was considered in the mobility (logistic projects) and living themes. Both the Municipality and smart city project leader try to also include the safety aspects in their logistics agenda and discussions. Statements from an interviewee is in line with the documents as follows:

“[...] at the end, [...] it’s about how to control it if it safe and secure, it’s about security, [...].” (P6)

This statement strengthens the individual safety aspect, the actors have control the safety elements in the smart city projects. Interviewee P5 also specifically stated that the individual safety could be achieved by developing smart city project on the energy theme.

4.1.3.2. Housing Quality

The housing quality aspect was mentioned in one interview and one document (see Appendix H for the supporting statements). It is under the value of relevance threshold and “very weak” to represent smart city projects in Amsterdam. This aspect only came from a smart city project, namely “100.000 Energy-neutral Homes” which is as an example of smart city project in this study. Based on the statement from the interview and document, it reveals that the project on the energy theme also considers the housing quality through their problem analysis on the existing housing quality. Then, they try to solve it with their smart city project.

4.1.3.3. Livability

The livability aspect was found in two interviews and one document (see Appendix H for the supporting statement). It is under the value of relevance threshold and “weak” to represent smart city projects in Amsterdam. Statements from transcripts reveal that livability aspect is a goal for the smart city project development which is achieved by initiating smart city projects. Most people are aware about the livability aspect of Amsterdam, therefore, they are taking action to make the city always livable by implementing related environmental projects.

4.1.3.4. Concluding Remark

All in all, it can be concluded that smart living category of Amsterdam has three aspects with a new aspect emerge, namely livability. All aspects in this category are considered as less relevant because it is represented by less than 32% of the total number of interview and document transcripts. Those less relevant aspects are divided into two levels, namely “weak”, and “very weak”.

4.1.4. Smart Governance

Based on the coding analysis, 15 aspects emerge on the category of smart governance (see Table 16).

Table 16. Smart Governance Aspects of Amsterdam

| Smart Governance Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|-------------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Stakeholders collaboration | 5 | 6 | 11 | 58% |
| Partnership | 6 | 4 | 10 | 53% |
| Database resources | 1 | 6 | 7 | 37% |
| Collective intelligence | 4 | 2 | 6 | 32% |
| Communication | 4 | 1 | 5 | 26% |
| Control system | 1 | 4 | 5 | 26% |
| IT Infrastructure | 0 | 5 | 5 | 26% |
| Leadership | 4 | 1 | 5 | 26% |
| Service-oriented information system | 2 | 3 | 5 | 26% |
| Data-exchange | 1 | 3 | 4 | 21% |
| Participation | 4 | 0 | 4 | 21% |
| Data security and privacy | 1 | 2 | 3 | 16% |
| Digital network | 1 | 1 | 2 | 11% |
| Flexible government | 4 | 0 | 4 | 21% |
| Learning by doing | 2 | 2 | 4 | 21% |

New Aspect
 Relevant Aspect
 Less Relevant Aspect:
 Not Strong Enough
 Weak
 Very Weak

Table 16 shows two new aspects that are emerged from the interview and document transcripts, namely flexible government and learning by doing. From those new aspects, only the flexible government is above the relevance threshold value. The flexible government bring new element for this category, namely the tolerance of governmental parties to adopt new things. “Learning by doing” also bring new element for this category, namely the principle brought by governmental parties to do something first then learn from it. That also become a reason why the aspect is included in this category.

Regarding the result, the most mentioned aspect is the stakeholder collaboration which is represented in 11 out of 19 transcripts. It is considered as the most relevant aspect in the smart governance category. The less mentioned aspect is the digital network which is only found in two transcripts. It seems that the aspect is less relevant and “very weak” to represent smart city projects in Amsterdam. This result will be further elaborated in the digital network section. Moreover, in this category, I divided the partnership and participation as a separate aspect because there is a difference in the meaning of those two aspects.

Another point is that there are four aspects from the literature which were not found in the transcripts, namely interface facility; transparency; accessibility; political strategies and perspectives. It seems that those aspects are not relevant in the development of smart city projects in Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper elaboration.

4.1.4.1. Stakeholders Collaboration

Stakeholders collaboration was mentioned in five interviews and six documents. It is a relevant aspect in this category. One of the documents stated this aspect as follows (see Appendix H for more supporting statements):

“Amsterdam is doing its utmost to provide a local contribution, together with its citizens, building owners, housing corporations, schools and SME.” (D7)

Statements from the documents reveal that most of smart city project developments adopt the aspect of stakeholders collaboration. This aspect emerges both in the mobility and energy themes in which most of stakeholders in the themes collaborate with each other to implement a project. A statement from one of the interviewees confirm this aspect in Amsterdam as follows:

“[...] we work together with logistic providers and also Post NL, so we invited our suppliers and we invited either the service providers, and they were put together to make this (logistic hub) work.” (P4)

Most of the interview statements came from the smart city project leaders which confirm that they collaborate with different stakeholders to organize and implement a project. The project leaders attract and involve various stakeholders in the project development. The stakeholders can collaborate in a project based on their interests and resources.

4.1.4.2. Partnership

Partnership is mentioned in six interviews and four documents. It is a relevant aspect to represent smart city projects in Amsterdam. One of the interviewees stated this aspect as follows (see Appendix H for more supporting statement):

“Alliander already knew Amsterdam Smart City because they are a partner. So they together with Municipality of Amsterdam and other companies they are partner of the Amsterdam Smart City. And such a way they support the platform by money, by man-hours.” (P7)

Most of the interviewees' statements reveals that smart city project leaders work with their partners in a certain partnership scheme. The partners usually give their resources, such as finance, human resources, and even ideas, in a partnership scheme to make the project happen. It is in line with the mindsets of the environmental-related documents which stated that the Municipality build a partnership with various partners to make a smart city project happens.

4.1.4.3. Database Resources

The database resources were mentioned in one interview and six documents. It is a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam, because the combination of the frequency mentioned is unequal. The document transcripts provided information about the existing data centers and its development, whereas the interview transcript reveals the weakness of the data centers (see Appendix H for the supporting statements). It reveals that database resources are mostly considered by the Municipality. They want to have a real-time view of the city by developing the database resources. The data itself are gathered from the use of mobile technologies which can contribute to the

need of data in both mobility and energy project themes. But, some data are still not available for the energy project theme which become a constraint for the smart city project, as one of the interviewees mentioned as follows:

"[...] another big part was finding data, finding the information about the building (to make the energy neutral homes project happen). (P3)

4.1.4.4. Collective Intelligence

Collective intelligence was mentioned in four interviews and two documents. It is a relevant to represent the implementation of smart city projects in Amsterdam. One of the documents stated as follows (see Appendix H for more supporting statements):

"The project should become a learning environment as well so that it can be scaled to the bigger city and go beyond national borders." (D11)

This statement shows that the Municipality wants to make a smart city project as a learning environment for the people. The learning environment might emerge from the knowledge and networks sharing among actors in the project. One of the interviewees also stated as follows:

"[...] mainly innovation comes from the city itself. So they can be from the stakeholder and the location itself. It's not we (the CTO) decide something and that the typical smart city innovation. So we invite them or they just include us in some way." (P5)

This statement reveals that the collective intelligence also emerges from the cooperation among stakeholders and partners when they are developing a smart city project. Together, they collectively discuss a project which can be done through a co-creation platform.

4.1.4.5. Communication

The communication aspect was found in four interviews and one document (see Appendix H for the supporting statements). It is a less relevant aspect and "not strong enough" to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the communication is done by different actors, either the Municipality (through the CTO) or actors in smart city project. The communication can be done in either online or offline way. They even use ICT as a media for actors to communicate with each other during the implementation and operationalization of a smart city project.

4.1.4.6. Control System

Control system was found in one interview and four documents (see Appendix H for the supporting statements). It is a less relevant aspect and "not strong enough" to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the control system is done by the Municipality departments through the use of ICT, such as CCTV and traffic control system, which is mostly applied for mobility theme. But this aspect does not refer to the controlling of a non-government-based smart city project development.

4.1.4.7. IT Infrastructure

The IT infrastructure aspect was found in five documents (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the documents, it shows that the Municipality develop the IT infrastructure because they have a high consideration on providing it. The IT infrastructures are built to provide mobile data services and traffic control system. The provision of IT infrastructure is more the Municipality’s responsibility than non-governmental parties who develop smart city projects. However, most statements seems to contain “wishful thinking” for which several ideas still will be implemented in the future.

4.1.4.8. Leadership

The leadership aspect was found in four interviews and one document (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the leadership aspect does not emerge only from the Municipality but also the smart city project leaders. The form of the leaderships are such as, empowerments, connections, encouragements, and establishment of cooperation.

4.1.4.9. Service-oriented Information System

Service-oriented information system was found in two interviews and three documents (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the service-oriented information system emerges in the smart city projects which use information system as their tool to provide particular services in Amsterdam.

4.1.4.10. Data-exchange

The data-exchange aspect was found in one interview and three documents (see Appendix H for the supporting statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the government wants to provide the data-exchange through related media to make the data available and accessible. By doing so, they expect that the smart city projects can make use of it and help them to initiate the projects. However, most statement from the documents is “wishful thinking” for which several ideas still will be implemented in the future.

4.1.4.11. Participation

Participation was found in four interviews (see Appendix H for the supporting statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. I included it in the smart governance category because the participation is a key aspect which is used by both the Municipality and project leaders to develop a smart city project. Most of statements which are stated about the participation aspect are also intersected with the aspect of participation and coordination in development process in smart people categories and participatory approach in education and capacity category. It can be concluded that there is a same mindset between the people and governance to include the participation aspect in the smart city project development.

4.1.4.12. Data Security and Privacy

The livability aspect was found in one interview and two document transcripts (see Appendix H for the supporting statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that data security and privacy is an important aspect in adopting technologies for smart city project. It is mainly concerned by the Municipality when they want to initiate a smart city project which uses ICT technology.

4.1.4.13. Digital Network

Digital network was only stated in one interview and one document (see Appendix H for the statements). It is a less relevant aspect and “very weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that digital networks is considered to support the provision of data and information in the city. With that, the Municipality can monitor the condition of the city in a real-time way. But, this aspect is less considered in the development of smart city projects in Amsterdam, because the Amsterdam Smart City is built to connect and accelerate innovative projects in a collaborative way. They do not put digital networks and technologies as their end-goal, because they more focus on the collaboration among stakeholders in the development of a smart city project. By doing so, they want to increase the awareness of the citizens, because most of the smart city projects come from themselves. This will be further elaborated in chapter 5.

4.1.4.14. Flexible Government

Flexible government was found in four interviews (see Appendix H for the statements), and it is a new aspect emerged from the transcripts. It is a relevant aspect to represent the implementation of smart city projects in Amsterdam. From the transcript, it reveals that flexible government emerges from the Municipality which tries to accommodate new elements that came up from the smart city projects. The elements might be a new technology, themes, and accommodate the project with certain requirements and regulations to make it happens. Additionally, the Municipality also let the smart city project leaders to flexibly test and validate their projects everywhere in Amsterdam.

4.1.4.15. Learning by Doing

Learning by doing was found in two interviews and two documents (see Appendix H for the supporting statements), it is a new aspect emerged from the transcripts but less relevant and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. I included it into smart governance category because in the smart city project development, most of the actors stated that they want to do something first and then learn from it, whether it is successful or not.

It reveals that learning by doing emerges both in the Municipality and smart city project development. It seems that the Municipality and people in the projects want to develop a smart city project by just do it and learn from the implementation process and result. By doing so, they want to have some iteration process to always repair some elements in the project and have a better result in the future.

4.1.4.16. Concluding Remark

All in all, it can be concluded that smart governance category of Amsterdam has fifteen aspects including two new aspects emerged. The most mentioned aspect in this category is stakeholders collaboration which is represented by 58% of the total number of interview and document transcripts. It

is the most relevant aspect in this category. Aspects which are marked as less relevant are database resources, communication, control system, IT infrastructure, leadership, service-oriented information system, data-exchange, data security and privacy, digital networks, and learning by doing which are represented by either less than 32% of the total number of transcripts, unequal combination of the number of frequency mentioned, or less than the interview or document relevance threshold. Those less relevant aspects are divided into three levels, namely “not strong enough”, “weak”, and “very weak”. Moreover, there is an aspect which has a large “wishful thinking” level from the document, namely IT infrastructure. It has to be noticed that several ideas in the aspect might not be implemented yet.

4.1.5. Smart Mobility

Based on the coding analysis, four aspects emerge on the category of smart mobility (see Table 17).

Table17. Smart Mobility Aspects of Amsterdam

| Smart Mobility Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|----------------------------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Sustainable, innovative, and safe transport system | 4 | 9 | 13 | 68% |
| Local accessibility | 1 | 2 | 3 | 16% |
| Efficient logistics activity | 3 | 4 | 7 | 37% |
| Congestion reduction | 2 | 1 | 3 | 16% |




 New Aspect
  Relevant Aspect
 Less Relevant Aspect:
 Weak

Table 17 shows two new aspects that are emerged from the interview and document transcripts, namely efficient logistics activity and congestion reduction. However, the total percentage of congestion reduction indicates that the aspect is less relevant and “weak” for this category. The efficient logistic activity cannot be merged with other aspects in the conceptual framework because it contains a new element for this category, namely logistic. Congestion reduction cannot be merged with other aspects in the conceptual framework because it represents one of the goals in mobility category.

Regarding the result, the most mentioned aspect is the sustainable, innovative, and safe transport system which is represented in 13 out of 19 transcripts. Its total percentage is above the relevance threshold and it is considered as the most relevant aspect in the smart mobility category. However, not all statements represent elements in this aspect. Sometimes, there is only sustainable or innovative context which emerge in a statement. That will be further elaborated in the next section. The less mentioned aspect is the local accessibility that is only found in three transcripts. The aspect is considered as less relevant and “weak” to represent the development of smart city projects in Amsterdam.

Another point is that there is an aspect from the literature which was not found in the transcripts, namely (inter-)national accessibility. It seems that the aspect is not relevant in the development of smart city projects in Amsterdam. There is an aspect from the literature which was withdrawn from the framework, namely ICT infrastructure. The aspect has similarity with IT infrastructure aspect in the smart governance category. So, the aspect is more relevant to represent the governance than mobility category. The following sections will elaborate more on the aspects in the table to give a deeper elaboration.

4.1.5.1. Sustainable, Innovative, and Safe Transport System

Sustainable, innovative, and safe transport system aspect was mentioned in four interviews and nine documents. It is a relevant aspect for this category. This aspect, consists of three elements, namely sustainable, innovative, and safe transport system. I included statements from the transcripts based on each elements. For instance, if there is a statement that contains only a sustainable context of mobility, I still include it to this aspect. So, the number of interviewee and document statements in this aspect is an accumulation of each element. Most of the interviews and documents were mentioned the sustainable together with innovative element in the mobility theme. One of the interviewees stated this aspect as follows (see Appendix H for more supporting statements):

“[...] and together they made a logistical hub in south part of Amsterdam to make a distribution system that is more efficient and also electric, so more sustainable.” (P2)

It reveals that sustainable and innovative elements complement each other. Both the Municipality and smart city project leader achieve their sustainability goals by developing innovative intervention in the mobility theme. However, most documents that are stated about the sustainable and innovative elements contain “wishful thinking”, in which there might be several ideas that are not implemented yet. One of the statements about the safe transport system is as follows:

“[...] improve the loading and unloading locations and delivery time over the day. This also improves safety for all users of the roads, including bikers and pedestrians [...].” (D6)

Statements from the interviewees and documents show that the safe transport system element is not only about the road transport safety, but also the safety of the goods itself. It seems that innovation is a medium to achieve sustainable and safe transport system in mobility theme.

4.1.5.2. Local Accessibility

Local accessibility was found in one interview and two documents (see Appendix H for the supporting statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that local accessibility is considered in the mobility projects, such as mobility as service and logistics. However, most documents stated about the sustainable and innovative elements contain “wishful thinking” for which several ideas might not be implemented yet.

4.1.5.3. Efficient Logistics Activity

Efficient logistics activity is a new aspect which was found in three interviews and four documents. It is a relevant aspect for the implementation of smart city projects in Amsterdam. This aspect was found only in the logistic projects because one of the interviewees in this study is a project leader of “Logistic Hub Amsterdam” (P4) which gave several statements and references about logistics in Amsterdam. Statements from the interviewee P4 were confirmed by other interviewees and related documents (see Appendix H for the supporting statements).

It reveals that both the Municipality and project leader make the logistical activities more efficient by reducing the amount of freight transport to the city, developing cargo hubs, using electrified vehicles,

and providing a good spot to load and unload goods. By doing so, Amsterdam wants to make a smarter logistic in which make all part of logistical activities more efficient.

4.1.5.4. Congestion Reduction

Congestion reduction was found in two interviews and one document (see Appendix H for the supporting statements). It is a new aspect but less relevant and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. I included it into the smart mobility category because most of the goals of mobility projects themes in Amsterdam is to reduce the congestion and traffic in the city. It reveals that congestion reduction is the primary goal of the smart mobility projects theme. The improvement in the mobility projects has influence also to the environment and city accessibility.

4.1.5.5. Concluding Remark

All in all, it can be concluded that smart mobility category of Amsterdam has four aspects including two new aspects emerged. The most mentioned aspect in this category is sustainable, innovative, and safe transport system which is represented by 68% of the total number of interview and document transcripts. Most mentioned element in this aspect is “sustainable” which indicates that the aspect mainly represents a sustainable mobility projects development. Aspects which are under the relevance threshold value are local accessibility and congestion reduction, which is represented by less than 32% of the total number of transcripts. It is marked as a less relevant and “weak” aspect. Moreover, there are two aspects which contain “wishful thinking” from the document, namely sustainable, innovative, and safe transport system and local accessibility. But for the sustainable, innovative, and safe transport system aspect, the “wishful thinking” is just found in the sustainable and innovative elements. It has to be noticed that several ideas in each aspect might not be implemented yet.

4.1.6. Smart Environment

Based on the coding analysis, four aspects emerge on the category of smart environment (see Table 18).

Table 18. Smart Environment Aspects of Amsterdam

| Smart Environment Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|---------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Environmental pollution | 4 | 5 | 9 | 47% |
| Sustainable resource management | 1 | 3 | 4 | 21% |
| Energy neutral | 4 | 6 | 10 | 53% |
| Circular city | 3 | 0 | 3 | 16% |

New Aspect
 Relevant Aspect
 Less Relevant Aspect: Weak

Table 18 shows two new aspects that are emerged from the interview and document transcripts, namely energy neutral and circular city. However, the circular city is under the relevance threshold of interview which represents that it is a less relevant and “weak” aspect. The energy neutral cannot be

merged with other aspects in the conceptual framework because it specifically contains element about energy. The circular city cannot be merged because it contains circularity as an environmental goal. Besides, the aspect is included in this category because most statements from the transcripts stated about circular city.

Regarding the result, the most mentioned aspect is the energy neutral which is represented in 10 out of 19 transcripts. Its total percentage is above the relevance threshold and it is considered as the most relevant aspect of the smart environment category. This aspect was mentioned not only in the energy but also mobility project themes. It seems that Amsterdam is more focusing on the energy transition on all project themes. They want to make the city as energy-neutral as possible in any themes. The less mentioned aspect is the circular city, which is only stated by three interviewees. It is considered as a less relevant and “weak” aspect to represent a smart city projects in Amsterdam.

Another point is that there is an aspect from the literature which was not found in the transcripts, namely natural conditions of resource. It seems that the aspect is not relevant in the development of smart city projects in Amsterdam. There is an aspect from the literature which is not included in this category but it is still relevant for this category, namely the environmental protection. The aspect interrelates with all included aspects in this category because it becomes an end goal for environmental efforts. The following sections will elaborate more on the aspects in the table to give a deeper analysis.

4.1.6.1. Environmental Pollution

Environmental pollution was mentioned in four interviews and five documents. It is one of the relevant aspects in this category. Example of transcripts that are stated this aspect is as follows (see Appendix H for more supporting statements):

“[...] to keep the city livable and not to make it too crowded, too much waste and polluted air [...].” (P7)

“Amsterdam is working on the Amsterdam Climate Programme in accordance with the principle of “Trias Energetica”, an approach that results in an optimum reduction of CO₂.” (D7)

It reveals that environmental pollution includes several elements, such as noise, waste, air, and hazardous substances. There are several measures to reduce the CO₂ emission in Amsterdam, such as developing an environmental zone, self-governing of the Municipality building in reducing CO₂ emission, and adopt the principle of “*trias energetica*”. This aspect emerges in both mobility and energy themes.

4.1.6.2. Sustainable Resource Management

Sustainable resource management was mentioned in one interview and three documents (see Appendix H for the supporting statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts it reveals that the sustainable resource management only focuses on the waste as resource. The smart city projects in Amsterdam try to make use of waste by using several methods to reduce the environmental impacts.

4.1.6.3. Energy Neutral

Energy neutral, as a new aspect in the category, was mentioned in four interviews and six documents. It is one of the relevant aspects in this category. I included it in this category because most of

smart city projects and environmental-related agenda aims to reach energy neutral in various scales, such as building and district. One of the documents stated this aspect as follows (see Appendix H for more supporting statements):

"[...] in addition to these agreements, the Municipality sees 'Zero Energy Buildings' as an option to improve current housing stock." (D2)

Statements from documents reveal that the Municipality aim to build both buildings and districts in Amsterdam as energy neutral as possible by developing techniques for heating and cooling. The energy neutral is also in line with the idea of climate-neutral where all of the non-renewable energies both in the districts and buildings can be dismissed. Most documents stated a "wishful thinking" in which several ideas in the statement are not implemented yet. One of the interviewees' statements confirm this aspect as follows:

"[...] we believe in distributed energy networks. So, in the local area, we generate the energy, we distribute the energy in district scale. We believe that is part of the energy system." (P6)

The interviewee's statement added that there are intervention on the making of energy neutral building and district, such as replacing the building insulation, reducing energy waste, using solar panel, and replacing gas with electricity. This aspect also touches the climate goals of Amsterdam. This aspect also emerges in the mobility project theme. Most of mobility projects develop an electrified vehicle which try to diminish the use of fossil energy and CO₂ emissions.

4.1.6.4. Circular City

Circular city was mentioned in three interviews (see Appendix H for the statements). It is a new aspect but less relevant and "weak" to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it seems that Amsterdam wants to turn the city as circular as possible. Several smart city projects concern about the material reuse and avoid using non-renewable energy. The Municipality also encourages market to have more circular projects and products by including circularity as an element in their tenders.

4.1.6.5. Concluding Remark

All in all, it can be concluded that smart environment category of Amsterdam has four aspects including two new aspects emerged. The most mentioned aspect in this category is energy neutral which is represented by 53% of the total number of interview and document transcripts. It is the most relevant aspect in this category. Two aspects are above the relevance threshold (32%), namely environmental pollution and energy neutral. Those aspects are relevant for smart environmental category. Aspects which are under the relevance threshold value are sustainable resource management and circular city which is represented by less than 32% of the total number of transcripts. It is marked as a less relevant and "weak" aspect. Moreover, there is an aspect which has "wishful thinking" statements from the document, namely energy neutral. It has to be noticed that several ideas in the aspect might not be implemented yet.

4.1.7. Education and Capacity

Based on the coding analysis, 3 out of 6 aspects emerge on the category of education and capacity (see Table 19).

Table 19. Education and Capacity Aspects of Amsterdam

| Education and Capacity Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|--------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Participatory approach | 4 | 1 | 5 | 26% |
| Awareness of citizen | 1 | 3 | 4 | 21% |
| Knowledge networks | 3 | 1 | 4 | 21% |

Less Relevant Aspect:

■ Not Strong Enough ■ Weak

Table 19 shows that no new aspects emerged from the interview and document transcripts. All statements represented a similar idea with aspects in the conceptual framework. All aspects are under the relevance threshold and it is considered as a less relevant aspect. Regarding the result, the most mentioned aspect is the participatory approach which is represented in 5 out of 19 transcripts.

Another point is that there are three aspects from the literature which were not found in the transcripts, namely education rate, student per inhabitant, and satisfaction with educational system. It seems that those aspects are not relevant in the development of smart city projects in Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper description.

4.1.7.1. Participatory Approach

Participatory approach was mentioned in four interviews and one document (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent smart city projects in Amsterdam, because it is under the relevance threshold. Most of statements which are stated about the participatory approach aspect is also intersected with the aspect of participation and coordination in development process in smart people categories and participation in smart governance category. It reveals that both non-governmental and governmental parties are using participatory approach to implement their smart city projects and agenda.

4.1.7.2. Awareness of Citizen

Awareness of citizen was mentioned in one interview and three documents (see Appendix H for the supporting statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that both Municipality and smart city project leaders try to generate awareness of the citizens. They refer citizens as the inhabitants, business, and the authorities. The awareness of citizen is mostly driven by the Municipality for the environmental-related efforts.

4.1.7.3. Knowledge Networks

Knowledge networks were mentioned in three interviews and one document (see Appendix H for the statements). It is a less relevant aspect and “weak” to represent smart city projects in Amsterdam, because it is under the relevance threshold. Form the transcripts, it reveals that both the Municipality and

project leaders try to develop their initiative by creating knowledge networks. By doing so, they can share knowledge and learn from each other. The “wishful thinking” were confirmed by the interviewee which reveals that the ideas exist in reality.

4.1.7.4. Concluding Remark

All in all, it can be concluded that for the education and capacity category of Amsterdam, no new aspects emerged. The most mentioned aspect in this category is participatory approach which is represented by 26% of the total number of interview and document transcripts. All aspects in this category are under the relevance threshold (32%). It reveals that the aspects are less relevant, which are divided into three levels, namely “not strong enough” and “weak”. It also shows that most of smart city projects in Amsterdam less consider the aspects on education and capacity category.

4.1.8. Conclusion on Smart City Aspects of Amsterdam

To conclude, ten new aspects emerged in five smart city categories which are elaborated as follows: three in smart economy, one in smart living, two in smart governance, two in smart mobility, and two in smart environment. There are 43 aspects gathered from the interview and document transcripts which can be elaborated as follows: 9 relevant and 34 less relevant aspects (see Appendix I). It seems that most smart city projects in Amsterdam only consider a small number of smart city aspects. Comparing with the conceptual framework, there are 30 aspects in all categories which cannot be found in the smart city projects of Amsterdam. It also can be called as “not relevant” aspects for representing smart city projects in Amsterdam. It seems that aspects adopted in the framework are not used for identifying a specific smart city projects, but more on the valuing the degree of smartness in a city. That will be further discussed on chapter 5.

Finally, there are 7 aspects from four categories which contains “wishful thinking” from documents which can be elaborated as follows: Smart economy: development of ICT facilities, mobile technology, and capability to transform; Smart governance: IT infrastructure; Smart mobility: sustainable and innovation elements and local accessibility; Smart environment: energy neutral. It has to be noticed that several ideas in those aspects might not be implemented yet. All aspects included in the smart city are based on the several smart city projects in the energy and mobility themes. Therefore, the interaction between aspects in each category might be different in other project themes.

4.2. Environmental Management Aspects of Amsterdam

The information related to the environmental management aspects of Amsterdam is based on the coded document and interview transcripts. The elaboration of the result for this section is based on the three categories of environmental management adopted in the framework, namely, advisory, economic or fiscal, and regulatory, in which each category has several aspects as can be seen in Figure 17. Several new aspects also emerged from the interview and document transcripts. The alignment of new aspects to the conceptual framework will be discussed in chapter 5. The following sections will elaborate the results on the environmental management aspects gathered from Amsterdam in each category.

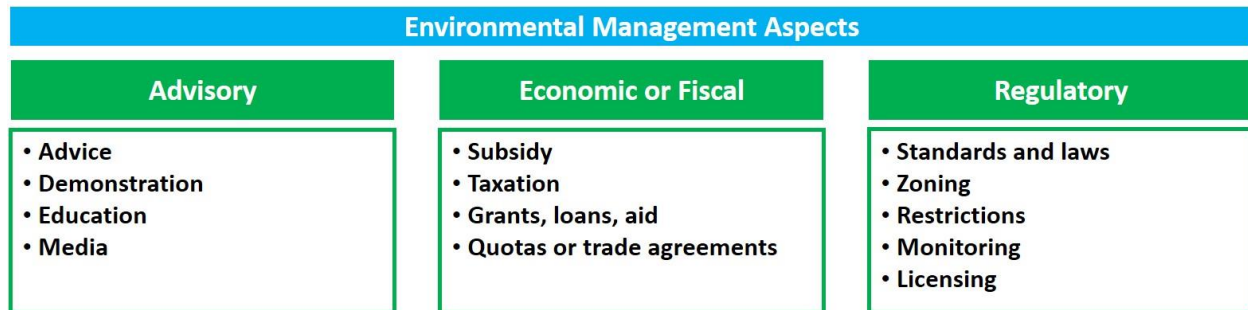


Figure 17. Environmental Management Categories and Aspects based on the Conceptual Framework

4.2.1. Advisory

Based on the coding analysis, five aspects emerge on the category of advisory (see Table 20).

Table 20. Advisory Aspects of Amsterdam

| Advisory Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|-------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Advice | 6 | 7 | 13 | 68% |
| Demonstration | 4 | 1 | 5 | 26% |
| Education | 1 | 1 | 2 | 11% |
| Adopting digital technologies | 3 | 5 | 8 | 42% |
| Support initiative | 5 | 2 | 7 | 37% |

New Aspect
 Relevant Aspect
 Less Relevant Aspect:
 Not Strong Enough
 Very Weak

Table 20 shows two new aspects emerged from the interview and document transcripts, namely adopting digital technologies and support initiative. The total percentage of those aspects are above the relevance threshold value which reveals that all new aspects are relevant for representing advisory category in Amsterdam. Adopting digital technologies cannot be merged with other aspects in the conceptual framework because it contains specific element about adoption of technologies in which there is no aspect can accommodate it. Support initiative cannot be merged because it contains new element about role of government to support the environmental-related initiatives.

Regarding the result, the most mentioned aspect is advice which is represented in 13 out of 19 transcripts. Its total percentage is above the relevance threshold value and it is considered as the most relevant aspect in the advisory category. The less mentioned aspect is education which is only mentioned once both in the interview and document. It seems that the aspect is less relevant in the environmental management of Amsterdam.

Another point is that there is an aspect from the literature which was not found in the transcripts, namely media. It seems that the aspect is not relevant in the environmental management of Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper description.

4.2.1.1. Advice

Advice was found in six interviews and seven documents. It is a relevant aspect in this category. There are three elements which support this aspect, namely advise partners, encouragement, and connecting people. Each element is a representation of advisory role of the Municipality. Regarding advice partners, one of the interviewees stated this aspect as follows (see Appendix H for more supporting statements):

“[...] they (partners) are sitting on the tables with the government. [...] we support, we help, sometimes we host staffs, discuss together and say, hey this is research or this is development, and we help to define that.” (P6)

It reveals that the advisory role of the Municipality is mostly to advise their partners when they are trying to develop a project. Therefore, the advice aspect emerges only in cross-department of the Municipality and between departments in the Municipality and their partners.

Regarding the encouragement, the Municipality tries to encourage all actors in Amsterdam to take part in their environmental management efforts. The encouragement is done several themes of environmental management, such as circular economy, CO₂ emission reduction, energy, and mobility projects. The Municipality drives themselves to encourage the citizens to make their agenda and projects a success, such as the electrified vehicles charging. They also try to encourage various stakeholders to work together in initiating an environmental-related project, as a document stated that:

“[...] the Municipality of Amsterdam has worked hard on encouraging bicycle use by providing cycle paths and lanes [...] and an extensive network of bicycle parking facilities.” (D8)

Finally, regarding connecting people, the government tries to make right connections among all actors in the city to work together in the environmental-related projects. The Municipality also tries to connect people to their related departments to discuss the projects. To conclude, it seems that the government gives advice by using various ways, such as encouragement, and with various targets, such as partners and the citizens. As one of the interviewees stated:

“[...] we try to connect them (the market) to the right people, we try to connect it to the right department in our Municipality.” (P7)

4.2.1.2. Demonstration

Demonstration was found in four interviews and one document (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent environmental management in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the government tries to demonstrate environmental-related projects and policy to the citizens through various ways, such as summer event, promotion, exposition, contest, and subsidies.

4.2.1.3. Education

Education aspect was found in one interview and one document transcript (see Appendix H for the statements). It is a less relevant aspect and “very weak” to represent environmental management in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the education which is driven by the Municipality emerges in their campaign to educate people. They also

drive the knowledge institutes to link sustainability elements with their courses and training programme. However, the documents stated a “wishful thinking” for which several ideas are not implemented yet.

4.2.1.4. Adopting Digital Technologies

Adopting digital technology, as a new aspect, was mentioned in three interviews and five documents. It is one of the relevant aspects in this category. I included it in this category because most of transcripts stated that the governmental parties try to adopt new technologies in the city. One of the documents stated as follows (see Appendix H for more supporting statements):

“[...] it involves investing in digital infrastructure as a means of improving the city’s own mobility applications (that is, traffic control installations, etc.).” (D5)

It reveals that the Municipality tries to adopt various digital technologies to enhance the quality of mobility and save energy. However, the documents stated a “wishful thinking” for which several ideas might not be implemented yet. Statements from one of the interviewees confirm this aspect as follows:

“[...] the parking apps nowadays when we pay for (park) 50% by app nowadays. So we (the Municipality) don’t need the machine anymore, which is more sustainable and cheaper. Through the app now it’s 0% (for the first transaction) because they (the providers) have to change and develop the business model, and now we have 3 or 4 providers who compete, that’s what we want.” (P6)

Based on this statement, the Municipality drives themselves to adopt more digital technologies to make the maintenance of mobility and energy projects cheaper and more sustainable. The adoption of digital technologies also helps to create new business model for the market and more competition in those sectors. The interviewee’s statements confirm the existence of adopting digital technologies in Amsterdam which also prove that the “wishful thinking” from the documents has been implemented.

4.2.1.5. Support Initiative

Support initiative, as a new aspect, was mentioned in five interviews and two documents (see Appendix H for the supporting statements). It is one of the relevant aspects to represent environmental management of Amsterdam. I included it in the category because most of the transcripts stated that the governmental parties give their support to various initiatives in the city through several ways.

It reveals that the Municipality is open to various new initiatives which are in line with their agenda, such as reducing environmental impacts. They also declared that they would support all initiatives from a wide range of actors because they want to make Amsterdam as a locus for sustainable activity and innovative products. Additionally, the “wishful thinking” from documents are confirmed by the interviewees who explained that this aspect exists in environmental management of Amsterdam.

4.2.1.6. Concluding Remark

All in all, it can be concluded that advisory category of Amsterdam has five aspects including two new aspects emerged. The most mentioned aspect in this category is advice which is represented by 68% of the total number of transcripts. It is the most relevant aspect in this category. Aspect which is under the value of relevance threshold is demonstration and education which is represented by less than 32% of the total number of transcripts. It reveals that the aspects are less relevant, which are divided into three

levels, namely “not strong enough” and “weak”. Moreover, there is an aspect which has a “wishful thinking” from the documents, namely education. It has to be noticed that several ideas in each aspect might not be implemented yet.

4.2.2. Economic or Fiscal

Based on the coding analysis, five aspects emerge on the category of economic or fiscal (see Table 21).

Table 21. Economic or Fiscal Aspects of Amsterdam

| Economic or Fiscal Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|----------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Subsidy | 5 | 5 | 10 | 53% |
| Taxation | 1 | 4 | 5 | 26% |
| Grants, loans, aid | 3 | 4 | 7 | 37% |
| Circular tenders | 2 | 3 | 5 | 26% |
| Financial instruments | 3 | 3 | 6 | 32% |

New Aspect
 Relevant Aspect
 Less Relevant Aspect:
 Not Strong Enough

Table 21 shows two new aspects emerged from the interview and document transcripts, namely circular tenders and financial instruments. However, the circular tender is under the relevance threshold value which reveals that this aspect is less relevant. Circular tenders cannot be merged with other aspects in the conceptual framework because it specifically stated about the tender process in which there is no aspect focusing about that. Financial instruments cannot be merged because it contains a general aspect about financial elements to conduct an environmental-related project.

Regarding the result, the most mentioned aspect is the subsidy which is represented in 10 out of 19 transcripts. Its total percentage is above the relevance threshold value and it is considered as the most relevant aspect in the economic or fiscal category. The less mentioned aspect is circular tenders which are mentioned in two interviews and three documents. It represents that the aspect is less relevant in the environmental management of Amsterdam.

Another point is that there is an aspect from the literature which was not found in the transcripts, namely quota or trade agreements. It seems that those aspects are not relevant in the environmental management of Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper analysis.

4.2.2.1. Subsidy

The subsidy was found in five interviews and documents. One of the documents stated as follows (see Appendix H for more supporting statements):

“[...] Amsterdam is one of the few cities that does subsidize electric vehicles including electric freight transport.” (D9)

It reveals that the Municipality provides subsidy to the environmental-related projects both in the energy and mobility themes. One of the statements from interviewee P6 confirm this aspect, as follows:

“We have subsidy for solar panel on the roof initiative.” (P6)

This statement reveals that the Municipality drives themselves to subsidize energy and mobility projects in several ways, such as giving funding for replacing solar panel on the roof and placing charging station for electrified vehicles.

4.2.2.2. Taxation

Taxation aspect was found in one interview and four documents (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent environmental management in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that taxation aspect emerges both in energy and mobility projects. The taxation scheme will be arranged after the project is successfully implemented.

4.2.2.3. Grants, Loans, Aid

Grants, loans, and aid were found in three interviews and four documents which represents that it is a relevant aspect. There is only grants and aid element found in Amsterdam. Regarding the grant element, three interviewees stated as follows:

“Amsterdam won an award in 2016, the European Commission gives the titled to Amsterdam to be the European Capital of Innovation also known as the I-Capital. And they granted for almost a million euros and with that money they could innovate.” (P1, P2, P5)

It reveals that the grant aspect emerges as funding from the European Commission because Amsterdam won an award. With that money, the Municipality created a start-up competition and innovation contest which has theme related to the environmental impacts. They use the grant also for the environmental-related projects in Amsterdam.

Regarding the aid element, it is more about investment and its institution to manage the funds. As the transcripts stated this aspect as follows (see Appendix H for more supporting statements):

“Amsterdam is investing in clean, quiet and efficient electric transport to help reduce the CO₂ emissions of the traffic and transport sector.” (D7)

It reveals that the government tries to finance related energy and mobility projects with an investment scheme. There is a long term budget for the project in which guarantee the continuity of the project development in Amsterdam. Regarding the funding institution, it reveals that investment funding institution helps the government to manage funds for the energy transition projects. However, I only found this aspect for energy projects.

4.2.2.4. Circular Tenders

Circular tenders was found in two interviews and three documents (see Appendix H for the supporting statements). It is a less relevant aspect and “not strong enough” to represent environmental management in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that circular tenders emerge in the Municipality and knowledge institutes for tendering goods and

projects. They stimulate the companies which want to involve in the tender process to do the project in a more sustainable way, such as using recycled materials and electrified vehicles. This aspect emerges both in energy and mobility project themes.

4.2.2.5. Financial Instruments

Financial instrument was found in three interviews and three documents. It is a relevant aspect for representing the environmental management in Amsterdam. I included it in the category because finance is an important aspect in the environmental-related project development in Amsterdam. It contains finance, fines, and incentives elements. Regarding the finance, one of the transcripts stated this aspect as follows:

“The transition to a sustainable city requires a case-by-case approach to funding: [...] The risks associated with these issues can mean that normal financiers cannot or will not provide financing. The City of Amsterdam understands that providing financial support for project initiatives will be effective. Through targeting funding, significant advances in impact and scale can be made with regard to sustainability.” (D2)

It reveals that the financial instrument basically comes from both public and private parties. But, if the private parties cannot or will not fund an environmental-related project because of the high uncertainty and risk, the Municipality (public party) will handle the funding. All of the financial instruments are arranged to make Amsterdam more sustainable.

Regarding the fines element, it reveals that fines have been implemented in Amsterdam to control the environmental quality. By doing so, the citizens are expected to follow the standard and laws which was formulated by the government, as an interviewee stated as follows (see Appendix F for the supporting statements):

“(a scheme of) fines if you don’t treat your waste or you dump it.” (P7)

Regarding the incentive element, it reveals that the incentive emerges in the price of renewable energy used in Amsterdam. Private sectors who can sell the energy as competitive as possible will earn incentive from the Municipality. Therefore, the price of renewable energy is affordable for the citizens. Different departments in the Municipality give various incentive types to the private sectors to make a competitive price in the market, as stated by a document as follows:

“[...] price incentives are necessary to ensure fair competition, whereby the cost of polluting is no longer transferred elsewhere but expressed in these prices.” (D7)

4.2.2.6. Concluding Remark

All in all, it can be concluded that economic or fiscal category of Amsterdam has five aspects including two new aspects emerged. The most mentioned aspect in this category is subsidy which is represented by 53% of the total number of interview and document transcripts. Aspects which is less relevant and “not strong enough” to represent environmental management of Amsterdam are taxation and circular tenders which is represented by less than 32% of the total number of transcripts.

4.2.3. Regulatory

Based on the coding analysis, seven aspects emerge on the category of regulatory (see Table 22).

Table 22. Regulatory Aspects of Amsterdam

| Aspects | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|-------------------|---------------------------------------------|-----------------------------------------|--------------------------------------------|---------------------|
| | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Standard and laws | 6 | 5 | 11 | 58% |
| Zoning | 2 | 5 | 7 | 37% |
| Restriction | 1 | 5 | 6 | 32% |
| Monitoring | 0 | 3 | 3 | 16% |
| Agenda | 4 | 8 | 12 | 63% |
| Agreements | 1 | 7 | 8 | 42% |
| Spatial planning | 2 | 1 | 3 | 16% |

New Aspect
 Relevant Aspect
 Less Relevant Aspect:
 Not Strong Enough
 Weak

Table 22 shows three new aspects emerged from the interview and document transcripts, namely agenda, agreements and spatial planning. The total percentage of agreements and spatial planning are under the relevance threshold value, so it is a less relevant aspect. Agenda cannot be merged with other aspects in the conceptual framework because it contains visions and ambitions of the Amsterdam Municipality which is not represented by other aspects. Agreements cannot be merged because it contains a cooperation scheme between actors to ensure that an environmental goal can be achieved, and there is no aspect which focuses about that. Spatial planning cannot be merged because it contains planning scheme of the Municipality which is related to space in the area of Amsterdam city.

Regarding the result, the most mentioned aspect is agenda which is represented in 12 out of 19 transcripts. Its total percentage is above the relevance threshold value and it is considered as the most relevant aspect in this category. The less mentioned aspects are monitoring and spatial planning which is represented in 16% of the total number of transcripts. It shows that the aspect is less relevant in the environmental management in Amsterdam.

Another point is that, in this category, I divided the restriction and monitoring as a separate aspect. There is a difference in the meaning of those two aspects which was found when I was conducting the coding analysis. Besides, there is an aspect from the literature which was not found in the transcripts, namely licensing. It seems that the aspect is not relevant in the environmental management of Amsterdam. The following sections will elaborate more on the aspects in the table to give a deeper elaboration.

4.2.3.1. Standard and Laws

The standard and laws aspect was found in six interviews and five documents. It is one of the relevant aspects in this category. This aspect contains two elements, namely regulation and exemptions. Regarding the regulation, one of the interviewee's statements is as follows (see Appendix H for more supporting statement):

“[...] we have a lot of regulation on protecting the environment, such as not dumping, no chemicals, and how heavy industry can be in a certain area” (P7)

It reveals that the Municipality controls the quality of environment by developing standards and laws in various themes. The standards can also come from the higher institutions, like the European Union (EU), because as a city in the Netherlands, Amsterdam has to follow the standards and laws of the EU. Most documents stated a “wishful thinking” for which several ideas might not be implemented yet.

Regarding the exemptions, it reveals that exemptions mostly emerge in the mobility theme. The Municipality gives exemption for several vehicles which enter the city center based on its specification. The citizens can request to the Municipality to have an exemption for them, as stated by an interviewee as follows:

“[...] if you drive an electric vehicle, you can have some exemptions, so for example you can park on the bridge, or you can park on the square, [...] you can get some privileges.” (P4)

4.2.3.2. Zoning

The zoning aspect was found in two interviews and five documents (see Appendix H for the supporting statements). It is one of the relevant aspects in this category. It reveals that the zoning, as an instrument, is applied by the Municipality to keep the quality of environment by implementing environmental zone where several polluted vehicles cannot enter it. The Municipality also develop free zones for sustainable and circular activities to enhance the sustainability and circularity of the city.

4.2.3.3. Restriction

The restriction aspect was found in one interview and five documents (see Appendix H for the statements). It is a less relevant aspect and “not strong enough” to represent environmental management in Amsterdam, because of an unequal combination of the frequency mentioned. From the transcripts, it reveals that the restriction is mostly formulated by related policies from the Municipality. Several objects will be restricted in the city, such as the logistic trucks which cannot meet the requirements of environmental zone. The restriction can also drive actors in the city to transform their vehicles to more sustainable one, such as electrified vehicles, non-motorized vehicles, and come to the city center by public transports.

4.2.3.4. Monitoring

The monitoring aspect was found in three documents (see Appendix H for the statements). It is a less relevant aspect and “weak” to represent environmental management in Amsterdam, because it is under the relevance threshold. From the transcripts, it reveals that the monitoring is done by the Municipality to monitor both the energy and mobility elements in the city. The monitoring becomes law enforcement for the citizens of Amsterdam by monitor them through inspections and cameras. This aspect also gives the Municipality an accumulation of information about the condition of the city. However, document D2 stated the inspection as a “wishful thinking” for which the ideas might not be implemented yet.

4.2.3.5. Agenda

The agenda aspect was found in four interviews and eight documents. It is one of the relevant aspects in this category. Most of the statements from various documents stated this aspect as follows (see Appendix H for more supporting statements):

“[...] Sustainability Agenda is not a definitive implementation programme, but it does formulate ambitions, goals and directions. In this sense it is literally an ‘agenda’. [...]. The ambition is to use 20 per cent less energy per inhabitant in 2020, compared to 2013” (D2)

It reveals that the Municipality formulates their directions, goals, and ambitions by developing an agenda. Both energy and mobility projects were mentioned in the agenda to have a clear goal in the future. But, the Municipality did not formulate the way to achieve the goals, like one of the interviewees stated as follows:

“[...] but (the agenda) not really very specific or concrete. They say, we want to have a Hub, but it’s not really mention what they will do. [...] It says smart logistics need to be encouraged by the use of the current three Cargo Hubs, they should be further stimulated and facilitated and we need to offer space for 2 additional Cargo hubs. But it’s not really for allocating space, but more giving room.” (P4)

This statement reveals that there is no specific action programme which will be taken to achieve the goals. Therefore, several actors do something with their way to achieve the goals. Another interviewee also stated this aspect as follows:

“[...] we have sustainability agenda, which is made by our politicians. [...] so we have a whole agenda on the environment and climate change, and that’s the basis of a lot of regulations.” (P7)

It reveals that one of the agendas, called Sustainable Agenda become a guideline for other regulations in Amsterdam. The agenda summarizes almost all of environmental goals of Amsterdam. So, agenda is a key regulation for managing environment in Amsterdam even though there is no clear action programme to achieve the goals.

Furthermore, the agenda also frequently stated about the energy neutral ambitions which reveals that the Municipality aims to make the energy in the buildings and districts scale in Amsterdam as efficient as possible. They want to have an energy neutral building and district to get rid of non-renewable energies and reduce the environmental impact. By doing so, the Municipality also expects the building and district are climate friendly.

4.2.3.6. Agreements

Agreements was found in one interview and seven documents (see Appendix H for the statements). It is a new aspect, but less relevant and “weak” to represent environmental management in Amsterdam, because of an equal combination of the frequency mentioned. I included this aspect in the category because it is one of the regulatory instruments which is used by the government to manage the environment. From the transcripts, it reveals that the agreements become one of the instruments to manage the environment sustainably. The agreements between the Municipality, business, and project

leaders emerge both in mobility and energy project themes in which accelerate the project implementation. Most documents stated a “wishful thinking” for which the ideas might not be implemented yet. But the interviewee’s statement proves that agreements exist in the environmental management of Amsterdam.

4.2.3.7. Spatial Planning

The spatial planning aspect was found in two interviews and one document (see Appendix H for the statements). It is a less relevant aspect and “weak” to represent environmental management in Amsterdam, because it is under the relevance threshold. I included this aspect because it is one of the regulatory instruments which represents the way the Municipality is managing the environment of Amsterdam through an intervention on urban space. From the transcripts, it reveals that the spatial planning also accommodates related energy and mobility projects. The aspect also accommodates other sectors which need space in developing its projects in Amsterdam. But, an interviewee has different perspective towards spatial planning as follows:

“[...] nowadays, we’re in some kind of situation that we also learn from Structure vision (spatial planning document) that putting everything in a blue print but that doesn’t work. That’s is not really a way how we should plan, because, it’s impossible task for futurologist to know what urban designers should put on a paper. You can’t look that clear into the future.” (P5)

This statement came from an interviewee who also works with the planning department in the Municipality. The interviewee pointed out the long term planning of the spatial planning in which arranging plan for the future of spatial development in Amsterdam from 2011-2040 (at around 30 years). Several elements in the plan cannot be implemented in the city because the city transform quickly in the future and nobody cannot know what will happen with Amsterdam 30 years later. However, the spatial planning still exists in Amsterdam to organize spatial needs of the city in the future.

4.2.3.8. Concluding Remark

All in all, it can be concluded that the regulatory category of Amsterdam has seven aspects including three new aspects emerged. The most mentioned aspect in this category is agenda which is represented by 63% of the total number of transcripts. Aspects which is under the value of relevance threshold are restriction, monitoring, agreements and spatial planning which is represented by either less than 32% of the total number of transcripts or unequal combination of the number of frequency mentioned. Those aspects are marked as a less relevant aspect which is divided into two levels, namely “not strong enough” and “weak”. Moreover, there are three aspects which contain “wishful thinking” from the document, namely standard and laws (only in the regulation element), monitoring, and agreements. It has to be noticed that several ideas in each aspect might not be implemented yet.

4.2.4. Conclusion on Environmental Management Aspects of Amsterdam

To conclude, there are seven new aspects in all categories of environmental management which are elaborated as follows: two in advisory, two in economic or fiscal, and three in regulatory. Additionally, there are 17 aspects gathered from the interview and document transcripts which can be elaborated as follows: 9 relevant and 8 less relevant aspects (see Appendix I). It seems that the environmental-related projects adopt most of the aspects in environmental management but still there are several aspects which

are less considered. Comparing with the framework, there are three aspects in all categories which cannot be found the environmental management in Amsterdam, namely media (advisory), quotas or trade agreements (economic or fiscal), and licensing (regulatory). It can be marked as a “not relevant” aspects for representing environmental management in Amsterdam. Since there are only three aspects which are not relevant, it seems that Amsterdam Municipality just does not apply that kind of approach yet to manage their environment.

Finally, there are three aspects from regulatory category which contains “wishful thinking” from the documents, namely standards and laws (only in regulation element), monitoring, and agreements. It has to be noticed that several ideas in those aspects might not be implemented yet. All aspects included in the environmental management are based on the several environmental-related projects in the energy and mobility themes. Therefore, the interaction between aspects in each category might be different in other project themes.

4.3. The Interaction Process between Smart City Projects and Environmental Management Aspect

Information related to the interaction between the aspects of smart city and environmental management in Amsterdam is based on the coded interview and document transcripts. The analysis of interaction processes are based on the interaction prerequisites (see Figure 18).

| Interaction Prerequisite | | |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1. Variables | 2. Process | 3. Effects |
| <ul style="list-style-type: none"> • Two or more variables • Mediation variable | <ul style="list-style-type: none"> • Occasion • Reciprocal activities | <ul style="list-style-type: none"> • Reaction form |

Figure 18. Interaction Prerequisites based on the Conceptual Framework

Based on the result, variables category is fulfilled as there are two variables (smart city and environmental management) and a mediation variable (intermediaries actors, such as Amsterdam Smart City or NGO, it will be further elaborated in chapter 5). The process category is fulfilled as there is an occasion between variables and reciprocal activities which will be further elaborated in this section. Effects category is identified through the reaction form of each variable which will be further discussed in chapter 5.

This section, therefore, will only focus on the process category, namely occasion which is represented by the interaction process column and reciprocal activities which is represented by activities column (see Table 23). Additionally, this section will also elaborate a finding which will be labelled as “no interaction” process. That process contributes to the discussion about an institutional interaction which will be further discussed on chapter 5.

Table 23. Interaction Processes between Smart City Projects and Environmental Management in Amsterdam

(sorted from the largest to smallest total number in each interaction process)

| Occasion (Interaction Process) | Activities | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|-----------------------------------|---------------------------------------------------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Work together | Work with partners | 3 | 4 | 7 | 37% |
| | Communicate with other departments | 2 | 0 | 2 | 11% |
| | Different objective among partners | 1 | 1 | 2 | 11% |
| | Partners connection | 2 | 0 | 2 | 11% |
| | Share networks | 1 | 0 | 1 | 5% |
| | Share knowledge | 1 | 0 | 1 | 5% |
| | Merge the goals | 1 | 0 | 1 | 5% |
| Consider each other | “Consideration to the regulations” | | | | |
| | Smart city projects consider the regulation | 6 | 0 | 6 | 32% |
| | Smart city projects consider the regulation indirectly | 2 | 0 | 2 | 11% |
| | Smart city projects does not always consider agenda | 2 | 0 | 2 | 11% |
| | Smart city projects are not obligatory to consider environmental policies | 1 | 0 | 1 | 5% |
| | Smart city projects supporting the spatial planning | 1 | 0 | 1 | 5% |
| | “Consideration to the smart city projects” | | | | |
| | Environmental management includes smart city theme | 2 | 0 | 2 | 11% |
| | Environmental management consider the smart city projects | 2 | 0 | 2 | 11% |
| | The government create legitimacy to smart city projects | 2 | 0 | 2 | 11% |
| | Environmental management does not consider the smart city projects | 1 | 0 | 1 | 5% |

Relevant Activity Less Relevant Activity (Very Weak)

Table 23 shows two interaction processes that emerged to represent the interaction between smart city and environmental management aspects in Amsterdam, namely “work together” and “consider each other”. Each process consists of several activities which indicate the reciprocal activities in the interaction process. The result of each category is elaborated in paragraphs below.

First, the “work together” process has seven activities in which there is only one activity that is above the relevance threshold, namely work with partners. It reveals that the activity is relevant for representing work together process. Other activities are under the value of relevance threshold which reveals that those aspects are less relevant and “very weak” for representing the process. However, it might give a small contribution to the interaction process.

Second, the “consider each other” process can be divided into two parts, namely “consideration to the regulations” and “consideration to the smart city projects”. In the following sections, this interaction process will be also divided into two parts to have a clearer elaboration on activities in it. The “consideration to the regulations” comes from the smart city projects side which has five activities in which there is only one activity that is above the relevance threshold, namely smart city projects consider the regulation. It reveals that the activity is relevant for representing the interaction process. Other activities are under the value of relevance threshold which reveals that the activities are less relevant and “very weak” for representing the process. However, it might give a small contribution to the interaction process. The “consideration to the smart city projects” come from the environmental management side which has four activities that are under the value of relevance threshold. Those activities are less relevant and “very weak” for representing the process. But, the activities in this process still represent a small contribution to the interaction process.

4.3.1. Work Together

In this process, the interaction between smart city projects and environmental management emerge at the working together principle. The non-governmental and governmental parties work together in the field of smart city project to achieve environmental goals of Amsterdam. On the one hand, the smart city project leaders develop their projects by working together with their partners (government and non-governmental parties). On the other hand, the government achieves their environmental objectives by working with various actors in the city. So, there is a bidirectional direction between smart city projects and environmental management under this process which is in line with all interaction prerequisites.

This process is supported by a relevant activity, namely work with partners which was stated in three interviews and four documents. It reveals that both smart city projects and environmental management have to find partners in implementing their ideas. Both of them have the same partners and sometimes they directly work together with several partners. It means that the smart city project leaders collaborate with the Municipality to have insights about related data and regulations, as interviewee P1 stated as follows:

“[...] there is no project that is not in the triple or quadruple helix. So it's always the governmental and semi-governmental stakeholders. [...] and you need public institutions for legal issues.” (P1)

The interaction in working with partners also emerge from the government perspective in the environmental management. They also try to include various parties in the city to help them in achieving their environmental goals stated in the agenda as document D2 stated as follows:

“[...] the Municipality wants to join forces with partners in the city to invest more in energy efficiency and in the local production of renewable energy.” (D2)

Another point leads to the contribution of other two less relevant activities, namely partner connection and communicate with other departments. To be able to work with partners, the smart city project leaders and Municipality must have a connection with each other (partner connection). The Municipality has to recognize the project, therefore, they can help smart city project leaders to discuss the project together and connect with their prospective partners. They also connect the smart city project leaders to the other departments in the Municipality (communicate with other departments).

After they are connected with their partners and departments in the Municipality, they start to develop the project by using various ways which were not identified from the interview and document transcripts. Several less relevant activities in this process, such as share knowledge, share networks, and merge the goals, might be an example on the way all partners intervene the projects.

It can be concluded that work together is one of the interactions between smart city projects and environmental management which includes one relevant activities, namely work with partners. It is supported by other less relevant activities, namely partners connection, and communicate with other departments. Each partner might intervene the projects through various ways, such as share knowledge, share networks, and merge the goals.

4.3.2. Consideration to the Regulations

In this part, the interaction between smart city projects and environmental management happen when the smart city projects consider the environmental management agendas or policies. It means that when the smart city project leaders develop their projects, they try to consider related environmental regulations which have been developed by the government. So, there is a one-sided direction from smart city projects to the environmental management under this process.

This process is supported by a relevant activity, namely smart city projects consider the regulation. It means that the project leader tries to align their projects with several regulations from the Municipality. Most of the considered regulations are the agenda, plan, or zoning area which was developed by the Municipality, as stated by the interviewees as follow:

"[...] to link this (energy project) to the planning and the agenda of the Municipality, this project would obviously something that good for Amsterdam. So it falls in line with their agenda of the Municipality." (P3)

"[...] Yes (we consider the environmental zone), because that was also used for message for the suppliers [...]. It will be more complicated to go to the city with your polluting vehicles [...]. So, please make sure you prepare for this, and you have to better use the Hub [...]." (P4)

This statements were mentioned by the smart city project leader in the energy and mobility themes. Both of them consider related regulations which might affect their project. They try to align their project with the objectives and rules mentioned in the regulation. But, it seems that the regulations related to spatial planning are less considered by the smart city project leaders because not all of the projects touch the field of spatial planning.

It can be concluded that most smart city projects in Amsterdam consider the regulations from the Municipality directly. But, there is no obligatory for a smart city project to consider the rule because the Municipality themselves also do not provide specific regulation for the project yet. It seems that most

smart city projects consider the regulations, because most of the interviewees stated that they always consider the regulations in the implementation of their project.

4.3.3. Consideration to the Smart City Projects

In this part, the interaction between smart city projects and environmental management happen when the environmental management consider the smart city projects. It means that the Municipality has already included the smart city themes in related environmental policies or agenda and try to legitimate several smart city projects. So, there is one-sided direction from environmental management to the smart city projects under this process. All activities in this process are less relevant which reveals that there is a small effort from the government to consider the smart city projects. I tried to identify that “small effort” based on the activities in this process because there is still an interaction happen even though it gives only a small effect to the other variables.

The most mentioned activities in this process are environmental management includes smart city theme, environmental management consider the smart city projects, and the government creates legitimacy to smart city projects. “The environmental management includes smart city theme” means that the government includes smart city themes, such as energy, mobility, and circular city, in their agenda and policies. Those themes are already included in the various agenda, such as sustainable agenda, mobility agenda, and logistic agenda. In the energy theme, the sustainable agenda already included it as objective on using smart grid, energy-neutral building and district, and the use of digital technologies in the energy projects. In the mobility theme, the mobility agenda already included it also as objective on using digital technologies for the parking system, sensor and cameras in the roads, and electrified vehicles. The circularity aspect also emerge in the sustainable agenda as the Municipality has the ambition to make use of waste as resources.

Another activity is the “environmental management consider the environmental projects”. Based on the transcripts, it seems that the consideration emerges as the Municipality include the smart city theme in their agenda. Besides it also relates to another aspect, which is the government create legitimacy to smart city projects. Interviewee P6 reveals that smart city projects which are successfully tested and validated in the area of Amsterdam can be implemented as a formal project by considering the legal aspects of the project, as he stated as follows:

“[...] so we will make regulations for idea of a company when it’s all validated [...] so they have to try it (the project) first, then we can start to make regulation that fits to it.” (P6)

A reflection on the environmental-related agenda or policies emerges from interviewee P3 which stated that although the Municipality has included several smart city themes, they did not elaborate how to achieve the goals in the agenda. The Municipality seems does not know how to achieve the goals. Therefore, certain smart city projects cannot be directly included in the agenda, because the Municipality still does not know which project will fit in Amsterdam. That is the reason why interviewee P6 stated that the projects have to be tested and validated first in the area of Amsterdam. It also reveals the “learning by doing” and “flexible government” aspect from the smart governance category.

It can be concluded that the environmental management consider the existence of smart city projects in Amsterdam by including its theme to their agenda and creating regulations for tested and validated projects to legitimate it. However, the Municipality still cannot consider a certain smart city

projects which are not tested and validated yet in their policies or agenda. It makes all activities in the consideration to the smart city projects are less relevant, because the government just make a small contribution to the smart city projects.

4.3.4. The “No Interaction” Process

A “no interaction” process was also found from the result which may contribute to the finding of this study. It emerges under the institutional vision development process (see Table 24).

Table 24. Institutional Vision Development Process

| No Interaction Process | Effect | Frequency Mentioned | | Total Number (out of 19 transcripts) | Total Percentage |
|----------------------------------|----------------------------------|---------------------------------------------|-----------------------------------------|-----------------------------------------|------------------|
| | | Total Interviewees (out of 7 interviews) | Total Document (out of 12 documents) | | |
| Institutional Vision Development | Work separately | 3 | 0 | 3 | 16% |
| | Scattered environmental programs | 2 | 0 | 2 | 11% |
| | Disturb other initiatives | 1 | 0 | 1 | 5% |

Less Relevant Effect:

■ Weak ■ Very Weak

“Institutional vision development” has three effects which are under the relevance threshold of interview category. In this process, the interaction between smart city projects and environmental management is analyzed based on the institutional arrangement. The non-governmental and governmental parties work separately as an institution in the field of smart city project and environmental management in Amsterdam. As an institution, they have their own goals, interests, programs, and projects which cannot be aligned with other institutions. So, there is no interaction between smart city projects and environmental management under this process.

The process has two most mentioned effects, namely work separately and scattered environmental programs. Regarding the work separately, most of interviewee mentioned their statements as follows:

“[...] Amsterdam Smart City community is a platform that falls outside our Municipality. So it is sort of, we support it, but it is not a governmental organization.” (P7)

It reveals that “work separately” means the institution of Amsterdam Smart City and Municipality is a separate organization. Consequently, they have different programs to be implemented. It leads to the second effect, namely scattered environmental programs in Amsterdam, as interviewee P2 and P3 stated as follows:

“[...] the difficult part is, it is not one topic or one organization within Amsterdam. It is really topic all over the organizations [...]. (P2)

“[...] because we’re not working together, we often get in the way. It’s not like the Municipality sees Amsterdam Smart City and the Moonshot as an instrument in reaching this goal. It separates things that happen. And you can imagine that doesn’t really help each other [...].” (P3)

These statements reveal that there are different environmental projects which are going on in Amsterdam but not under the domain of the Municipality. The projects are scattered all around Amsterdam. It is the implication of a separate work of the Amsterdam Smart City and Municipality. Another implication is that, each project might disturb each other because each institution formulates their project in which there might be the same project or project with the same partner which is conducted by each institution.

It can be concluded that the Amsterdam Smart City and Municipality is a separate institution which implies to the scattered environmental projects in Amsterdam. The work separation might disturb each other initiative if it has a similar idea and partners. However, as all effects are less relevant, the “private visions” of each institution might be bridged by the work together interaction process.

4.3.5. Conclusion on the Interaction Process between Smart City Projects and Environmental Management in Amsterdam

To conclude, there are two interaction processes reveal from the interaction between smart city projects and environmental management in Amsterdam, namely “work together” and “consider each other”. Each process has relevant and less relevant activities which, in general, can be elaborated as follows: 2 relevant and 14 less relevant activities (see also Appendix I). Moreover, there is a “no interaction” process emerge, namely institutional vision development, but the total percentage indicates that the process is less considered in the interaction because it seems to be bridged by the work together interaction process. The interaction processes emerge under energy and mobility project themes.





CHAPTER 5

DISCUSSION

- 5.1. Smart City Aspects of Amsterdam
- 5.2. Alignment of the Smart City Aspects of Amsterdam to the Conceptual Framework
- 5.3. Environmental Management Aspects of Amsterdam and its Alignment to the Conceptual Framework
- 5.4. The Interaction Process between the Smart City Projects and Environmental Management
- 5.5. Aspects Contributing to the Interaction between the Smart City Projects and Environmental Management
- 5.6. The Interlinkage to Urban Planning
- 5.7. Discussion on Data Analysis

CHAPTER 5. DISCUSSION

So far, based on chapter 4, three concepts from the framework has been elaborated, namely smart city aspects, environmental management aspects, and interaction processes that were identified between them in the case of Amsterdam. Each category has either aspects mentioned from literature or new aspects gathered from the interview and document transcripts. The aspects were categorized based on the relevance threshold which indicates the relevance of an aspect for representing a category based on its frequency mentioned. The less relevant aspects give less contribution to the operationalization of a smart city or environmental-related projects. There are also aspects from the literature which were not found in the transcripts, both from the smart city and environmental management categories, these are labelled as “not relevant” aspects for representing a category. Moreover, two interaction processes were identified, namely “work together” and “consider each other”. A “no interaction” process was also identified, namely the “institutional vision development”.

Moving forward, this chapter will discuss the crosslink between the conceptual framework and the results. The structure of this chapter will be in line with the specific and main research questions (see below). This section will also discuss new theory which “emerges” from the analysis to help me explain about the “no interaction” process (institutional interaction), namely urban innovation system. It will be followed with a discussion on the interlinkage of this study to urban planning to reflect the research findings upon the problem description of this study. At the end of this chapter, a discussion on the analysis method will be elaborated to have a reflection on the challenges and assumptions used in the data analysis process. A discussion about the interlinkage between this study and another research project, called R-LINK, which is investigating the connection between bottom-up incremental initiatives and strategic planning of a city in several sectors, can be seen in Appendix K.

To wrap up, this section will discuss smart city aspects of Amsterdam (5.1), the alignment of the smart city aspects of Amsterdam to the conceptual framework (5.2), environmental management aspects of Amsterdam and its alignment to the conceptual framework (5.3), the interaction process between the smart city projects and environmental management (5.4), aspects contributing to the interaction between the smart city projects and environmental management aspects (5.5), the interlinkage to urban planning (5.6), and discussion on data analysis method (5.7).

A text box will provide a direct answer to the research questions at the beginning of each subsection, more explanation will be presented after that. To recap, these are the general and specific research questions:

- **General research question:**
What kind of aspects do contribute to the interaction between the non-government-based smart city projects and government-based environmental management in Amsterdam?
- **Specific research question:**
 1. *What kind of aspects does the non-government-based smart city projects have in Amsterdam based on the seven smart city categories?*
 2. *How does the non-government-based smart city project aspects of Amsterdam align with the general smart city aspects based on the seven smart city categories?*

3. *What kind of aspects does the government-based environmental management have in Amsterdam based on the three environmental management categories?*
4. *How does the government-based environmental management aspects of Amsterdam align with the general environmental management aspects based on the three environmental management categories?*
5. *How do the non-government-based smart city project and the government-based environmental management interact with each other in Amsterdam?*

5.1. Smart City Aspects of Amsterdam

Specific Research Question 1:

What kind of aspects does the non-government-based smart city projects have in Amsterdam based on the seven smart city categories?

The non-government-based smart city projects in Amsterdam have 43 aspects based on the seven smart city categories. Smart economy has 9 aspects, namely innovation, development of ICT facilities, mobile technologies, capability to transform, entrepreneurship spirit, economic image & trademarks, cost of innovation process, innovation platform, and cost agreement. **Smart people has 5 aspects**, namely participation and coordination in development process, citizen-centric, creativity, social capital, and social lifelong learning. **Smart living has 3 aspects**, namely individual safety, housing quality, and livability. **Smart governance has 15 aspects**, namely stakeholders collaboration, partnership, database resources, collective intelligence, communication, control system, IT Infrastructure, leadership, service-oriented information system, data-exchange, participation, data security and privacy, digital networks, flexible government, learning by doing. **Smart mobility has 4 aspects**, namely sustainable, innovative, and safe transport system, local accessibility, efficient logistics activity, and congestion reduction. **Smart environment has 4 aspects**, namely environmental pollution, sustainable resource management, energy neutral, and circular city. Finally, **education and capacity has 3 aspects**, namely participatory approach, awareness of citizen, and knowledge networks. However, those aspects are mostly based on two smart city project themes, namely energy and mobility.

Based on the result analysis, it reveals that the aspects are in line with Fernandez-Anes and Velazques-Romera (2015). They stated that a smart city is the integration of physical, IT, social, and business elements to achieve a collective intelligence in a city. It is represented by the stakeholders collaboration, partnership, and participatory-related aspects in which there are various actors involved, such as businesses, government, IT, and social parties. Based on their interaction on smart city projects, a collective intelligence is one of the goals in the collaboration. It also shows that the definition developed by Fernandez-Anes and Velazques-Romera (2015) are best to represent the smart governance category, because most aspects supporting the definition come from this category. Moreover, Fernandez-Anes and Velazques-Romera (2015) explained that their definition focuses more on smart city as a connecting tool. It seems in line with the case of Amsterdam, in which the Municipality together with several partners initiated a connecting platform called Amsterdam Smart City with the objective to connect all sectors in implementing a specific smart city project in Amsterdam.

The aspects are also in line with the framework developed by Mosannenzadeh and Vettorato (2014) (see also section 2.1.2), there are four main elements in smart city, namely the necessity of a smart city project development (yellow ring), main elements in smart city project development (blue ring), main

stakeholders involved (green ring), and the way to create a smart city (purple box). The integration of a sub-system, application of ICT infrastructures, investment on social capital, and stakeholders collaboration as stated in the purple box is in line with aspects which emerged in the smart people and smart governance category. There is no aspect about energy and environmental preservation which is stated in the yellow ring. It is important to include it in the yellow ring, because energy transition and environmental preservation are an objective for the smart city implementation, based on the Amsterdam case.

Based on the results, I see that each aspect in a smart city category can have a connection with other aspects. It has also been stated by several scholars in their smart city conceptual framework which was adopted in this study, such as Chourabi et al. (2012) and Mosannenzadeh and Vettorato (2014). As Chourabi et al. (2012) stated that each aspect of the smart city framework influence or is influenced by other aspects. But, their framework was too general, they only elaborated about a general aspect, such as government, technology, people, environment, and etcetera. So, there has to be a discussion towards the connection between aspects specifically. This section will discuss the possible connection among smart city aspects of Amsterdam in each category. Based on my analysis, I assume that the aspects in each category can have a connection with other aspects. There are aspects in each smart city category which represents the end connection in the development of smart city projects in Amsterdam, which will be labelled as “end-aspect”.

5.1.1. Smart Economy

Each identified aspect in the smart economy category seems to have a connection with other aspects. One aspect can support another aspect in the smart economy category as can be seen in figure 19.

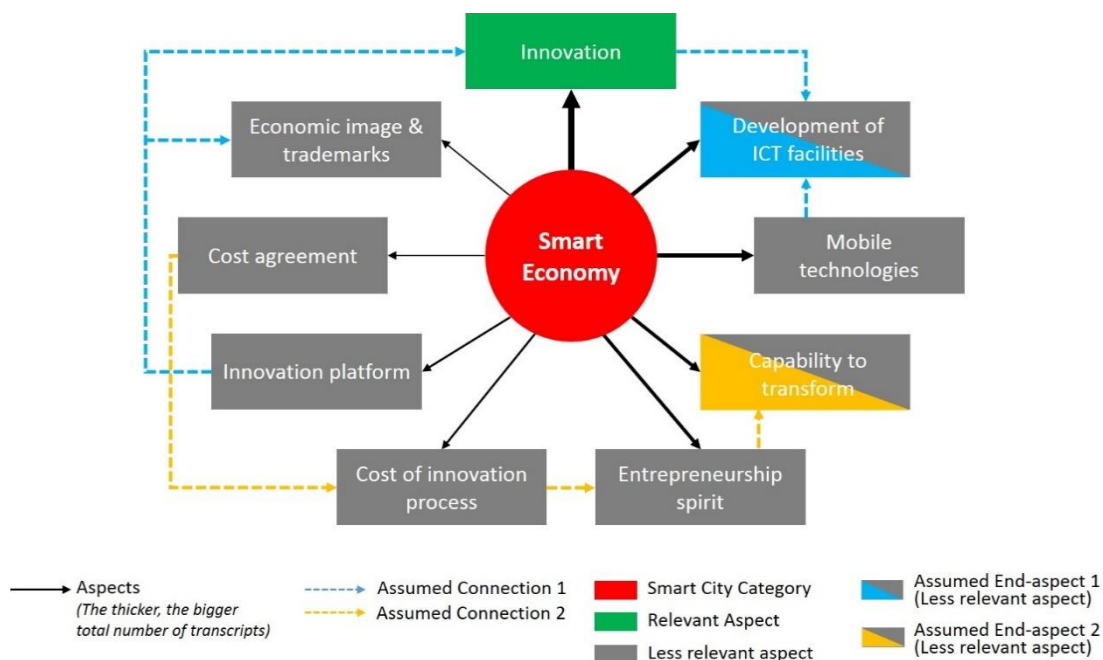


Figure 19. Smart Economy Aspects Connection

There are two important connections between aspects of the smart economy category (see Figure 19). Firstly, the development of ICT facilities is supported by the mobile technologies and innovation; the innovation itself is supported by the innovation platform. It means that all efforts in the innovation platform, which mostly brings ICT innovation, aims to support the development of ICT facilities. The innovation platform becomes also an economic image and trademark of the city as a marketer for all innovation projects. Secondly, a scheme of cost agreement can support the cost of innovation process, which means that if the cost of innovation process can be reduced or investment in the project is beneficial, actors in Amsterdam will have a high entrepreneurship spirit. When the entrepreneur tries to make innovation as business, the product will be broader developed and finally the city can be capable of transforming from one to another technology. Based on the above elaboration, there are two end-aspects in the category of smart economy of Amsterdam, namely development of ICT facilities and capability to transform. Those aspects might be important in this category, but based to the result, both aspects are less relevant for Amsterdam case (see also table 13).

5.1.2. Smart People

Each identified aspect in the smart people category has a connection with other aspects. One aspect can support another aspect in the smart people category as can be seen in figure 20.

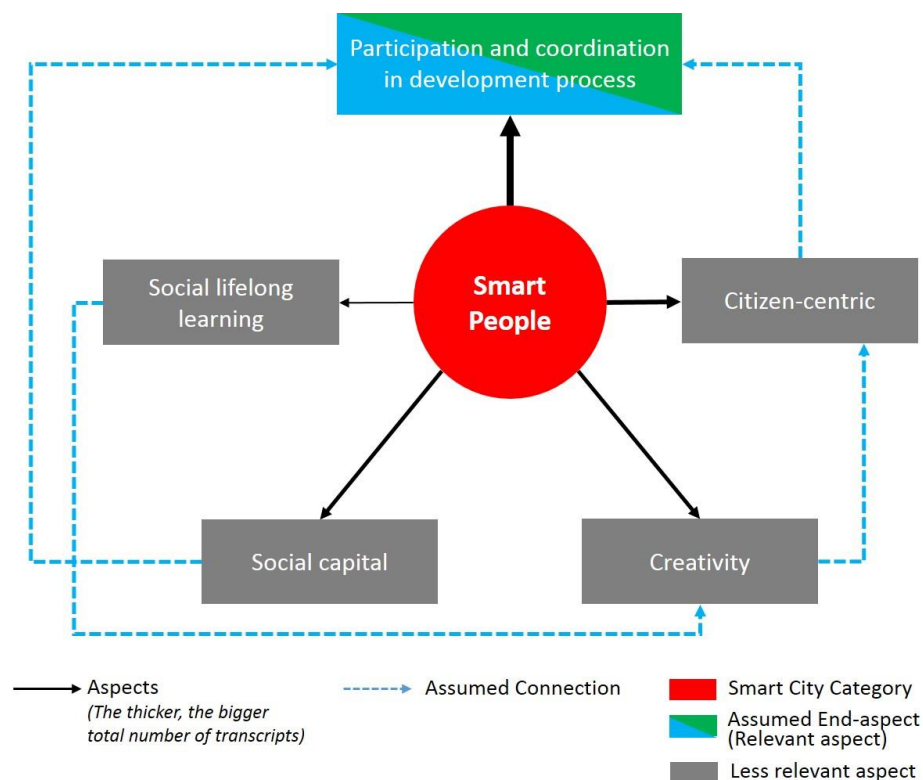


Figure 20. Smart People Aspects Connection

The participation and coordination in development process as the end-aspect in this category has two important points (see Figure 20). Firstly, the social lifelong learning makes people in the city more creative which leads to the citizen-centric aspect. When people in the city become more creative, they can develop related smart city projects in the city based on their interests. The development in the city

becomes more citizen-centric which means that the development is based on the citizen ideas. It reveals that the citizen actively participates in the development process of the city. Secondly, a lot of social capital in the city also supports the participation and coordination in the development process, because they can develop communities which are actively involved in the development process of the city.

5.1.3. Smart Living

Each identified aspect in the smart living category has a connection with other aspects. One aspect can support another aspect in the smart living category as can be seen in figure 21.

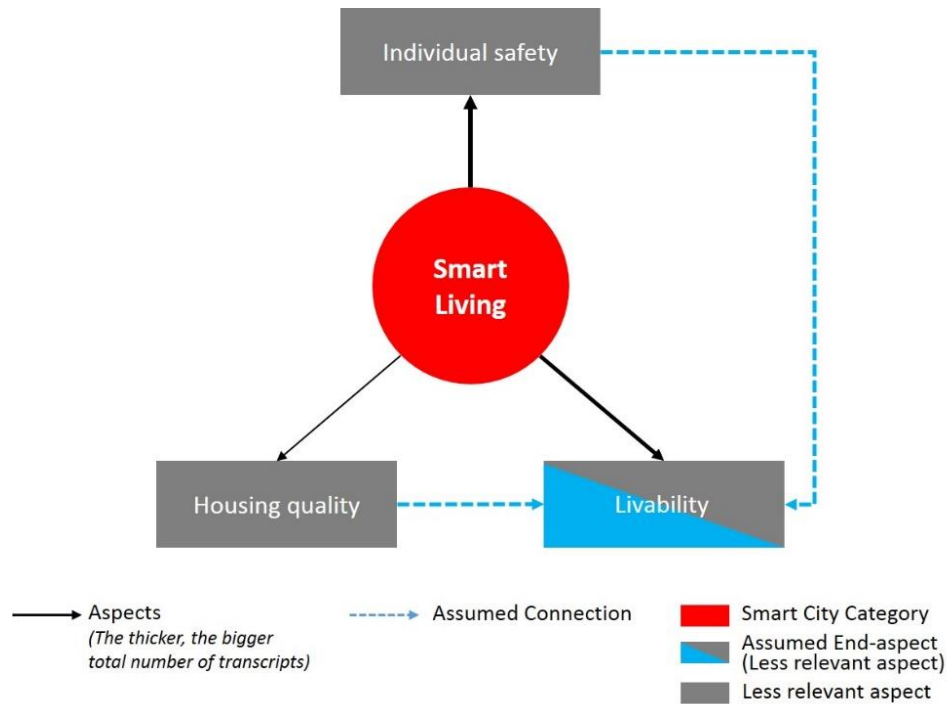


Figure 21. Smart Living Aspects Connection

Livability as the end-aspect even though it is judged as a less relevant aspect in this category (see Figure 21). It reveals that livability is a key goal of all aspects in smart living category, so there are related projects which might still be in the implementation process to achieve the livability. The individual safety emerges in the mobility projects which reveals that the project aims to increase the livability of the city by focusing on the road safety and street lighting. Housing quality emerges in the energy projects which reveals that the project aims to increase the livability of the city by focusing on the transformation of houses to be more energy neutral.

5.1.4. Smart Governance

Each identified aspect in the smart governance category has a connection with other aspects. One aspect can support another aspect in the smart governance category as can be seen in figure 22.

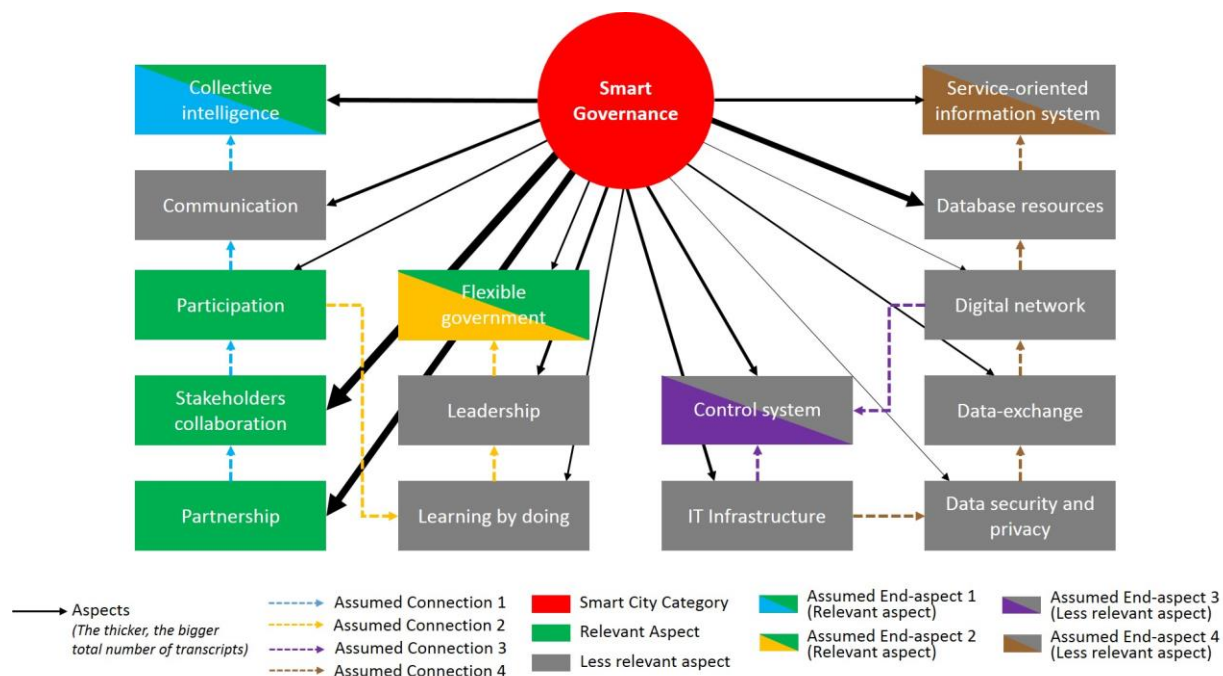


Figure 22. Smart Governance Aspects Connection

There are four important points that need to be elaborated (see Figure 22). Firstly, the emerging of partnership scheme contributes to the emerging of stakeholders collaboration where the stakeholders collaboration increase the participation in a smart city project. A lot of participation and collaboration and many partnerships support the aspect of collective intelligence in which all ideas, knowledge, resources, and experiences from all actors are disseminated. To have a collective intelligence, there has to be communication in the partnership, collaboration, and participation aspects.

Secondly, the participation aspect also drives the project leaders and Municipality to implement the project under “learning by doing” situation. Based on that, the actors will either adopt more or reject several elements from the project to make it suitable in Amsterdam, it includes the rule and technological requirements for the project. It brings the flexible government aspect, where the government acts as flexible as possible to adapt new technologies and provide new standards and rules for the project. It is also supported by the leadership aspect of the government.

Thirdly, the data from digital networks can be used for the control system, where the government can monitor various condition in the city. It is also supported by the IT infrastructure as a medium.

Finally, the data security and privacy determine the optional data-exchange among partners in the city. Once the data can be exchanged, there will be service-oriented information system, where all data will be analyzed to provide service for the citizens. The data security and privacy also determine the digital network. Once, the data from the digital network can be used responsibly, it can be compiled in the database resources. Data from the database resources can also be used for the service-oriented information system. All aspects which interact with the service-oriented information system are supported by the IT infrastructure, where the data and information can be transferred either to the database resources or digital network.

Based on the above elaboration, there are four end-aspects, namely collective intelligence, flexible government, control system, and service-oriented information system, which contribute to the

smart governance category. These aspects might be important in this category, but based on the result, the control system and service-oriented information system are less relevant for Amsterdam case (see also Table 16).

5.1.5. Smart Mobility

Each identified aspect in the smart mobility category has a connection with other aspects. One aspect can support another aspect in the smart mobility category as can be seen in figure 23.

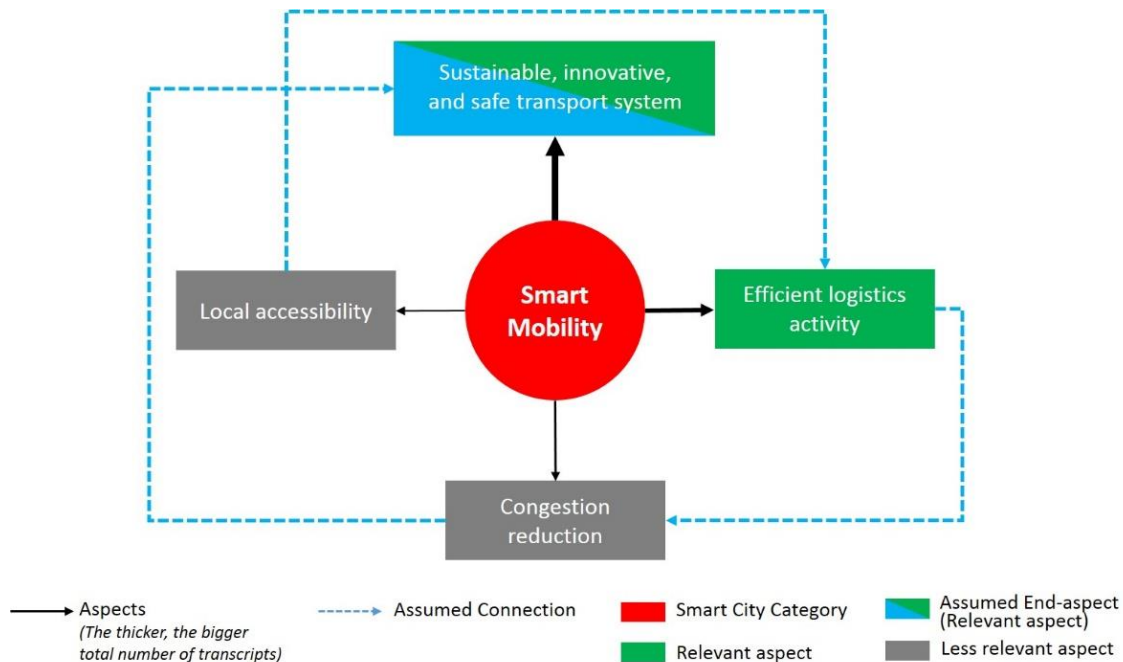


Figure 23. Smart Mobility Aspects Connection

Sustainable, innovative, and safe transport system as the end-aspect in this category (see Figure 23). The local accessibility contributes to the efficient logistics activity which helps to reduce congestion in the city. All of the efforts lead to a sustainable, innovative, and safe transport system. All aspects adopt the sustainable element, because most of it uses environmental-friendly objects, such as electrified vehicles and logistic hub.

5.1.6. Smart Environment

Each identified aspect in the smart environment category has a connection with other aspects. One aspect can support another aspect in the smart environment category as can be seen in figure 24.

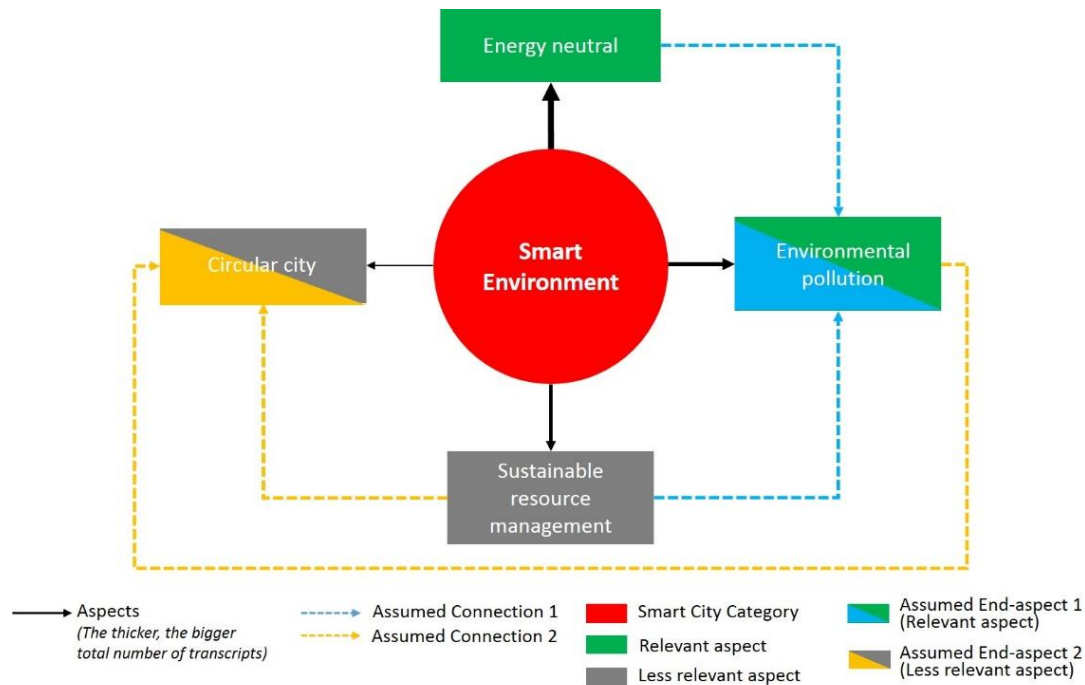


Figure 24. Smart Environment Aspects Connection

There are two important points that can be elaborated (see Figure 24). Firstly, the energy neutral aspect contributes to the reduction of environmental pollution in Amsterdam. Secondly, the sustainable resource management, mostly from waste, contributes to the reduction of environmental pollution. The treatment of waste as resources brings it to a circular city, where all waste resources in the city are treated in various ways to reduce the environmental impact. Based on the above elaboration, there are two end-aspects in this category, namely environmental pollution and circular city. Those aspects might be important in this category, but, based on the result, circular economy is a less relevant aspect in Amsterdam case (see also Table 18).

There is an aspect in this category from Giffinger et al. (2007) which was not included in the result chapter, namely environmental protection. It seems that the environmental protection is an umbrella for all aspects in this category, because all aspects seem to have the objective to protect the environment. It also becomes a reflection towards the theory, as they mentioned environmental protection as an independent aspect in smart city category. Based on the result of this study, it reveals that environmental protection is not an independent aspect, but more as a dependent aspect based on other aspects in the smart environmental category. The essential reason is that all aspects of the category aim to protect the environment. Thus it will be confusing to have environmental protection as an independent aspect in this category.

5.1.7. Education and Capacity

Each identified aspect in the education and capacity category has a connection with other aspects. One aspect can support another aspect in the education and capacity category as can be seen in figure 25.

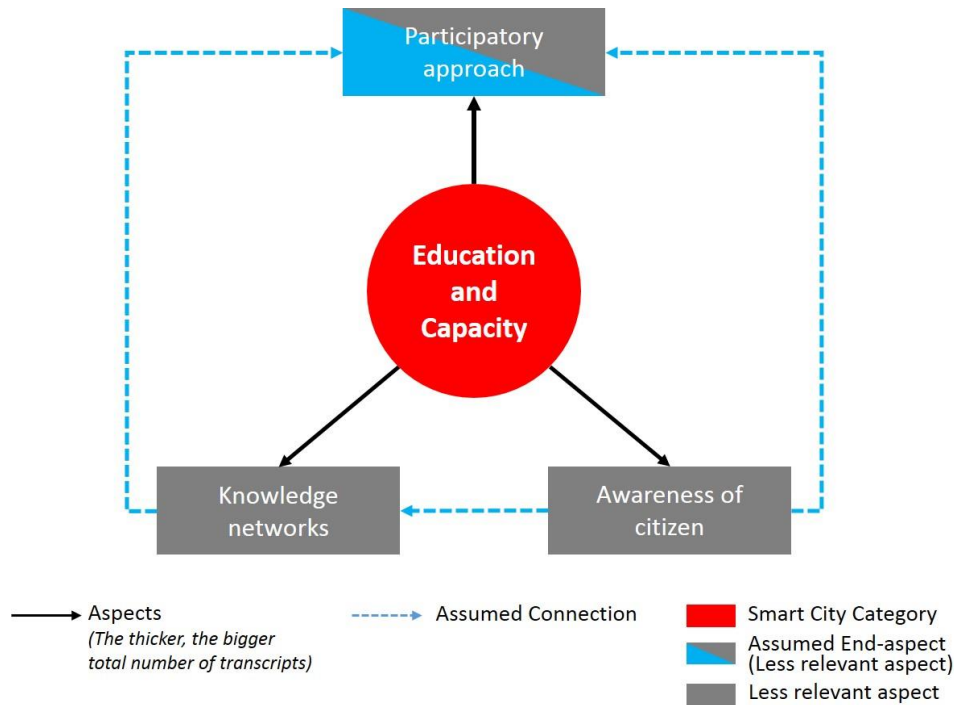


Figure 25. Education and Capacity Aspects Connection

Participatory approach as the end-aspect in this category (see Figure 25). The raising of the awareness of citizen contributes to the participatory approach which is implemented in various smart city projects. The awareness of citizen can also contribute to the knowledge networks, because as people are aware with what happens in the city, they try to take and give insights about a specific knowledge. The knowledge networks also contribute to the participatory approach, as the people use their knowledge networks to participate in the development process of the city.

5.2. Alignment of the Smart City Aspects of Amsterdam to the Conceptual framework

Specific Research Question 2:

How does the non-government-based smart city project aspects of Amsterdam align with the general smart city aspects based on the seven smart city categories?

The aspects of non-government-based smart city projects in Amsterdam can be aligned with other aspects from the conceptual framework based on the seven smart city categories. There is no need to add another category of smart city to accommodate smart city aspects from Amsterdam, because most of aspects found in Amsterdam were also stated in the literature. **However, not all aspects from the literature exist in the case of Amsterdam, while new aspects emerged from the case that can be aligned in the smart city categories.** So, there are three groups of alignment, namely aspects from literature and exist in Amsterdam, new aspects emerge from Amsterdam, and aspects from literature but not exist in Amsterdam. The new aspects make the knowledge of smart city, as a concept, more specific without overriding the aspects from the literature which does not exist in the case of Amsterdam.

Smart city aspects that are used in this study are based on the aspects from various smart city categories and frameworks. The categories of smart city used in this study were based on Dubey and

Sharma (2017) which developed smart city category from Giffinger et al. (2007). Based on Dubey and Sharma (2017), there are seven categories of smart city, namely smart economy, smart people, smart living, smart governance, smart mobility, smart environment, and education and capacity. The categories were adopted for the conceptual framework of this study. Comparing the categories from the literature and results from the interview and document analysis, it reveals that all categories can accommodate smart city aspects of Amsterdam. No new category emerged from the field work, and a used all categories from the literature.

Regarding the smart city aspects, the aspects came from smart city category (on Dubey and Sharma, 2017) and various smart city conceptual frameworks developed by different scholars, namely Nam and Padro (2011), Chourabi et al. (2012), Mosannenzadeh and Vettorato (2014), and Fernandez-Anes and Velazques-Romera (2015). I made an inventory and combined the smart city aspects gathered from those scholars' works. There are 15 aspects in smart economy, 11 aspects in smart people, 8 aspects in smart living, 16 aspects in smart governance, 4 aspects in smart mobility and smart environment, and 6 aspects in education and capacity. Then, I used those aspects in the case of Amsterdam. The alignment of aspects gathered from Amsterdam and the literature resulted in three groups, namely aspects from literature and exist in Amsterdam, new aspects emerge from Amsterdam, and aspects from literature but not exist in Amsterdam (see Figure 26).

Figure 26 shows ten new aspects that emerged from the case of Amsterdam (represented by orange color). These aspects are aligned in the category of smart economy, smart governance, smart mobility, and smart environment. It also makes the knowledge in each category more specific. Scholars can use it to define the degree of smartness of a city. As Giffinger et al. (2007) stated each aspect of smart city could be used to value the degree of smartness in a city. The smart city aspects were also used by Giffinger et al. (2007) to rank the degree of smartness of medium size cities in Europe. The new aspects seem to enhance the quality of valuing the degree of smartness of a city. The aspects in the literature which exist in Amsterdam confirm the smart city theory provided by the scholars.

The aspects from literature which does not exist in Amsterdam can still be applied in each category because the aspects can still be important to value the degree of smartness of a city, as Giffinger et al. (2007) have shown their aspects can be used to rank the smartness of cities in Europe. There are two possibilities why the aspects do not exist in Amsterdam. Firstly, it can be because most of the aspects are formulated with the purpose to value the degree of smartness of a city, not specifically for a smart city project. Whereas, this study focuses on the smart city projects, not the city of Amsterdam, therefore, these aspects might not be well represented at the project level. Secondly, it can be because the aspects do not exist in the smart city projects which are going on in Amsterdam. The interviewee and documents have not stated those aspects.

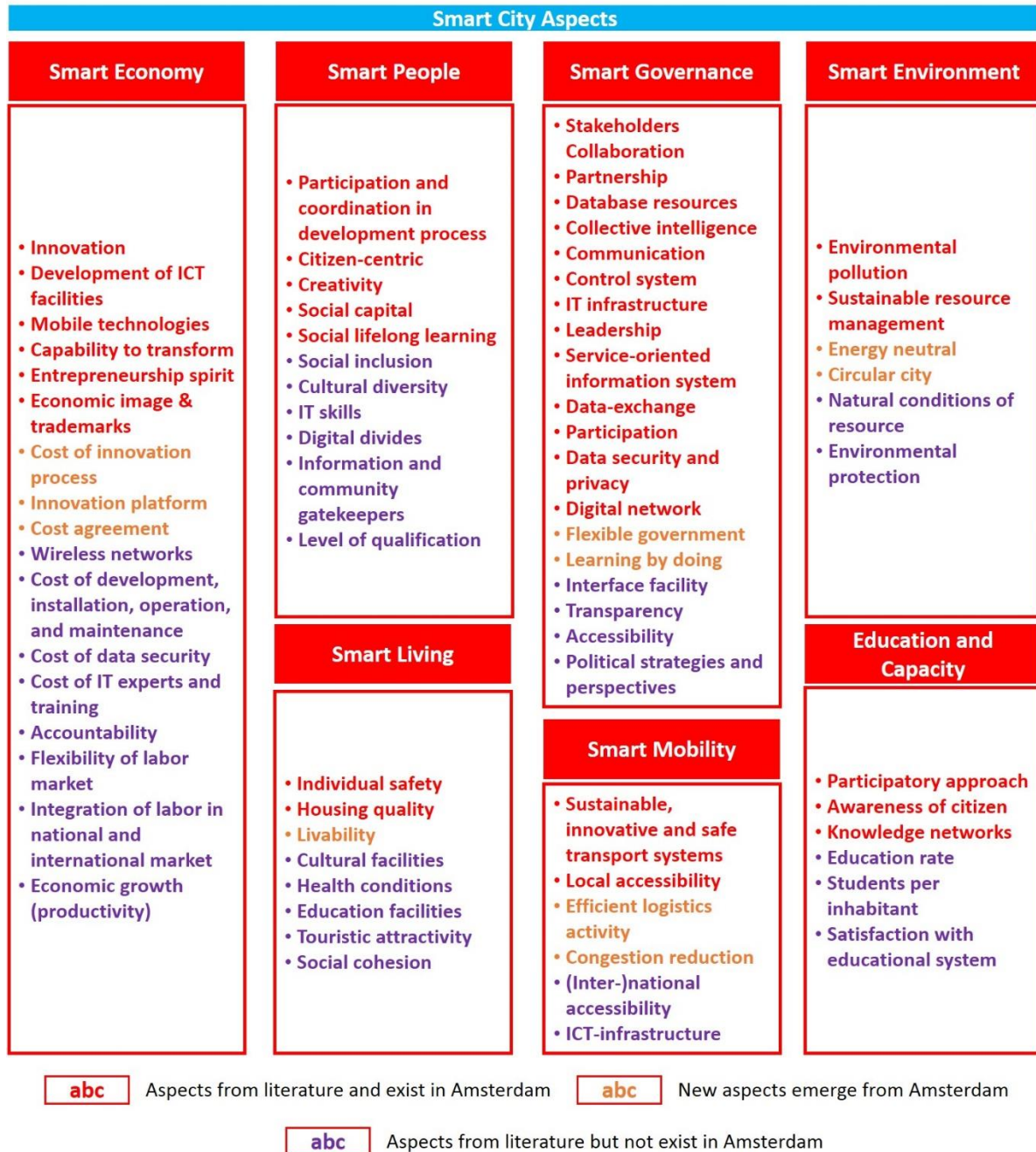


Figure 26. Alignment of Smart City Aspects of Amsterdam to the Conceptual Framework

Moreover, based on the definitions suggested by different scholars (see also section 2.1.1), this study summarized it as follows: smart city is a city which uses Information and Communication Technologies to increase the citizens quality of life by sensing, analyzing, and integrating information through the multi-dimensional approach and collaboration among policy, citizens, research, and private partners in six categories (people, economy, governance, mobility, environment and living). Comparing the definition with the result, it reveals that there is a theoretical reflection upon the definition which can be divided into three parts, namely the use of Information and Communication Technologies, the way of sensing, analyzing, and integrating information, and the smart city categories.

First, comparing with the result, Information and Communication Technologies is not the only tool to increase the citizens quality of life in a smart city. From the Amsterdam case, it reveals that there are several aspects which can contribute to the increasing quality of life of the citizen, such as collective intelligence, stakeholders collaboration, social capital, and awareness of citizen. Those aspects are non-technological elements in the smart city project development, but it is important to be also considered in the development of smart city projects. That is in line with several scholars who stated that human value through education, learning, and knowledge networks should be the central part of the smart city project development rather than depending on Information and Communication Technologies itself as a tool which can improve the citizens quality of life (Hollands, 2008; Nam and Padro, 2011; Cavada et al., 2014; Albino et al., 2015; Alpopi and Silvestru, 2016; Dameri, 2017). It is in line with the statement of Amsterdam Smart City (2017a) in which Amsterdam as a smart city uses Information and Communication Technologies only as an enabler for them, but the end-goal is to develop smart city projects which can both solve certain challenges in the city and create awareness of the citizens. Therefore, most smart city projects in Amsterdam are created by using a co-creation platform, in which all stakeholders, including “ordinary” citizens, can be involved in the process. It is also called by the Amsterdam Smart City as a public-private-people-partnership (P-P-P-P). That confirms the critical statement from Hollands (2015) which stated that the “ordinary” citizens are not well represented when a city only uses public-private partnership in its smart city project development.

Second, it reveals that the way of sensing, analyzing, and integrating information is not only by using Information and Communication Technologies. The result shows that it can also use a co-creation platform where people bring their sense towards the city, discuss it in the platform, and integrating the information from each other. After that, they can come up with a solution towards a certain problem in the city. The sensing, analyzing, and integrating of information is not only in the context of monitoring the city in a real-time basis using the Information and Communication Technologies, then come up with a certain decision, but it is also in the context of citizen as “sensor”, “processor”, and “decision taker” to come up with certain solution based on their needs. That is the essence of a “self-organization” which will be further elaborated in section 5.6.

Third, it reveals that a suggested aspect from Dubey and Sharma (2017), namely education and capacity, represents that a smart city has to enhance their education and capacity level and quality. As Komninos (2011) stated intelligent communities and collective intelligence could contribute to the enhancement of the problem-solving capability of the community and make the governance in the city more efficient.

So, the above definition of smart city can be revised as follows: a smart city is a city which uses both technological and non-technological resources to increase the citizens quality of life by sensing, analyzing, and integrating information through a multi-dimensional approach and collaboration among partners in seven categories (people, economy, governance, mobility, environment, living, and education and capacity). The revised definition seems to have a balance between the technological and non-technological resources which co-influence the smart city project development.

It also has to be noticed that the level of complexity for each smart city category is different. Some categories only have six aspects, such as smart mobility, smart environment, and education and capacity. Some other categories have more than 15 aspects, such as smart economy and smart governance. An attention on the level of complexity is required to deal with a “smart city” project.

5.3.Environmental Management Aspects of Amsterdam and Its Alignment to the Conceptual Framework

Specific Research Question 3:

What kind of aspects does the government-based environmental management have in Amsterdam based on the three environmental management categories?

The government-based environmental management in Amsterdam has 17 aspects based on the three environmental management categories. Advisory has 5 aspects, namely demonstration; advice; education; adopting digital technologies; support initiative. **Economic or fiscal has 5 aspects**, namely subsidy; taxation; grants loans, aid; circular tenders; financial instruments. **Regulatory has 7 aspects**, namely standard and laws; zoning; restriction; monitoring; agenda; agreements; spatial planning. **However, those aspects are mostly based on two themes in environmental-related policies or agenda, namely energy and mobility.**

Specific Research Question 4:

How does the government-based environmental management aspects of Amsterdam align with the general environmental management aspects based on the three environmental management categories?

The aspects of government-based environmental management in Amsterdam can be aligned with other aspects from the conceptual framework based on the three environmental management categories. There is no need to add another category of smart city to accommodate smart city aspects from Amsterdam, because most of aspects found in Amsterdam were also stated in the literature. **However, not all aspects from the literature exist in the case of Amsterdam, while new aspects emerge from the case that can be aligned in the environmental management categories. So, there are three groups of alignment, namely aspects from literature and exist in Amsterdam, new aspects emerge from Amsterdam, and aspects from literature but not exist in Amsterdam. The new aspects make the knowledge of urban environmental management, as a concept, more specific without overriding the aspects from literature which does not exist in the case of Amsterdam.**

A comparison on the results analysis with the urban environmental management concept developed by Barrow (2006) reveals that most of aspects gathered from Amsterdam are in line with the theory. The most relevant aspect in advisory category, which is advice, and economic or fiscal category, which is subsidy, came from the literature. There is a shifting definition on the advice aspect from the theory to this study. Barrow (2006) suggested the examples of advice are giving publication in the leaflet, drop-in shops, and helplines. This study interpreted advice as an active role of the government which contains three elements, namely advise partners, encouragement, and connecting people. So, it shows that in theory, advice is more on developing a publication for advising people, whereas the result shows that advice may also refer to an active role of the government to directly (face-to-face) advise people by encouraging and connecting them in a certain occasion to manage the environment.

The most relevant aspect in the regulatory category is agenda. The agenda aspect refers on the visions and ambitions of the government towards a certain idea in which there are no aspects from the literature which can accommodate the idea. Barrow (2006) only suggested standards and laws which is more on the rules and policies from the government, whereas an agenda is not a policy but a vision and ambition of

the government to be achieved in the future. This aspect can be considered as a “new” aspect which can contribute to the theory.

However, I am aware that the urban environmental management concept used in this study come from literature which was published in 2006. I could not find recent literature which can add new insights for this study regarding the definition, categories, and aspects of urban environmental management. There might be other relevant literature that can contribute to this study.

Regarding the alignment to the conceptual framework, environmental management aspects used in this study are based on the aspects from three environmental management categories developed by Barrow (2006), namely advisory, economic or fiscal, and regulatory. Comparing the categories from the literature with the result, it reveals that all categories can accommodate environmental management aspects. Besides, there is no new category emerge from the field and a withdrawn from the literature. The categories from the literature can be applied in the case of Amsterdam.

Regarding the environmental management aspects, it came from aspects in each environmental categories in Barrow (2006). Then, I tested those aspects in the case of Amsterdam. The alignment of aspects from Amsterdam and the literature resulted in three groups of alignment, namely aspects from literature and existed in Amsterdam, new aspects emerge from Amsterdam, and aspects from literature but not existing in Amsterdam (see Figure 27).

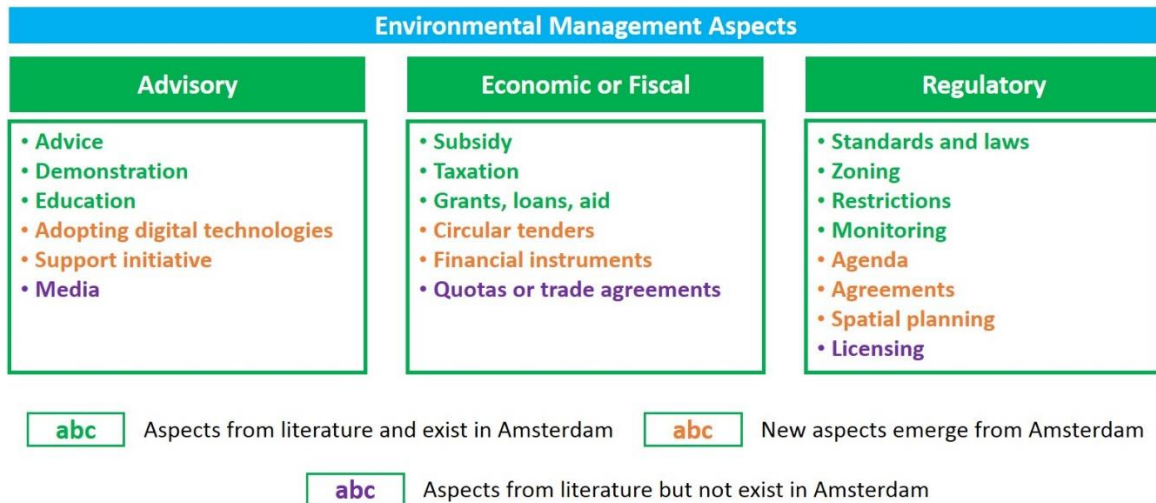


Figure 27. Alignment of Environmental Management Aspects of Amsterdam to the Conceptual Framework

Figure 27 shows seven new aspects that emerge from the case of Amsterdam (represented by orange color). The aspects are aligned in all categories which also make the knowledge in each category more specific.

The new aspects make the definition of each category more specific. The advisory, based on Barrow (2006), means the spreading of related environmental knowledge or policy to gain the awareness of people. A new aspect in the category, namely adapting digital technologies, is likely in line with the definition. But another aspect, namely support initiative, cannot be accommodated within that definition. Support initiative is more giving assistance to the environmental-related projects in which one of the assistance is by giving advice. A new element can be added into the definition of advisory based on Barrow

(2006), namely assisting. So, advisory is not only about spreading environmental knowledge or policy but also assisting the people to make an environmental policy or projects successfully implemented.

The definition of economic or fiscal is also expanded. The economic or fiscal, based on Barrow (2006), means the use of economic policy instruments to drive the behavior of people from the economic side when dealing with environmental issues. The new aspects in the category, namely circular tenders and financial instruments, can be accommodated on that definition because those aspects can drive the people to have better behavior in dealing with their environment. But grant, loan, and aid aspect, which is related to investment, cannot be accommodated within that definition. The elements cannot steer the behavior of people directly in dealing with the environmental issues. The grant, loan, and aid is more on the funds which will be spent to have something that is profitable or useful in the future. In the case of Amsterdam, grant, loan, and aid are used to implement new technologies and environmental-related projects. New element can be added into the definition of economic or fiscal based on Barrow (2006), namely grant, loan, and aid. So, economic or fiscal is not only driving behavior of people when dealing with environmental issues, but also give room for an investment from grant, loan, and aid to implement an environmental project which profitable and useful in the future which can change the behavior of people in a long-term basis.

Finally, the definition of regulatory can also be expanded. The regulatory, based on Barrow (2006), means the steering of the people to do or not to do something related to the environment. New aspects in the category, namely agreements and spatial planning, can be accommodated within that definition because those aspects can steer the behavior of people towards their environment. But an agenda cannot be accommodated within that definition. Agenda cannot steer the behavior of people directly in dealing with their environment, but more on the regulatory objective. It means that the government put the aspect in their regulatory instruments to have a common understanding towards “things to be done” in the future. Although the aspect is not a direct instrument for the government to steer the behavior of people from the regulatory side, it gives common insights for related parties in the city about the regulatory objectives formulated by the government. Therefore, people will take a look at the objectives and then they will automatically focus on those objectives. Based on that, it also can steer people to behave better to the environment based on the regulatory objectives. A new element can be added to the definition of regulatory based on Barrow (2006), namely regulatory objectives. So, regulatory is steering people to do or not to do something related to the environment either directly from the implemented-regulations or indirectly from the regulatory objectives which become a common guideline for people to do something towards the environment.

Aspects from literature which does not exist in Amsterdam can still be important to be an alternative instrument for environmental management. The aspects do not exist in Amsterdam because the Municipality just does not adopt these aspects yet in their environmental-related agenda and policies in Amsterdam.

5.4. The Interaction Process between the Smart City Projects and Environmental Management

Specific Research Question 5:

How do the non-government-based smart city project and the government-based environmental management interact with each other in Amsterdam?

The interaction process between non-government-based smart city projects and the government-based environmental management in Amsterdam based on the interaction prerequisites are “work together” and “consider each other”. There has also a “no interaction” process emerged, namely “institutional vision development”. Based on that findings, there are two level of interaction found in Amsterdam. The first level is institutional interaction which results in the smart city projects and environmental management. At this level, new theory emerge, namely urban innovation system which was used to explain the institutional interaction. The second level is the interaction between smart city projects and environmental management (projects interaction). **From the level of interaction, it is concluded that the interaction at the second level cannot start if there is no interaction at the first level. An institution must have a reason first as a prerequisite to start an interaction process.**

The result reveals two levels of interaction that were identified from the case of Amsterdam. The first level is the institutional interaction and the second level is the smart city projects and environmental management interaction (projects interaction) as can be seen in figure 28.

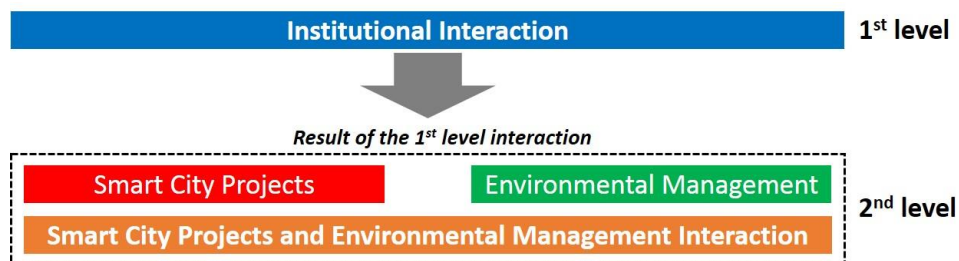


Figure 28. Level of Interaction in the case of Amsterdam

Figure 28 presents the level of interaction in the case of Amsterdam. The first level is an institutional interaction which was analyzed by using a new theory adopted for this study, namely urban innovation system. This theory helps me to explain the interaction among actors involving in a smart city project and environmental management of Amsterdam. It will be further discussed in section 5.4.1. Then, the interaction between institutions in Amsterdam results in the smart city projects and environmental management which interact with each other because the institutions also interact with each other. A new insight emerges, an interaction between smart city projects and environmental management will only exist if the institutions interact with each other. Section 5.4.2 will further elaborate that insight by showing the interaction processes.

5.4.1. Institutional Interaction

I conducted a separate study to analyze the institutional interaction between institutions which interact with each other in implementing smart city projects in Amsterdam. The full result of the study and further explanation about urban innovation system theory can be seen in Appendix J. This section will only present the result of the study on the interaction among institutions by using an urban innovation system framework as can be seen in figure 29.

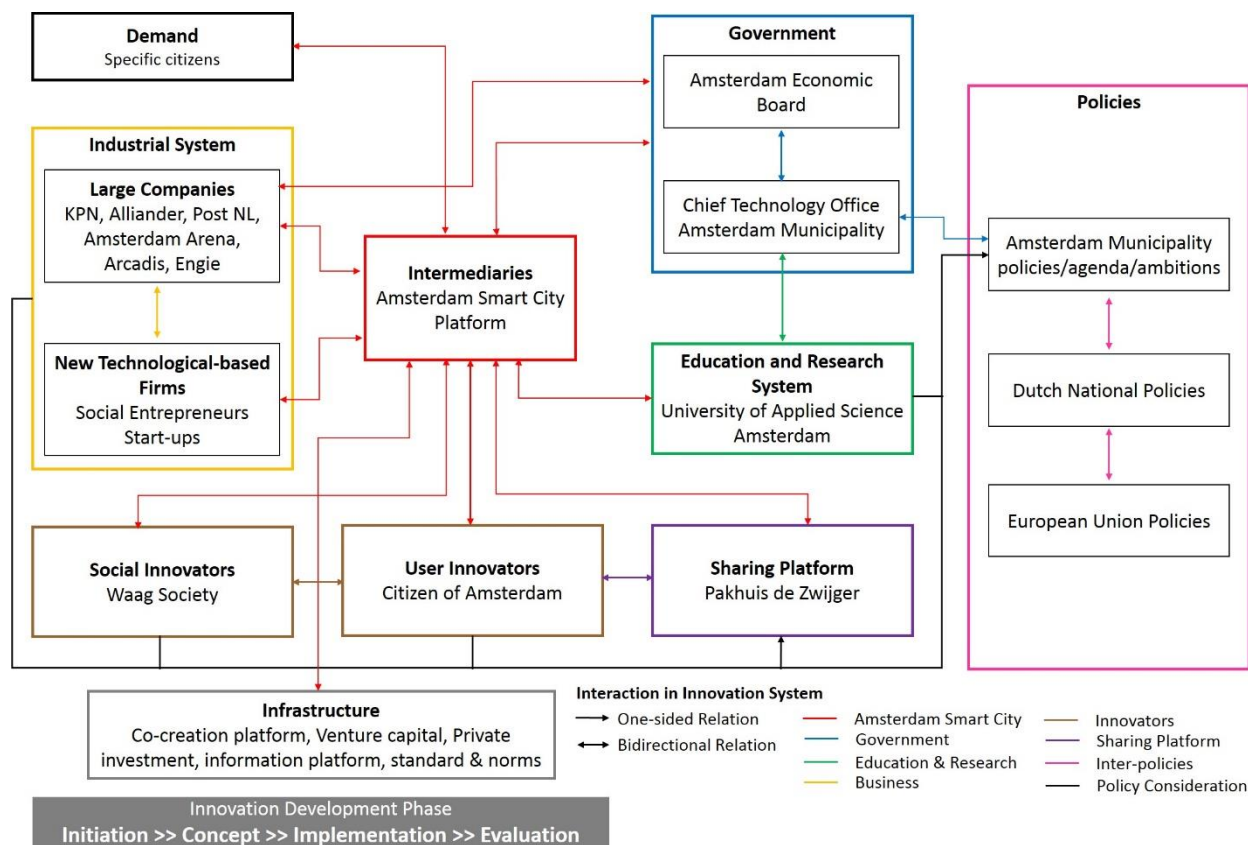


Figure 29. Institutional Interaction in the Innovation System of Amsterdam
(Source: based on the paper result in Appendix J)

Figure 29 presents the interaction between institutions in the innovation system of Amsterdam. From the perspective of urban innovation system theory, an institution is called an actor. There are two kinds of relationships between actors in an urban innovation system, namely a one-sided and a bidirectional relation. A one-sided relation is a relationship that has only a one-way direction of the connection and interaction. For instance, actor X connect and interact with actor Y, but there is no response from actor Y to connect and interact with actor X. However, actor X gets information from actor Y from the open-information provided by actor Y. A bidirectional relation shows a two-way direction of the connection and interaction, active exchange of information between actor X and Y. The actors dynamically interact with each other in different development phases, namely initiation, concept, implementation, and evaluation (see the grey box in the Figure 29). Each actor can join in a different phase based on their interests and resources. The framework used in the study is based on the dynamic interaction between actors within the innovation system.

Based on figure 29, the Amsterdam Smart City platform is the intermediary actor in the innovation system that plays a central role as an active actor to connect various actors. So, all actors have a bidirectional relation with the platform, because there is an exchange of information from one to the other actors through an intermediary actor, the Amsterdam Smart City platform. It is in line with the statement of Amsterdam Smart City (2017a) that Amsterdam Smart City wants to be a “networked organization” to connect and facilitate various parties in Amsterdam to deal with the urban problems in Amsterdam. Therefore, the demander is a particular type of citizen which have related societal problems

in Amsterdam. The citizens can be people who are living in a particular area or a category of people. The societal problems are related to recent issues in the city, such as environmental degradation, CO₂ emissions, and crowdedness which have impact on the citizens.

Looking into more detail, there are two governmental actors included in the innovation system, namely the Amsterdam Economic Board (AEB) and the Chief Technology Office of Amsterdam Municipality (CTO). The AEB seems to have a role as the connector between large companies, the Amsterdam Smart City and the CTO. The large companies sometimes directly connect with the CTO as a Municipality body to propose a smart city project. The CTO also has a role to connect the program partners of Amsterdam Smart City to the other departments within the Amsterdam Municipality. This reveals that not all Municipality departments are involved in the innovation system. That means that not all smart city projects that are currently going on in Amsterdam are linked with the agenda of the Municipality. However, the Municipality, through CTO, has high consideration towards the existence of the innovation system. Only the CTO as a representative of the Municipality legitimates the smart city projects by creating related regulations and requirements which are needed if the projects have been successfully tested and validated in Amsterdam area. Therefore, when the projects are being tested and validated, actors in the system are restricted and shaped by the policies/agenda of the Municipality, while there is no legitimation for them from the Municipality as a government institution.

Regarding the innovators and sharing platform, we came across unique actors in the system. There is the Waag Society that focuses on the specific research related to arts, culture, and emerging technologies. As it is a research community, it can be considered as a social innovator that brings related innovation to the citizens and platform. The citizens of Amsterdam can be considered as a user innovator because they are not only a user, they also can propose and develop their own innovative ideas to the platform. They also have interaction with the Waag Society and the sharing platform, because of their possible involvement with these institutions. Pakhuis de Zwijger is a platform for citizens of Amsterdam to discuss about recent circumstances in the city. They have an annual meeting for which they invite citizens to discuss about their perception of living in the city. Amsterdam Municipality also support the sharing platform by providing subsidy to them and be present in the meeting to hear about the citizen's problems, needs, and ideas directly. In that way, the sharing platform has a tight connection with the Municipality.

Another actor is the Amsterdam University of Applied Science which is a partner of the Amsterdam Smart City platform as an education and research institute. The university provides a research-based initiative which is related to the smart city projects in Amsterdam. They conducted research about the organization of Amsterdam Smart City itself and smart city projects which can be implemented in Amsterdam. Next to the platform, the university also has a tight relationship with the Amsterdam Municipality through the CTO. They can propose a research as a smart city project, and ask the CTO to connect them with other Municipality departments.

To implement the smart city projects successfully, most actors through Amsterdam Smart City use various infrastructures both in the development process and during the implementation of the projects. In the development process, most of the smart city projects are developed by creating a co-creation platform which involves stakeholders in an annual meeting or discussion. For this, people can give their opinion towards a smart city project. In that way, the project can be in line with the expectation of the users. Then the initiator needs to acquire venture capital or private investment as a funding source to be

able to implement the project. The Municipality does not provide subsidy for all smart city projects, therefore the initiators have to look for other funding alternatives themselves. For this part, Amsterdam Smart City has a role as a marketer for the projects offering the prospective investors to have an overview of all interesting projects within the platform. The platform also becomes a source of information as a digital agglomeration of smart city projects, where people can get an overview about different projects easily. Thus, the projects might have a higher chance to be funded when it is registered in the platform.

Finally, interaction among actors, their roles, and the smart city projects are restricted and shaped by the standard, norms, and policies in the city. Each actor consider the policies applied by the government. The Municipality is obligatory to consider other levels of policies, such as national and European Union policies that are related to the smart city projects. The Municipality might receive a positive impact from a higher policy level, such as a grant, or a national/international pilot project on smart city, and thus creating a higher chance of investment and scaling up the project.

5.4.2. Smart City Projects and Environmental Management Interaction

The result reveals two interaction processes that are identified between smart city projects and environmental management, namely “work together” and “consider each other”. This section will discuss a comparison of the interaction process with the theory used in this study. The theory stated that interaction is an activity or occasion of two or more variables in a particular way which has direct mutual or reciprocal action, effect, or influence to one another. Besides, Steiger (2009) stated that representation of the interaction can be indicated by an arrow, wires or slings (see also section 2.3). This section will discuss about the representation of the interaction processes by using a path diagram which also helps to show all interaction prerequisites (see also section 2.3). First, the interaction process in “work together” can be seen in figure 30.

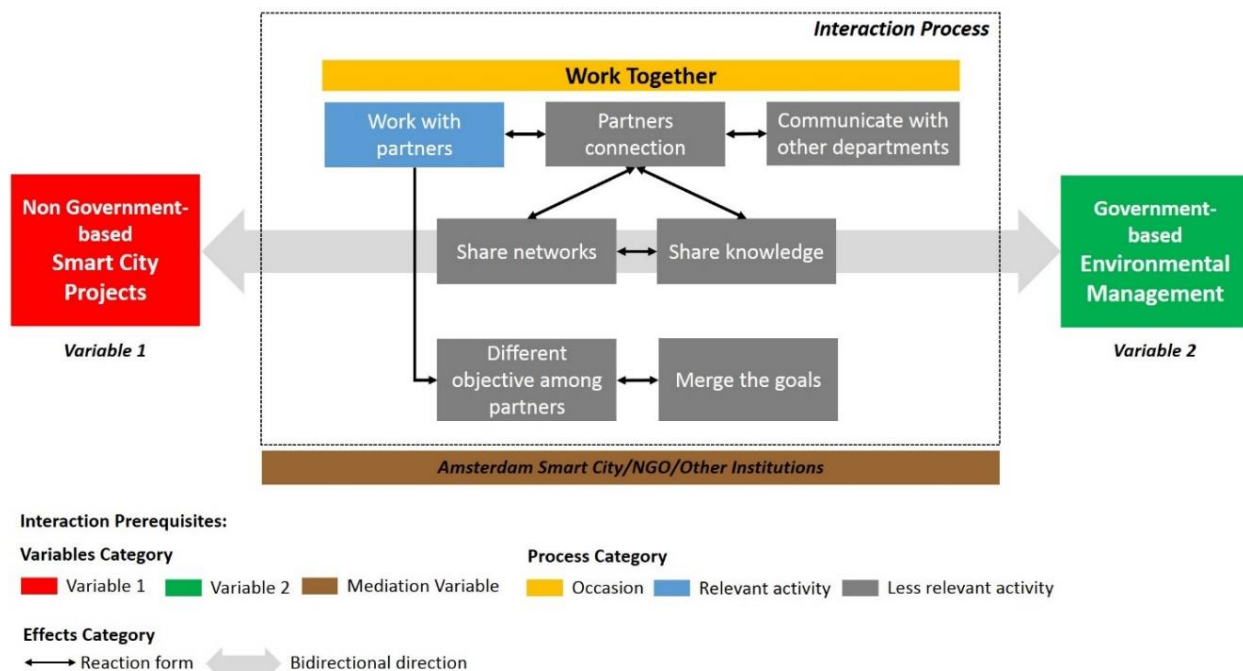


Figure 30. Interaction Process in “Work Together”

Figure 30 shows that all prerequisites of interaction has been fulfilled. There are two variables and a mediation variable to make the smart city projects and environmental management begin the interaction process. The “work together” is labelled as an occasion in the process. Then, the actors begin their reciprocal activities, such as work with partners, share knowledge and networks, and communication. The last prerequisite is the reaction form, which is represented by the slings between activities, such as merger each actor’s goals as a consequence of the “work together” process and debating about the end-goals of the project. In this process, the interaction is more on the type of approach which an institution or actor from each variables try to interact with the other.

Second, the “consider each other” has an interaction from one to another and is represented by a sling (see Figure 31).

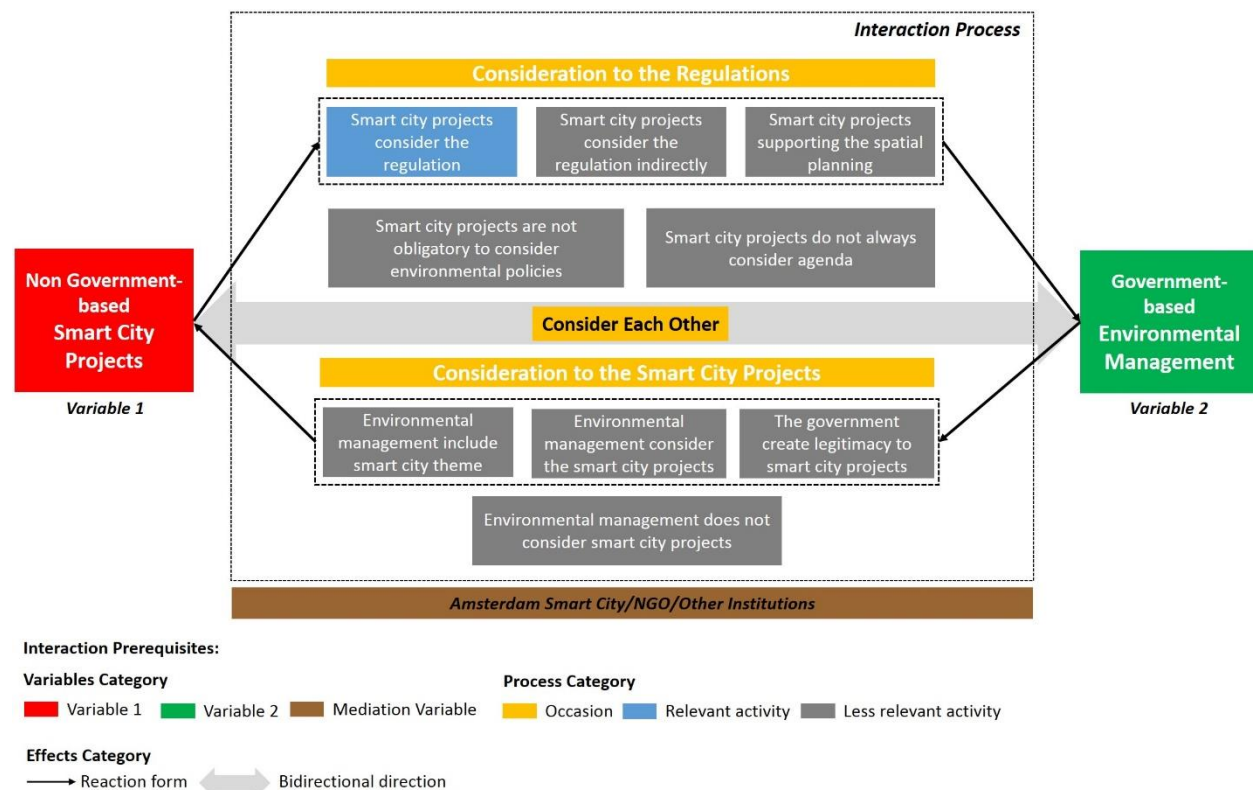


Figure 31. Interaction Process in “Consider Each Other”

In figure 31, an interaction effort of a variable to another is represented by arrows. The arrows represent a direct relationship between the variable and activities, and in vice versa, which indicates a direct relationship but in one-sided direction. It shows that an occasion and activities are happening in the middle of an interaction process between two variables. On the one hand, the smart city projects consider the environmental management regulations which are represented by three aspects, and on the other hand, the environmental management considers the smart city projects which are also represented by three aspects. It is represented by a bidirectional direction (represented by a sling) between the smart city projects and environmental management.

Figure 31 shows that all prerequisites of interaction has been fulfilled. There are two variables and a mediation variable to make the smart city projects and environmental management begin the

interaction process. The “consider each other” is labelled as an occasion in the process. The actors begin their reciprocal activities which come from each side, such as consider the Municipality agenda and regulations (from smart city projects side) and create legitimacy to the smart city project (from the environmental management side). The last prerequisite is the reaction form, which is represented by activities, such as propose a technical and regulation requirement for a tested smart city project to the government (from the smart city projects side) and include smart city theme in the government agenda (from the environmental management side).

There is no interaction in the process of “institutional vision development”, because there is no mediation variable to start an interaction process between them (see Figure 32).

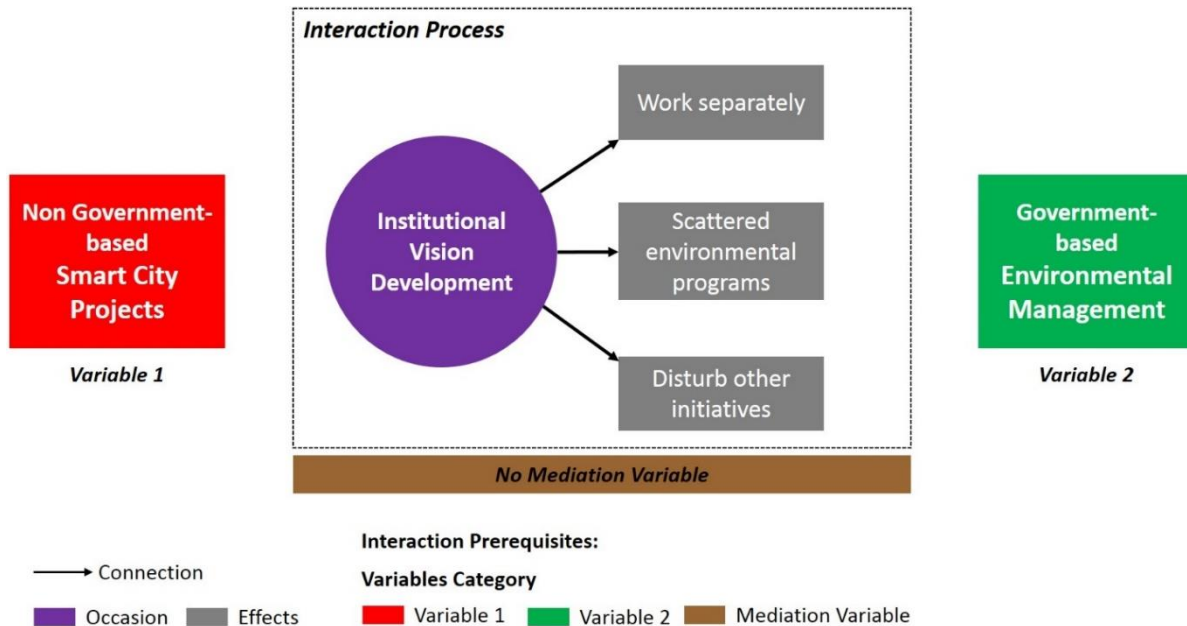


Figure 32. The “No Interaction” in Institutional Vision Development Process

Figure 32 shows that the interaction prerequisites are not fulfilled. It gives this study a finding, that an interaction cannot take place between them if there is no mediation variable. As the mediation variable does not present, the other prerequisites, namely occasion, reciprocal activities, and reaction form, also do not present. So, it is just the “no interaction” process and its effects.

The “no interaction” process represents the institutional separation between the Amsterdam Smart City and Amsterdam Municipality which might cause scattered environmental projects, because each institution has their own vision, ambitions, and programs to be achieved and implemented in Amsterdam. Additionally, each institution can implement their various environmental projects everywhere in the city. But as an institution, they have to interact with others in a project development, therefore, when they work together in a specific project, there will be no work separation among institutions. It is also in line with the urban innovation theory (see Appendix J) which reveals that the interaction among institutions in an innovation process is at the project development level, not at the institutional level, as has been elaborated in the section 5.4.1.

Furthermore, Steiger (2009) did not elaborate the way to represent two variables which have no interaction. Therefore, this process is represented by no arrows or slings between the smart city projects and environmental management. This study might have choose a wrong theory for the interaction representation because a path diagram cannot represent the “no interaction” process.

It can be concluded that the interaction process has different activities which reveals that the interaction between smart city projects and environmental management in Amsterdam cannot be generalized into one interaction process. The definition of interaction makes a narrower understanding on an interaction. Two variables have interaction if only they have a bidirectional direction. If two variables only have a one-sided or no direction to each other, it cannot be seen as an interaction.

5.5.Aspects Contributing to the Interaction between the Smart City Projects and Environmental Management

General Research Question:

What kind of aspects do contribute to the interaction between the non-government-based smart city projects and government-based environmental management in Amsterdam?

Aspects which contribute to the interaction between the non-government-based smart city projects and government-based environmental management in Amsterdam depends on the interaction process between them. **The “work together” is supported by eight aspects in smart city and six aspects in environmental management categories. The “consider each other” is supported by six aspects in smart city and four aspects in environmental management categories.** It reveals that aspects between smart city and environmental management have a linkage which show that there is an interaction between smart city projects and environmental management, as a concept, through the aspects of smart governance. **In the “work together”, collective intelligence seems to be a foundation aspect from the smart governance in building the interaction process. In the “consider each other”, flexible government seems to be a foundation aspect from the smart governance in building the interaction process. So, aspects in smart governance category become a foundation for the interaction processes between the non-government-based smart city projects and government-based environmental management in Amsterdam.**

Referring to the aim of this study and the general research question, this section discusses aspects which contribute to the interaction process between the smart city projects and environmental management. The finding is based on the analysis and discussion of specific research questions as elaborated in the previous sections. The kind of aspects which contribute to the interaction will be elaborated based on each interaction process. I only include the relevant aspects of smart city and environmental management to the interaction processes, because it represents the most considered aspects in the smart city and environmental-related projects implementation in Amsterdam (see Table 25).

Table 25. Aspects Contributing to the Interaction Processes in Amsterdam

| No | Interaction Process | Aspects | |
|----|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | Smart City | Environmental Management |
| 1 | “Work Together” | Smart Economy - Innovation Smart People - Participation and coordination in development process Smart Governance - Stakeholders collaboration - Partnership - Collective intelligence - Participation Smart Mobility - Sustainable, innovative, and safe transport system Smart Environment - Energy neutral | Advisory - Advice - Adopting digital technologies Economic or Fiscal - Subsidy - Grants, loans, aid - Financial instruments Regulatory - Standards and laws |
| 2 | “Consider Each Other” | Smart Economy - Innovation Smart Governance - Flexible Government Smart Mobility - Sustainable, innovative, and safe transport system - Efficient logistics activity Smart Environment - Environmental pollution - Energy neutral | Advisory - Support initiative Regulatory - Standards and laws - Zoning - Agenda |

Table 25 shows that not all aspects and categories both from smart city and environmental management contribute to the interaction processes. There are eight aspects in five categories of smart city and six aspects in three categories of environmental management contribute to the “work together” interaction process. There are six aspects in four categories of smart city and four aspects in two categories of environmental management contribute to the “consider each other” interaction process. It means that, in Amsterdam, the smart city projects and environmental management will “work together” and “consider each other” if only those aspects emerge in the middle of the interaction process. I identified that the emerging of the aspects in the middle of an interaction process is based on an “interaction building”. So, there has to be a “foundation”, “column”, and “roof” in building an interaction process between the two variables. Reflecting to the section 5.4.2 (see also Figure 30 and 31), an “interaction building” emerges in each process. The following sections will further elaborate the “interaction building” in each interaction process.

5.5.1. “Work Together” Interaction Building

The interaction building of “work together” has a foundation and three piles, two columns, and a roof that becomes a bridge to make the interaction process happen (see Figure 33).

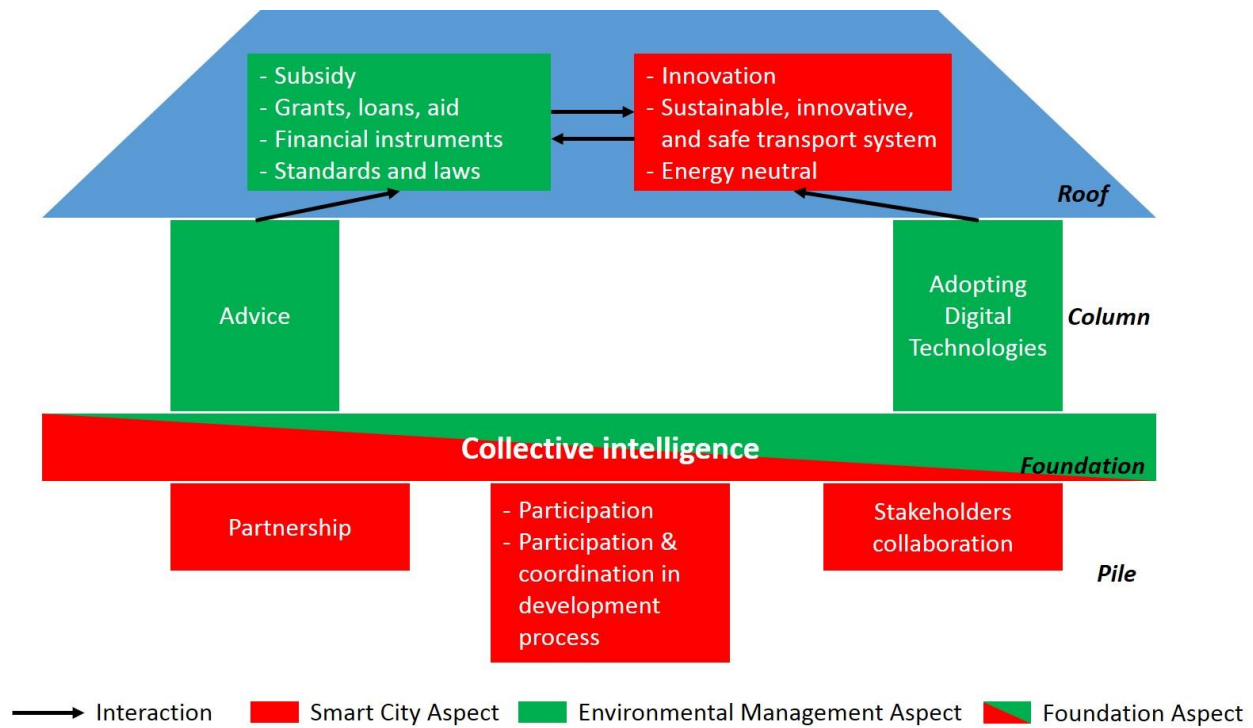


Figure 33. The Position of Aspects in the “Work Together” Interaction Building

Collective intelligence is considered as a basic foundation for the “work together” interaction process (see Figure 33). I consider it as a key aspect in the interaction process, because if there is no collective intelligence, other aspects cannot emerge in the process. Consequently, an interaction cannot happen. I assumed that there are three piles that support the collective intelligence, namely partnership, participation, and stakeholders collaboration. Those aspects need to emerge first to make a collective intelligence. Two columns stand to support the interaction, namely advice and adopting digital technologies, both are environmental management aspects. The advice aspect give room to the non-governmental parties to discuss about a smart city project with the governmental parties. In the process, the non-governmental and governmental parties seem to discuss an economical instrument, such as subsidy, grants, loans, and aid, and financial instrument, and regulations to make the project happen. The adopting digital technologies aspect gives an opportunity for non-governmental parties to make an innovation. Since this research only focuses on the energy and mobility project themes, the innovation is only identified in the energy neutral and sustainable, innovative, and safe transport system aspects. In the roof, the non-governmental and governmental parties interact. The interaction seems to appear via a discussion or co-creation platform, where the governmental parties can give their advice and information about economic and regulatory instruments to the non-governmental parties. While, the non-governmental parties can give their knowledge and innovative projects to the governmental parties. So, the foundation and its piles, columns, and roof become a unity to build a “work together” interaction process.

5.5.2. “Consider Each Other” Interaction Building

The interaction building of “consider each other” has a foundation, two columns, and a roof that becomes a bridge to make the interaction process happen (see Figure 34).

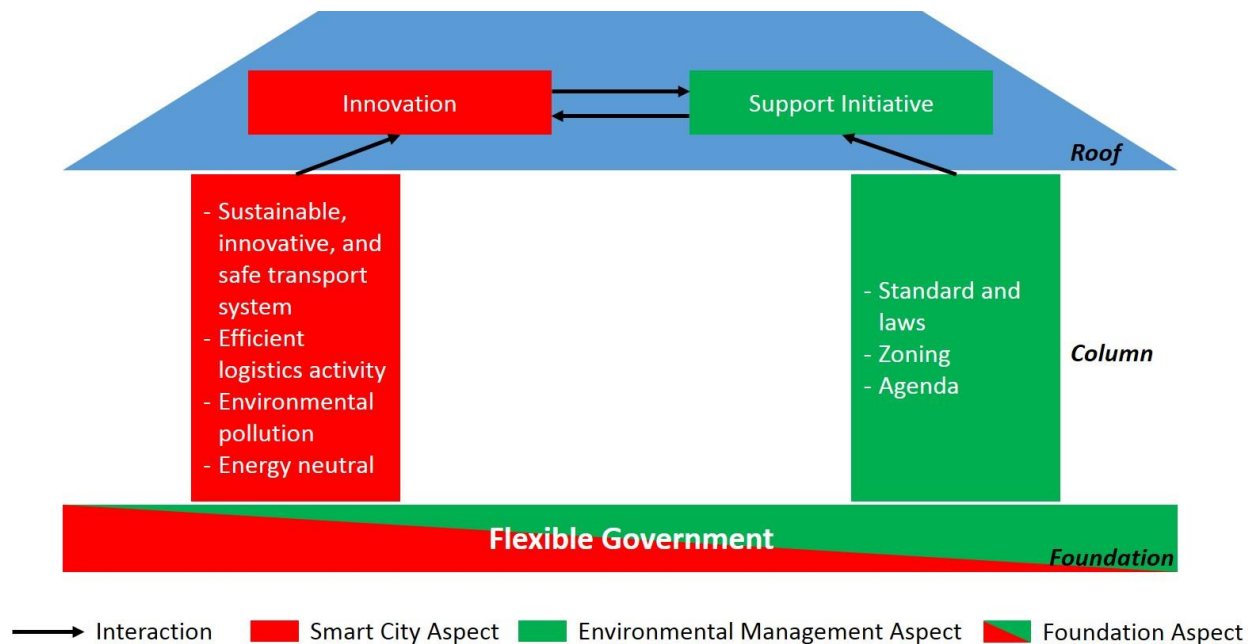


Figure 34. The Position of Aspects in the “Consider Each Other” Interaction Building

Flexible government is considered as a basic foundation for the “consider each other” interaction process (see Figure 34). I consider it as a key aspect in the interaction process, because if there is no flexible government, other aspects cannot emerge in the process. Consequently, an interaction cannot happen. In the flexible government aspect, the governmental parties can accept any successful tested projects and create a new regulation to support it, while the non-governmental parties can flexibly test and implement their projects in all locations of Amsterdam without an obligatory to follow the Municipality’s agenda. Two columns, which are aspects from the smart city projects and environmental management, stand to support the interaction. The smart city aspects, which specifically represent the smart city projects, become the first column. It support the innovation process of various smart city projects. The environmental aspects, which specifically represents the regulatory category of environmental management, become the second column. It support initiatives, including the smart city projects, through an innovation platform, which is Amsterdam Smart City. In the roof, the non-governmental and governmental parties interact. The interaction process seems to appear from both side. From the smart city projects side, the non-governmental parties consider related regulations and agenda of the Municipality, such as standards and laws, zoning, and agenda. While from the environmental management side, the governmental parties consider the smart city projects by supporting initiative by accepting any successfully tested projects and make related regulations for them. So, the foundation, columns, and roof become a unity to build a “consider each other” interaction process.

5.5.3. Concluding Remark

To conclude, I noticed an “interaction building” between the smart city projects and environmental management through the aspects in smart governance category (see Figure 35).

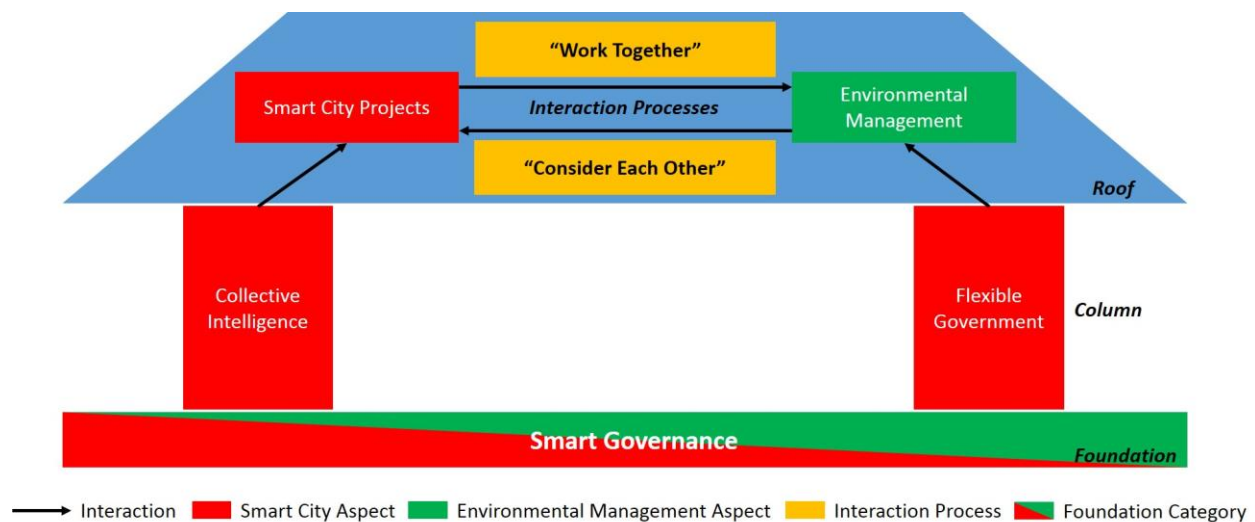


Figure 35. The Linkage between Aspects of Smart City Projects and Environmental Management in the Interaction Buildings

Smart governance is considered as a basic foundation of the interaction processes between smart city projects and environmental management (see Figure 35). It is supported by two columns, namely collective intelligence and flexible government. Those columns give room for smart city projects and environmental management to interact under the “work together” and “consider each other” interaction processes. So, in the Amsterdam case, collective intelligence and flexible government under the category of smart governance become key aspects to make the interaction between smart city projects and environmental management happen.

5.6. The Interlinkage to Urban Planning

This section tries to identify the interlinkage between the results of this study with planning theory which might be relevant to explain the interlinkage. The identification is focused on the interaction process between the non-government-based smart city projects and environmental management. Two interactions emerged from the case, namely “work together” and “consider each other” which reveals that it is not only the government or planners but also non-governmental parties (companies, NGO, knowledge institutions, and residents) which can initiate the actions to achieve a planning vision.

The interaction such as “work together” which is supported by several aspects, such as partnerships, stakeholders collaboration, and participation, shows that transactive planning is happening in Amsterdam. As Friedmann (1973) stated that in transactive planning, there is an exchange of knowledge between planners and residents to reveal any information and find best practices on a certain project. It is also in line with a study conducted by Whittemore (2014) which revealed that in 1960’s, there were several planners that were practicing transactive planning. As stated by Andrews (1960) and Evans (1961) in Whittemore (2014), insights, participation, and leadership from the citizens contribute to the analysis performance and implementing knowledge to actions in which the Municipality plays role as an adviser. It reveals that in transactive planning, the government or planners are more open-minded towards the taken-actions and end-goals formulation. A “learning by doing” principle is adopted to implement related projects in the city to find a best-fit solution for certain challenges, such as environmental challenges.

In that sense social learning might emerge in the process of “learning by doing” whether it is a single, double, or triple loop learnings (see also Hurlbert and Gupta, 2015). A single loop learning can be found in the “institutional vision development” process (“no interaction” process), where an institution strictly define their own visions, programmes, and projects. The institutions just follow the rules that have been formulated. So, there is a little room for learning in that kind of loop. A double loop learning can be found in the “consider each other” interaction process, where the government can flexibly change their related regulations to accommodate a successful smart city project to further implement and upscale it. A triple loop learning can be found in the “work together” interaction process, where the non-governmental and governmental actors can learn from what they have done. For instance, the smart city project leaders can learn from their own experience in implementing a smart city project to not to repeat a similar failure in the past.

Another point is that, comparing the transactive planning and the social learning theory with the results, it also reveals that there has been a shifting in the planning process and the role of planner in it. The planning process seems to be more flexible, because there are no exact planning procedures determined in the process in which each actor can start and end the process based on their framework. It seems in line with the notion of self-organization suggested by Boonstra and Boelens (2011), where the citizens (non-governmental parties) can initiate projects which contribute to the urban development without intervention from the governmental parties and procedures. In the case of interaction between smart city projects and environmental management of Amsterdam, two selected example projects which are “100.000 Energy-neutral Homes” and “Logistic Hub Amsterdam” are initiated by non-governmental parties. They organized themselves to make their initiative happen without any intervention from the government. At the end, their projects contribute to the city transition process, such as solar panel application in buildings and districts and also the emerging of logistic hubs and transformation of logistics activities in the city.

The government has their ambitions and plans to develop their city, where several “self-organized” projects might not be accommodated in the agenda or plan. The planning documents seem to be a “static” document and less flexible to be modified as it is a long-term plan in which it underestimates the process of self-government which is happening in the city. A short-term plan is better to be applied in the city, because the future condition and needs can be planned more accurately. It also give a quicker time for the planners to evaluate the plan. So, the plan will be more flexible and accurate.

Based on the result of this study, interactions between the non-government-based smart city projects (as “self-organized” project) and government-based environmental management (as governmental procedures) have to be built at the project arrangement level (not in the institutional level). This study reveals that there are two interaction processes, namely “work together” and “consider each other”, which may be used to bridge that two different planning approaches in the city. In that sense, the self-organized projects and the governmental procedures can “walk side by side” under that interaction processes.

Further finding is that the interaction between the smart city and environmental management under the transactive planning can also be seen from the governance arrangement theory. Newman (2001) suggested a governance model which reveal four models based on four characteristics (see Figure 36).

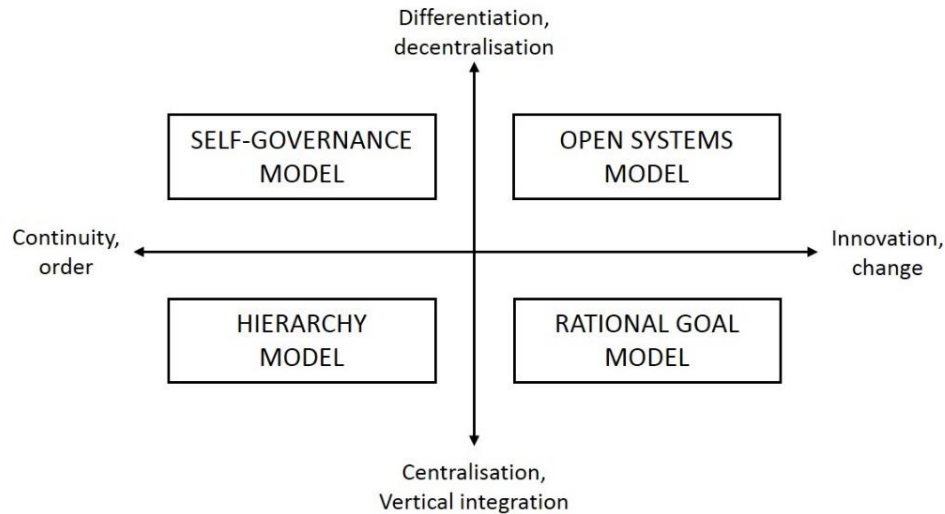


Figure 36. Governance Model
(Source: Newman, 2001)

Based on Newman (2001), it reveals that an open systems model represents the interaction between non-government-based smart city projects and government-based environmental management. As Newman (2001) stated that an open systems model refers to the decentralisation of power from the government to the non-governmental parties in which it allows experimentation and innovation as an action to achieve the goals and push the environment towards flexibility, expansion, and adaptation of the recent challenges and needs. There is interdependence among actors involved which also reveals a “network” governance model (see also Rhodes, 1996) in which the system can, flexibly and dynamically, change depending on the environment. The change is achieved by self-organization without intervention from external parties. Rhodes (1996) added that the function of the government in the open systems model is to manage the networks. It had been done by the Amsterdam Municipality in managing the urban environment by using partnership, participation, collective intelligence, and stakeholders collaboration aspects (smart governance category).

As this study focuses on a project level, Korbee et al. (2014) stated that a policy arrangement theory could also be adopted for project arrangement. In their paper, they adopted policy arrangement dimensions developed by Arts et al. (2000) as an approach to explaining about institutional changes in a project. Adopting the definition of Korbee et al. (2014), a key element in project arrangement approach is the “*temporary stabilization of the content*” (Korbee et al., 2014 p.3). It refers to the institutionalization of organizations and substance of the project which can be seen from four dimensions of policy arrangement theory of Arts et al. (2000) (see Figure 37).

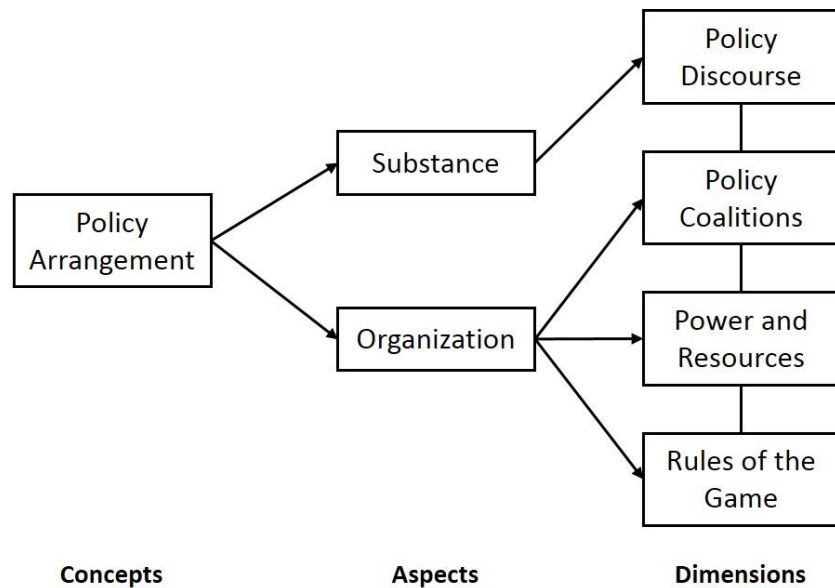


Figure 37. Policy Arrangement Operationalization
(Source: Arts et al., 2000)

Figure 37 shows that a project arrangement can also be seen from two aspects, namely organization and substance. The organization contains three dimensions, namely policy coalitions, power and resources, and rules of the game, whereas substance contains policy discourses. According to Arts et al. (2000), policy coalitions refers to the coalitions of inter-organizations in a project development which has been showed in one of the interaction processes between smart city projects and environmental management, namely “work together”, where various non-governmental and governmental organizations build a coalition in project development. Power and resources refer to the level of resources and power among actors in a project development which also has been shown in the institutional interaction, where different actors dynamically interact with each other to mobilise their resources and give their influence to others. Finally, the rules of the game refer to the behaviour of actors to determine their action based on the active rules, which were also revealed in one of the interactions processes, namely “consider each other”. On the one hand, smart city project leaders consider related agenda and policies from the government, and on the other hand, the government consider the smart city projects by including smart city themes in their agenda and policies and also creating legitimacy to the tested and validated projects. Another dimension, which is policy discourse in the substance aspect, refers to the context of the project, such as idea and notions, which contribute to the project arrangement.

Based on the above elaboration on the planning process, it also leads to the shifting role of planners in which “the planners” can be divided into two part. First, “the planners” can be the people who have the higher degree or certification in the field of urban and regional planning, it can be called as an expert planner. Second, “the planners” can be the citizens themselves who organize their projects to solve particular urban challenges, it can also be called as a citizen planner. Based on the result, the expert planner seems to have an advisory role for the citizen planner, in which the citizen planner can have more influence in the planning process, as they arrange it themselves, as the transactive and social learning theory stated above. Additionally, the expert planner might give advise on the regulations, planning visions, and other knowledge to the citizen planner.

It can be concluded that the interaction process emerged between non-governmental-based smart city projects and government-based environmental management is a representation of transactive planning. Reflecting the problem description with the result and theory (see also section 1.2), it reveals that in an open system governance model, smart city, as a concept, links to urban planning, in the part of the governance and project arrangements in a smart city project development. The linkage is in the governance arrangement because, based on the discussion, smart governance is a basic foundation for the interaction processes between the non-governmental-based smart city projects and government-based environmental management. The linkage is in the project arrangements because the interaction processes emerged in the smart city or environmental-related projects. So, the planners have to be aware of the governance and project arrangements in a city to make use and take benefit of the interaction between the non-governmental-based smart city projects and government-based environmental management. Smart city and environmental management actors work together under the aspect of the collective intelligence. On the one hand, smart city projects consider related planning documents and regulations from the government, on the other hand, environmental management legitimates the projects. That interaction is done under the flexible government aspect.

5.7. Discussion on Data Analysis

There were several challenges and assumptions when analyzing the data which might influence the result and conclusion of this study. The challenges and assumptions can be divided into five parts, namely subjective interpretation, reconsidered aspects, relevance threshold, “wishful thinking”, and technical challenge. First, I used an interpretive philosophy in conducting this study, in which the data analysis and discussion are based on my subjective interpretation. For instance, I coded aspects of smart city and environmental management based on my interpretation on the interview and document statements, therefore different interpretation might appear if the codes are made by other researchers which may affect the conclusion. Additionally, there might be several statements from the interview and document transcripts which were not coded in this study because I did not notice it.

Second, there are several aspects which were reconsidered, because the quotes were not strong enough to represent the aspect to be included in the category when I was writing the result section. The aspect is flexibility of labor market in smart economy category because there are no aspects related to employment in smart city categories. Another reconsidered aspect is efficient logistics routes and efficient logistics activity because quotes and codes of those aspects seems similar. I merged them into one aspect, namely efficient logistics activity because it touches all elements in the logistics. Regarding the environmental management aspects, I merged 8 aspects with the other aspects which has the same idea, for instance, I merged fines and incentives with financial instruments. However, most of them are new aspects which at first, I interpreted that it has different ideas with aspects from the literature.

Third, the relevance threshold was created to be a guideline for me to judge whether an aspect is relevant or not based on the frequency mentioned of an aspect within the interview and document transcripts. It was divided into three kind of thresholds because I want to accommodate an aspect which was only stated in either interview or document, in which it will have a different relevance in representing a reality. Each threshold has different value which represents the minimum frequency mentioned to determine whether an aspect is relevant, less relevant, or not relevant. In the interview threshold, the value is 4 out of 7 interview transcripts, because more than 50% of interview statements are assumed to

give a better accuracy of the statement. In the document threshold, the value is 6 out of 12 document transcripts, because most documents analyzed in this study came from the Amsterdam Municipality, therefore, there might be several ideas which are not implemented yet in Amsterdam. To take in to account that possibility, there have to be at least half of documents which stated the same idea towards a certain topic. It is assumed that 50% of document statements are better to represent the accuracy of a statement towards an aspect. Finally, if a source of an aspect is a combination of interview and document, the value is 32% (6 out of 19 transcripts) or one-third of the frequency mentioned. An equal source from the interview and document can confirm the accuracy of the statement to each other (intertextuality strategy). But if there is an unequal combination of the number of frequency mentioned, such as 1-5 or 5-1, an aspect will be still considered as a less relevant. A less relevant aspect is divided into three level, namely “not strong enough”, “weak”, and “very weak” to differ the level of less relevance among the aspects that are included in this range. As the values were just an assumption from me to approach the relevance of an aspect in each category, there might be a less accurate value of the relevance threshold which might affect the categorization of the relevant and less relevant aspects.

Fourth, as I used governmental documents as one of its data sources, it might contain “wishful thinking”. It means that there are several statements representing a vision, ambition, or plan which might not be implemented yet in Amsterdam. To notice it, I marked the aspects which contain a “wishful thinking” at the end of each aspect description in chapter 4.

Finally, there were technical challenges which had to be faced when analyzing the data, namely the use of Atlas ti.7 software and a dependency on interview transcript. Regarding the use of Atlas ti.7, it is the first time for me to use that software. I only used a common feature of the software, such as generating code, grouping code, and arranging the coding report from the software. There might be other features that I do not know yet in which it can enhance the quality of the coding result. Another point is that, I was so dependent on the interview transcript when analyzing the data. If there was any error in the recorder, there was a few notes to fulfill the unrecorded statement from the interview. It might also influence the coding result.





CHAPTER 6

CONCLUSION

- 6.1. Conclusion
- 6.2. Reflection on the Research
- 6.3. Recommendation for Amsterdam Smart City
- 6.4. Recommendation for Future Research

CHAPTER 6. CONCLUSION

This chapter will discuss the conclusion of this study followed by several reflections on the research and recommendations. The conclusion section will provide the most prominent findings based on the discussion chapter. The reflection section will provide a reflection on the process and implementation of this study in the data collection, analysis, and writing. The recommendations will provide several practical suggestions for related actors in smart city and environmental management of Amsterdam and future research which may be conducted based on the same problem with this study.

6.1. Conclusion

This study aimed to investigate the interaction between the non-government-based smart city projects and government-based environmental management by analyzing aspects which contribute to the interaction using Amsterdam case. A conceptual framework was developed from three concepts, namely smart city, urban environmental management, and interaction to come up with the smart city and environmental management aspects from the literature and understand the interaction prerequisites and its representation. The smart city aspects, environmental management aspects, and interaction process was analyzed in the case of Amsterdam.

There are 43 smart city aspects (see Figure 26) and 17 environmental management aspects (see Figure 27) that were divided into two parts, namely relevant and less relevant aspects (see Appendix I). The relevant aspects seem to be considered more by both smart city project leaders and the Municipality than the less relevant aspects in implementing smart city or environmental-related projects. There are 30 smart city and 3 environmental management aspects which were not found in the case of Amsterdam for which these were labelled as “not relevant” aspects for representing a smart city or environmental-related projects in Amsterdam.

Aligning the gathered aspects with the conceptual framework, there are two prominent findings. First, in smart city concept, aspects, such as partnership, participation, and collective intelligence, contribute to the addition of new elements which have to be considered in a smart city project, namely non-technological resources and collaboration. So, in a smart city concept, it is not only technological but also non-technological resources that contribute to the improvement of citizen quality of life by making use of information and collaborating with partners in the city. Second, in urban environmental management concept, a new element was added to the definition of advisory, economic or fiscal, and regulatory. Advisory is not only about spreading environmental knowledge or policy but also about assisting the people. Economic or fiscal is not only driving behavior of people when dealing with environmental issues, but also give room for investment. Regulatory is not only steering people directly from the implemented-regulations but also indirectly from the regulatory objectives.

There are two interaction processes that were identified, namely “work together” and “consider each other”. Also a “no interaction” process emerged, namely “institutional vision development”. These interaction processes reveal two levels of interaction, namely institutional interaction (level 1) and projects interaction (level2). The “institutional vision development” was represented by each institution that can define their own visions, ambitions, programs, and projects. In that sense, there is no interaction between institutions in the city, which might cause a scattered environmental program. The urban innovation system theory brought insight to this study that an institution can build a certain relationship

with other institutions. In that sense, institutions will have an interaction with others to make their projects happen, but they have to have a reason first as a prerequisite to begin an interaction.

The relationship between the institutions brings the interaction to the second level, namely the interaction between smart city projects and environmental management. So, the interaction in the second level cannot start if there is no relationship between institutions. Looking into more detail, at the second level of interaction, the non-government-based smart city projects and government-based environmental management interact with each other in two processes, namely “work together” and “consider each other”.

In the interaction processes, collective intelligence and flexible government are aspects from the smart governance category which play a key role in the interaction between the non-government-based smart city projects and government-based environmental management. Those aspects become a basic foundation for building the “work together” and “consider each other” interaction process which can bridge the smart city projects as a “self-organized” project and the environmental management as a governmental procedure. Therefore, the smart city projects and environmental management can “walk side by side” on the smart governance foundation in the city. So, in an open system governance model and under the transactive planning approach, smart city, as a concept, links to urban planning, in the part of the governance and project arrangements.

However, I am aware that there are aspects which contain “wishful thinking” from documents in both smart city and environmental management categories. It has to be noticed that several ideas in those aspects might not be implemented yet. All aspects included in the smart city and environmental management categories are based on the several smart city projects in the energy and mobility themes. Therefore, the interaction between aspects in each category might be different in other project themes.

6.2. Reflection on the Research

This section discusses reflection upon the intervention of the researcher towards this study which might influence the result, discussion, and conclusion. There will be three reflections in this section, namely, trustworthiness, reflection on data collection, and limitation of the research. By reflecting on that parts, it is expected that the reader can have an insight that this study and its result was conducted and concluded under several conditions.

6.2.1. Trustworthiness

When analyzing the data, this study needs to keep the credibility of the data to make sure the consistency and accuracy of the research findings. According to Schwartz-shea and Yanov (2012), an interpretive research use terminology trustworthiness to help me in controlling the research quality. This study use four research evaluations suggested by Schwartz-shea and Yanov (2012), as follows:

a. Member checking

This evaluation is conducted by delivering the transcribed interview back to the interviewees and determining the accuracy of them based on the interviewees thinking and feeling. The interviewees give several comments towards the interview transcript which is used to enhance the accuracy of the information. This evaluation aims to confirm the information gathered to get the most right understanding towards the interviewee’s means.

In this study, the member checking was done by giving the interviewees the transcribed interview as soon as possible after the interview was conducted. The interview transcript was sent by email to an interviewee, then he/she clarified a particular statement in the transcript. From seven interviewees, there were only four interviewees who clarified the transcript. I assumed that the others who did not clarify the transcript approve the information that I wrote in the transcript.

b. Cross checking

This evaluation is conducted by comparing information from different interviewees to have an understanding of contradictory or complementary information. In this study, the cross checking was done by checking the coherence and contradictory statements in each sources, namely interview and document analysis. So, there is a clear inventory of the coherence and contradictory statements between both an interviewee to other interviewees and a document to other documents.

Based on the cross checking, it reveals that all documents analyzed are coherent with each other. It seems that the “Sustainability Agenda Amsterdam” is a benchmark for other agendas, such as “Amsterdam Mobility Implementation Agenda”, “Smart Mobility Action Plan”, “Amsterdam Urban Logistic Implementation Agenda”, “Amsterdam Energy Strategy 2040”, and “Amsterdam Environmental Zone”. So, policies and strategies that are related to the energy and mobility themes are coherent in each agenda. The “Sustainability Agenda Amsterdam” is developed based on the “Amsterdam in 2020” as a grand design for Amsterdam towards a sustainable city. There is also a different kind of document, namely “Structural Vision Amsterdam” which focuses more on the spatial plan of Amsterdam. The document has a similar objective as the others to have a sustainable environment, only it pursues the objective through intervention on the spatial development and long term development. The “Benchmark Zero-emission City” distribution policy by European cities document was given by the project leader of “Logistic Hub Amsterdam” to give an overview on how Amsterdam act to reduce CO₂ emission. That document was also analyzed to give a broader perspective about environmental management in Amsterdam from EU level. The document also confirms the coherence among the Municipality’s agendas and visions about the environmental management.

Regarding the interviews, it reveals that there were contradictory statements emerged among interviewees. The contradiction emerged on specific topics, such as consideration of the environmental policies of Amsterdam to the existence of smart city project. However, there are more coherent statements which represent the interaction process between the smart city projects and environmental management, such as the smart city projects consider the environmental agenda or policies of Amsterdam; work with partners to support smart city projects, environmental management include the smart city themes, the government create legitimacy for the smart city projects; partner connections on the development of smart city projects.

c. Intertextuality

This evaluation aims to give a validation or confirmation about information gathered from the interview or document analysis by comparing information from the interviews to the documents, and vice versa. In this study, a similar procedure with cross checking was done for the intertextuality.

The interviews and documents complement each other to confirm and validate information. However, sometimes, there is only one source of document or interview in a code which reveals that the

accuracy of the information is weak. This was elaborated in the discussion about the relevance threshold (see also section 5.7).

d. Positionality

This evaluation aims to present the personal characteristics of the researcher. The researcher's background and history will influence the way he/she analyze the information gathered from the field and develop evidence based on that. In this study, I am an Indonesian whose background is urban planning and has no skill in Dutch. The analysis process for this study is based on an urban planner mindset and culturally differences. That also influences the analysis and writing process of this study.

6.2.2. Reflection on Data Collection Execution

There were several challenges when collecting the data which might influence the result analysis for this study. The challenges can be divided into three parts, namely technical, contact, and language challenge. Firstly, the technical challenge emerged when most of the interviewees preferred to have an interview session via Skype or phone. The unstable connection influenced the unclearness of some interviewee's statements. It happened in a Skype interview with the officer from the Chief Technology Office Amsterdam Municipality (interviewee P7). To handle this, I asked the interviewee to repeat his statements once the connection becomes stable. However, the repeated statements might be slightly different with the previous statements. I also did a member checking to clarify his statements. Another challenge was an error in the recorded interview for a few seconds which was noticed when I made a transcript of it. That happened in the interview session with the project manager of Amsterdam Smart City Academy from Amsterdam University of Applied Science (interviewee P2). The interview was conducted via phone and I used a recorder software on the laptop. After 11 minutes of the interview, the record was unclear because there was a software error. Although the error happened only for 12 seconds, I was unable to identify the statement. It was handled by matching the statement line with my field note and also using the member checking evaluation by giving the transcript to the interviewee to clarify her statement.

Secondly, the contact challenge emerged when I tried to find the interviewees which were capable to answer the interview questions. I just contacted the prospective interviewees through contact information in various websites, namely Amsterdam Municipality, Amsterdam Smart City, Amsterdam Economic Board, Amsterdam Institute for Advanced Metropolitan Solution, Alliander company, Amsterdam University of Applied Science, Waag Society, and Pakhuis de Zwijger. I also tried to contact people from Wageningen University and Research who might have contact with the prospective interviewees from an institution. There were 30 people from different institutions representing the program partners of Amsterdam Smart City who were contacted by email, phone, and short messaging service from the beginning of October to the beginning of December 2017. However, in the end, only seven interviewees were successfully interviewed for this study. There might be important prospective interviewees who were not interviewed yet for this study. So, it might influence the result of this study. I tried to handle this by interviewing different stakeholders, such as various program partners in Amsterdam Smart City, the Municipality, and the project leaders of several smart city projects to have a broad and balance perspectives from the non-government-based smart city projects and government-based environmental management.

Finally, the language challenges emerged when I was conducting the document analysis. There were four documents which were written in Dutch, namely “Structural Vision Amsterdam”, “Amsterdam Mobility Implementation Agenda”, “Amsterdam Urban Logistic Implementation Agenda”, and “Amsterdam Environmental Zone” which I cannot understand the exact meaning of the text. To handle this, I used an online document translator platform (onlinedoctranslator.com) and clarify it with a Dutch native speaker but only for a few lines of the text which had a weird meaning. It might degrade the accuracy of the original text meaning. All in all, I can handle the challenges emerged from the data collection execution even though with several limitations.

6.2.3. Limitation of the Research

There are several limitations of this study. Firstly, this study did not select a smart city project to focus on. I intentionally asked the interviewee about an example of a smart city project. This study depends on the interviewee statement about an example of smart city project in Amsterdam. It also depends on the subjective perspective of the interviewee regarding what smart city project which is the most important for he/she to be stated. Based on that, there were only two smart city projects which were selected as an example, namely “100.000 Energy-neutral Homes” and “Logistic Hub Amsterdam” which represent two different themes, namely energy and mobility, that became my focus for further investigation. It is in line with other interviewees which stated smart city projects mostly in the energy and mobility themes. Based on that, aspects and interaction identified from the two projects and focus themes could not represent the whole interaction between non-government-based smart city projects and government-based environmental management. So, the conclusion of this study cannot be generalized to represent the condition of both other smart city projects and themes.

Secondly, the results and conclusion of this study were based on only seven interviewees and 12 documents, because of the time limitation and contact challenges as has been elaborated in section 6.2.2. Therefore, there might be other key interviewees who were not interviewed yet whose statements might influence the results and conclusion of this study. The other key interviewees might be a representation from the NGO, such as Waag Society and Pakhuis de Zwijger; from the companies, such as KPN, Arcadis, and PostNL; from Amsterdam Smart City community itself; and other departments in the Amsterdam Municipality, such as planning department and environmental-related divisions. There might be also other related documents which were not gathered in the data collection stage. That also might influence the results and conclusion of this study. The conclusion which is based on only seven interviews and 12 documents might oversimplify the reality.

Finally, regarding the document analysis, it was based on an official document from the Amsterdam Municipality and Amsterdam Smart City. But I did not check the implementation of the agendas or policies stated in the official document from the Municipality in the field, because there are several agendas and policies which will be implemented in next years. It is assumed that all agendas or policies were, are being or will be implemented in Amsterdam. It might influence the results, especially in the environmental management aspects.

6.3. Recommendation for Amsterdam Smart City

Based on the result of this study, the Amsterdam Smart City and the Municipality (as programme partner) can obtain information and knowledge about the interaction between the non-government-based smart city projects and government-based environmental management. I also want to recommend

the Amsterdam Smart City and the Municipality based on the lesson learned from interaction processes, as follows:

- a. Develop an integrated grand vision about the smart city projects among the programme partners of Amsterdam Smart City to maximize and take benefits from the “work together” interaction process.
- b. Make an obligatory consideration from the smart city projects to the agenda of the Municipality to accelerate the process in achieving the government’s agendas.
- c. Assist the smart city projects in the testing and validating process to make the projects in line with related regulations and legally implemented in Amsterdam.

6.4. Recommendation for Future Research

Based on the limitation and results of this study, there are recommendations for future researches. Future research may discuss and focus on other smart city projects and themes in Amsterdam Smart City platform to compare the interaction processes which might appear between the non-government-based smart city projects and government-based environmental management in different project themes. In doing the research, the researcher is suggested to add more interviews and documents to have a broader information and comprehensive result on the interaction process. The researcher can also adopt other theories of smart city, urban environmental management and interaction which may work better in investigating the interaction. I also suggest future research to investigate the interaction by using governance arrangement and self-organization theories to have a deeper discussion on the interaction between the smart city projects and environmental management and the linkage between smart city concept and urban planning discourse.



References

Books, Journal Articles, and Reports

- Akaslan, D., Taşkın, S., & Oğuz, Y. (2017). The Extensible Analogy for Supporting the Aspects of Smart Cities : Demander and Supplier. In *Smart Grid and Cities Congress and Fair (ICSG), 2017 5th International Istanbul* (pp. 171–174). Istanbul: IEEE. <http://doi.org/10.1109/SGCF.2017.7947627>
- Albino, V., Berardi, U., & Dangelico, R. M. (2015). Smart Cities: definitions, dimensions, performance, and initiatives. *Journal of Urban Technology*, 22(1), 3–21. <http://doi.org/10.1080/10630732.2014.942092>
- Alizadeh, T. (2017). An Investigation of IBM's Smarter Cites Challenge : what do participating cities want? *Cities*, 63, 70–80. <http://doi.org/doi.org/10.1016/j.cities.2016.12.009>
- Alpopi, C., & Silvestru, R. (2016). Urban Development towards Smart City – a case study. *Administration and Public Management*, (27), 107–122.
- Amsterdam Smart City. (2017a). Frequently Asked Questions: Amsmarterdam City. Amsterdam.
- Amsterdam Smart City. (2011). Smart Stories: Amsmarterdam City. Amsterdam.
- Angelidou, M. (2015). Smart cities : a conjuncture of four forces. *Cities*, 47, 95–106. <http://doi.org/doi.org/10.1016/j.cities.2015.05.004>
- Anthopoulos, L. G. (2017). The Rise of the Smart City. In *Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick?* (1st ed., pp. 5–45). Cham: Springer International Publishing. <http://doi.org/10.1007/978-3-319-57015-0>
- Anthopoulos, L. G., & Vakali, A. (2012). Urban Planning and Smart Cities : interrelations and reciprocities. In F. Álvarez, F. Cleary, P. Daras, J. Domingue, A. Galis, A. Garcia, T. Zahariadis (Eds.), *The Future Internet: Future Internet Assembly 2012: From Promises to Reality* (pp. 178–189). Berlin: Springer, Berlin, Heidelberg.
- Arts, B., van Tatenhove, J., & Leroy, P. (2000). Policy Arrangements. In J. van Tatenhove, B. Arts, & P. Leroy (Eds.), *Political Modernisation and the Environment* (1st ed., pp. 53–69). Dordrecht: Springer Netherlands. <http://doi.org/10.1007/978-94-015-9524-7>
- Baccarne, B., Mechant, P., & Schuurman, D. (2014). Empowered Cities? An Analysis of the Structure and Generated Value of the Smart City Ghent. In R. P. Dameri & C. Rosenthal-Sabroux (Eds.), *Smart City: How to Create Public and Economic Value with High Technology in Urban Space* (1st ed., pp. 157–182). Cham: Springer International Publishing Switzerland. <http://doi.org/10.1007/978-3-319-06160-3>
- Barrow, C. J. (2006). *Environmental Management for Sustainable Development* (2nd ed.). New York: Routledge.

- Bolici, R., & Mora, L. (2015). Urban Regeneration in the Digital Era: how to develop smart city strategies in large european cities. *TECHNE - Journal of Technology for Architecture and Environment*, 10, 110–119. <http://doi.org/10.13128/Techne-17507>
- Boonstra, B., & Boelens, L. (2011). Self-organization in Urban Development: towards a new perspective on spatial planning. *Urban Research & Practice*, 4(2), 99–122. <http://doi.org/10.1080/17535069.2011.579767>
- Caragliu, A., Bo, C. Del, Nijkamp, P. (2011). Smart Cities in Europe. *Journal of Urban Technology*, 18(2), 65–82. <http://doi.org/10.1080/10630732.2011.601117>
- Cavada, M., Hunt, D. V. L., & Rogers, C. D. F. (2014). Smart Cities: contradicting definitions and unclear measures. In World Sustainability Forum 2014 – Conference Proceedings Paper (pp. 1–12). Basel: Sciforum.net.
- Cocchia, A. (2014). Smart and Digital City: a systematic literature review. In R. P. Dameri & C. Rosenthal-Sabroux (Eds.), *Smart City: How to Create Public and Economic Value with High Technology in Urban Space* (pp. 13–43). Cham: Springer International Publishing. <http://doi.org/10.1007/978-3-319-06160-3>
- Ching, T., & Ferreira, J. (2015). Smart Cities: concepts, perceptions, and lessons for planners. In S. Geertman, J. Ferreira, J. R. Goodspeed, & J. Stillwell (Eds.), *Planning Support Systems and Smart Cities* (1st ed., pp. 145–168). Cham: Springer International Publishing Switzerland. <http://doi.org/10.1007/978-3-319-18368-8>
- Chourabi, H., Gil-garcia, J. R., Pardo, T. A., Scholl, H. J., Walker, S., & Nahon, K. (2012). Understanding Smart Cities : an integrative framework. In R. H. Sprague Jr. (Ed.), *Proceedings of the Forty-Fifth Annual Hawaii International Conference on System Sciences* (pp. 2289–2297). Maui: IEEE. <http://doi.org/10.1109/HICSS.2012.615>
- Creswell, J. W. (2009). *Research Design: qualitative, quantitative, and mixed methods approaches*. (V. Knight, Ed.) (3rd ed.). California: SAGE Publications.
- Dameri, R. P. (2017). *Smart City Implementation: creating economic and public value in innovative urban systems* (1st ed.). Cham: Springer International Publishing. <http://doi.org/10.1007/978-3-319-45766-6>
- Dameri, R. (2013). Searching for Smart City definition : a comprehensive proposal. *International Journal of Computers & Technology*, 11(5), 2544–2551.
- Dijkstra, L., & Poelman, H. (2012). *Cities in Europe: the New OECD-EC Definition*. Brussel.
- Dubey, S. K., & Sharma, D. (2017). An Overview of Sustainable Dimensions and Indicators for Smart City. In R. Singh & S. Kumar (Eds.), *Green Technologies and Environmental Sustainability* (1st ed., pp. 229–240). Cham: Springer International Publishing. <http://doi.org/10.1007/978-3-319-50654-8>
- Fernandez-Anez, V., & Velazquez-Romera, G. (2015). *Smart Cities : concept & challenges*. Luxembourg.

- Friedmann, John. (1973). *Retracking America: A Theory of Transactive Planning*. New York: Anchor Press.
- Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanović, N., & Meijers, E. (2007). *Smart cities Ranking of European Medium-Sized Cities*. Vienna.
- Hall, P. (2000). Creative Cities and Economic Development. *Urban Studies*, 37(4), 639–649. <http://doi.org/10.1080/00420980050003946>
- Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). Foundations for Smarter Cities. *IBM Journal of Research and Development*, 54(4), 1–16. <http://doi.org/10.1147/JRD.2010.2048257>
- Hollands, R. G. (2008). Will the Real Smart City Please Stand Up? City: Analysis of Urban Trends, Culture, Theory, Policy, Action, 12(3), 303–320. <http://doi.org/10.1080/13604810802479126>
- Hollands, R. G. (2015). Critical Interventions into the Corporate Smart City. *Cambridge Journal of Regions, Economy and Society Advance*, 8(1), 61–77. <http://doi.org/10.1093/cjres/rsu011>
- Hurlbert, M., & Gupta, J. (2015). The Split Ladder of Participation: a diagnostic, strategic, and evaluation tool to assess when participation is necessary. *Environmental Science and Policy*, 50, 100–113. <http://doi.org/10.1016/j.envsci.2015.01.011>
- IBM. (2010). *Smarter Thinking for a Smarter Planet*. New York.
- Janssen-jansen, L. B., & van der Veen, M. (2017). Contracting Communities: conceptualizing community benefits agreements to improve citizen involvement in urban development projects. *Environment and Planning A*, 49(1), 205–225. <http://doi.org/10.1177/0308518X16664730>
- Komninos, N. (2011). Intelligent cities: variable geometries of spatial intelligence. *Intelligent Buildings International*, 3(3), 172–188. <http://doi.org/10.1080/17508975.2011.579339>
- Komninos, N. (2014). *Age of Intelligent Cities Strategies: smart environments and innovation-for-all strategies*. New York: Routledge.
- Korbee, D., Mol, A. P. J., & Tatenhove, J. P. M. Van. (2014). Building with Nature in Marine Infrastructure: toward an innovative project arrangement in the melbourne channel deepening project. *Coastal Management*, 42(1), 1–16. <http://doi.org/10.1080/08920753.2013.863722>
- Kuyper, T. (2016). *Smart City Strategy and Upscaling: comparing Barcelona and Amsterdam*. Universitat Pompeu Fabra. <http://doi.org/10.13140/RG.2.2.24999.14242>
- Levelt, M., & van Berkel, F. (2016). Legitimacy of Bottom-up Planning: the need for facilitation of substantive discussions in planning. In *New Pressures on Cities and Regions*. London: Regional Studies Association.

- Liu, Z., Wang, Y., Xu, Q., & Yan, T. (2017). Study on Smart City Construction of Jiujiang based on IOT Technology. In *IOP Conference Series: Earth and Environmental Science* (pp. 1–6). Chengdu: IOP Publishing Ltd. <http://doi.org/10.1088/1755-1315/69/1/012105>
- Monzon, A. (2015). Smart Cities Concept and Challenges: bases for the assessment of smart city projects. In M. Helfert, K.-H. Krempels, C. Klein, B. Donellan, & O. Guiskhin (Eds.), *Smart Cities, Green Technologies, and Intelligent Transport Systems* (1st ed., pp. 17–31). Cham: Springer International Publishing Switzerland. <http://doi.org/10.1007/978-3-319-27753-0>
- Mora, L., & Bolici, R. (2017). How to Become a Smart City : learning from Amsterdam. In A. Bisello, D. Vettorato, R. Stephens, & P. Elisei (Eds.), *Smart and Sustainable Planning for Cities and Regions: Results of SSPCR 2015* (1st ed., pp. 251–266). Cham: Springer International Publishing. <http://doi.org/10.1007/978-3-319-44899-2>
- Mosannenzadeh, F., & Vettorato, D. (2014). Defining Smart City: a conceptual framework based on keyword analysis. *Journal of Land Use, Mobility and Environment*, (1), 683–694. <http://doi.org/10.6092/1970-9870/2523>
- Moussiopoulos, N., Achillas, C., Vlachokostas, C., & Spyridi, D. (2010). Environmental, Social, and Economic Information Management for the Evaluation of Sustainability in Urban Areas: a system of indicators for Thessaloniki, Greece. *Cities*, 27(5), 377–384. <http://doi.org/10.1016/j.cities.2010.06.001>
- Nam, T., & Pardo, T. A. (2011). Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. In *The Proceedings of the 12th Annual International Conference on Digital Government Research* (pp. 282–291). New York: ACM.
- Newman, J. (2001). *Modernizing Governance: new labour policy and society* (1st ed.). London: SAGE Publications Ltd.
- Northstream. (2010). *The Revenue Opportunity for Mobile Connected Devices in Saturated Markets*. Sweden.
- Ojo, A., Dzhusupova, Z., & Curry, E. (2016). Exploring the Nature of the Smart Cities Research Landscape. In J. R. Gil-Garcia, T. A. Pardo, & T. Nam (Eds.), *Smarter as the New Urban Agenda: a comprehensive view of the 21st century city* (1st ed., pp. 23–47). Cham: Springer International Publishing. <http://doi.org/10.1007/978-3-319-17620-8>
- Rhodes, R. A. W. (1996). The New Governance: governing without government. *Political Studies*, 44(4), 652–667. <http://doi.org/10.1111/j.1467-9248.1996.tb01747.x>
- Samat, N., & Harun, N. (2013). Urban Development Pressure: challenges in ensuring sustainable tourism development in Langkawi Island. *Procedia-Social and Behavioral Sciences*, 91, 385–394. <http://doi.org/10.1016/j.sbspro.2013.08.435>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research Methods for Business Students* (5th ed.). Essex: Pearson Education.

- Su, K., Li, J., & Fu, H. (2011). Smart City and the Applications. In *2011 International Conference on Electronics, Communications and Control (ICECC)* (pp. 1028–1031). Ningbo: IEEE. <http://doi.org/10.1109/ICECC.2011.6066743>
- Schwartz-shea, P., & Yanow, D. (2012). *Interpretive Research Design: concepts and processes* (1st ed.). New York: Routledge.
- Steiger, J. H. (2009). *Path Diagrams*. Nashville.
- Stuckey, H. L. (2015). The Second Step in Data Analysis: coding qualitative research data. *Journal of Social Health and Diabetes*, 3(1), 7–10. <http://doi.org/10.4103/2321-0656.140875>
- Tyrväinen, L., Ojala, A., Korpela, K., Lanki, T., & Tsunetsugu, Y. (2014). The Influence of Urban Green Environments on Stress Relief Measures: a field experiment. *Journal of Environmental Psychology*, 38, 1–9.
- United Nations. (2016). *The World's Cities in 2016*. New York.
- Winden, W. Van, Oskam, I., Buuse, D. van den, Schrama, W., & Dijck, E. van. (2016). *Organising Smart City Projects: lessons from Amsterdam*. Amsterdam.
- Whittemore, A. H. (2015). Practitioners Theorize, Too: reaffirming planning theory in a survey of practitioners' theories. *Journal of Planning Education and Research*, 35(1), 1–10. <http://doi.org/10.1177/0739456X14563144>
- Yigitcanlar, T. (2015). Smart cities: an effective urban development and management model? *Australian Planner*, 52(1), 27–34. <http://doi.org/10.1080/07293682.2015.1019752>
- Yin, R. K. (2003). *Case Study Research Design and Methods*. (S. Robinson, K. Wiley, & G. Dickens, Eds.) (3rd ed.). California: Sage Publications.

Policy Documents

- Amsterdam Municipality. (2009). *Amsterdam in 2020*. Amsterdam.
- Amsterdam Municipality. (2011). *Structural Vision Amsterdam 2040*. Amsterdam.
- Amsterdam Municipality. (2015). *Sustainable Amsterdam: Agenda for renewable energy, clear air, a circular economy, and a climate-resilient city*. Amsterdam.
- Amsterdam Municipality. (2015). *Amsterdam Mobility Agenda Implementation*. Amsterdam.
- Amsterdam Municipality. (2016). *Smart Mobility Action Plan 2016-2018*. Amsterdam.
- European Commission. (2010). *EUROPE 2020: a European strategy for smart, sustainable and inclusive growth*. Brussels.

Websites

Amsterdamsmartcity. (2017b). Amsterdamsmartcity. Retrieved September 12, 2017, from amsterdamsmartcity.com

bussinessdictionary.com. (2018). co-creation. Retrieved January 11, 2018, What is co-creation? definition and meaning from <http://www.businessdictionary.com/definition/co-creation.html>

dictionary.cambridge.org. (2017). interaction. Retrieved September 29, 2017, from <http://dictionary.cambridge.org/dictionary/english/interaction>

dictionary.com. (2017). in-ter-ac-tion. Retrieved September 29, 2017, from <http://www.dictionary.com/browse/interaction>

en.oxforddictionaries.com. (2017). interaction. Retrieved September 29, 2017, from <https://en.oxforddictionaries.com/definition/interaction>

macmillandictionary.com. (2017). Interaction - definition and synonyms. Retrieved September 29, 2017, from <http://www.macmillandictionary.com/dictionary/american/interaction>

merriam-webster.com. (2017). interaction. Retrieved September 29, 2017, from <https://www.merriam-webster.com/thesaurus/interaction>

R-LINK. (2018). R-LINK. Retrieved January 25, 2018, from <http://rlink.tertium.nl/>

Setis-EU. (2017). European Initiative on Smart Cities. Retrieved September 21, 2017, from <https://setis.ec.europa.eu/set-plan-implementation/technology-roadmaps/european-initiative-smart-cities> 1/5

vocabulary.com. (2017). Interaction. Retrieved September 29, 2017, from <https://www.vocabulary.com/dictionary/interaction>



Appendixes

A. Comparison of Major Philosophies in the Research

Comparison of Major Philosophies in the Research (Saunders et al., 2009) (keyword in bold)

| Philosophies Perspectives | Positivism | Realism | Interpretivism | Pragmatism |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ontology <i>(The researcher's view of the nature of reality or being)</i> | External, objective, and independent of social actors | Objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist) | Socially constructed, subjective, may change, multiple | External, multiple, view chosen to best enable answering of research question |
| Epistemology <i>(The researcher's view regarding what constitutes acceptable knowledge)</i> | Only observable phenomena can provide credible data, facts. Focus on causality and law like generalizations, reducing phenomena to simplest elements | Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts | Subjective meanings and social phenomena. Focus on the details of situation, a reality behind these details, subjective meanings motivating actions | Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data |
| Axiology <i>(The researcher's view of the role of values in research)</i> | Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance | Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research | Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective | Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view |
| Data collection techniques | Highly structured, large samples, measurement, quantitative, but can use qualitative | Methods chosen must fit the subject matter, quantitative or qualitative | Small samples, in-depth investigations, qualitative | Mixed or multiple method designs, quantitative and qualitative |

B. List of Analyzed Documents

| Type of Documents | Agenda/Policy | Key Purpose(s) | Key Aspects | Timeline | Code used in text |
|------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------------|
| Governmental Documents | Structural Vision Amsterdam | To direct Amsterdam urban development to become economically strong and environmentally sustainable | Land use planning Transportation Green and water Energy Public space | 2011-2040 | D1 |
| | Amsterdam in 2020 | To direct Amsterdam development towards sustainable city | Quality of life Sustainable economy and innovation Energy transition | 2009-2020 | D2 |
| | Sustainability Agenda Amsterdam | To direct agenda on renewable energy, clear air, circular economy, and climate-resilient city | Renewable energy Clear air Circular economy Climate-resilient city | 2015-2018 | D3 |
| | Amsterdam Mobility Implementation Agenda | To direct agenda on mobility development and management based on related agenda and policies | Space for non-motorized vehicle Space for parking on the water and land Flow on the main routes Circulation of goods Accessibility and connection | 2015-2018 | D4 |
| | Smart Mobility Action Plan | To direct the improvement of the safety, accessibility, air quality, quality of life, and attractiveness of Amsterdam by using Information and Communication Technological interventions To support the Mobility Implementation Agenda and Sustainable Amsterdam policy | Mobility management by Internet of Things Data-driven mobility monitoring Service mobility Self-driving transport | 2016-2018 | D5 |
| | Amsterdam Urban Logistic Implementation Agenda | To direct agenda on urban logistic development and management based on related agenda and policies | Traffic flow Efficiency of shippers and carriers Traffic safety Air quality | 2017-2018 | D6 |

| Type of Documents | Agenda/Policy | Key Purpose(s) | Key Aspects | Timeline | Code used in text |
|------------------------------|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------|
| | Amsterdam Energy Strategy 2040 | To direct the energy transition pathway to meet the environmental goals | Energy for building Clean transport Port and industry Sustainable energy | 2010-2040 | D7 |
| | Amsterdam Environmental Zone | To restrict particular vehicles entering the city center based on the zoning regulation | Restriction for trucks, delivery vans, mopeds, taxis, buses, and coaches | Gradually implemented to particular vehicles from 2008 | D8 |
| | Benchmark zero-emission city distribution policy by European cities | A comprehensive analysis of policies taken by Amsterdam to be a zero-emission in urban logistic | Subsidy Logistic distribution timeframe Vehicles exemptions Procurement Parking lots Awareness measures | Policies and agenda from Amsterdam Municipality in various timeframe | D9 |
| Smart City Project Documents | 100.000 Energy-neutral Homes | Description about the 100.000 Energy-neutral Homes | - | - | D10 |
| | Logistic Hub Amsterdam | Description about the Logistic Hub Amsterdam | - | - | D11 |
| | City Sense | Result on the first meeting with stakeholders | - | - | D12 |

C. Interview Guideline

INTERVIEW GUIDELINE THESIS RESEARCH

The Interaction between Non-Government-based Smart City Projects and Government-based Environmental Management: The Case of Amsterdam

Preparation

- If the interview is conducted in face-to-face or using digital communication, ask the interviewee if the interview session can be recorded or not.
- Make sure to ask the interviewee whether he/she wants to be mentioned in the report and read/confirm the transcribed interview

Organizational Box

| | |
|------------------------------------------------------------------------------------------------------|--|
| Date | |
| Time | |
| Location | |
| Interviewee (specify: name, company, position towards Amsterdam Smart City/environmental management) | |

"Greetings (good morning/afternoon/evening), my name is Zul, I am a student of Urban Environmental Management, Wageningen University and Research. Currently, I am conducting a thesis research about "The Interaction between Non-Government-based Smart City Projects and Government-based Environmental Management: The Case of Amsterdam". This interview will take around 30-45 minutes. I will mainly ask topics about smart city projects and environmental management of Amsterdam.

Interview Questions

I. Smart City Projects

1. Do you know about a project which is initiated by non-governmental parties in Amsterdam Smart City platform? If yes, what is it?
2. What is the purpose of the project?
3. How is the development process of the project?
4. How does it become a project of Amsterdam Smart City?
5. Do you know about these smart city dimensions?
Smart Economy, Smart Governance, Smart Living, Smart Mobility, Smart Environment, Smart People, and Education and Capacity
6. In your opinion, which dimensions are included in the project?
7. What are elements in the project which are related to each dimension? Can you explain it one by one?
8. Who are the users of the product/service?
9. Does the Amsterdam Smart City platform adopt those dimensions? Which dimensions are Amsterdam Smart City platform adopted?

II. Environmental Management

1. Do you know about these environmental management approaches?
Advisory, Economic or Fiscal, and Regulatory

2. Does Amsterdam adopt the approaches? If yes, what kind of advisory/economic or fiscal/regulatory approach does Amsterdam do to manage the environment? Can you explain it one by one?
3. What is the purpose of the advice/economic or fiscal instrument/regulation?
4. How does the Amsterdam Municipality manage the urban environment by implementing that approach?
5. Who is affected by the policy?

III. Interaction between Smart City Projects and Environmental Management

1. Does the smart city project consider the environmental policy of Amsterdam?
 - 1.1. If yes, to what extent does smart city project consider the environmental policy of Amsterdam?
 - 1.2. If no, why is it?
2. Does the environmental policy of Amsterdam consider the existence of smart city project?
 - 2.1. If yes, to what extent does environmental policy of Amsterdam consider the existence of smart city project?
 - 2.2. If no, why is it?

D. List of Interviewee

| Interviewee | Code used in text |
|---------------------------------------------------------------------------|--------------------------|
| Scientific Director of Advanced Metropolitan Solution Institute Amsterdam | P1 |
| Smart City Academy Manager from University of Applied Sciences Amsterdam | P2 |
| Project Leader of “100.000 Energy-neutral Homes” | P3 |
| Project Leader of “Logistic Hub Amsterdam” | P4 |
| Project Coordinator of CitySense project/Project Manager at CTO Amsterdam | P5 |
| Chief Technology Officer (CTO) of Amsterdam Municipality | P6 |
| Officer at CTO Amsterdam Municipality | P7 |

E. Summary of Data Collection Execution

| Research Question | Method | Data | Data Source |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Specific research question 1: What kind of aspects does the non-government-based smart city projects have in Amsterdam based on the seven categories of smart city? | Document analysis | Transcript of the aspect of smart city of Amsterdam | <ul style="list-style-type: none"> - “100.000 Energy-neutral Homes” overview description from Amsterdam Smart City website - “Logistic Hub Amsterdam” overview description from Amsterdam Smart City website |
| | Interview | | Interviewee from Amsterdam Smart City program partners <ul style="list-style-type: none"> - Community and Program Assistant, Amsterdam Smart City (information clue) - Smart City Academy Manager from University of Applied Sciences Amsterdam - Scientific Director of Advanced Metropolitan Solution Institute Amsterdam - Project Leader of “100.000 Energy-neutral Homes” - Project Leader of “Logistic Hub Amsterdam” - Project Coordinator of CitySense project/ Project Manager at CTO Amsterdam |
| Specific research question 3: What kind of aspects does the government-based environmental management have in Amsterdam based on three categories of environmental management? | Document analysis | Transcript of the aspect of environmental management of Amsterdam | See Appendix B |
| | Interview | | <ul style="list-style-type: none"> - Chief Technology Officer (CTO) of Amsterdam Municipality - Project Manager at CTO Amsterdam Municipality - Officer at CTO Amsterdam Municipality - Chief Urban Planning Amsterdam Municipality (information clue) |
| Specific research question 5: How do the non-government-based smart city project and the government-based environmental management interact with each other in Amsterdam? | Document analysis | Transcript of the aspect of Amsterdam Smart City Transcript of the aspect of Amsterdam environmental management | 1. Smart city project <ul style="list-style-type: none"> - “100.000 Energy-neutral Homes” overview description from Amsterdam Smart City website - “Logistic Hub Amsterdam” overview description from Amsterdam Smart City website 2. Environmental management See Appendix B |
| | Interview | Transcript of the interaction of aspects of smart city to the | 1. Interviewee from smart city project parties <ul style="list-style-type: none"> - Community and Program Assistant, Amsterdam Smart City (information clue) |

| Research Question | Method | Data | Data Source |
|-------------------|--------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | environmental management in Amsterdam (and vice versa) in the context of selected smart city projects | <ul style="list-style-type: none"> - Smart City Academy Manager from University of Applied Sciences Amsterdam - Scientific Director of Advanced Metropolitan Solution Institute Amsterdam - Project Leader of “100.000 Energy-neutral Homes” - Project Leader of “Logistic Hub Amsterdam” - Project Coordinator of CitySense project/Project Manager at CTO Amsterdam <p>2. Interviewee from environmental management parties</p> <ul style="list-style-type: none"> - Chief Technology Officer (CTO) of Amsterdam Municipality - Project Manager at CTO Amsterdam Municipality - Officer at CTO Amsterdam Municipality - Chief Urban Planning Amsterdam Municipality (information clue) |

F. Frequency of Interviewee's Statement

 New Aspects Weak Frequency

| Aspects | Frequency Stated Aspect per Interviewee in an Interview Session (many time(s)) | | | | | | |
|-------------------------------------------------------|-----------------------------------------------------------------------------------|----|----|----|----|----|----|
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 |
| Smart Economy | | | | | | | |
| Innovation | 1 | - | - | - | 1 | - | - |
| Development of ICT facilities | - | - | - | - | - | 1 | - |
| Mobile technologies | - | - | - | - | 2 | - | - |
| Capability to transform | - | 1 | - | - | - | 3 | - |
| Entrepreneurship spirit | - | - | - | - | 1 | 4 | - |
| Economic image & trademarks | - | - | 1 | - | - | - | - |
| Cost of innovation process | - | - | 1 | 1 | - | - | - |
| Innovation platform | - | - | - | - | 1 | - | - |
| Cost agreement | - | - | - | - | - | - | - |
| Smart People | | | | | | | |
| Participation and coordination in development process | - | 1 | - | 1 | 1 | 3 | - |
| Citizen-centric | - | 1 | - | 1 | 1 | 3 | - |
| Creativity | - | - | - | - | - | 2 | - |
| Social capital | - | - | 1 | - | - | 2 | - |
| Social lifelong learning | - | - | - | - | - | 2 | - |
| Smart Living | | | | | | | |
| Individual safety | - | - | - | - | 1 | 2 | - |
| Housing quality | - | - | 4 | - | - | - | - |
| Livability | - | - | - | - | 1 | - | 2 |
| Smart Governance | | | | | | | |
| Stakeholders collaboration | 4 | - | 3 | 1 | 1 | 3 | - |
| Partnership | - | 2 | 3 | 2 | 3 | 6 | 5 |
| Database resources | - | - | 3 | - | - | - | - |
| Collective intelligence | - | - | 2 | 1 | 1 | 8 | - |
| Communication | 1 | - | 1 | 4 | 2 | - | - |
| Control system | - | - | - | - | - | 1 | - |
| IT Infrastructure | - | - | - | - | - | - | - |
| Leadership | - | - | 2 | 3 | 1 | 1 | - |
| Service-oriented information system | - | - | - | - | 1 | 1 | - |
| Data-exchange | - | - | - | - | - | - | 1 |
| Participation | 2 | - | - | 2 | 5 | 1 | - |
| Data security and privacy | - | - | - | - | - | 1 | - |
| Digital networks | - | - | - | - | - | - | 1 |

| Aspects | Frequency Stated Aspect per Interviewee in an Interview Session (many time(s)) | | | | | | |
|----------------------------------------------------|-----------------------------------------------------------------------------------|----|----|----|----|----|----|
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 |
| Flexible government | 1 | - | - | - | 4 | 8 | 1 |
| Learning by doing | - | - | - | - | 1 | 13 | - |
| Smart Mobility | | | | | | | |
| Sustainable, innovative, and safe transport system | 1 | 2 | - | 8 | - | 1 | - |
| Local accessibility | - | - | - | - | 1 | - | - |
| Efficient logistics activity | - | 2 | - | 6 | - | 1 | - |
| Congestion reduction | 2 | 1 | - | - | - | 1 | - |
| Smart Environment | | | | | | | |
| Environmental pollution | 1 | 3 | - | 2 | - | - | 1 |
| Sustainable resource management | - | - | - | - | - | - | 2 |
| Energy neutral | 1 | - | 1 | - | - | 3 | 1 |
| Circular city | - | 1 | - | 1 | - | - | 2 |
| Education and Capacity | | | | | | | |
| Participatory approach | 2 | - | - | 1 | 2 | 1 | - |
| Awareness of citizen | - | - | - | 1 | - | - | - |
| Knowledge networks | - | 3 | 1 | - | 1 | - | - |
| Advisory | | | | | | | |
| Demonstration | - | 1 | 1 | - | 1 | - | 2 |
| Advice | 4 | - | 1 | 2 | 1 | 9 | 4 |
| Education | - | - | - | - | - | - | 1 |
| Adopting digital technologies | - | 1 | - | - | 2 | 2 | - |
| Support initiative | 1 | 1 | 1 | - | 1 | 6 | 4 |
| Economic or Fiscal | | | | | | | |
| Subsidy | - | 1 | 1 | 1 | - | 2 | 2 |
| Taxation | - | - | - | - | - | 2 | - |
| Grants, loans, aid | 1 | 1 | - | - | 1 | - | - |
| Circular tenders | - | 1 | - | 1 | - | - | - |
| Financial instruments | - | - | 1 | - | - | 1 | 1 |
| Regulatory | | | | | | | |
| Standard and laws | 1 | 1 | - | 4 | 2 | 9 | 2 |
| Zoning | - | 2 | - | 2 | - | - | - |
| Restriction | - | - | - | 1 | - | - | - |
| Monitoring | - | - | - | - | - | - | - |
| Agenda | - | - | 2 | 3 | - | 5 | 2 |
| Agreements | - | - | - | - | 1 | - | - |
| Spatial planning | - | - | - | - | 3 | 1 | - |
| Work Together | | | | | | | |

| Aspects | Frequency Stated Aspect per Interviewee in an Interview Session (many time(s)) | | | | | | |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----|----|----|----|----|----|
| | P1 | P2 | P3 | P4 | P5 | P6 | P7 |
| Work with partners | 3 | - | 2 | - | - | 5 | - |
| Communicate with other departments | - | - | - | - | 2 | 1 | - |
| Different objective among partners | - | - | 2 | - | - | - | - |
| Partners connection | 1 | 1 | - | - | - | - | - |
| Share networks | - | - | - | - | - | - | 1 |
| Share knowledge | - | - | - | - | - | - | 1 |
| Merger the goals | - | - | - | - | - | - | 1 |
| Institutional Vision Development | | | | | | | |
| Work Separately | 1 | - | 6 | - | - | - | 1 |
| Scattered environmental programs | - | 1 | - | 1 | - | - | - |
| Disturb other initiatives | - | - | 2 | - | - | - | - |
| Smart City Consider the Regulations | | | | | | | |
| Smart city projects consider the regulation | 1 | - | 3 | 1 | 1 | 1 | 1 |
| Smart city projects consider the regulation indirectly | - | - | - | 1 | - | - | 1 |
| Smart city projects does not always consider agenda | - | 1 | - | - | 2 | - | - |
| Smart city projects are not obligatory to consider environmental policies | 1 | - | - | - | - | - | - |
| Smart city projects supporting the spatial planning | - | - | - | - | 1 | - | - |
| Environmental Management Consider the Smart City projects | | | | | | | |
| Environmental management include smart city theme | - | - | - | 1 | 1 | - | - |
| Environmental management consider the smart city projects | 1 | - | - | - | - | 2 | - |
| The government create legitimacy to smart city projects | 1 | - | - | - | - | 2 | - |
| Environmental management does not consider the smart city projects | - | - | 4 | - | - | - | - |

 New Aspects
  Weak Frequency

G. Frequency of Document's Statement

 New Aspects Weak Frequency

| Aspects | Frequency Stated Aspect per Document (many time(s)) | | | | | | | | | | | |
|-------------------------------------------------------|--------------------------------------------------------|----|----|----|----|----|----|----|----|-----|-----|-----|
| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Smart Economy | | | | | | | | | | | | |
| Innovation | 1 | 2 | - | - | 3 | - | 1 | 2 | - | - | - | - |
| Development of ICT facilities | 1 | - | - | 1 | - | 4 | - | 2 | - | - | - | - |
| Mobile technologies | - | - | - | 2 | 1 | - | - | 1 | - | - | 1 | - |
| Capability to transform | - | - | - | - | - | - | 1 | - | 1 | - | - | - |
| Entrepreneurship spirit | - | - | - | - | 1 | - | - | - | - | - | 1 | - |
| Economic image & trademarks | - | - | - | - | - | - | - | - | - | - | - | - |
| Cost of innovation process | - | - | - | - | - | - | - | - | - | - | - | - |
| Innovation platform | - | - | - | - | - | - | - | 1 | - | - | - | - |
| Cost agreement | - | - | - | - | - | - | - | - | - | - | - | 1 |
| Smart People | | | | | | | | | | | | |
| Participation and coordination in development process | - | - | - | 1 | - | - | - | - | - | - | 2 | - |
| Citizen-centric | - | - | - | - | - | - | - | - | - | - | 1 | - |
| Creativity | - | - | - | - | 1 | - | - | - | - | - | - | - |
| Social capital | - | - | - | - | - | - | - | - | - | - | - | - |
| Social lifelong learning | - | - | - | - | - | - | - | - | - | - | - | - |
| Smart Living | | | | | | | | | | | | |
| Individual safety | - | - | - | - | - | 1 | - | - | - | - | 3 | - |
| Housing quality | - | - | - | - | - | - | - | - | - | 1 | - | - |
| Livability | - | - | - | - | - | - | - | - | - | - | 1 | - |
| Smart Governance | | | | | | | | | | | | |
| Stakeholders collaboration | - | 2 | - | 1 | - | 1 | 2 | - | - | 3 | 2 | - |
| Partnership | 1 | 2 | - | - | - | - | 2 | 1 | - | - | - | - |
| Database resources | - | 1 | - | 1 | 2 | 1 | 1 | - | - | - | 1 | - |
| Collective intelligence | - | - | - | - | - | - | - | 1 | - | - | 1 | - |
| Communication | - | - | - | 1 | - | - | - | - | - | - | - | - |
| Control system | - | 1 | - | 1 | 1 | - | - | 1 | - | - | - | - |
| IT Infrastructure | 1 | - | 1 | - | 1 | 1 | - | 1 | - | - | - | - |
| Leadership | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Service-oriented information system | - | - | - | 1 | 4 | - | - | 1 | - | - | - | - |
| Data-exchange | - | 2 | - | - | - | 1 | - | - | - | - | 1 | - |
| Participation | - | - | - | - | - | - | - | - | - | - | - | - |
| Data security and privacy | - | - | - | - | 1 | 1 | - | - | - | - | - | - |
| Digital networks | - | - | - | - | 1 | - | - | - | - | - | - | - |

| Aspects | Frequency Stated Aspect per Document (many time(s)) | | | | | | | | | | | |
|----------------------------------------------------|--------------------------------------------------------|----|----|----|----|----|----|----|----|-----|-----|-----|
| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Flexible government | - | - | - | - | - | - | - | - | - | - | - | - |
| Learning by doing | - | - | - | - | - | - | - | 1 | - | - | 1 | - |
| Smart Mobility | | | | | | | | | | | | |
| Sustainable, innovative, and safe transport system | 2 | 3 | - | 3 | 1 | 3 | 5 | 3 | 1 | - | - | 2 |
| Local accessibility | - | - | - | - | - | 1 | - | - | - | - | 1 | - |
| Efficient logistics activity | - | 1 | - | 1 | - | 2 | - | - | - | - | - | 1 |
| Congestion reduction | - | 1 | - | - | - | - | - | - | - | - | - | - |
| Smart Environment | | | | | | | | | | | | |
| Environmental pollution | 1 | 4 | - | - | - | - | 3 | 1 | 1 | - | - | - |
| Sustainable resource management | 2 | 5 | - | - | - | - | - | 1 | - | - | - | - |
| Energy neutral | 4 | 3 | - | - | - | - | 6 | 3 | - | 1 | 1 | - |
| Circular city | - | - | - | - | - | - | - | - | - | - | - | - |
| Education and Capacity | | | | | | | | | | | | |
| Participatory approach | - | - | - | - | - | - | - | - | - | - | 1 | - |
| Awareness of citizen | 1 | 1 | - | - | - | - | 1 | - | - | - | - | - |
| Knowledge networks | - | - | - | - | - | - | - | 1 | - | - | - | - |
| Advisory | | | | | | | | | | | | |
| Demonstration | - | 2 | - | - | - | - | - | - | - | - | - | - |
| Advice | 1 | 7 | - | 1 | 1 | - | 3 | 3 | - | - | 1 | - |
| Education | - | - | - | - | - | - | - | 3 | - | - | - | - |
| Adopting digital technologies | 2 | 3 | - | 2 | 2 | 1 | - | - | - | - | - | - |
| Support initiative | - | - | - | - | - | - | - | 1 | - | - | 1 | - |
| Economic or Fiscal | | | | | | | | | | | | |
| Subsidy | - | 7 | 5 | - | - | 1 | 1 | - | 1 | - | - | - |
| Taxation | - | 3 | 1 | - | - | 1 | 3 | - | - | - | - | - |
| Grants, loans, aid | - | 4 | - | - | - | 1 | 2 | 2 | - | - | - | - |
| Circular tenders | - | 2 | - | - | - | - | - | 1 | 2 | - | - | - |
| Financial instruments | - | 1 | 2 | - | - | - | 1 | - | - | - | - | - |
| Regulatory | | | | | | | | | | | | |
| Standard and laws | - | 6 | 6 | - | - | 1 | 4 | - | 1 | - | - | - |
| Zoning | - | 7 | 4 | 1 | - | 1 | - | 1 | - | - | - | - |
| Restriction | 2 | - | 1 | - | - | 1 | 1 | 1 | - | - | - | - |
| Monitoring | - | 3 | 1 | 2 | - | - | - | - | - | - | - | - |
| Agenda | 5 | 14 | 1 | - | - | 1 | 10 | 5 | - | 1 | 1 | - |
| Agreements | 1 | 8 | - | 1 | - | 1 | 2 | 3 | 1 | - | - | - |
| Spatial planning | 4 | - | - | - | - | - | - | - | - | - | - | - |

| Aspects | Frequency Stated Aspect per Document (many time(s)) | | | | | | | | | | | |
|---------------------------------------------------------------------------|--------------------------------------------------------|----|----|----|----|----|----|----|----|-----|-----|-----|
| | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | D10 | D11 | D12 |
| Work Together | | | | | | | | | | | | |
| Work with partners | 1 | 6 | - | 1 | - | - | 2 | - | - | - | - | - |
| Communicate with other departments | - | - | - | - | - | - | - | - | - | - | - | - |
| Different objective among partners | - | - | - | 1 | - | - | - | - | - | - | - | - |
| Partners connection | - | - | - | - | - | - | - | - | - | - | - | - |
| Share networks | - | - | - | - | - | - | - | - | - | - | - | - |
| Share knowledge | - | - | - | - | - | - | - | - | - | - | - | - |
| Merger the goals | - | - | - | - | - | - | - | - | - | - | - | - |
| Institutional Vision Development | | | | | | | | | | | | |
| Work Separately | - | - | - | - | - | - | - | - | - | - | - | - |
| Scattered environmental programs | - | - | - | - | - | - | - | - | - | - | - | - |
| Disturb other initiatives | - | - | - | - | - | - | - | - | - | - | - | - |
| Smart City Consider the Regulations | | | | | | | | | | | | |
| Smart city projects consider the regulation | - | - | - | - | - | - | - | - | - | - | - | - |
| Smart city projects consider the regulation indirectly | - | - | - | - | - | - | - | - | - | - | - | - |
| Smart city projects does not always consider agenda | - | - | - | - | - | - | - | - | - | - | - | - |
| Smart city projects are not obligatory to consider environmental policies | - | - | - | - | - | - | - | - | - | - | - | - |
| Smart city projects supporting the spatial planning | - | - | - | - | - | - | - | - | - | - | - | - |
| Environmental Management Consider the Smart City projects | | | | | | | | | | | | |
| Environmental management include smart city theme | - | - | - | - | - | - | - | - | - | - | - | - |
| Environmental management consider the smart city projects | - | - | - | - | - | - | - | - | - | - | - | - |
| Environmental management does not consider the smart city projects | - | - | - | - | - | - | - | - | - | - | - | - |
| The government create legitimacy to smart city projects | - | - | - | - | - | - | - | - | - | - | - | - |

 New Aspects
  Weak Frequency

H. Supporting Statements

 New Aspect

| No. | Aspects | Selected Quotation (s) |
|----------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Smart Economy | | |
| 4.1.1.1 | Innovation | <p><i>"[...] Smart Grids – innovative technologies to manage the power grid –connect demand and supply in more efficient way at the local level." (D1)</i></p> <p><i>"The Municipality will realize an urban innovation programme focusing on circular economy, in collaboration with knowledge institutes, and will start with the Circular Economy Quicksan. This also means input for the long-term circular economy innovation programme by AMS". (D2)</i></p> <p><i>"Crowd management: during Sail 2015, the Amsterdam City Council, in cooperation with the Amsterdam Institute for Amsterdam Metropolitan Solutions (AMS institute) and private-sector parties, carried out a test using various techniques to get a picture of pedestrian flows in real-time, to predict congestion, and to manage slow-moving traffic. Cameras, social media, data, GPS, WiFi and Bluetooth were used for the purpose." (D5)</i></p> |
| 4.1.1.2 | Development of ICT facilities | <p><i>"[...] we started the project (energy display) as a small project 5 or 6 years ago. Nowadays, half of the households have a display, because ENECO started to make that kind of products." (P6)</i></p> <p><i>"[...] in cooperation with Amsterdam Metropolitan Solutions we want to develop more ICT facilities (for car and bicycle parking; loading and unloading process of logistic trucks) in the future." (D4)</i></p> <p><i>"[...] beacon transmitter which transmits a unique signal, and can be detected by other IT systems (apps, route planning systems, etc.). The idea is to optimize the urban logistics with the use of the transmitter." (D6)</i></p> <p><i>"Amsterdam lies on the key junction in the global ICT infrastructure, as we have a large ICT sectors in the city." (D8)</i></p> |
| 4.1.1.3 | Mobile technologies | <p><i>"[...] at the moment we develop an application about car management." (P5)</i></p> <p><i>"[...] we continue to put this approach and extend this to other transportation modes. We also optimized it in order to make more use of new data source, such as travel patterns from apps." (D4)</i></p> <p><i>"[...] application that ensures that owners can find their bicycles at the cycle depot in the event that they have been removed by enforcement officers [...]" (D5)</i></p> <p><i>"[...] the Personal Travel Assistant (PTA), which is a unique individual online navigation system, offers travel advice based on the timetables and GPS to monitor the positions of passengers and public transport vehicles, and presents departure times, locations, connections, travel times, and alternative travel plans." (D8)</i></p> |
| 4.1.1.4 | Capability to transform | <p><i>"[...] energy display is an example. We started the project as a small project 5 or 6 years ago. Nowadays, half of the households have a display, because ENECO started to make that kind of products." (P6)</i></p> <p><i>"Amsterdam will therefore facilitate the conversion to electric transport. It is expected that between 60% and 90% of all the kilometers travelled by car in Amsterdam in 2040 will be powered by green electricity generated by windmills, solar panels and biomass power stations." (D7)</i></p> |

| No. | Aspects | Selected Quotation (s) |
|---------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1.1.5 | Entrepreneurship spirit | <p><i>"[...] some projects are Start-Up residence, it's an incubator in the city, so where start-ups can deliver their ideas together with other programs and a mentor." (P5)</i></p> <p><i>"Our starting point is Amsterdam's DNA – its creativity, entrepreneurship, and freedom. It is important in this context that we continue to be an inclusive city in the future [...]." (D5)</i></p> |
| 4.1.1.6 | Economic image & trademarks | - |
| 4.1.1.7 | Cost of innovation process | <p><i>"[...] there is a minimum budget for the community, the size, it has to be run, and the different partners supply small budget for them. In that arrangement, some partners give more money [...]" (P3)</i></p> <p><i>"[...] there are a lot of actors involved, and we are really have to make some investments in the beginning. So, the economic part is also a challenge. Because we are convincing in the long term, if you make this big, then it would be more efficient. You need to have a lot of companies that delivered to the Hubs, before it becomes economically visible." (P4)</i></p> |
| 4.1.1.8 | Innovation platform | - |
| 4.1.1.9 | Cost agreement | - |
| Smart People | | |
| 4.1.2.1 | Participation and coordination in development process | <p><i>"[...] one of the reasons why they (the Municipality) won the I-Capital award last year (2016) is related to the participation of the citizens in the part of the innovation projects." (P1)</i></p> <p><i>"[...] it's called citizen's evening, they can look up the models or the drawings, and they can give their reaction. [...] in that way there's some form of dialogue and they (the Municipality) can also adjust their plan by listening to the citizens and what their need are. [...] we (the Chief Technology Office) also include the citizens, and we always do that in the co-creation (platform)." (P5)</i></p> <p><i>"[...] sometimes a pilot project will be designed and implemented in close cooperation with neighborhood. In other measures, it will be a combination of informal consultations in the preparation and formal participation for the arrangement of the concrete designs." (D4)</i></p> <p><i>"We must move from treating citizens as recipients of services [...] to be citizens as participants in the co-creation of improved quality of life." (D11)</i></p> |
| 4.1.2.2 | Citizen-centric | <p><i>"[...] we from the CTO really busy with the market wants, citizen wants." (P5)</i></p> <p><i>"We wrapped things up by discussing what a possible goal for the pilot project could be. There was quite a bit of overlap between all the individually formulated goals of everyone." (D11)</i></p> |
| 4.1.2.3 | Creativity | <p><i>"[...] they (the people) can just put their idea on the platform, share it, if people interested." (P6)</i></p> <p><i>"[...] Amsterdam's DNA – its creativity, entrepreneurship, and freedom. [...]" (D5)</i></p> |
| 4.1.2.4 | Social capital | <i>"[...] have a way in involving tenants, because may be not all tenants will be able to do this, but if only a few in each block can help out that it feels that a great sense of we're doing this together." (P3)</i> |

| No. | Aspects | Selected Quotation (s) |
|-------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1.2.5 | Social lifelong learning | <i>"[...] people put in an idea [...] what it means into the years, what the experiment is needed to validate if this is true or possible, and what do we have to do to make it happen." (P6)</i> |
| Smart Living | | |
| 4.1.3.1 | Individual safety | <i>"[...] the smart lighting is initiated in the district [...] so we can improve the area's safety" (P5)</i> <i>"[...] road safety blockades may increase the safety risk of other (road) users from loading and unloading activities (of logistics). Particularly for cyclists and pedestrians." (D6)</i> <i>"Main safety challenges focus on dark and silent spots in the city. [...] we discussed the feeling of safety according to crime rates and how stereotyping the area with obvious safety measures will not help." (D11)</i> |
| 4.1.3.2 | Housing quality | <i>"[...] the buildings are getting older, but also more expensive, but the quality of the building is fall behind because it doesn't get repaired on the new situation [...]" (P3)</i> <i>"[...] cost effective building designs that answer to the needs of our residents [...]" (D10)</i> |
| 4.1.3.3 | Livability | <i>"[...] livability aspect is very important, because you do it for the local people here, you do it to keep the city livable and not make it too crowded, [...] the whole aspect of addressing those topics is to keep the city a livable city." (P7)</i> <i>"[...] livability at 'awkward places': around metro station and at interarea connections and tunnels [...]" (D11)</i> |
| Smart Governance | | |
| 4.1.4.1 | Stakeholders collaboration | <i>"[...] and in this research, workshops, like whole of them, we work together with stakeholder in environment Zuid Oost." (P5)</i> <i>"The first, being actually to realize scale in renovating design, transforming design by collaborating with the house corporation, because they have the most property." (P3)</i> <i>"[...] we work together with logistic providers and also Post NL, so we invited our suppliers and we invited either the service providers, and they were put together to make this (logistic hub) work." (P4)</i> <i>"Platforms such as Amsterdam Smart City, the Amsterdam Economic Board and various sustainable networks in the city [...] are collaborating and ensuring acceleration in the field of sustainability." (D2)</i> <i>"The success of this agenda depends on a good cooperation between all parties, such as the cooperation between the city and districts, [...] the involvement of residents, businesses and interest groups." (D4)</i> <i>"[...] in implementing this agenda, the various expertise within Transport and Public Space, Sustainability and Economics Section, and Chief Technology Office. The cooperation with the districts is also essential." (D6)</i> <i>"Amsterdam is doing its utmost to provide a local contribution, together with its citizens, building owners, housing corporations, schools and SME." (D7)</i> |
| 4.1.4.2 | Partnership | <i>"Alliander already knew Amsterdam Smart City because they are a partner. So they together with Municipality of Amsterdam and other companies they are partner of</i> |

| No. | Aspects | Selected Quotation (s) |
|---------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <p><i>the Amsterdam Smart City. And such a way they support the platform by money, by man-hours.” (P7)</i></p> <p><i>“[...] UN Studio and called Freedom Lab, [...] they contacted us (the CTO) [...] so we have this meeting with UN Studio and Freedom Lab, and they ask for if we would like to develop a couple of work in sessions and doing research of a smart infrastructure.” (P5)</i></p> <p><i>“[...] we work together with Datacom but also City Hub, [...] and Hutzelhof. So there are more organizations in this institution (logistic hub).” (P4)</i></p> <p><i>“Through a targeted data programme, the Municipality will collaborate (in partnership) with other entities to develop this understanding. These partners include the Amsterdam Economic Board, the Advanced Metropolitan Solutions Institute, [...] the Port of Amsterdam, Alliander, [...] and a wide range of municipal departments.” (D2)</i></p> <p><i>“Considerable energy savings have been realized by the business community in cooperation with Amsterdam SME, Chamber of Commerce, ORAM (Amsterdam Region Business Association) and the city districts.” (D7)</i></p> <p><i>“In cooperation with several financial institutions and energy companies, a concept is being developed in which it will make the companies easier to get benefit from energy savings.” (D8)</i></p> |
| 4.1.4.3 | Database resources | <p><i>“[...] another big part was finding data, finding the information about the building (to make the energy neutral homes project happen). (P3)</i></p> <p><i>“[...] continue the development of a data programme [...] to map (open and real-time) datasets [...], so that they can be used for more integrated projects and to make policy more effective.” (D2)</i></p> <p><i>“We also optimized the approach by applying new data sources, such as travel patterns from (mobile) apps.” (D4)</i></p> <p><i>“We are also gaining a better real-time view of what is happening in the city [...], which enables us to make smarter use of the limited amount of available space.” (D5)</i></p> <p><i>“In cooperation with the ICT sector, existing data centers will be made more energy efficient and new sustainable centers will be designed.” (D7)</i></p> |
| 4.1.4.4 | Collective intelligence | <p><i>“[...] mainly innovation comes from the city itself. So they can be from the stakeholder and the location itself. It’s not we (the CTO) decide something and that the typical smart city innovation. So we invite them or they just include us in some way.” (P5)</i></p> <p><i>“[...] we are involved in quite a lot, like a group knowledge, dissemination group for the Municipality.” (P4)</i></p> <p><i>“The project should become a learning environment as well so that it can be scaled to the bigger city and go beyond national borders.” (D11)</i></p> |
| 4.1.4.5 | Communication | <p><i>“[...] it’s the responsibility from the Municipality that everybody gets well informed, and (for) that there is some kind of forms of community building (not only) online but also offline.” (P5)</i></p> |

| No. | Aspects | Selected Quotation (s) |
|----------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <p><i>"So, basically, the initiator, or project team have to communicate with the CTO to make it in line with the government's agenda [...]." (P1)</i></p> <p><i>"[...] we look together with the industry on how we can better communicate the availability of loading and unloading (logistics) locations. For that, ICT applications are obvious. [...]." (D4)</i></p> |
| 4.1.4.6 | Control system | <p><i>"[...] by taking control of all resources, an overview is created that also makes it easier to determine how the different resources can reinforce each other [...]. (D2)</i></p> <p><i>"[...] the traffic of different modes is improved by increasing the use of traffic management and IT solutions. [...] to monitor the traffic in a real time basis [...]. This updated information can be used by the traffic control center to sanction the people if they break the traffic rules at intersections." (D4)</i></p> |
| 4.1.4.7 | IT Infrastructure | <p><i>"[...] this basic infrastructure consists of, the "fixed" infrastructures, such as glass fiber, and also antenna networks for mobile data and telephone traffic." (D1)</i></p> <p><i>"[...] it involves investing in digital infrastructure as a means of improving the city's own mobility applications (that is, traffic control installations, etc.)." (D5)</i></p> |
| 4.1.4.8 | Leadership | <p><i>"[...] this is also a way of using developments going on which come from the markets and start-ups. That we as the government also include this innovations and also link them to the citizens." (P5)</i></p> <p><i>"[...] we try to empower organizations to be part of this solution and make them enthusiastic of the idea, may be to make things more clearly for them." (P3)</i></p> <p><i>"We connect partners, so we create awareness. And we're now evaluating on how the (logistic) Hub is used and what the effects. So we raise awareness and evaluating." (P4)</i></p> <p><i>"The Municipality is taking the lead to establish the cooperation. Since in the middle of 2007, the Municipality has contacted a large number of companies, institutions and civil society." (D1)</i></p> |
| 4.1.4.9 | Service-oriented information system | <p><i>"[...] (the Municipality) help researchers with gathering data [...]" (P7)</i></p> <p><i>"When Amsterdam citizens and their organizations and businesses seek information and support, we must be available and accessible. We must provide a platform for emerging pioneers [...]." (D2)</i></p> <p><i>"[...] specifically, this measure consists in [...] make available the most promising data and make it accessible to the logistics sector." (D6)</i></p> |
| 4.1.4.10 | Data-exchange | <p><i>"[...] in this way we think about solution and it's called Mobility as a Service, [...] so we customized the mobility for everyone." (P5)</i></p> <p><i>"We also carry out a number of pilot projects this year, implementing an innovative bicycle parking solutions, like wayfinding apps (digital guidance systems)." (D4)</i></p> |
| 4.1.4.11 | Participation | See quotations on the aspect of participation and coordination in development process in Smart People category |
| 4.1.4.12 | Data security and privacy | <p><i>"[...] Smart energy is nice, brilliant idea, but in another hand, it's pretty hackable. So the limitation of the technology itself." (P6)</i></p> <p><i>"[...] smart also means taking account of the risks and protecting and not sharing private and commercially sensitive information, proper security for systems [...]." (D5)</i></p> |

| No. | Aspects | Selected Quotation (s) |
|-----------------------|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.1.4.13 | Digital networks | <i>"The number of sensors in 'things' is rising exponentially [...]. As soon as objects in the city are connected to the internet, they will be smarter and more information will become available." (D5)</i> |
| 4.1.4.14 | Flexible government | <p><i>"[...] and the question is now not when then Municipality will deal with these development but how. And in that we need also a flexible government (to adopt new ways) [...]." (P5)</i></p> <p><i>"[...] now we want to see if we can roll it (smart city projects) out and bring it better. What are the rules you need to do this in broad ways. Is it the tender things, you need to do tender different to the markets, is this about payment in or business model things your companies [...]." (P6)</i></p> <p><i>"[...] through time new aspect will pop up, [...] aspect we do not discuss yet will be important for the next twenty years, and then it will be added [...] and others that we resolved would be drowned out."(P7)</i></p> |
| 4.1.4.15 | Learning by doing | <p><i>"The CTO develop differently, and sometimes a program or projects like to develop the way that CTO does, and just learning by doing." (P5)</i></p> <p><i>"[...] I do believe that learning more but doing than just do it on paper or whiteboard." (P6)</i></p> <p><i>"[...] individually formulated goals of everyone. Mentioned were: platform approach, bottom-up collaboration, learning and 'Bijlmer-pride' as cornerstones for the pilot project." (D11)</i></p> |
| Smart Mobility | | |
| 4.1.5.1 | Sustainable, innovative, and safe transport system | <p><i>"[...] and together they made a logistical hub in south part of Amsterdam to make a distribution system that is more efficient and also electric, so more sustainable." (P2)</i></p> <p><i>"[...] additionally accelerated electrification of the vehicle fleet will significantly contribute to the possibilities to compact because it is quieter and cleaner for the city." (D1)</i></p> <p><i>"[...] for example the Dutch Bank, they also use the (logistic) Hub [...] because for the Bank, it's really a matter of security, because they don't want to have all different drivers and companies coming to supply their goods. [...] So, when it comes to security, there might also a reason to have a Hub." (P4)</i></p> <p><i>"[...] improve the loading and unloading locations and delivery time over the day. This also improves safety for all users of the roads, including bikers and pedestrians [...]." (D6)</i></p> <p><i>"[...] Logistics transports, both on the road and water, will be electrically powered." (D8)</i></p> |
| 4.1.5.2 | Local accessibility | <p><i>"[...] (the mobility as service also touches) reachability (of the district) [...]." (P5)</i></p> <p><i>"[...] the Municipality can facilitate the accessibility [...] to improve the (logistics loading and unloading) points." (D6)</i></p> |
| 4.1.5.3 | Efficient logistics activity | <i>"[...] it's also about making the logistic more efficient. [...] to reduce the amount of freight transport in the city [...]. So you only need to go in the city with a few parcels, then it's better to drop them at the (logistic) Hub, and then go follow your own to the next stop (of the goods in the city) [...]. So it's also about efficiency." (P4)</i> |

| No. | Aspects | Selected Quotation (s) |
|--------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <p><i>"[...] organizing goods transportation more efficiently will reduce traffic in the city. [...] creating smarter logistics [...]. This includes, for example, the creation of at least two additional sustainable cargo hubs at the city perimeters. Here goods can be transferred by a clean (preferably emission-free) urban transportation modes." (D2)</i></p> <p><i>"[...] efficient logistics, where the carriers and shippers are faster and easier to find a good spot to load and unload goods with less mileage and shorter stops." (D6)</i></p> |
| 4.1.5.4 | Congestion reduction | <p><i>"[...] in principle, the first improvement is always congestion (reduction). But indirectly, or almost directly relate is the aspect of the environment, the pollution and so forth." (P1)</i></p> <p><i>"[...] the Mobility Approach and Mobility Agenda concentrate primarily on reducing the traffic burden and on maintaining the accessibility of the city." (D2)</i></p> |
| Smart Environment | | |
| 4.1.6.1 | Environmental pollution | <p><i>"[...] it's a zone where the vehicle that produce the most CO2 are not allowed to come. So they try to reduce the CO2." (P2)</i></p> <p><i>"[...] the environmental aspect is to reduce the pollution in the city." (P4)</i></p> <p><i>"[...] to keep the city livable and not to make it too crowded, too much waste and polluted air [...]." (P7)</i></p> <p><i>"In 2013, CO2 emissions from the municipal organization reached 93,000 tons annually. [...] target for reductions in CO2 emissions was adapted and redefined in a roadmap extending to 2025 with specific measures to save energy, which will reduce CO2 emissions by 45 per cent compared to 2012." (D2)</i></p> <p><i>"[...] ships docked in the port will no longer have to provide their own power supply because of the availability of shore power supplies. This prevents the emission of hazardous substances and reduces noise pollution." (D7)</i></p> <p><i>"Amsterdam is working on the Amsterdam Climate Programme in accordance with the principle of "Trias Energetica", an approach that results in an optimum reduction of CO2." (D7)</i></p> |
| 4.1.6.2 | Sustainable resource management | <p><i>"[...] waste is a resource. So if you don't burn waste but use it as a resource, you can leave the resource on the ground, so there's less environmental impact." (P7)</i></p> <p><i>"[...] waste legislation concerning the reuse of natural resources. [...] recover four times as many natural resources from waste compared to 2014 through the post-separation of household waste; recover minerals from bottom ash [...]" (D2)</i></p> |
| 4.1.6.3 | Energy neutral | <p><i>"[...] to make houses one hundred percent energy neutral. So they try to re-insulate it, reduce the energy waste, place solar panel on it, and transform from gas to electric." (P7)</i></p> <p><i>"[...] we believe in distributed energy networks. So, in the local area, we generate the energy, we distribute the energy in district scale. We believe that is part of the energy system." (P6)</i></p> <p><i>"[...] in addition to these agreements, the Municipality sees 'Zero Energy Buildings' as an option to improve current housing stock." (D2)</i></p> <p><i>"Pilot projects will be set up related to building new climate-neutral, houses, schools and offices. [...] Only climate-neutral buildings will be constructed in Amsterdam from</i></p> |


| No. | Aspects | Selected Quotation (s) |
|-------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <p>2015. [...]Heat and cold storage and district heating will also be used to make existing buildings more energy efficient." (D7)</p> <p>"[...] we aim to realize building designs that can be applied to transform frequently found houses into energy neutral homes." (D10)</p> |
| 4.1.6.4 | Circular city | <p>"[...] in the circular city you of course reuse materials that's one aspect, but you also try to avoid using non-renewable resources." (P7)</p> <p>"[...] in the tendering, they (the Municipality) now ask the market to tender on circular projects. And they try to stimulate circularity in the different project tenders they conducted. [...] try to make project more circular and more environmental friendly." (P2)</p> |
| Education and Capacity | | |
| 4.1.7.1 | Participatory approach | See quotations on the aspect of participation and coordination in development process in Smart People category |
| 4.1.7.2 | Awareness of citizen | <p>"We connect partners, so we create awareness. And we're now evaluating on how the Hub is used and what the effects. So we raise awareness and evaluating." (P4)</p> <p>"[...] create awareness and behavioral change (of the) citizens and businesses." (D1)</p> |
| 4.1.7.3 | Knowledge networks | <p>"[...] it's really trying to share knowledge because trying to sell it with an example of lesson you learned." (P3)</p> <p>"Amsterdam Smart City, the organization focuses [...] also to share knowledge about products or projects or research and knowledge." (P2)</p> <p>"[...] the Amsterdam Metropolitan Area will become an important 'laboratory for sustainable development'. Knowledge will be developed and shared by an international innovative network of sustainable cities." (D8)</p> |
| Advisory | | |
| 4.2.1.1 | Advice | <p>"[...] from the CTO is to advise them (another Municipality department) to help them or to advise them in some way that they will plan differently." (P5)</p> <p>"[...] they (partners) are sitting on the tables with the government. [...] we support, we help, sometimes we host staffs, discuss together and say, hey this is research or this is development, and we help to define that." (P6)</p> <p>"[...] EV (Electrified vehicles) charging we started it out with giving free parking place for people who have EV, free, so that helps [...]." (P6)</p> <p>"[...] in that way we empower people to work together, to find each other, to ask question, to interact, that's also how we help [...]." (P7)</p> <p>"[...] we try to connect them (the market) to the right people, we try to connect it to the right department in our Municipality." (P7)</p> <p>"[...] the Municipality will encourage innovation and circular activities as part of its active contribution in this respect [...]." (D2)</p> <p>"A key success factor in accelerating the transition to a sustainable city is working together and making the right connections. These might be between people, knowledge and money, between policy and implementation or between business, government, education and residents." (D2)</p> |

| No. | Aspects | Selected Quotation (s) |
|---------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <p><i>"[...] a strong appeal will also be made to the general public and the business community to contribute towards the reduction of their own CO2 emissions." (D7)</i></p> <p><i>"[...] the Municipality of Amsterdam has worked hard on encouraging bicycle use by providing cycle paths and lanes [...] and an extensive network of bicycle parking facilities." (D8)</i></p> |
| 4.2.1.2 | Demonstration | <p><i>"[...] some of the events that we have this summer, "We Make City". It's mainly about innovation, about making city more eco-friendly and the environment also." (P2)</i></p> <p><i>"[...] from the waste department in our Municipality trying to promote waste as a resource. We also, just did a circular exposition in the town hall about circular economy in Amsterdam where we try to show some projects that currently happening in the city [...]." (P7)</i></p> <p><i>"[...] continue subsidies to promote clean mobility [...], so that it is possible to meet the air-quality standard." (D2)</i></p> |
| 4.2.1.3 | Education | <p><i>"[...] we have a campaign from our waste department. They try to make people aware, on the fact that, waste is a resource." (P7)</i></p> <p><i>"The University of Amsterdam is considering the integration of sustainability concept into its training programmes, while sustainable development might also become an integral part of the education provided by university and regional training centers [...]." (D8)</i></p> |
| 4.2.1.4 | Adopting digital technologies | <p><i>"[...] our try is to reduce the maintenance cost by using smart technology. So that will cost less [...]." (P5)</i></p> <p><i>"[...] the parking apps nowadays when we pay for (park) 50% by app nowadays. So we (the Municipality) don't need the machine anymore, which is more sustainable and cheaper. Through the app now it's 0% (for the first transaction) because they (the providers) have to change and develop the business model, and now we have 3 or 4 providers who compete, that's what we want." (P6)</i></p> <p><i>"[...] in the future, there will be taken into account new possibilities in the field of smart grids, dynamic traffic management, including dynamic weighing, smart homes/buildings [...]" (D1)</i></p> <p><i>"[...] it involves investing in digital infrastructure as a means of improving the city's own mobility applications (that is, traffic control installations, etc.)." (D5)</i></p> |
| 4.2.1.5 | Support initiative | <p><i>"The government is needed for all types of things, but we don't know what the future is. So many companies say, hey the future is here, (and we say) ok let's see if it works." (P6)</i></p> <p><i>"[...] support a lot of initiative that try to diminish the environmental impacts. So if somebody has a good idea or they want to pilot something or they want to implement in a small scale or they want to research it, we try to help them." (P7)</i></p> <p><i>"The city will serve as a source of inspiration for a wide range of sustainable start-up businesses, as a locus for sustainable activity, and as a launch pad for innovative products." (D8)</i></p> |

| No. | Aspects | Selected Quotation (s) |
|---------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Economic or Fiscal | | |
| 4.2.2.1 | Subsidy | <p><i>"[...] there's also subsidies for electric vehicles. So there are some financial measures from the city that can help." (P4)</i></p> <p><i>"We have subsidy for solar panel on the roof initiative." (P6)</i></p> <p><i>"[...] district subsidy schemes in the areas of climate-neutral building and energy conservation and generation in the housing stock." (D2)</i></p> <p><i>"[...] Amsterdam is one of the few cities that does subsidize electric vehicles including electric freight transport." (D9)</i></p> |
| 4.2.2.2 | Taxation | <p><i>"[...] we have solar panel on the roof of the Amsterdam Arena, there's battery and energy management system installed. [...] To do so, we need to make new regulations, like if we want to generate energy, way they pay tax [...]." (P6)</i></p> <p><i>"Smarter Enforcement (action from Smart Mobility) is working on identifying fault parking [...]. The aim is to be able to deal with the tax enforcement (from the fault parking sanctions) [...]." (D6)</i></p> |
| 4.2.2.3 | Grants, loans, aid | <p><i>"[...] setting up a simple, effective and revolving Energy Fund. This fund will be the investment vehicle [...]." (D2)</i></p> <p><i>"[...] the construction company guarantees that the home will no longer have an energy bill after refurbishment. With this guarantee, money reserved for the energy bill can be used to finance the refurbishment work to make the home sustainable. This creates additional investment budget." (D2)</i></p> <p><i>"Amsterdam is investing in clean, quiet and efficient electric transport to help reduce the CO2 emissions of the traffic and transport sector." (D7)</i></p> |
| 4.2.2.4 | Circular tenders | <p><i>"[...] in the tendering, they (the Municipality) now ask the market to tender on circular projects. They try to stimulate the project more circular and more environmental friendly." (P2)</i></p> <p><i>"[...] when we (knowledge institutes) procure our goods, we asks suppliers, for example, whether it is made from sustainable materials, but we also want to ask whether they can transport it in a sustainable way. This is now done in more and more tenders." (P4)</i></p> <p><i>"The city will also use an innovative tender policy to stimulate the development of sustainable and creative products, it includes the building and road works." (D8)</i></p> |
| 4.2.2.5 | Financial instruments | <p><i>"(a scheme of) fines if you don't treat your waste or you dump it." (P7)</i></p> <p><i>"You will be fined € 90, - (rate 2017) if you enter the environmental zone for lorries without exemption. You will receive a payment slip [...]." (D3)</i></p> |
| Regulatory | | |
| 4.2.3.1 | Standard and laws | <p><i>"[...] if you drive an electric vehicles, you can have some exemptions, so for example you can park on the bridge, or you can park on the square, [...] you can get some privileges." (P4)</i></p> <p><i>"[...] because more and more polluting vehicles are banned out of the city. So this has an influence on the company that they start to re-think whether they should deliver in the city or not. So, this is basically the rule." (P4)</i></p> |

| No. | Aspects | Selected Quotation (s) |
|---------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <p><i>"[...] we have a lot of regulation on protecting the environment, such as not dumping, no chemicals, and how heavy industry can be in a certain area" (P7)</i></p> <p><i>"We must eliminate obstructive regulations, but must set clear standards as well." (D2)</i></p> <p><i>"[...] the EU will tighten up standards for the CO2 emissions of vehicles." (D7)</i></p> <p><i>"Amsterdam works with an exemption on the RVV (Regulations on road signs). Derogations can be made to deliver in a wider timeframe. [...] According to Amsterdam, about 80% of the requests can currently be permitted." (D9)</i></p> |
| 4.2.3.2 | Zoning | <p><i>"If you look at regulatory, I think, we have this Milieu Zona [...], it's a zone where vehicles that produce the most CO2 are not allowed to come." (P2)</i></p> <p><i>"[...] development of free zones for sustainable and/or circular activities." (D2)</i></p> |
| 4.2.3.3 | Restriction | <p><i>"[...] it will be more complicated to go to the city with your (logistic providers) polluting vehicles, and it will be more restricted. So, please make sure you prepare for this, and you have to better use the (logistic) Hub. [...]." (P4)</i></p> <p><i>"[...] within the A10 ring road, the city is restricted for trucks that cannot meet the requirements of the environmental zone." (D3)</i></p> |
| 4.2.3.4 | Monitoring | <p><i>"Regulation and enforcement: Amsterdam will organize random inspections of energy-performance levels" (D2)</i></p> <p><i>"The environmental zone is checked with cameras at exits of the A10 and in the city. Based on the license plate, these cameras record whether a vehicle can enter the environmental zone or not" (D3)</i></p> |
| 4.2.3.5 | Agenda | <p><i>"[...] but (the agenda) not really very specific or concrete. They say, we want to have a Hub, but it's not really mention what they will do. [...] It says smart logistics need to be encouraged by the use of the current three Cargo Hubs, they should be further stimulated and facilitated and we need to offer space for 2 additional Cargo hubs. But it's not really for allocating space, but more giving room." (P4)</i></p> <p><i>"[...] A huge challenge is to make an energy efficiency for the existing housing stock." (D1)</i></p> <p><i>"[...] implementing energy-saving measures within homes, businesses and social real estate, and by encouraging climate-neutral construction." (D2)</i></p> <p><i>"[...] Sustainability Agenda is not a definitive implementation programme, but it does formulate ambitions, goals and directions. In this sense it is literally an 'agenda'. [...] The ambition is to use 20 per cent less energy per inhabitant in 2020, compared to 2013" (D2)</i></p> <p><i>"[...] it is expected that between 60% and 90% of all the kilometers travelled by car in Amsterdam in 2040 will be powered by green electricity generated by windmills, solar panels and biomass power stations." (D7)</i></p> <p><i>"Amsterdam aims to become the Dutch frontrunner in the development of smart energy grids." (D8)</i></p> <p><i>"In a climate neutral district, the decentralized energy productions are kept in balance through the use of local energy storage and exchange via the energy grid." (D8)</i></p> |

| No. | Aspects | Selected Quotation (s) |
|---------|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.2.3.6 | Agreements | <p><i>"[...] the companies we try to remain with them that we have some kind of contract, so they will guarantee that the workers will not come with their car." (P5)</i></p> <p><i>"As part of the agreement to establish the districts (mobility). Mobility Approach Amsterdam will further implement "car-free policy" [...]." (D1)</i></p> <p><i>"Make arrangements with housing associations and businesses regarding the utilization of roof surfaces [...]." (D2)</i></p> |
| 4.2.3.7 | Spatial planning | <p><i>"Spatial policy aims to inventory claims from various sectors (housing, transportation, business, education, environment, water) all claims and complaints related to space. [...] its principle is to make an optimal use of the land. [...] reserve space for the expected increasing mobility on the road, including freight. [...] spatial policy can also be conducted by placing heating and cooling system next to each different building functions. " (D1)</i></p> |

 New Aspect

I. List Relevant and Less Relevant Aspects

| Categories | Aspects/Activities/Effects | |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Relevant (Above-relevance threshold value) | Less Relevant (Under-relevance threshold value) |
| Smart City | | |
| Smart Economy | <ul style="list-style-type: none"> • Innovation | <ul style="list-style-type: none"> • Economic image & trademarks • Innovation platform • Cost agreement • Development of ICT facilities • Mobile technologies • Capability to transform • Entrepreneurship spirit • Cost of innovation process |
| Smart People | <ul style="list-style-type: none"> • Participation and coordination in development process | <ul style="list-style-type: none"> • Creativity • Social lifelong learning • Citizen-centric • Social capital |
| Smart Living | - | <ul style="list-style-type: none"> • Individual safety • Housing quality • Livability |
| Smart Governance | <ul style="list-style-type: none"> • Stakeholders collaboration • Partnership • Collective intelligence • Participation • Flexible government | <ul style="list-style-type: none"> • Database resources • Communication • Control system • IT Infrastructure • Leadership • Service-oriented information system • Data-exchange • Data security and privacy • Digital network • Learning by doing |
| Smart Mobility | <ul style="list-style-type: none"> • Sustainable, innovative, and safe transport system • Efficient logistics activity | <ul style="list-style-type: none"> • Local accessibility • Congestion reduction |
| Smart Environment | <ul style="list-style-type: none"> • Environmental pollution • Energy neutral | <ul style="list-style-type: none"> • Sustainable resource management • Circular city |
| Education and Capacity | - | <ul style="list-style-type: none"> • Participatory approach • Awareness of citizen • Knowledge networks |
| Environmental Management | | |
| Advisory | <ul style="list-style-type: none"> • Advice • Adopting digital technologies • Support initiative | <ul style="list-style-type: none"> • Demonstration • Education |
| Economic or Fiscal | <ul style="list-style-type: none"> • Subsidy • Grants, loans, aid • Financial instruments | <ul style="list-style-type: none"> • Taxation • Circular tenders |
| Regulatory | <ul style="list-style-type: none"> • Standard and laws • Zoning • Agenda | <ul style="list-style-type: none"> • Restriction • Monitoring • Agreements |

| | | |
|------------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | <ul style="list-style-type: none"> • Spatial planning |
| Interaction | | |
| Work Together | <ul style="list-style-type: none"> • Work with partners | <ul style="list-style-type: none"> • Communicate with other departments • Partners connection • Different objective among partners • Share networks • Share knowledge • Merge the goals |
| Consideration to the Regulations | <ul style="list-style-type: none"> • Smart city projects consider the regulation | <ul style="list-style-type: none"> • Smart city projects consider the regulation indirectly • Smart city projects does not always consider agenda • Smart city projects are not obligatory to consider environmental policies • Smart city projects supporting the spatial planning |
| Consideration to the Smart City Projects | - | <ul style="list-style-type: none"> • Environmental management includes smart city theme • Environmental management consider the smart city projects • The government create legitimacy to smart city projects • Environmental management does not consider the smart city projects |
| Institutional Vision Development | - | <ul style="list-style-type: none"> • Work separately • Scattered environmental programs • Disturb other initiatives |

J. The Study of Institutional Interaction

The following paper was submitted for 4th PlanoCosmo Bandung Institute of Technology International Conference and under the review for publication on the Journal of Regional and City Planning.

Urban Innovation System and the Role of Open Web-Based Platform: The Case of Amsterdam Smart City Platform

Z D W Putra, W G M van der Knaap

Land Use Planning Group, Wageningen University and Research, P.O. Box 47, 6700 AA, Wageningen, the Netherlands

zulfikar.dinar@gmail.com

Abstract. This study discusses urban innovation system and the role of digital technology by using the Amsterdam Smart City platform as a case. Based on semi-structured interviews and document analysis, this study reveals that the Amsterdam Smart City platform can be considered as an example of a new form of the urban innovation system. There are nine actor categories involved with either a one-sided or bidirectional relationship between them in this innovation system. The actors dynamically interact with each other in different innovation phases based on their interests and resources. Besides, the use of an open-web based platform to connect actors and exchange information in the innovation system makes the information distributed fairly and transparently among actors. Additionally, it can reach more actors to join the innovation system. There is also no geographical limitation among actors to collaborate and innovate on a specific idea. Therefore, a dynamic interaction among actors which are facilitated by an open-web based platform can be a new way to develop an innovation system in the urban area.

1. Introduction

One of the urbanization trends is a rapidly increase of the urban population. It makes cities facing complex issues, especially around environmental management, such as rising of CO₂ emissions [1, 29, 31]. Therefore, cities must use more advance environmental management to deal with these complex issues.

At the same time, there is a rapid development of Information and Communication Technologies (ICT) that urban people are using to support their live in the city [10, 26]. ICT becomes an important tool for people in the city to satisfy their information and communication needs more effectively and efficiently.

Understanding the potency, impact, and importance of ICT in cities, many governments adopt various technologies to cope with the more complex urban challenges to improve the citizen quality of life [31]. Governments expect that dedicated ICT can provide them with a quicker way to manage urban environment more effective and efficient.

A fine example comes from Amsterdam. The city-government together with specific (private) stakeholders developed a web-based open platform named Amsterdam Smart City (ASC) to increase collaboration among citizens and organizations in finding solutions for specific environmental problems in the city, with one of the key purposes to reduce CO₂ emissions [4, 36]. To realise this, both government and non-governmental parties can initiate a project to deal with particular urban problems affiliated with environmental aspects.

An urban innovation system as a term refers to networks of set of companies and organizations with a free exchange of information among them in an urban context [18]. It can be an agglomeration with different outlines, either physical or not. Nowadays, it is supported by the development of ICT, therefore the information exchange can be conducted via digital technologies, i.e. websites, mobile-apps, and social media.

As Iizuka [22] stated, the innovation system has shifted from firm-centralized to community-centralized. It means that currently the innovation system is not only used to improve the performance of a firm but also to enhance the quality of life of the community. The innovation system appearing in an urban area can be called an urban innovation system.

The implementation of a smart city strategy in Amsterdam is a suitable example for explaining the shift within an innovation system. This paper aims to identify the role of digital technologies used in the Amsterdam Smart City

platform as an urban innovation system. However, to identify it, we have to analyse the innovation system of the ASC first, because it helps to reveal whether the ASC can be considered as an urban innovation system or not. Therefore, two intertwined research questions were raised, namely what is the interaction between the actors in the Amsterdam Smart City platform based on the urban innovation system framework? And what is the role of the web-based open platform in Amsterdam Smart City as an urban innovation system?

After this introduction, the method used for this research is explained. It will be followed by an explanation on the urban innovation system about the historical perspectives of the concept, resulting in a framework. Based on this framework, the ASC platform will be described, including its development, actors and operations of the platform. The next step is to describe the interaction among actors who are involved in the platform using the framework. Additionally, that section also explains about the role of digital technology in the ASC platform. Finally, the discussion and conclusion section will present the research findings.

2. Methodology

A case study approach seems the most suitable strategy to deal with the research questions further. Yin [37] stated that a case study is a suitable strategy when you want to analyse a contemporary case with no manipulation towards relevant behaviours. Furthermore, a case study is an investigation strategy to deeply explore a program, event, process, or individuals that is bounded in time and activity by using a variety of data collection methods in a limited period to gather detailed information [11]. To find an answer to our research questions we use a specific actual situation. In this paper we use a single case study with two unit analyses. The case is the ASC platform and we focus on the actors and web-open platform as unit analysis. The data is collected through semi-structured interviews and document analysis. The interviewees are people from the partners of the ASC platform. The analysis focuses on the actors involved in and on the web-based open platform technology applied for the ASC platform.

3. Urban Innovation System

So far four innovation system approaches are distinguished in scientific papers, namely a national, regional, sectoral, and technological innovation system [8, 15, 35]. However those approaches are different to each other and should be applied in its own context. In this section, each approach will be shortly described to give an understanding about its definition and characteristic.

The national innovation system was first introduced by Freeman [16]. He stated that a national innovation system is a network of public and private institutions functioning as a joint effort to develop new technologies. Then that approach was adopted by the Organisation for Economic Co-operation and Development (OECD) in 1997 to help the policy makers leveraging the innovation performance in their country. Moreover, OECD [30] explained that a national innovation system stands for understanding the relationship among actors in the network as a collective understanding to introduce and extend a new technology into society. Based on the definition above, it implies that the national innovation system is an approach to help the national policy makers understand the relationship among actors, then develop various innovations as an outcome of the well-known relationship. The analysis of a relationship is conducted at national level and the actors are all public and private institutions at the national level, namely governments, industries, firms, universities, research institutes, and other actors who have a focus on the (national) development of science and technology [8].

The second approach is the regional innovation system which originally comes from the national innovation system [14]. Therefore, their characteristics are similar. It is argued that the distinction between national and regional innovation system cannot be clearly revealed [14]. Consequently, the definition of a regional innovation system is basically the same as a national innovation system. However, they can differ in context and focus. A regional innovation system has a specific territory which becomes a specialized location for various actors, such as industries, firms, research institutes, and other actors, to share their knowledge and support each other in a systemic way to produce innovative products on a regional level [24]. Hence, it focuses more on a specific innovation of firm's products to put a more competitive product in the market.

The next approach is the sectoral innovation system which resembles a regional innovation system [8]. However, this approach focuses more on a specific sector or industry which usually have heterogeneous actors inside it, such as various firms, research institutions, and other supporting institutions [27]. The dynamic process of technological development within this approach determines its differentiation with the more static regional innovation system. The idea of a sectoral innovation system is based on the dynamic changing of technological use in the sector.

The final approach is a technological innovation system in which the actors and their relationships bring about an innovation as the focus. However, its characteristic differs from the other approaches. It does not have a specific spatial and context boundary like the previous approaches [8, 15]. Actors can come from anywhere and join the system to pursue an innovation upon a specific technology. They can also come and go during the innovation process. Therefore,

this approach is more dynamic than the other approaches. Due to its focus on a specific technology, the number of actors involved is smaller than in the national or regional innovation system [24].

Based on the description of each innovation system above, all approaches have their focus on the analysis of the actors involved and their relationship in pursuing new technology. However, they differ in characteristics. A national and regional innovation system is based on a specific administrative spatial boundary and is more static in terms of actors involved, mainly because of the policies at the national or regional level that instruct them to have consistent actors. On the other hand, a sectoral and technological innovation system is not based on a specific administrative spatial boundary, but more on the functional boundary, such as an industrial district, an innovation environment, or a technopole [14]. Additionally, these last two approaches are dynamic because every actor can come and go somewhere in the innovation process. Compared to each other, Grosetti [18] argued that a national and regional innovation system is a top-down approach in which the innovation system is dictated by the national or regional policies. While a sectoral and technological innovation system is a bottom-up approach in which the innovation system grows from a local context and not from policies.

This study tries to look for an approach that have the following characteristics: (1) spatial boundary area; (2) dynamic system. Therefore, this research uses the approach of urban innovation system by adopting the characteristic of a national or regional innovation system for the spatial boundary area and a sectoral or technological innovation system for the dynamic system. Next to the administrative boundary, an urban area has many actors who can be involved in all or parts (phases) of the innovation process. Especially the adoption of an open web-based platform stimulates many actors to join in and go out from an innovation project. For instance, they can be involved only during the idea development phase or within an implementation process. Therefore, a more dynamic system is needed for an urban innovation system in this context of study.

We constructed a framework for this study based on the national innovation system framework developed by Kuhlman and Arnold [23] which was revised by Warnke et al. [35] to be relevant for existing conditions (figure 1). There are two main elements of the framework relevant to the current condition, namely the emergent actors involved in the innovation system and the shifted definition from innovation system for leveraging a firm's product to innovation system for improving the community quality of life. That relevance will influence how we identify the ASC as an urban innovation system, because there are several emerging actors involved in it with the goal to improve the citizen quality of life. This study analyses the actors involved and their relationship to the urban context by testing the framework using the case of the ASC platform. The revised framework is also in line with Iizuka [22], as in the current situation the innovation process is not only linked to a firm's product and to gain a more competitive product for the firm, region, or nation. But nowadays, the innovation system seems to be a way to improve the life of a community. Furthermore, citizens cannot only be seen as a customer, but also as the agent of innovation in which they can be the innovator who have an idea towards an application and use of new technology.

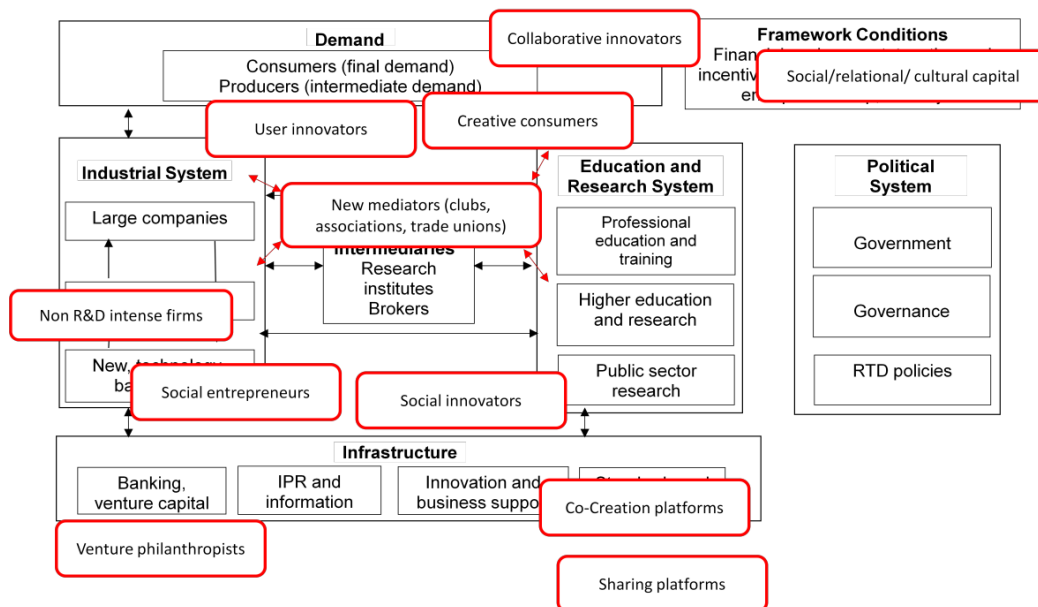


Figure 1. Revised Innovation System Model [23, 35]

Figure 1 shows the actors and their relationships. Warnke et al. [35] added new actors and relationships in the framework, represented by the red box and arrows, to make it more relevant for the present situation. It reveals that more actors emerge as a response to deal with specific problems. The most important actor is the group of intermediaries (“new mediators”) that are the backbone of an innovation system, as they help to connect actors with the same interest [35]. Nowadays, the intermediaries emerge as a specific network organization which organize a platform to connect and facilitate various actors to be involved in an innovation system. They have to be an active actor to make sure that different actors are accommodated and in that way, the innovation system will keep on going. Other actors that can be involved are the industrial system, education and research system, and demand³. They are the sub-system of the intermediary actor which are influencing and being influenced by each other through the intermediaries. However, Warnke et al. [35] stated that the industrial system has to have more focus on the social entrepreneurs and non R&D intense firm, as they emerge as a new technology-based firm which focus on a specific urban problem. In that way, they offer a specific solution to the problem. Besides, Warnke et al. [35] also added three new actors with an “innovator” label, namely the user innovators, the social innovators, and the collaborative innovators, which have a fuzzy interaction with other actors. This addition is also applied for new actors at the infrastructure level, namely the venture philanthropist, a co-creation platform, and a sharing platform. Furthermore, all actors are restricted and shaped by the political system, and the framework is based on the condition of social, relational, and cultural capital of the city.

4. Amsterdam Smart City Platform

There are various definition of smart city which makes it more a contextual than a general term (see table 1).

Table 1. Smart City Definitions (based on [13]) (keyword in bold)

| Defintion | Ref. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| “A city that monitors and integrates conditions of all of its critical infrastructures , including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens” | [19] |
| “A Smart City is a city well performing built on the ‘smart’ combination of endowments and activities of self-decisive, independent and aware citizens ” | [17] |
| “Smart city is defined by IBM as the use of information and communication technology to sense, analyze and integrate the key information of core systems in running cities” | [21] |
| “A city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance ” | [7] |
| “Smart City is the product of Digital City combined with the Internet of Things ” | [33] |
| “A smart city is a well-defined geographical area , in which high technologies such as ICT, logistic, energy production, and so on, cooperate to create benefits for citizens in terms of well-being, inclusion and participation, environmental quality, intelligent development; it is governed by a well-defined pool of subjects, able to state the rules and policy for the city government and development” | [12] |
| Smart city is the collaboration among policy, citizens, research, and private partners as an ecosystem facilitate idea exchange and innovation by using media, ICT, and open big data | [6] |
| “Smart city is the implementation of multi-dimensional approach which consists of four different approach, namely smart machines and informed organizations, partnerships and collaborations, learning and adaptation, and investing for the future ” | [9] |
| “A Smart City is an integrated system in which human and social capital interact , using technology-based solutions. It aims to efficiently achieve sustainable and resilient development and a high quality of life on the basis of a multistakeholder, Municipality based partnership.” | [28] |
| “Smart city is the utilization of ICT and innovation by cities (new, existing or districts), as a means to sustain in economic, social and environmental terms and to address several challenges dealing with six (6) dimensions (people, economy, governance, mobility, environment and living)” | [5] |

³ Based on [35], the demand formed by the consumers as a final demand and producers as an intermediate demand.

Based on the definitions above, it can be summarized that a smart city is a city which uses ICT to increase the citizen quality of life by sensing, analysing, and integrating information through the multi-dimensional approach and collaboration among policy, citizens, research, and private partners in six dimensions (people, economy, governance, mobility, environment and living).

Amsterdam Smart City platform was started in 2009 as an initiative between Amsterdam Municipality (the governmental part and the Amsterdam Economic Board) and (private) companies (KPN and Liander). It more focuses on the citizen-oriented strategies in its operationalization to increase the awareness of citizens towards environmental issues in the city [13]. Eventually, all projects developed via the ASC platform come from the collaboration among citizens, communities, and related companies. And they participate in the platform organisation together with governments, knowledge institutions, and other emerging actors (see table 2). It illustrates that technology is not the central point of the platform [36], while most of cities in the world are more focused on technology as a central aspect of the development of smart city. The ASC platform has defined smart city as follows:

“Smart city is all about the total sum of innovative technology, behavioural change and sustainable economic investments. By bringing partners together and setting up small local projects, it creates opportunities for these initiatives to be tested.” [4 p 7]

Based on the ASC definition, the operationalization of smart city in Amsterdam is more on the creation of small local projects by using or creating innovative technology, generating behavioural change, and using sustainable economic investment. The creation of small local project is steered by the collaboration between all parties, such as the Municipality, related organizations⁴, a private company, a community, and also inhabitants. All parties can conduct their projects in a collaborative atmosphere, then they can test it directly everywhere in the city. By doing so, the strategy of ASC is “learning by doing”. They want to make the city as a living lab, where different projects can be tested and scaled up. The term living lab itself refers to the process of innovation which involve the users themselves as the active contributor for the creative and evaluative processes [32]. There are various projects initiated by different parties in the city to solve particular urban problem.

Table 2. Actors and Program Partners in Amsterdam Smart City Platform (Based on [2, 4])

| No | Actors Category | Actors | Role | Status & Current Situation |
|----|---------------------|------------------------------------------------|-----------------------------------------------------------------|----------------------------|
| 1 | Government | Amsterdam Municipality | - Programme partner - Partly funder | Initiator, active |
| | | Amsterdam Economic Board | - Programme partner - Connector | Initiator, active |
| | | Chief Technology Office Amsterdam Municipality | - Technology developer - Start-up facilitator | Recent partner, active |
| 2 | Private Company | Amsterdam Innovation Motor | - Programme partner - Connector | Initiator, not active |
| | | KPN | | Initiator, active |
| | | Alliander | | Initiator, active |
| | | PostNL | | Recent partner, active |
| | | Arcadis | - Programme partner - Partly funder | Recent partner, active |
| | | Amsterdam Arena | | Recent partner, active |
| | | Engie | | Recent partner, active |
| 3 | Knowledge Institute | TNO | - Programme partner - Knowledge generator | Initiator, not active |
| | | University of Applied Science Amsterdam | - Programme partner - Partly funder - Knowledge generator | Recent partner, active |

⁴ Related organizations refer to the resident representative organizations, NGO, start-ups, and other forms of organizations that are currently active in the city of Amsterdam.

| No | Actors Category | Actors | Role | Status & Current Situation |
|----|-----------------------|----------------------|-----------------------------------------------------------------|----------------------------|
| 4 | NGO | Waag Society | - Programme partner - Partly funder - Knowledge generator | Recent partner, active |
| | | Pakhuis de Zwijger | - Programme partner - Partly funder - Clearinghouse | Recent partner, active |
| 5 | Other emerging actors | User innovators | - Smart city project initiator | Emerging actor, active |
| | | Start-up | - Smart city project initiator and developer | Emerging actor, active |
| | | Social entrepreneurs | - Smart city project initiator - Co-creation platform | Emerging actor, active |

The ASC platform aims to look for solutions for better use of natural resources and reducing greenhouse gas emissions through collaboration among citizens and organizations by using a web-based open platform [2, 13]. To achieve that objective, ASC focuses on six themes, namely infrastructure and technology; energy, water, and waste; mobility; circular city; governance and education; citizens and living. Each citizen, community, and private company can initiate a project related to these themes.

They have four pillars to operationalize their organization of smart city projects. The first pillar is the collective approach which means that every project conducted at the ASC platform is based on the cooperation of all relevant parties to achieve viable results. It also emphasizes the higher involvement of end-users to achieve a successful project. The second pillar, innovation and awareness, is required in each project. Therefore, the project has to have not only innovative technology but also need to induce behavioural change at the end users with its implementation. The third pillar is knowledge dissemination which refers to the knowledge exchange among stakeholders by sharing experiences through the ASC platform. Finally, the project has to be economically viable to have a bigger chance for upscaling. They do not only want to implement the project in Amsterdam but also replicate it in other cities.

In 2016, the ASC created a web-based open platform which is launched under the name ‘amsterdamsmartcity.com’. This platform was formed to facilitate the rapid growing number of interested people to collaborate within the ASC [2]. From 2009 until 2017, there are 230 projects led under all themes of ASC. Most of the projects focus on the environmental-related objectives, such as reducing CO₂ emissions, renewable energy, and circular resources. However, ASC concentrates its efforts more on the energy, mobility, and circular city themes [36]. Each project has its indicator for a specific development phase, namely initiation, concept, implementation, and evaluation.

5. Amsterdam Smart City Platform and Innovation System

In this section we start to analyse the actor network of the platform by using the urban innovation system framework. It includes the mapping of each actor based on their role, and also an identification about their relationship. Secondly, we extend more on the role of a web-based open platform in ASC as an urban innovation system. It includes the identification on the use of an open web-based platform and its implication to the ASC as an urban innovation system.

5.1. Actors Interaction in the Innovation System Model

Actors are the key aspect in an urban innovation system because they connect to each other, based on their different roles, and contribute to the emerging of an innovation system. Exchanging information emerges an interaction as a consequence. Therefore, an urban innovation can be developed by expanding the connection and interaction among various actors. The connection and interaction of various actors can be typified as a relationship. There are two kind of relationships between actors in an urban innovation system, namely a one-sided and a bidirectional relation. A one-sided relation is the relationship that has only a one-way direction of the connection and interaction. For instance, actor X connect and interact with actor Y, but there is no response from actor Y to connect and interact with actor X. However, actor X gets information from actor Y from the open-information provided by actor Y. While a bidirectional relation the relationship shows a two-way direction of the connection and interaction, an active exchange of information between actor X and Y. In the framework, the actors dynamically interact with each other in different development phases, namely initiation, concept, implementation, and evaluation. Each actor can join in a different

phase based on their interests and resources. It is in line with the previous section that the framework used in this study is based on the dynamic interaction within the innovation system.

Regarding that, it is necessary to analyze the innovation system model of the ASC platform. The actors are program partners of ASC and other possible actors in Amsterdam. Therefore, we re-arranged the framework developed by Warnke et al. [35] to be more relevant and clear to the case of ASC to map and analyze the relationship among actors in the ASC platform as shown in figure 2. It is necessary to keep in mind that the interaction among actors is spatially bounded in the Amsterdam urban area and they dynamically interact with each other in different innovation phases.

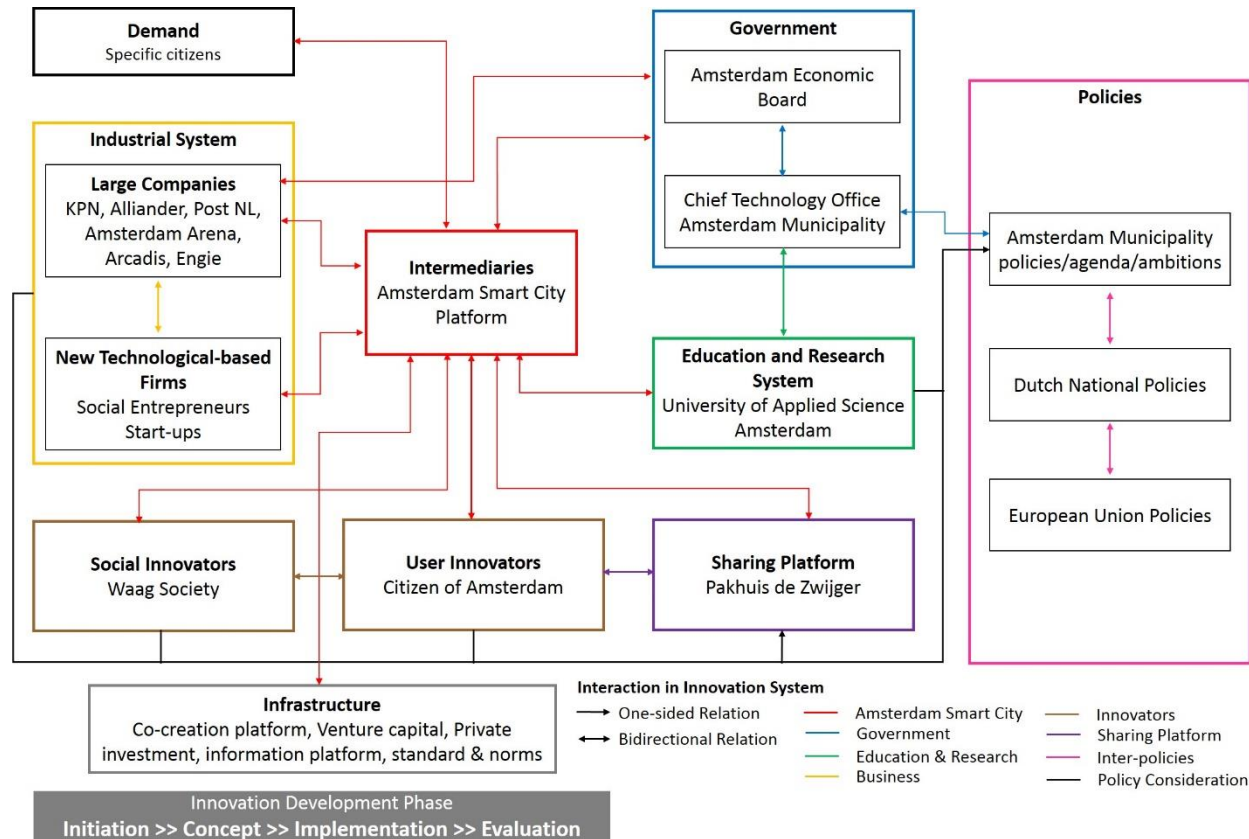


Figure 2. Innovation System Model for Amsterdam Smart City (Adapted and Modified from [35])

The ASC platform is the intermediary actor in the innovation system that plays a role as an active actor to connect various actors. It indicates that every actor has a bidirectional relation with the platform, because there is an exchange of information from one to another actor through the intermediary actor, the ASC platform. It is in line with the statement of Amsterdam Smart City [2] that ASC is a networked organization to connect and facilitate various parties in Amsterdam to deal with the urban problems in Amsterdam. Therefore, the demander is a particular type of citizens which have related societal problems in Amsterdam. The citizens can be people who are living in a particular area or a category of people. The societal problems are related to recent issues in the city, such as environmental degradation, CO₂ emissions, and crowdedness which have impact for the citizens.

Looking into more detail, the unique part is the governmental actors group in the platform. There are two governmental actors included in the innovation system, namely the Amsterdam Economic Board (AEB) and the Chief Technology Office of Amsterdam Municipality (CTO). The AEB seems to have a role as the connector between large companies, the ASC and the CTO. The large companies sometimes directly connect with the CTO as a Municipality body to propose a smart city project. The CTO also has a role to connect the program partners of ASC to the other departments within the Amsterdam Municipality. This reveals that not all Municipality departments are involved in the innovation system. That means that not all smart city projects that are currently going on in Amsterdam are linked with the agenda of the Municipality. However, the Municipality, through CTO, has high consideration towards the existence of the innovation system. Only the CTO as a representative of the Municipality legitimates the smart city

projects by creating related regulations and requirements which are needed if the projects have been successfully tested and validated in Amsterdam area. Therefore, when the projects are being tested and validated, actors in the system are restricted and shaped by the policies/agenda of the Municipality, while there is no legitimation for them from the Municipality as a government institution.

Regarding the innovators and sharing platform, we came across unique actors in the system. There is the Waag Society that focuses on the specific research related to arts, culture, and emerging technologies. As it is a research community, it can be considered as a social innovator that brings related innovation to the citizens and platform. The citizen of Amsterdam can be considered as a user innovator because they are not only a user, they also can propose and develop their own innovative ideas to the platform, even as an individual. They also have interaction with the Waag Society and the sharing platform, because of their possible involvement with these institutions. Pakhuis de Zwijger is a platform for citizens of Amsterdam to discuss about recent circumstances in the city. They have an annual meeting for which they invite citizens to discuss about their perception of living in the city. Amsterdam Municipality also support the sharing platform by providing subsidy to them and be present in the meeting to hear about the citizen's problems, needs, and ideas directly. In that way, the sharing platform has a tight connection with the Municipality.

Another actor is the Amsterdam University of Applied Science which is a partner of the ASC platform as an education and research institute. The university provides a research-based initiative which is related to the smart city projects in Amsterdam. They conducted research about the organization of ASC itself and smart city projects which can be implemented in Amsterdam. Next to the platform, the university also has a tight relationship with the Amsterdam Municipality through the CTO. They can propose a research project, as a smart city initiative, and ask the CTO to connect them with other Municipality departments.

To implement the smart city projects successfully, most of actors through ASC use various infrastructures both in the development process and during the implementation of the projects. In the development process, most of the smart city projects are developed by creating a co-creation platform which involves stakeholders in an annual meeting or discussion. For this, people can give their opinion towards a smart city project. In that way, the project can be in line with the expectation of the users. Then the initiator needs to acquire venture capital or private investment as a funding source to be able to implement the project. The Municipality does not provide subsidy for all smart city projects, therefore the initiators have to look for other funding alternatives themselves. For this part, ASC has a role as a marketer for the projects offering the prospective investors to have an overview of all interesting projects within the platform. The platform also becomes a source of information as a digital agglomeration of smart city projects, where people can get an overview about different projects easily. Thus, the projects might have a higher chance to be funded when it is registered in the platform.

Finally, interaction among actors, their roles, and the smart city projects are restricted and shaped by the standard, norms, and policies in the city. Each actor has to consider the policies applied by the government. However, the Municipality also has to consider other levels of policies, such as national and European Union policies that are related to the smart city. The Municipality might receive a positive impact from a higher policy level, such as a grant, or a national/international pilot project on smart city, and thus creating a higher chance of investment and scaling up the project.

5.2. The Role of Open Web-based Platform in the Innovation System

With the increasing number of people and partners who participate in the platform, ASC created an open web-based platform in 2016 to reach a larger number of people as well as to professionalize the platform (see figure 3).

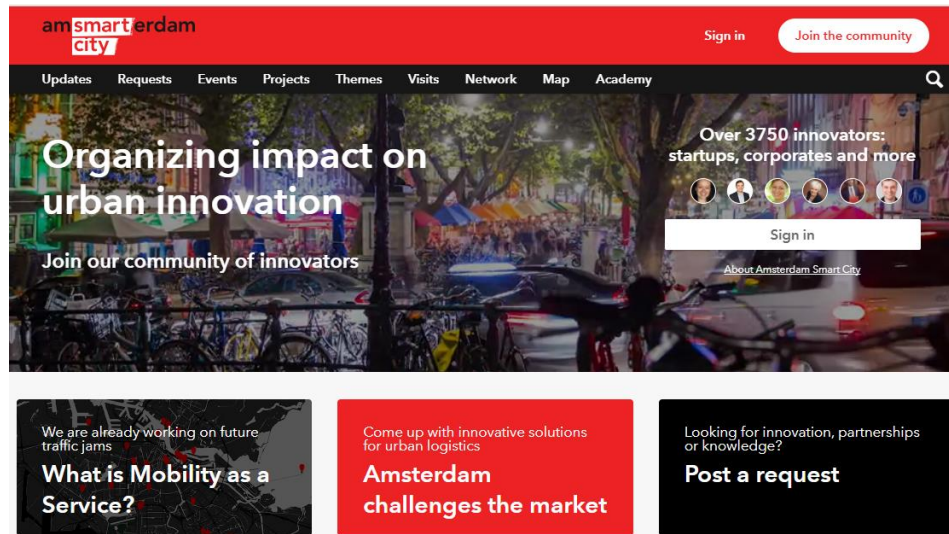


Figure 3. Interface of Amsterdam Smart City Website [3]

By using a website as the online platform, ASC wants to facilitate the cooperation among various parties to make the city smarter and inspire cities worldwide. Amsterdam Smart City [2 p 9] stated that the online platform can be used by various parties to:

- *“Post a request to ask for inspiration, ideas, or partners to bring more opportunities to realize the smart city project.*
- *Share project, experience, good practice to have bigger opportunities to be supported by other people and share knowledge among innovators.*
- *Manage an organization page to show the themes that are currently active in and people who are involved in the organization. By this, they can exchange ideas and make an online discussion by commenting.*
- *Read and create events about urban innovation.*
- *Offer workshops or guided tours.”*

Based on a survey conducted by ASC [2], it can be noticed that people who are joining the platform want to acquire knowledge, find smart city projects, stay up to date of events, find partners, and expand their network. The ASC seems to handle these expectations through facilities offered in the platform.

Essentially, the open web-based platform has two main roles, namely connector and information exchanger. Firstly, the website as connector means that it helps people, not only in the Amsterdam city but also all around the world, to get in touch with others, contribute to urban innovation, and gather related information about projects which are currently going on. There are two types of people who use the website, namely the supplier and demander. The supplier is a person who shares ideas, information, knowledge, and projects via the website. The demander is a person who is looking for ideas, information, knowledge, and projects related to a specific interest in one of the smart city themes. Thus, as a connector, the website brings together the supplier and demander. Therefore, an urban innovation process can be developed more quickly.

Secondly, the website as an information exchanger indicates that it facilitates the supplier and demander to share their ideas, information, knowledge, and projects. Additionally it creates a knowledge network about recent development of smart city projects in Amsterdam. Therefore, people can refer to the website when they want to ask and discuss about topics related to smart city in Amsterdam. Both roles support the function of ASC as a network organization.

It reveals that the use of an open web-based platform is a prerequisite to build a broader actor network and to accelerate the urban innovation within Amsterdam. It also has implications for the urban innovation system. Firstly, an open web-based platform offers opportunities to connect more actors in the innovation system. Therefore, more ideas, information, knowledge, and projects can be shared, discussed, initiated, and developed more quickly. The actors themselves will directly refer to the platform when they have information and projects to share and discuss. By doing so, the open web-based platform also becomes a digital marketer for any posted smart city project. Secondly, the platform shares ideas, information, knowledge, and projects among actors fairly and transparently because every actor can access it. Regarding the information fairness, Lievrouw et al. [25] stated that information is fairly distributed

if people can take it without any consideration on their ability-to-pay, there is an open information resource, people are able to use the resources to gather the information, and the available information have to be relevant and meaningful for their context. The ASC platform fulfills all those criteria in which it provides an open web-based platform where all actors can take and give information through it every time and everywhere easily and for free. An information transparency depends on several factors, namely, information availability, the condition of its accessibility, and how it can support the decision-making of its users [34]. Based on that, ASC as the facilitator of the open web-based platform has made information via the platform as transparent as possible for all actors by moderating all inputted information from all people joining the platform. Therefore, all actors can access the available information just by entering the website and choose the information from a particular menu. As the menu in the website was developed as comprehensive as possible to support the innovation system, all actors should be able to choose a wide range of information which can support their decision and further interact with other actors in several projects.

6. Discussion and Conclusion

The results show that the ASC can be considered as an example of a new form of the urban innovation system. The system consists of roles and relationships between different actors in the platform based on a re-arranged innovation framework developed by Warnke et al. [35]. Compared with the framework, the results for this study of the ASC platform reveals that there are nine actor categories involved with either a one-sided or a bidirectional relationship between them in the innovation system. The actors dynamically interact with each other in the different innovation phases based on their interests and resources. Further research can also reveal if other cases of urban innovation system will make a difference by using the framework to analyze the dynamic role and relationship among actors.

Also, the use of an open-web based platform to connect actors and exchange information in the innovation system makes that the information can be distributed fairly and transparently among actors. Additionally, it can reach a broader group of actors to join the innovation system. With that, it seems that there is no real geographical limitation among actors to collaborate and innovate on a specific idea even though the field of innovation is still bounded spatially, namely the Amsterdam urban area. Further research might also reveal if different types and uses of digital technologies in an urban innovation platform will have influence to the way of organizing an urban innovation system. It is necessary to further explore the potency of ICT in leveraging the development of an urban innovation system.

All in all, a dynamic interaction among actors which are facilitated by an open-web based platform can be a new way to develop an innovation system in the urban area.

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References

- [1] Akaslan D, Taşkın S and Oğuz Y 2017 *The Extensible Analogy for Supporting the Aspects of Smart Cities: Demander and Supplier. Proc. Smart Grid and Cities Cong. and Fair (ICSG) 2017 5th Int. Istanbul.* (Istanbul: IEEE) pp 171–174.
- [2] Amsterdam Smart City 2017 *Frequently Asked Questions: Amsterdamsmarterdam City.* Amsterdam.
- [3] Amsterdam Smart City 2017 *Amsterdam Smart City* (Amsterdam: Amsterdam Smart City) Online: <http://amsterdamsmartcity.com>.
- [4] Amsterdam Smart City 2011 *Smart Stories: Amsmarterdam City.* Amsterdam.
- [5] Anthopoulos L G 2017 *The Rise of the Smart City (Understanding Smart Cities: A Tool for Smart Government or an Industrial Trick?)* (Cham: Springer International Publishing) pp 5–45.
- [6] Baccarne B, Mechant P, Schuurman D 2014 *Empowered Cities? An Analysis of the Structure and Generated Value of the Smart City Ghent (Smart City: How to Create Public and Economic Value with High Technology in Urban Space)* ed Dameri, R P and Rosenthal-Sabroux, C (Cham: Springer International Publishing) pp 157–182.
- [7] Caragliu A, Bo C Del, Nijkamp P, 2011 *Smart Cities in Europe Smart Cities in Europe. J. Urban Technol.* **18** pp 65–82.
- [8] Carlsson B, Jacobsson S, Holmén M, Rickne A 2002 *Innovation Systems: Analytical and Methodological Issues. Res. Policy.* **31** pp 233–245.
- [9] Ching T, Ferreira J 2015 *Smart Cities: Concepts, Perceptions and Lessons for Planners (Planning Support Systems and Smart Cities)* ed Geertman, S et al (Cham: Springer International Publishing) pp 145–168.
- [10] Cocchia A, 2014 *Smart and Digital City: A Systematic Literature Review (Smart City: How to Create Public and Economic Value with High Technology in Urban Space)* ed Dameri R P and Rosenthal-Sabroux C

- (Cham: Springer International Publishing) pp 13–43.
- [11] Creswell J W 2009 *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* vol 3, ed Knight V (California: SAGE Publications).
 - [12] Dameri, R 2013 *Searching for Smart City Definition: A Comprehensive Proposal*. *Int. J. Comput. Technol.* **11** pp 2544–2551.
 - [13] Dameri R P 2017 *Smart City Implementation: Creating Economic and Public Value in Innovative Urban Systems*. (Cham: Springer International Publishing) 1st ed.
 - [14] Doloreux D 2002 *What We Should Know About Regional Systems of Innovation*. *Technol. Soc.* **24** pp 243–263.
 - [15] Edquist C 2005 *Systems of Innovation: Perspectives and Challenges (The Oxford Handbook of Innovation)* ed Fagerberg J and Mowery D C (New York: Oxford University Press) pp 181–208.
 - [16] Freeman C 1987 *Technology and Economic Performance: Lessons from Japan* (London: Pinter).
 - [17] Giffinger R, Fertner C, Kramar H, Kalasek R, Pichler-Milanović N, Meijers E 2007 *Smart Cities Ranking of European Medium-Sized Cities* (Vienna: Centre of Regional Science, Vienna University of Technology).
 - [18] Grossetti M 1999 *The Genesis of Two Urban Innovation Systems in France: Grenoble and Toulouse. NECSTS/RICTES-Conf. on Reg. Inno. Syst.* (San Sebastian: HAL).
 - [19] Hall P 2000 *Creative Cities and Economic Development*. *Urban Stud.* **37** pp 639–649.
 - [20] Hekkert M P, Negro S O 2009 *Technological Forecasting & Social Change Functions of Innovation Systems as a Framework to Understand Sustainable Technological Change: Empirical Evidence for Earlier Claims*. *Technol. Forecast. Soc. Chang.* **76** pp 584–594.
 - [21] IBM 2010 *Smarter Thinking for a Smarter Planet* (New York: IBM) Online: http://www.ibm.com/smarterplanet/global/files/us_en_us_loud_ibmlbn0041_transtasman_book.pdf.
 - [22] Iizuka M 2013 *Working Paper Series*. (Maastricht: UNU-MERIT) no 5.
 - [23] Kuhlmann S, Arnold E 2001 *RCN in the Norwegian Research and Innovation System*. (Karlsruhe: Fraunhofer Institute for Systems Engineering and Innovation Research (ISI)).
 - [24] Lau A K W, Lo W 2015 *Technological Forecasting & Social Change Regional Innovation System, Absorptive Capacity and Innovation Performance: an Empirical Study*. *Technol. Forecast. Soc. Chang.* **92** pp 99–114.
 - [25] Lievrouw L A, Farb S E 2003 *Information and Equity*. *Annu. Rev. Inf. Sci. Technol.* **37** pp 499–540.
 - [26] Liu Z, Wang Y, Xu Q, Yan T 2017 *Study on Smart City Construction of Jiujiang Based on IOT Technology*. *IOP Conf. Series: Earth and Env. Sci.* (Chengdu: IOP Publishing Ltd) pp 1–6.
 - [27] Malerba F 2005 *Economics of Innovation and New Technology Sectoral Systems of Innovation: a Framework for Linking Innovation to the Knowledge Base, Structure and Dynamics of Sectors*. *Econ. Innov. New Technol.* **14** pp 37–41.
 - [28] Monzon A 2015 *Smart Cities Concept and Challenges: Bases for the Assessment of Smart City Projects (Smart Cities, Green Technologies, and Intelligent Transport Systems)* ed Helfert, M et al (Cham: Springer International Publishing) pp 17–31.
 - [29] Nam T, Pardo T A 2011 *Conceptualizing Smart City with Dimensions of Technology, People, and Institutions*. *The Proc. of the 12th Annual Int. Conf. on Digital Government Research*. (New York: ACM) pp 282–291.
 - [30] OECD 1997 *National Innovation Systems*. (Paris: OECD).
 - [31] Ojo A, Dzhupova Z, Curry E 2016 *Exploring the Nature of the Smart Cities Research Landscape (Smarter as the New Urban Agenda: A Comprehensive View of the 21st Century City)* ed Gil-Garcia J R et al (Cham: Springer International Publishing) pp 23–47.
 - [32] Scholl C, Ablasser G, Eriksen M A, Baerten N, Blok J, Clark E, Cörvers R, Domian W, Drage T, Essebo M, Graham T, Hillgren P-A, Hoeflehner T, Janze A, Kemp R, Klingsbigl G, Köhler W-T, de Kraker J, Landwehr A, Leitner G, Nilsson P-A, Pelin O, Nicole R-K, Seravalli A, Simons J, Vandermosten G, Wachtmeister A, van Wanroij T, Wlasak P, Friedrich Z 2017 *Guidelines for Urban Labs*. (Antwerp: URB@exp).
 - [33] Su K, Li J, Fu H 2011 *Smart City and the Applications*. *Proc. 2011 Int. Conf. on Elec., Comm. and Cont.* (ICECC) (Ningbo: IEEE) pp. 1028–1031.
 - [34] Turilli M, Floridi L 2009 *The Ethics of Information Transparency*. *Ethics Inf. Technol.* **11** pp 105–112.
 - [35] Warnke P, Koschatzky K, Dönitz E, Zenker A, Stahlecker T, Som O, Cuhls K, Güth S 2016 *Opening Up the Innovation System Framework Towards New Actors and Institutions* (Karlsruhe: Fraunhofer Institute for Systems and Innovation Research (ISI)) no 49.
 - [36] Winden W Van, Oskam I, Buuse D van den, Schrama W, Dijck E van 2016 *Organising Smart City Projects: Lessons from Amsterdam*. (Amsterdam: Amsterdam University of Applied Sciences).
- Yin R K 2003 *Case Study Research Design and Methods* vol 3, ed Robinson S et al (California: SAGE Publications).

K. The Interlinkage to R-LINK Project

R-LINK is a long term research project (from 2016-2020) which aims to investigate the connection between Community-Linked Incremental Urban Developments (CLIUDs) and long-term social and spatial issues, in five different sectors, namely accessibility, urban vitality, inclusiveness, sustainability and economic competitiveness (Wageningen University & Research, 2016). The research is trying to bridge the gap between the small bottom-up initiatives and government strategic ambitions and planning. To investigate that, the research has two focus location, namely Amsterdam and Groningen. It follows the development of 12 projects in both cities to see the work of Community-Linked Incremental Urban Developments within each project and how each project connect with the strategic ambitions and planning from the government. It is a partnership of broad actors in each city, such as knowledge institutions, public sectors, companies, and local communities.

As a long-term project, it has six sub-projects in which each sub-project has different research questions (R-LINK, 2018). The questions from each sub-projects are as follows, sequentially:

1. *How can CLIUDs be conceptualized and how do they influence and change urban and regional planning and development processes?*
2. *How can the relationship between strategic planning and CLIUDs be optimized?*
3. *What is the potential of contracts to manage urban development and responsibilities for CLIUDs?*
4. *How do social innovation and learning play a role in the co-creation of CLIUDs within planning processes and practices and how is this determined by the capacities of the actors involved?*
5. *How can CLIUDs be activated? What action perspectives are needed to realize major urban ambitions and spatial and societal challenges with new alliances such as CLIUDs?*
6. *How can civil servants and originators of citizen-initiated CLIUDs use business models to gain support and legitimacy? What are the main characteristics of the CLIUDs studied and what are the most important lessons that can be learned from these CLIUDs?*

R-LINK has an interlinkage with this study in the research focus, namely the investigation on the linkage between non-government-based initiatives and government-based strategic ambitions and planning. Only, this study focuses the non-government-based initiatives on the smart city projects and the government-based strategic ambitions and planning on environmental management. This study also only focuses on the case of Amsterdam by taking two unit analysis, namely smart city projects in the Amsterdam Smart City and environmental management agenda or policies in the Amsterdam municipality. From the non-government-based initiative, R-LINK focuses not only smart city projects but also all bottom-up initiatives under the label of Community-Linked Incremental Urban Developments (CLIUDs). From the government-based strategic policies, it focuses on broader sectors in urban planning, namely accessibility, urban vitality, inclusiveness, sustainability and economic competitiveness.

Comparing with R-LINK's research questions, this study seems only to focus on the first question, but it does not investigate the influence of the non-government-based initiatives to the urban planning, but its interaction with each other. This study only focuses on two themes, namely energy and mobility projects. Looking into more details, several findings on aspects in this study intersect with the R-LINK research question, such as co-creation which was found in the aspect of participation in smart city projects; contract which was found on regulatory category of government-based environmental management; legitimacy which was found on the interaction aspect of consideration to the smart city

projects. However, I only found two types of research which are related to contract and legitimacy from the R-LINK project.

Regarding the contract, Janssen-Jansen and van der Veen (2017) stated that the contract between market and public sector could be made within a community benefits agreement in urban development programmes. Community benefits agreements is a contractual arrangement which can encourage local and bottom-up initiatives. It means that a contract might be arranged as a community benefits agreements to tackle problems in the city which are not captured by the government. They also stated that the community benefits agreement could be adopted in the policy-making stage for urban planning and development. It is in line with the aspect of contract found under the regulatory category in this study in which the contract can be arranged as a community benefits agreement.

For the legitimacy, Levelt and van Berkel (2016) stated that bottom-up initiatives could be legitimated by using a tool to present the process of policy-making with all stakeholders involved in it. Therefore, legitimacy for bottom-up initiatives can be achieved by making a reflective discussion and visualize the need for policy arrangement in the initiative. It becomes an example of how to create legitimacy for non-government-based initiatives. Therefore, the requirement and regulations made for the initiative can accommodate all stakeholders' interest.

Besides two aspects of this study, there might be other aspects which interlink with R-LINK research focus. Thus, this study may contribute to the R-LINK research by taking into account the aspects of the non-government-based smart city projects and government-based environmental management in this study. R-LINK can learn from the aspects which contribute to the interaction process between the non-government-based smart city projects and government-based environmental management in this study when arranging the sub-project which relates to the searching for knowledge in bridging the gap between Community-Linked Incremental Urban Developments (CLIUDs) and the government strategic ambitions and planning.