

# **Defining two smart cities** Comparing London with Amsterdam



Jan Pieter Mulder, 2018

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# Defining two smart cities

# Comparing London with Amsterdam

Bachelor thesis

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# Def·i·ni·tion

The act of defining, or of making something definite, distinct, or clear

## Preface

#### Defining two smart cities

In front of you lies my research "Defining two Smart Cities" which is filled with: **twenty-one thousand** words, **over three hundred** cups of coffee, **twelve** weeks of sweat, **endless hours** of reading & re-writing and **one kilogram** of peanut butter. This research is the final piece of my pre-master's program Human Geography at Radboud University.



When I started writing this thesis, I knew nearly nothing about the smart city concept. That is actually also one of the reasons why I picked this topic to write about. Writing this thesis turned out to be an intensive journey. I moved to Nijmegen for example, to be able to focus more on my study (and enjoy the student-life here). During the writing-process, I even went on an (impulsive) short trip to Morocco with fellow thesis-writing friends (and classmates) to clear our heads.

In this research I have been searching for a suitable definition for two all-round accepted smart cities, London and Amsterdam. In my opinion, smart city is a very hot topic in several (education) fields, yet the term is also very interpretable. I was and am curious what this concept means for different cities with different institutions and contexts. But, to be able to define this concept for different institutions, I had to define to the concept for myself in the first place. This turned out to be a difficult job, where I had to read and re-write some chapters again and again. Eventually, based on many different theories and angles of approach of different writers, three frameworks have been set up. These frameworks have been used in two case studies to define these case studies. It turned out to be a very discussable and therefore in my opinion, a very interesting concept. There are many different definitions and aspects how a smart city can be described. Some definitions claim that the technological component (ICT based solutions) fulfil a central role in 'upgrading' the city, while other definitions claim the importance of quality of life and the human factor. Furthermore, there is confusion with terms like an intelligent or creative city. Writing this thesis and based on many different definitions and experiences, in my opinion a smart city is a city that is able to adapt to the challenges that it faces. The way to do this, is another story. Forged out of all the theories: an approach, strategy and conceptual layout have been set up to be able to define the cities.

I would like to thank Ary Samsara in the first place, to navigate me into the right track. Especially in the beginning stage, where I was really searching for angles to research. Also, I would like to thank my classmates, who were writing a thesis as well. It felt like we wrote the thesis's together, where we motivated each other if needed.



Enjoy and thank you for reading this thesis in advance.

Jan Pieter Mulder

Nijmegen, 2018

#### Summary

The term smart city becomes more and more popular in scientific literature and policies. This is mainly due to the difficult challenges cities face in the future. In 2020, 80% of Europe's population is expected to live in urban areas (United Nations, 2009). This leads to big challenges for urban areas, especially in relation to urban planning. Think about livability, competiveness and performance (McKinsey & Company, 2013). Cities around the world are looking for solutions which enable linkages in transportation, mixed land uses, and high-quality urban services with long-term positive effects on the economy (Albino, Berardi, & Dangelico, 2015). These solutions can be grouped under the concept 'smart city'. However, due to diversity in context, institutions, resources and sizes of cities, a single definition for every single city is not possible. Amsterdam and London are two of these so called smart cities (Cohen, 2014), yet they are very different. Many studies (Ramaprasad et al., 2017; Abbas, 2017; European Parliament, 2014) came to agree that six main components, conducted by the Vienna University of Technology, describe the smart city in a hollistic way: smart governance, smart people, smart living, smart economy, smart ecology and smart mobility (Giffinger & Gudrun, 2010). Next, Nam and Pardo (2011) added three dimensions which define a smart city: technology, human and institution (Nam & Pardo, 2011). Combining the six variables and three dimensions, a holistic definition was found, which acts as a basis definition: "[...] 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, Del Bo, & Nijkamp, 2011). However, a basic definition is not enough to define a smart city. Out of the theories, three frameworks are conducted. The first framework by Angelidou (2014) describes four approaches wich can be picked to develop smart cities (Angelidou, 2014). The second framework by Letaifa (2015) illustrated a strategic guidance for smart cites (Letaifa, 2015). The last framework by Zygiaris (2012) is describes the conceptual layout of a smart city (Zygiaris, 2012).

This research has multiple goals. First of all, further smart city research is done, by analyzing and comparing different smart city studies. By discussing and implementing three frameworks in two case studies, eventually a definition of two smart cities can be given. The research question of this study reads: *"How did London and Amsterdam approach and strategize the smart city concept and how can their cities be best defined?"* The research strategy that is being used in this research is a combination of a (two cases) case study, substantiated and supplemented with desk research. The following research questions have been used to answer the main research question:

- How did London and Amsterdam approach the concepts of Smart City?
- How did London and Amsterdam strategize their Smart City concepts?
- How can London and Amsterdam's smart city be described using six layers of innovation?
- How are their approaches and strategies different and how are they similar?

The three frameworks formed the foundation for the approach, strategy and conceptual layout of the two case studies. London and Amsterdam are constantly compared with each other to look for similarities and differences in their approach and strategy, they approach and strategize their concepts in very different ways. London approaches the concept as becoming the smartest city in the world for the technology business scene. Amsterdam on the other hand wants to be the start-up capital of the world. Their strategies are adjusted to this approach. London uses a top-down strategy and focusses on city-wide collaboration between public institutions and tech communities. Most of Amsterdam's projects start through its Amsterdam Smart City (ASC) platform. ASC is a public-private partnership with a bottom-up character. London uses digital technology to meet the diverse needs of its citizens to create inclusion, and digital exclusion is tackled by promoting the creation of digital technologies. This way, digital technology is one of the main components of their smart city. The creative class of Amsterdam forms the base of its smart city, where the city is a living lab for start-up companies. Amsterdam invests in a sustainable economic climate for their citizens and small enterprises. In both cities, much innovation finds place, based on big- and open data. London for example has cameras and sensors throughout the city that form a digital infrastructure, applicable on different fields. Amsterdam uses open data for opportunities in decentralized block chain technology. Eventually, worked out from the basic definition, two specific definitions for both cases are formed:

London: "London Invests in digital inclusion and diverse needs for its citizens by promoting its digital technologies in multiple ways. A digital infrastructure is created to manage traffic congestion, advice is given to (tech) start-ups and a very attractive economic climate is created to maintain its position the smartest city in the world for the technology business scene. Doing this, London focusses on city-wide collaboration between public institutions and tech communities."

Amsterdam: "Amsterdam Smart City is formed by its citizens who co-create the city. Amsterdam invests in a sustainable environments for its citizens by investing in emission free traffic, renewable energy, fast internet and optimized traffic flows. Amsterdam invests in small enterprises and start-up companies by offering the best working conditions and block chain technology. ASC is a public-private partnership, where the city government is one of its partners."

These definitions form a combination of the approach, strategy, conceptual layout and six variables of a smart city and are there for the most holistic definitions for Amsterdam and London.

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## **Chapter 1- Introduction**

#### 1.1 Context

In the last two decades, the 'smart city' concept has become significant more popular in scientific literature and (inter)national policies (Albino, Berardi, & Dangelico, 2015). It is important to recognize and understand why cities are considered key elements for the future. According to Mori and Christodoulou, cities for fill a prime role in economic and social aspects worldwide and have a huge environmental impact (Mori & Christodoulou, 2012). By 2050, 66% of the entire population is expected to live in urban areas (IEC, 2018). In 2020, 80% of Europe's population is expected to live in urban areas (United Nations, 2009). Especially in relation to urban planning, cities face numerous challenges concerning growth, livelihoods, competitiveness and performance (McKinsey & Company, 2013). Cities around the world are looking for solutions which enable linkages in transportation, mixed land uses, and highquality urban services with long-term positive effects on the economy (Albino, Berardi, & Dangelico, 2015). Many of the approaches to face the challenges are based on harnessing technologies, with a key factor for ICT (Information and Communication Technology). These approaches are commonly grouped under the concept of 'smart city'. The definition of a so called 'smart city' is much debated over the years and has been documented profoundly (Cocchia, 2014; Hollands, 2008; Neirotti et al., 2014) and will be addressed in §1.2 and in chapter 2. However, due to the diversity in range of contexts, resources and sizes of different cities, one single (same) definition or approach for every city is not possible (Vanolo, 2013; Neirotti et al, 2014).

#### 1.2 Smart cities

As §1.1 states, there is not a single approach for every city possible. A range of variances of the word 'smart' exists where smart is replaced by for example, 'intelligent' or 'digital'. The term is vague (Nam & Pardo, 2011) and is often used inconsistent (Albino, Berardi, & Dangelico, 2015). The term of smart cities came

up first in the 1990s. The significance of ICT stood central at that time linking it with modern infrastructure within cities (Alawadhi, et al., 2012). Upon this time, the concept of smart city was technically oriented. However, the smart city concept cannot be limited to just the application of technology in cities. Different researchers came to mind that the concept should also be governance-oriented which had made the role of human and social capital in urban development come more to its right. However, the smart city concept changed in the beginning of this century as a phenomenon that was 'urban labeled'. Different researchers started asking themselves what the hidden aspects were behind the smart city phenomenon and researches aimed to find 'real' smart cities (Hollands, 2008). Nam and Pardo (2011) researched possible smart city concepts with different dimensions of technology, people and institutions, stating that definitions of smart cities differ per city due to different contexts. For big companies like IBM and Siemens, the technological component is the key factor for their smart city conception. This creates possible confusion, because these companies try to create smart cities with top-down, technology based visions and actions. Technological innovations have always impacted the way how we work and live in the urban space, throughout history (National League of Cities, 2016). Think about technological-innovative cities like Detroit where T-Ford became the fundament of the American automobile industry around 1900. But there are also examples from way earlier, where technologicalorganizational solutions formed the base of the success for cities. For example Rome with aqueducts in the Roman empire (Hospers, 2005). There is also confusion with similar terms like the virtual, intelligent or digital city, which is linked to smart cities but is definitely not the same (Caragliu et al., 2011; Deakin & Alwaer, 2011). The missing component in all of these terms is the human factor. People shape smart cities through their actions. Agreeing on this, some more connections have been added to the smart city concept, for example the creative class is accepted as one of the key factors for a smart city, because knowledge, learning and education play central roles in a human and institutional smart city (Thuzar, 2011). According to Richard Florida (2003), economic growth occurs in places where highly educated people (creative class) live. Saying that, a smart city is also about creating a climate where these people will live. A smart city should therefore be an holistic togetherness of multiple aspects.

#### 1.3 Problem statement

As §1.2 describes, there is much confusion about the terminology and definitions of smart cities. This could be because the term is applied to more kinds of "domains" and understood differently by different institutions. It is applied to a certain 'hard' and 'soft' side. The hard domain holds things like mobility, logistics and infrastructure (Neirotti et al, 2013) where ICT is applied to upgrade these systems. On the other side, the term is applied to soft domains like social inclusion, education and culture, where ICT is usually not determinative (Albino, Berardi, & Dangelico, 2015). Also, smart city is a term where different layers of institutions write policies for, with their own perspective, making it a multi-level

governance concept. There is not a singe suitable definition of a smart city applicable to every city, but there is certainly need for hollistic framework which looks at the smart city as an organic whole (Kuyper, 2016). Many studies (Ramaprasad et al., 2017; Abbas, 2017; European Parliament, 2014) came to agree that six main components (framework), conducted by the Vienna University of Technology, describe the smart city in a hollistic way: smart governance, smart people, smart living, smart economy, smart ecology and smart mobility (Giffinger & Gudrun, 2010), which include both hard and soft domains. This framework should be applied to individual cities to be able to define that particular smart city in a way that is only applicable to that single city. In this research, two casestudies are conducted for two leading smart cities in the world. Both cases have their own ideas and processes and 'general definitions' of 'a' smart city, yet they do not have a detailed explanation and definition of their smart city.

#### 1.4 Research goals

This research has more goals. First of all, further smart city research is conducted, by doing document studies to the most recent researches. By discussing and implementing three frameworks in two case studies, eventually a definition of two smart cities can be given. This also includes multiple levels of institutions which have thoughts and policies on the concept. This brings us to the second goal: the application of the theoretical discussion and frameworks to two European cities: London (Great Britain) and Amsterdam (the Netherlands). These are two of the top ten 'smartest cities' in Europe (Cohen, 2014). These cities have also been classed as 'more than' an intelligent city (like Toronto or Singapore) or creative city (like Montreal or Berlin), which made them classify under the category 'smart city', a combination of six elements (Giffinger, 2010 & Letaifa, 2015). Yet these two cities are two very different cities, with different institutions and approaches to be a smart city. This study analyses the way how the cities appear as a smart city by looking at multiple levels of institutions (topdown and bottom-up) and finally gives a suitable, holistic, smart city definition for both cities. Last but not least, recommendations are made for both cities to define their city and other cities could potentially learn from it to define their own city. This research does not describe what Amsterdam and London could do best to upgrade their city, it describes their cities using all relevant literature that is available.

#### 1.5 Relevance

This research has both practical and theoretical goals. Theoretically, this research tries to discuss the relevant literature regarding to defining smart cities. Doing this, the latest literature is being discussed and put into one theoretical framework. These theories are conducted into a framework of six variables. By applying the theories to London and Amsterdam, the research gains more validity. This brings us to the practical goals of this research. By applying the theories to the case studies, initiators

and practioners of the smart city can see how their smart city is defined and gain understanding of what their smart city means to them. Also, this research is relevant to multiple levels of governmental institutions, where European, national, city-level governments and initiators are addressed. It is important to recognize that this study tries to show the differences between two smart cities, due to different contexts of these cities and different institutions. This study does not give handles to the smart cities for upgrading purposes.

#### 1.6 Research outline

The research question of this study reads: *"How did London and Amsterdam approach and strategize the smart city concept and how can their city be best defined?"*. In chapter 3, the research question is further refined into sub questions. Chapter 2 discusses all the relevant literature for this research. All the relevant literature leads to three frameworks, which form the base of the practical implementation of this research in chapter 4. In chapter 4, two cases are compared with each other and constantly put against each other to gain insights in differences and similarities. The frameworks that are discussed is chapter 2 form together chapter 4: approach, strategy and conceptual layout. It is important to understand that this research does not describe how Amsterdam and London are able to upgrade their cities in the future, but it gives an explanation of how they approached and strategized their smart cities. Therefor this research works out conceptions of smart cities in different contexts with different institutions.

# Chapter 2- Theory forming

#### 2.1 Introduction

In chapter 1, an introduction is given to the smart city discussion. This chapter further elaborates on this, using the six variables as starting point. The six variables are linked with indicators. Those indicators point out the most important aspects of that variable and will serve as basis for the case studies. The main research question exists of three important factors: 'approach', 'smart city concept' and 'definition'. Those factors are being discussed based on the most recent and important literature available. This chapter ends with an operational framework that is used in chapter 4 and 5. Recent literature is used.

#### 2.2 Governance

Besides the six variables where the cities operate in, that describe the smart city concept in a holistic way, an approach on different levels of institutions is taken by the cities as well. This paragraph describes the multiple levels of institutions that have policies and thoughts on the smart city concept.

#### Multi-level governance

According to different researchers, the interdependent concepts of smart city, integrated planning and multi-level governance greatly determine the current discussion on practice and planning theory in Europe. This comes together in new challenges for e-planning. E-planning is not anymore just a way of describing current tools for governing space anymore, it becomes a new philosophy of public decision-making (Damurski, 2016). Smart Cities is a policy domain which belongs to various levels of authority and policy, as stated in the introduction. Multi-level governance (MLG) is often used by so called innovation policy where decentralization has made local and regional governments more powerful. This is characterized by the shift from the main focus on national level for the design of innovation policy, to both the international (EU) and sub-national (regional) levels (The Innovation Policy Platform, 2013).

#### Governmentality and public-private partnerships

In the bigger picture, multi-level governance fits in the process of governmentality. Governmentality refers usually to 'the practices of knowledge in the mechanisms of government in the production of police systems (discipline systems)' as first conducted by Michel Foucault (Rose, 1999). Vanolo (2013) assumes that urban imaginaries of 'the smart city' influence urban policies deeply and that the smart city is an optimistic concept for the city of the future. Vanolo also assumes that cities are made responsible to achieve smartness in their cities, that can be defined as a 'smart mentality'. In this research, Amsterdam and London are the cases which try to reach a certain 'smart mentality'. A big part of the smart mentality focusses on the public-private partnership in producing and managing the

smart cities. This refers to a certain balance between the city governments and inhabitants of the cities. This means that on the one hand, the cities are responsible to create a climate where smart citizens and private companies can practice and participate and on the other hand people have to be willing to live in- and adapt to smart cities. Vanolo emphasizes the importance of the different roles of different institutions in shaping the smart city. (Vanolo, 2013)

#### Institutional levels

This paragraph focusses mainly on the European institutional level. This is the highest governmental level this research focusses on. The fact that the European Parliament has a policy document about smart cities makes the importance of the subject clear. Their vision is about smart city goals for the year 2020. The European Parliament describes a Smart City vision for Europe 2020, based on the six variables. Their working definition of a Smart City in general is: *'A Smart City is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership'* (European Parliament, 2014). According to the European Parliament, 90% of the cities over 500.000 inhabitants in Europe, are smart cities, while in the category 100.000-200.000 inhabitants, only 43% of the cities are smart. This could indicate that the smart city variables are more applicable to bigger cities, or metropolitan areas, than average sized cities (European Parliament, 2014). Based on their findings and research about Smart cities in Europe, both London and Amsterdam can be addressed as a Smart City, because in both cities, multiple factors of the six variables. The more variables occur, the smarter the city. Further definitions of smart cities by different institutions of both case studies are represented in table 1.

Institution	Definition	
European Parliament	"Public issues are addressed via ICT-based solutions by a	
	multi-stakeholder, local government based partnership"	
	(European Parliament, 2014).	
European Commission	"The management and efficiency of the urban	
	environment are improved with Technological solutions"	
	(European commission, 2011).	
Great Britain (national government)	"Citizens should be engaged with all the services on offer	
	in a smart city, public as well as private, in a way best	
	suited to someone's needs. Digital technologies, hard	
	infrastructure and social capital is brought together to fuel	
	sustainable economic development and an attractive	

	environment for everyone is provided" (UK government,	
	2013).	
London (city government	"A smarter London must be a place where people want to	
	work, live and play. It fosters talent and supports and	
	accommodates population growth. In a smarter London,	
	data as a service is employed. It allows business as usual,	
	but easier, faster and cheaper. It is not a single definitive	
	solution but a series of interventions as response to its	
	changing needs" (GLA, 2013).	
The Netherlands (national government	"Dutch Smart Cities work on smart solutions for	
	increasing the livability, sustainability and accessibility	
	and the competitiveness of the Netherlands"	
	(complemented with a detailed explanation) (Ministerie van	
	infrastuctuur en milieu, 2014).	
Amsterdam (city government)	"A smarter Amsterdam is a city where sustainable growth	
	is facilitated and accelerated by social and technological	
	infrastructures. Technology plays an important role in this	
	city's development, but it is not a goal itself"	
	(amsterdamsmartcity, 2016).	

Table 1: Definitions institutions case studies

When the definitions are analyzed, a few aspects stand out. Firstly, the differences in scale between the different institutional levels. In this multi-level governance policy area, there is clear distinction between the visions (definitions) of different governmental levels. For example, The European parliament and Commission clearly give no detailed information, but they do state the efficiency of the urban environment, which can be conducted by 'multi-stakeholder, municipally based partnerships. This is a top-down view, in which the highest governmental institution state what lower-level institutions (city governments) should do to become a smart city. Looking at the lower-level institutions, a first distinction in both cities strategies are recognized. Amsterdam focusses on both social and technological infrastructures (soft and hard side) and London focusses more on hard infrastructure (technology and business). Chapter 4 explains this in detail.

#### 2.3 Smart city definition

As stated in the introduction, there is not a single definition suitable for every smart city concept. Yet, there is holistic framework which describes the smart city concept in six variables, which is accepted by most studies. These six variables are smart economy, smart mobility, smart governance, smart

environment, smart living and smart people. These six variables have caused a change in the smart city perspective and include terms like smart mentality (Vanolo, 2013). According to Giffinger (2010), the best suitable, general definition of a smart city is:

# "A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens."

#### (Giffinger, 2010)

Smart economy is linked to a spirit of innovation, the ability to transform, integration in the international market and flexibility of the labor market. Smart mobility refers to (local and international) accessibility, ICT availability and modern, sustainable and safe transport systems. Smart governance, which is linked to the last paragraph and holds multi-level governance, also relates to participation in decision-making processes, transparency of governances, public services and quality of political strategies. Smart environment is understood in terms of lack of pollution and sustainable management of resources. Smart living is another term for quality of life, which includes cultural and educational services, tourist attractions, social cohesion and a healthy environment. Smart people is, lastly, linked to the amount of social capital, creativity and participation in a city. (Vanolo, 2013)



Figure 1: Griffingers six variables of a Smart City

Chapter 1 stated that there is confusion about the concept, where big companies like IBM and Siemens try to create the smart city with top-down technology based actions. The seconds confusion is the fluster with similar terms like the virtual, intelligent or digital city, where these terms refer to more specific and less inclusiveness in a city, so the smart city concept often includes these terms as 'subterms'. For example, the digital city can refer to a connected community which combines broadband communications infrastructure to satisfy the needs of businesses, governments and people (Albino, Berardi, & Dangelico, 2015). Nam and Pardo (2011) therefor add two more dimensions for a smart city: Human and institutional (besides technological) (Nam & Pardo, 2011). When the six variables and the three components are combined, a new, more holistic definition can be given, by Caragliu, Del Bo & Nijkamp (2012):

# "[...] 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, Del Bo, & Nijkamp, 2011)

This definition includes element of the European, national and city governments. The six elements of Griffingers framework are processed in this definition:

- Smart people: Human and social capital
- Smart mobility: Traditional and modern infrastructure
- Smart environment: wise management of natural resources
- Smart economy: Fuel economic growth
- Smart living: quality of life -
- Smart governance: Participatory governance

Therefore, this is the most holistic definition this research works with. The elements of this definition are processed within the research and the frameworks as discussed in the coming paragraphs.

#### 2.4 An approach

Smart city initiatives

Adam Greenfield argues in Against the Smart City (2013) that 'corporate-designed cities' like Masdar City (UAE) and planIT Valley (Portugal) are shy on actual knowledge about how cities function and

handle in unplanned scenarios and the mixed use of urban spaces. Strategic planning for planning a smart city is an abstract idea that cannot be just technology based (Angelidou, 2014). According to Chourabi (2012) there are eight essential factors that envision a smart city initiative: Organization, governance, policy, technology, people and communities, the economy, built infrastructure Figure 2: Factors that influence a smart city initiative



and finally the natural environment. *Figure 2* shows the different levels on influence the factors have on a smart city initiative. It assumes that technology, policy and organization have the most direct influence on a smart city initiative and vice versa.

#### Strategic choices

Angelidou (2014) outlines four strategic choices which can be picked to develop smart cities. The first choice describes a national and local strategy. In the first case, there is focus on a country or nation level where a local strategy focusses manily on cities, neighbourhouds or areas. Secondly, Angelidou describes a strategy where different institutions focus on a 'new city from scratch', where new cities are made by experiences of existing smart cities (like PlanIT or Masdar City). This is most likely not the case in this research, because there is focus on finding a definition of two already existing smart cities. The third choice concerns the difference between hard and soft infrastructure oriented strategies as introduced in §1.3. In a soft infrastructure-oriented strategy, there is a focus on participation, social innovation, inclusion and the enhancement of human of social capital, whereas in the hard strategy the focus lies way more on improving areas such as transport, waste, energy systems and water. However most of the researches, as stated in this research introduction as well, state that technology (hard infrastructure) cannot be the main priority and that cities need to focus on- and take advantage of human capital and knowledge that is available. The last strategy focusses on the reference area, which can be geographically- or sector based. Geographically based means a focus on education areas, development clusters, business districts or smaller areas such as neighborhoods. In a sector-based approach, which is accepted as the mainstream approach, cities are becoming smart by upgrading sociological economic aspects of all-day life, like governance, education and housing. (Angelidou, 2014 & Kuyper, 2016)

#### 2.5 Strategy

Besides a holistic framework as a basis for the smart city (Vanolo, 2013 & Giffinger, 2010) and different approaches that cities can take to become a smart city (Angelidou, 2014, Chourabi, 2012 & Kuyper, 2016), there is place for a strategy guidance to define the smart city. Therefor this research introduces the 'SMART framework' (Letaifa, 2015), a framework that illustrates how major cities like Montreal and Stockholm designed their smart city strategy. The framework is presented in figure 3.

#### Figure 3: SMART framework

#### Strategy

The first dimension in the SMART strategy is designing a coming vision for the city. Important aspects of this phase are understanding of the community's requirements to inspire the vision and strong political leadership. The focus in this first stage is to scope certain goals and ideas.

#### Multidisciplinary

The second dimension focusses on mobilizing multidisciplinary resources in the smart city co-creation process. This refers to the 'smart mentality' as discussed in §2.2.2. this perspective offers solutions for emphasizing the issues, outcomes and resources that a smart city transformation needs. It is important that the process includes and identifies stakeholders from public and private backgrounds, where they all provide insights. The focus in this stage in the right mindset.

#### Appropriation

In this dimension social acceptability by different actors is gained, to ensure project adoption and success. In this phase, the actors from the second dimension, need to work together to become active ambassadors of the smart city project.

#### Roadmap

After the third phase, a project needs details of activities' workflows. Identifying adequate steps to transform the city is the objective in this phase. In other words: to define all projects for different variables like smart economy or smart ecology, an action plan should be made.

#### Technology

In this last dimension, a transformation is being completed. In a smart city, transformative or enabled technologies are a requirement. Technology should not be a goal on its own, but it improves livability. Customer experience is improved by better infrastructure and technologies. (Letaifa, 2015)

#### Strategy levels

An important aspect about this framework is the dividing into macro, mezzo and micro strategy levels. Strategy and multidisciplinary belong to the macro level, which could indicate 'high level institutions'. The appropriation and roadmap phase belong to the mezzo level. Lastly, the technological transformation belongs to the last level, micro. Figure 4 illustrates this.

According to Jan Rotmans' *Transition theory* (2006) and *In the eye of the hurricane* (2014), the strategy levels have as (hidden) meaning to start a certain transition in the society. In this case it is a transition where multiple levels of governments agreed that cities in the future need to be smarter to cope with the challenges that they have to face (see §1.1). Letaifa's SMART framework is a top-down framework where designing an overall city strategy is the first step in designing a smart city strategy and it gets more detailed going deeper into the framework. According to Rotmans, this is called a *multi-pattern* concept, a concept which shines its light on a network of patterns that contribute to an overall regime. In this case it is a network of governments (meaning the EU, national governments and city governments). At the same time, it works the other way around: citizens come up with initiatives (bottom-up) what can be called a 'niche' on micro level. Top-down and bottom-up perspectives are taken into consideration in finding definitions for both case studies.

#### 2.5 Conceptual Layout

Zygiaris (2012) developed a holistic framework including policies, conceptions and processes related to smart city planning. This framework is used as an smart city innovation ecosystem, presenting seven unique layers. The framework is in this case used as a conceptual layout for two case studies. Zygiaris' framework expands the framework of Giffinger (2010) and Caragliu (2011). The seven layers are summarized in table 1.

	Layer name	Explanation
0	The City	The basic components of a city. Opportunities for a city to
		become a 'smart city'.
1	The Green City Layer	Sustainable development with the city. Policies and plans for a
		sustainable future of the city are present. In this layer,
		environmental impact of smart solutions are discussed.

2	The Interconnection Layer	This layer refers to the capacity of innovation support of the	
		telecomm infrastructure to interconnect citizens and devices	
		and to provide internet access city-wide.	
3	The Instrumentation Layer	This layer describes the hardware layer of a city, describing if	
		there is real-time connection such as sensors which provide	
		actual and real-time data.	
4	The Open Integration Layer	Applications within the city have to be able to communicate	
		and there is data sharing. All available systems with different	
		technologies need to have open information storage. Data is	
		used to upgrade systems within the city.	
5	The Application Layer	There is optimal use of applications in the city and data from	
		layer 1 till 4 is used.	
6	The Innovation Layer	The possibilities and positioning of a city to become an	
		attractive city for business and innovation.	

Table 2: Smart City Reference Model by Zygiaris (2012), explanation partly adopted from Kuyper (2016)

Zygiaris framework starts with layer 0: the city. This refers to a city's structures and urban resources. In this layer, the innovative character of this framework is not present in this first layer. The innovation layer (6) uses the information of layers 1 to 5 to show the innovative character of the city. In the end, this framework is a pathway which passes green, interconnected, instrumented, intelligent, open, and innovating development stages.

#### 2.5 Conceptual frameworks discussion

This theoretical framework discussed four frameworks. This paragraph discusses the frameworks and the usability of them for this research. All four frameworks are used in a different way to gain a holistic as possible view on the two case studies. In §2.3, two frameworks to become a smart city are introduced. The first framework is a holistic framework which defines a smart city in an holistic way, yet this is not a framework which can be used to explain how a certain city defines or strategizes itself

as a smart city. This framework, added with Nam and Pardo's three dimensions, will be used, however to give an eventual definition of the smart cities Amsterdam and London. Therefor the six variable have certain indicators (as presented in figure 4) added to them, which are researched in the case studies and used to give

the eventual definitions.

Human and social capital Traditional and modern infrastructure Wise management of natural resources Fuel economic growth Quality of life

Figure 4: indicators of the six variables

The second framework shows which factors envision a smart city initiative. This framework is not directly used, yet it shows us the importance different factors on a smart city initiative. The four strategic choices as explained in §2.3.2 form the basis of a smart city approach, which distinct the first differences in both case studies. In §2.4 and §2.5, two more frameworks are introduced. The SMART framework by Letaifa (2015) and Smart City Reference Model by Zygiaris (2012). The SMART framework is a top-down strategy plan which shows how national and city governments strategize and mobilize their smart city visions. Lastly, the Smart City Reference Model is a detailed model which describes the city's smartness in its most detailed way. The last framework (Smart City Reference Model) is the most holistic way to describe a smart city with all its components combined, where for example hard- and soft- infrastructures are discussed. Also multiple dimensions of the smart city are discussed, so Technologies, institutions and the human factor are appointed. This research tries to look beyond the lines of a 'top-down' (SMART-framework) or a 'bottom-up' model (eight essential factors with the initiative central) for a strategy to become a smart city and to define one. It also tries to put influences of technology, policies and organizations together. Therefor three frameworks have been introduced with their own piece in the puzzle regarding to strategize and define a smart city. The approach as discussed in §2.1 shows that multi-level governance is the underlying meaning in finding a suitable strategy and definition for both Amsterdam and London. Figure 4 shows the use of the frameworks in a total framework with a summarized explanation. The different views of governments are included within the frameworks of the two case studies.



Figure 5: Conceptual Model

# Chapter 3- Methodology

This chapter describes the methodology and strategy that is being used to answer the main research question. To be able to get answers for the research questions, certain choices are made. These choices are being discussed in this chapter. The methodology is divided into three sections: data collection, closing the data and using the data. The research question reads:

"How did London and Amsterdam approach and strategize the smart city concept and how can their cities be best defined?"

The main concepts of this research are:

- Understanding of the term 'smart city'
- Translating this understanding into three workable frameworks
- Applying these frameworks on two case study's: Amsterdam and London
- Gaining insights in the similarities and differences of both case studies
- Translating all this into 2 suitable definitions for both cases

This research is qualitative from nature. A qualitative research contributes to the development of modern social sciences. The main thought what comes to mind is that there are stories to be told. The topic of this research, Smart cities, is a very popular topic for (multi-leveled) governments. This research therefor offers an in-depth interpretation in terms of meaning and sense behind spatial actions, where eventually an answer is found for two different systems. The collected data in this research is holistic. Every piece (policy documents, visual documents, articles, interviews etcetera) forms a part of the bigger picture. In the end, a suitable definition for two different systems (cases) is given. The research uses up to date and actual data to fill in the research questions where for this research tries to be as reliable as possible.

#### 3.1 Strategy and data collection

In their book 'designing a research project' (2015), Verschuren & Doorewaard describe five strategies to do a research. These strategies are survey, experiment, case study, grounded theory approach and desk research (Verschuren & Doorewaard, 2015). These five strategies form the base of the core decisions that are taken in this research. The core decisions are quantitative versus qualitative research, Wide or in-depth and empirical versus desk research. The best strategy or strategies for this research are chosen out of these five. All the strategies, except desk research are empirical strategies. This research most likely exists of a triangulation of multiple strategies, where that would fit best.

#### Critical choice of research strategies

#### Survey-research (quantitative)

The first strategy is 'survey'. In this research, the choice is made to not use survey. Survey is mostly used in quantitative researches, with a big domain, existing of a large number of research units. At least 40 or 50. A survey research has a few variances such as cross-sectional-, panel- and time series research. The nature of this research type is to generate a big number of outcomes with the focus on a wide range. This research, however, is qualitative of nature and focusses on in-depth experiences of people and governments. One of the biggest restrictions of survey is the, in comparison with the other research strategies, small amount of depth and the aspect-like nature of the gained knowledge.

#### Experiment

This strategy is by nature the type of research where people gain experiences by creating new situations or processes. Doing this, it becomes clear what are the effects of these changes. This strategy is only useful by answering a very specific type of questioning: the causal influence of independent variable X on dependent variable Y. The researcher then manipulates X. This type of strategy is not applicable in this research as well, because this research does not focus on the causal relation between two variables. This research tries to grasp insights from different points of view and create a holistic definition.

#### Case study

Case study is a type of research strategy where the researcher tries to gain a profound and integral view in one or a few (time-spatial limited) phenomena. A case study is recognizable through its small domain, labor-intensive approach, focus on in-depth and qualitative data. Its small domain is the most important aspect of a case study, the other characteristics follow. This type of research does not focus on counting or calculating data, but more on comparing data. This research focusses on two cases: London and Amsterdam. They form the case studies where insights and experiences are collected. There are different variances of case studies where under a single case study and a comparing case study. This research focusses on a 'comparing case study', where two different systems are compared, read London and Amsterdam. Using case study has three advantages for this research:

- 1. This type of research strategy is easier sustainable within achievable proportions. This research is made in Nijmegen and has a time limit.
- 2. Even with little methodological pre-knowledge, very useful results can be achieved.
- 3. The case study is applicable in almost every situation and therefor very accessible.

#### Funded theory approach

Funded theory approach is a strategy where phenomena are continuously involved on each other to gain new theoretical insights. In a funded theory approach, the researcher does not start with a theory, which is being tested, but a theory arises out of empirical material. In this research, funded theories are used to answer the research questions. This type of research strategy is not applicable for this research due to the fact this research does not look for a new theory. This research uses already existing material to gain new insights.

#### Desk research

Desk research is a strategy where the researcher uses by other people produced material and consults literature to gain new insights. Desk research is recognizable by the use of textual and audiovisual material, logic and systematic thinking, no direct contact with the research object and the use of the material from another point of view than how it was originally created. The most important aspect is that the material is created by other persons. This type of strategy is applicable to this research, where different policy documents and literature form the base of the definitions and strategy that is being conducted for the two case studies Amsterdam and London.

#### Applied methods: case study and desk research

The research strategy that is being used in this research is a combination of a (two cases) case study, substantiated and supplemented with desk research. These are the two strategies that are being used to answer the main research question:

# "How did London and Amsterdam approach and strategize the smart city concept and how can their city be best defined?"

The following research questions have been used to answer the main research question:

- How did London and Amsterdam approach the concepts of Smart City?
- How did London and Amsterdam strategize their Smart City concepts?
- How can London and Amsterdam's smart city be described using six layers of innovation?
- How are their approaches and strategies different and how are they similar?

The research questions form together an answer on the main research question, where they all add up and complement each other. Saying this, an approach, strategy and detailed explanation using six layers is needed to be able to define both cities.

#### Selection of case studies

The chosen case studies are Amsterdam and London. Both cities are ranked in the top ten smartest cities of Europe (Cohen, 2014). Both cases are also accepted as being more than 'just' an intelligent or digital city, because of their levels of inclusiveness and the appearance of a combination of the six elements from Giffinger's (2010) framework. Furthermore, Amsterdam won the European Capital of Innovation (iCapital) prize in 2016, granted by the European Commission (European Commission, 2016). According to Winden et al. (2007), Amsterdam belongs to the 3 European 'star' cities, meaning that Amsterdam scores very high on Quality of life, accessibility and social equity (van Winden et al. 2007). London is classified as the world's best smart city, with Singapore and Barcelona, by Philips Lighting (Ross, 2018). Looking at the time limits of this research, these cases are very good researchable as well. Both cities have much documentary available which can be discussed. Figure 6 shows the reasons why these case studies are chosen, graphically.

Figure 6: Choice Case Studies

#### 3.2 Operationalization

As stated in paragraph 3.1, the research strategies that are being used are case study and desk research. This research focusses on two cases 'Case 1: London Smart City (LSC)' and 'Case 2: Amsterdam Smart City (ASC). These two cases are compared with each other to gain insights in different policies and understandings of their smart city. An important aspect is to look for causality

between the two cases. The method that is being used is a so called hierarchal method: The research is done in two phases.

First of all, all the relevant literature for this research is put together in 'ATLAS.ti'. This is literature going from broad ideas about definitions for smart cities to very detailed frameworks. When searching literature, always, the most actual pieces are used. This literature is used to write chapter 1 and 2. Eventually three frameworks are introduced, forged out all the literature. Figure 7 shows all the literature that formed the base of this research.



#### Figure 7: Theory forming documents

After the theory forming process, the two frameworks are filled in with documents, recent smart city initiatives and other input, depending on what is needed for that framework at that time. When filling in the frameworks, kept in mind is that these frameworks form together the input to define both cities. The two case studies are constantly compared with each other to gain insights in the differences and similarities between these two smart cities. Eventually, the cases are linked back to each other to create an in-depth holistic view. Figure 8 shows this graphically.



Figure 8: Research model

#### Definitions

To make this clearer, let us refer to the main question: *How did London and Amsterdam approach and strategize the smart city concept and how can their city be best defined?* London and Amsterdam are the cases in this study. Throughout the entire research, four main topics are discussed: "smart cities", "smart city approach", "strategy" and "definition". To avoid confusion, and to be clear about the different topics and frameworks this study uses, a definition of each of the topics is given.

A definition of Smart City is introduced in chapter 1 and is further expanded in chapter 2. The broad definition this research works with: "[...] 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, Del Bo, & Nijkamp, 2011). This definition is agreed as a general definition for smart cities, yet it says nothing about particular cities, approaches or strategies. Therefore, a definition for a smart city approach is given as well.

The definition for a smart city approach is in this study translated into four strategic choices by Angelidou (2014). These four strategic choices are complemented with key elements which are very likely present in a real smart city approach, as introduced in paragraph 2.1. these key elements are public-private partnerships, the presence of multi-level governance and a certain smart mentality that is presence in the city.

The definition for strategy is translated into the SMART framework as discussed in the theoretical framework. Therefor a strategy goes deeper in on an approach. With 'strategy' this study means concrete actions in how Amsterdam and London translated their vision into practice. Furthermore, it is important to understand that this study constantly puts the two cases against each other in

perspective, so the biggest differences and similarities between the city are clear. This is part of the strategy.

The last one, definition, is a tricky one. As discussed in chapter 2, a general definition is divided from the six elements from Griffingers framework. Yet studies show, this is not a framework which gives a city tools to define itself. Therefor a third framework was introduced (by Zygiaris). However, Griffingers framework is all-round accepted a being the most holistic smart city definition. Therefor his framework is used to eventually define the two cases, added with Nam and Pardo's three dimensions. Also, definition is in this research a combination of an approach and strategy.

#### Strategy per research question

First of all, it is important to acknowledge that this research works with three frameworks to gain the best insights, but the information that is gathered is done by the researcher's perspective. Therefore, the eventual definition that is found for the case study's remains partly subjective. Research questions one, two and three start with a framework which is complemented with documents, policies and relevant literature.

The first part of the research is: How did London and Amsterdam approach the concepts of Smart City? This question is answered by using Angelidous' four strategic guidelines (Angelidou, 2014) as basis framework. The frameworks are complemented with recent literature and policy documents regarding approached both cities took. These policy documents are written by for example the Greater London Authority (GLA) and Amsterdam Smart City (ASC), both responsible for innovation policies in their case cities. How did London and Amsterdam strategize their Smart City concepts? This research question is treated and discussed with strategy documents of both case studies complemented with personal communication. This personal communication is conducted with for example, the ministry of spatial planning. This research question fills in the SMART framework by Letaifa (Letaifa, 2015). Research question three reads: How can London and Amsterdam's smart cities be described using six layers of innovation? This is the most profound part of the research where most differences between the two case studies are made. Using 6 layers, the case studies are dissected as a whole. Doing this, the most detailed and useful information will come up. This research question fills in Zyrgiaris' model (Zyrgiaris, 2012). When the first three research questions are conducted, the focus of this research will shift to : how are their approaches and strategies different and how are they similar? Answering this research question, there will be no new information conducted. All the information that is needed has already been examined. This part of the research is more of an extended summary, where London and Amsterdam are being compared with each other. When this part of the research is done, a suitable definition for both case studies is found. The definition is written using Griffingers' 'six variables' framework (Giffinger, 2010), complemented with Nam and Pardo's three dimensions. Although, both

cities are already recognized as being smart cities, this research complements griffinger's framework with a detailed explanation. The last chapter gives conclusions, recommendations and ends with a discussion.

#### 3.3 Data collecting and analyzing

This paragraph discusses how the data will be collected, used and analyzed. Within this research, literature as well as policy documents form the input to find a suitable definition for both cases LSC and ASC. Literature and other documents are consulted to triangulate this data and to supplement this data with other data from researchers. The choice is made to do desk research, besides two case studies with recent policy document.

All the reports, policy documents and other information is stored in Atlas.ti where it is most clear. A projectbundle of all the important starting documents is made and eventually, all the sources (around 100) are coded in Atlas and put in sub groups. This way, oversight is kept of the data and it gets clear if the information that is conducted, is indeed of any use in that time of the thesis.

The data is divided into 9 sub-groups, as shown in figure 8 (the definitions are not a sub-group in Atlas since that is the part of the research that is a combination of a basis definition and an approach, strategy and conceptual layout). To form a theoretical framework and model, over 25 reports are used. Most of them are written between 2010 and 2018. This is shown in figure 7. For the approach, strategy and conceptual layout of both case studies, over 60 sources are used.

The documents to fill in the three frameworks are mainly written between 2016 and 2018 and are mostly documents written by organizations or citizens active in their smart city with initiatives or people who recently wrote a discussion topic about that smart city. figure 9, 10 and 11 show the documents that were used.

Figure 9: sources 2016

#### Figure 10: sources 2017



#### Figure 811: sources 2018

Almost all off the sources from 2017 and 2018 are used to fill in the conceptual frameworks. Sources written before 2016 are almost all used to define the theories and not the case studies. Appendix III shows these sources.



# Chapter 4- Amsterdam and London Approach, strategy and innovation



#### 4.1 Introduction

In the previous chapters, Current debated and literature about smart city strategies and definitions have been discussed. In this chapter, These strategies are applied to two case cities: Amsterdam and London. Amsterdam is the capital of the Netherlands with a population of a little more than 1 million people in its urban area (World Population Review, 2018) and London is the capital of Great Britain with a population of 10 million people (World Population Review, 2018)

Both cities (London and Amsterdam) are widely accepted as leaders in becoming smart cities, yet they are two very different smart cities. London for example focusses on city-wide collaboration, smart mobility, world-class connectivity and one of the world's smartest economies (Lorimer, 2018 & Letaifa, 2015). Amsterdam focusses more on bottom-up strategies, start-ups, livability and digital innovation through its Amsterdam Smart City platform (ASC), founded in 2009 (Letaifa, 2015). Studies show that both cities face very different challenges, might due to the different numbers in size and population of the cities. For example, London faces challenges like growing pressure on healthcare, pollution management and transport (SMARTCITY, 2017). Amsterdam faces problems concering its growing popularity, accompanied with a growing need for mobility. The space in Amsterdam is limited (AmsterdamSmartCity, 2017). In an interview from 'apoliticial' with Andrew Collinge, assistant director of the Greater London Authority (GLA) and its Smart City Lead, Collinge states that it is easier for Amsterdam to make progress than for London because the operating environment in London can be a bit more difficult due to the differences in scales (apolitical, 2017).

Even though the cities face different challenges and have a slightly different focus on their smart city ambitions, studies show that they are moving in the same direction in terms of their approach for developing their cities. Both cities (on different governance levels) claim the importancy of quality of life and participation in their smart city plans (GLA, 2013 & ASC, 2016). Although this is conducted in different forms and scales. London conducted it more as a top-down plan where the national government and mainly the city government state the importancy of citizen and organization participation. The GLA states that improiving the lives of londoners is the main element of their Smart City Plan and Smart london *must* put businesses and people at its heart (GLA, 2013).

Amsterdam divided its ASC into six mainthemes, comparible with the six themes from Griffingers framework, where citizens are one of the six main themes. Everyone willing to connect to the platform is welcome, what shows its bottom-up character (ASC, 2018). Furthermore, Ger Baron (CTO of gemeente Amsterdam), Baron states that the city focusses even more on participation, start-ups and small enterprises the coming years instead of the larger corporations (Kuyper, 2016). The EC granted

Amsterdam the prize of European Capital of Innovation of 2016 with the motto 'Amsterdam: Built by smart citizens' (EC, 2016).

The theoretical framework discussed how governance plays a very important role in creating a smarter city approach, where good governance can be keyfactor in creating a certain smartmentality in a city or area. In both cases, the smart city plans state that that their city governments need to take actions to be able to embrace their visions. London aims for more and better collaboration between the city governments and organizations, what would open many doors for embracing their smart city visions (apolitical, 2017 & GLA, 2013). Baron notes that the city governement of Amsterdam is in need of a transformation in order to support the vision to be able to include smaller parties (start-ups and small enterprises) so the smaller parties can take a lead in their contribution to smart city initiatives (Kuyper, 2016).

Further comparissons between the two cases will be done on the basis of the strategic frameworks as discussed in the second chapter, which have the common purpose to map the strategies of the different cities regarding their smart city vision and to be able to define both cities. Chapter 5 continues on these frameworks and compares two initiatives in the cities using Chourabi's eight essential factors. In both comparissons, contrasts between the two approaches are shown.

#### 4.2 Strategic choices (approach)

#### How did London and Amsterdam approach the concepts of Smart City?

Angelidou (2014) described four strategic choices which can be picked to develop smart cities. The first and second strategy, regarding having a local or national strategy and creating or being a new city are for both cities kind of similar. Both cities focus on assessing the needs of the cities and its citizens first, creating priorities, as discussed in §4.1. Furthermore, both cities assign areas of the cities to experiment with smart city initiatives, within the limits of the city, geographically. Angelidou describes a strategy where different institutions focus on a 'new city from scratch', where new cities are made by experiences of existing smart cities (like PlanIT or Masdar City). This is most likely not the case in this research, because there is focus on finding a definition of two already existing smart cities.

The third choice concerns the difference between hard and soft infrastructure oriented strategies. In a soft infrastructure oriented strategy, there is a focus on participation, social innovation, inclusion and the enhancement of human of social capital, whereas in the hard strategy the focus lies way more on improving areas such as transport, waste, energy systems and water. In this strategic path, the most differences are made between the approaches of both cities. London focusses much on its number one position regarding its tech scene. Boris Johnson, mayor of London in 2013, stated that London's technical powers need to be harnessed to help the capital of Great Britain work better as a city and to support its growths. Here for both hard- and soft infrastructures are important (Johnson, 2013). Yet, the soft infrastructure side seems to have the highest priority. London opened its *Talk London* platform in 2013, an online research community where people can share ideas about tackling London's greatest challenges and issues. Furthermore digital technology is used to meet the diverse needs of its citizens to create inclusion and digital exclusion is tackled by promoting the creation of digital technologies (GLA, 2013). Promoting the tech start-up scene in London by operating a number of support programs is one its main objectives. Such as the online platform Tech.London, a platform for tech start-ups, or London DataStore, an information and statistics website. Urban Sharing Organizations (USO) are included in the GLA's plans to support start-ups, yet the city does not have a sharing agenda. Yet results have so far been more in the hard-oriented areas, where technological innovations are delivered by collaboration between governments and big companies for street lighting or smart congestion charges (Zvolska, Lehner, Voytenko Palgan, & Mont, 2018).

Compared to London, the approach Amsterdam took is more balanced between hard and soft infrastructure orientation. The Amsterdam Smart City platform is a public-private partnership, founded in 2009. Six themes are being discussed and worked for, containing hard and soft infrastructure programs. The city government closely collaborates with its citizens and other parties. Furthermore the city has set up a new institute: Amsterdam Institute for Advanced Metropolitan Solutions (AMS). This is an institute aimed on designing new metropolitan solutions, in both hard and soft infrastructure sides. They organize for example a festival called 'WeMakeThe.City' where everyone is invited to tackle everyday challenges in the urban environment, together with experts. Amsterdam's citizens are very involved and there is very much human capital in the city. 24% of Amsterdam's residents are highly educated (van Winden, van den Berg, & Pol, 2007). Although citizens are not always the key player in smart city initiatives, many times governance characteristics for filled a central role. Capra (2015) states that Amsterdam actually exists of cooperation of different governance models, where complex projects hold much citizen participation (Capra, 2015).

The last strategic choice describes having a geographically versus a sector-based reference area. In this case, both cities are similar to each other. Regardless of its geography, both London and Amsterdam focus on everyday living and enhancing these socio-economic aspects such as governance, businesses, housing and education. Due to Amsterdam's more historical center, it means that geographically wise the city center needs specific attention where it is more complicated to transform this area. This area has less urban renewal due to its historic worth.

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#### 4.3 SMART strategy

#### How did London and Amsterdam strategize their Smart City concepts?

The SMART framework is divided into three strategic levels: micro, mezzo and macro. In this research, a combination is made with different governmental institutional levels (reading European, national and city governments) and their view on the cases London and Amsterdam. On the five pillars of the SMART framework, the different institutions with their view on the cases are enlightened. This is done in order to make it able to define the different smart cities eventually with different views of their governmental institutions. This chapter focusses more on the first two steps of the framework of Letaifa (2015): Strategy and Mobilizing, where the last three steps describe a smart city initiative in detail, which is not the case in this research. Although, in paragraph 4.4, more details are discussed within the smart city reference model by Zyrgiaris (2012). The first dimension in the SMART strategy is designing a coming vision for the city. Important aspects of this phase could be understanding of the communities requirements to inspire the vision and strong political leadership. The focus in this first stage is to scope certain goals and ideas.

#### Step 1: Strategy

Most of Amsterdam's smart city initiatives, start through its Amsterdam Smart City platform. The platform was set out by the Amsterdam Economic Board (AEB), driven by the sustainability goals, set out by the European Commission. The EC is working together with cities to ensure the quality of life. They bring together the EC, national ministries, city governments and other stakeholders to have easier access to funding and share knowledge in different fields (European Commission, sd). Furthermore, the EC is creating policies which would implement Smart Cities as an objective in national and European policies. According to Elkie Leenen, information officer at the national government, the Dutch national government does not have a formal strategy or policy about Smart Cities, but they outsource it to national institutions like Platform31 and PlanBureau voor de Leefomgeving (PBL). (personal communication, Leenen, May 2, 2018). The EC's goals have been translated to specific goals for the city, set out by AEB (AEB, 2015). Thus far, the Amsterdam Smart City platform exist of ongoing projects which enlightens the city's ongoing smart character. Amsterdam's platform has a 'public-private character' where the city government is not always leading its projects but for fills different roles, what suits the projects most. Even stronger, everyone can post pilot projects and questions on the platform and the Amsterdam Smart City team then reacts on it. This shows the transparency of the platform. In my opinion ASC is a good example of how e-planning works in practice. According to Ger Baron, the biggest challenges for the national government and particularly Amsterdam, are to change the planning culture of the country (Kuyper, 2016). The need of change in the Netherlands' planning culture is supported by the direction of Spatial Planning (Dutch ministry). They state that Smart Cities are not just about the technology but in special about futureproof architectures to establish working processes in such a way that cities are resilient enough for all the developments to come (personal communication, Direction Spatial Planning, May 24, 2018). To put in in a nutshell; Amsterdam strategizes itself by creating an atmosphere where innovation is built upon its (smart) citizens through collaboration. Amsterdam is an open platform for livability. They use advanced technology to upgrade upon social innovation. **Therefor, Amsterdam strategizes itself as the startup Capital of Europe** (Macpherson, 2017).

London took a whole different kind of strategy than Amsterdam. Sadig Khan outlined his vision for London to become the world's smartest city by using digital technology and data as a heart of making the city a better place to invest, live and work in. Even stronger, the mayor of London stated that the potential for cutting-edge technology to tackle a host of social, economic and environmental challenges is immeasurable. From air pollution and climate change to housing and transport, new technologies and data science will be at the heart of the long-term solutions to urban challenges (Mayor of London, 2017). The term 'smart city' means different things to different people for London. Smart London is about how the capital as a whole functions as a result of the interplay between its 'systems' - from local labor markets to financial markets, from local government to education, healthcare, transportation and utilities. Smart London is where the linkages between these different systems are better understood, where digital technology is used to better integrate these different systems, and London as a whole works more efficiently as a result - for the benefit of its inhabitants and visitors (GLA, 2013). As discussed in the approach section, results in London's smart city plan have mostly been in 'hard infrastructure' plans. A smarter London therefore focusses on city-wide collaboration between public institutions and tech communities. In 2017, the London Office of Technology and Innovation (LOTI) was launched. LOTI is aimed on enlarging digital collaboration and preparing London's public services technologically wise. Furthermore, LOTI is focused on ensuring data quality and encouraging partnerships within the private sector. LOTI is a joint enterprise between the GLA and London councils (represent of the 32 borough councils of London) (Collinge, 2012). This, however, shows the public nature of London's strategy. London strategizes itself by being and becoming a worldleader in the market for smart city technologies (Smart London, 2018). ARUP, a big independent firm in London, founded by sir Ove Arup, states the potential of the cities smart city market could reach to £13.4 billion by 2020 for smart energy, smart healthcare, smart transport, smart infrastructure and smart governance (ARUP, 2016).

#### Step 2: Multidisciplinary

In this step of the SMART framework, actors and stakeholders suitable in the cities strategies are mobilized. Important in a SMART strategy is that actors with different backgrounds are involved in creating the strategy. Regarding this step, both cities include actors and stakeholders with different backgrounds. Both cities have strategies where they include actors from different background. Amsterdam does it by using its platform. The platform has currently more than 5000 users and 11 program partners, where under companies like KPN (telecom company), PostNL (mail service), Amsterdam University of Applied Sciences, Alliander (Dutch energy company) and gemeente Amsterdam (ASC, 2018). This platform serves as a place where stakeholders can launch their projects. Together with all their platforms (like Amsterdam Institute for Advanced Metropolitan Solutions and other platforms) Amsterdam has 40.0000 city-makers who co-create the city. The different backgrounds from the program partners show the broadly oriented character of the platform and the chances it has to offer.

London, on the other hand works with 'boroughs', parts of London with their own council. And thus far, 1000 people per borough (with a total of 33.000 people) are included in Smart city-initiatives in the city. Yet citizen involvement and direct participation are not mainly present in London's smart city projects. Although, through its DataStore, citizen engagement got boosted. Moreover, through its Talk London platform, citizens get a chance to be involved in policy making. London involves its citizens more in an advisory or cooperative way.

#### 4.4 Conceptual Layout

# How can London and Amsterdam's smart city be described using six layers of innovation as conceptual lay-out?

In this paragraph, the Smart City Reference Model is applied to London and Amsterdam, to further illustrate the strategic approaches of the cities and their differences and similarities. This illustrated and defines the conceptual layout of both smart cities. In the meantime, innovational aspects of the different layers of the cities are discussed. This is done by discussing the 7 layers from Zygiaris (2012). According to Chourabi (2012), as described in the theoretical framework, strategic planning for a smart city cannot be just technology based. Therefore, aspects like policies, organizations, built infrastructure and governance are also taken into consideration when researching the 7 layers. Appendix 1 shows the sources that are used to conduct these conceptual layouts.

#### 0. The city Layer

According to Bélissent (2010), to understand a smart city, one must understand the basis of it first: the city (Bélissent, 2010). Amsterdam can be recognized by its historic city center. This is on the one hand a nice characteristic but on the other hand a bottleneck. Due to its history character, upgrades in hard infrastructures in the city would require major investments. For example, smart street lighting. The electricity grid finds its origin way back in the 20<sup>th</sup> century and is still an analogue system. Therefore, implementing internet connections in the street light system would be a very expensive investment (Kuyper, 2016). Moreover, the electricity grid is privatized (to Liander). This is at the same time an opportunity for the city because Liander is part of the Amsterdam Smart City network. Amsterdam is undergoing big city renewal projects in (among others) 'Amsterdam Nieuw-west' and 'Amsterdam Noord' what gives opportunities for implementing smart city features (in for example smart mobility).

London has more opportunities to make big changes in its infrastructure because of in the first place, the big challenges they are facing. According to its Smart City Plan, London needs at least 800.000 more homes by 2030 and public transport faces 600.00 extra passengers at peak times in 2030. Congestions on the roads cost the economy at least £2 Billion a year. Therefor big investments are needed. Secondly, the city is already undergoing big city renewal projects in for example its docks transports (smart mobility) and it had a lot of urban renewal projects late 20<sup>th</sup> century like the canary Wharf, London's biggest business district. Overall London should be able to absorb smart city features. In their case it is more technology based (and companies and institutions working together), where Amsterdam chooses more for a combination of Quality of Life for its citizens combined with start-up companies.

#### 1. The Green City Layer

Amsterdam focusses mainly on open data through (among other ways) its Amsterdam Smart City platform. Besides from this, their primary focus is on a sustainable environment. Their platform was in the first place set up to reach the sustainability goals as set out by the EU and they describe their self as one of the most sustainable cities in Europe (Iamsterdam, 2015). Amsterdam took several steps to reach their sustainability goals for 2020 (20% more renewable energy, 20% less energy per resident than in 2013 as well as an improved air quality and to ensure that 65% of all household waste is collected separately) (Gemeente Amsterdam, 2015). Furthermore, Amsterdam tries to have as much emission free traffic by 2025 as possible. They reach these goals, by focusing among other things, on sustainable garbage plans and focusing on the many bikes in the city, which is a big part of its smart mobility story. Lastly, they focus on rooftop solar generators which improves the opportunity for renewable energy (Berger, 2016).

Just like Amsterdam, London holds sustainability as one of its main priorities as well. London worked out its sustainability goals within their policy, where they have several departments focusing on different kinds of sustainability goals (such like Business and sustainability, Climate Resilient City and Low Carbon). Their main priority is to build a strong and sustainable economy. London achieves this by opening several consultancy firms that help companies with free advice and support on for example waste management and use of resources. Their sustainability goals are not necessarily driven by EU but they do implement some of their goals and work together with EU countries on reaching their goals. Also, London's sustainability goals are driven by their national goals and vision (GLA, 2013 & The International Development Committee, 2016). London has less specific goals than Amsterdam, but they do keep up with the Paris Agreement target to keep for example the global temperature rise below 2 degrees Celsius (City of London, 2018). To reach this agreement, they set a lot of challenges and possible solutions in their climate change adaption strategy in 2010 (City of London, 2010).

#### 2. The Interconnection Layer

Digital infrastructure is very important for London, since they strategize their selves as a leader in the smart city technology market for the world. To ensure their digital economy position, the national government provides superfast broadband access for over 42000 businesses throughout the United Kingdom (Poole, 2017). Since the Brexit, some assumes were made that the financial market in London would not maintain its position as the EU's financial center (Skolimowski & Look, 2018). However, London is still leading the world with the highest capacity of private datalinks in the world (159 terabytes per second) and they are going to retain this is 2020 by tripling this to 486 terabytes per second (Bloomberg, 2017). Furthermore, London launched an outdoor Wi-Fi network with broadband speeds of between 50 and 180 megabytes per second, which is world leading (Scroxton, 2017).

In contradiction with London, Amsterdam provides a Wi-Fi connection of around 10 Megabytes per Second, which is still one of the world's leading connections. Besides this, they also have possibly the best digital foundation in the world, thanks and due to the Amsterdam Internet Exchange (AMS IX) which is presence in the city and also the world's largest data transport hub in the world. (Amsterdam Science Park, 2014). Amsterdam has the Netherlands' biggest fibre to the home (ftth) network. Private investors, housing corporations and the municipality have together set up a new company: Glasvezelnet Amsterdam. Therefor the fribre network is a public-private fibre network connecting almost every home in Amsterdam with internet connections of around 100 Megabytes per Second (Fibre to the Home Council Europe, 2010). However, currently only one in five households in Amsterdam has access to this glasvezel network. This is in other cities in the Netherlands on average one in three homes (Het Parool, 2017).

#### 3. The Instrumentation Layer

Amsterdam invests a lot in Smart Mobility. The city focusses on alternative transport models for cars, for example its electric vehicle infrastructure. Furthermore, Amsterdam has a 'virtual traffic manager', which is unique. This is one of the fields managed by multiple institutions: Amsterdam municipality, the province management (Noord-Holland) and the national government. Within their management area, they all try to optimize traffic flows. It was necessary to work together on mobility, because conflict could occur where different institutions had different measures on the traffic flows. They all use the same system (Mobimaestro) now, providing real-time information throughout the entire city and it is accessible by private car users where they connect the system to their own navigate systems (ASC, 2016b). Smart lighting (as introduced in 0. The City Layer) is also implemented by Amsterdam. In various public areas in the city smart lighting is implemented with adjustable lanterns. Doing this lighting can be adjusted to the weather and colored lighting can be used for traffic flows of pedestrians. This is again a public-private partnership between the municipality of Amsterdam and various companies like Alliander and Philips (ASC, 2016c). They also have projects focusing on their many bikes, implementing smart lighting and solar panels into bike lines.

London is currently testing an adaptive-traffic system, where cyclists are detected and get priority at traffic lights. The system detects the number of cyclists waiting at a traffic light and can adjust the length of green (and red) lights for smoother traffic flows (Mighty Things, 2015). Real-time datamanagement is implemented is London's traffic management, just as in Amsterdam. Except, for London there is more need for smart traffic management than in Amsterdam due to the growing pressure on its roads especially in the financial district (Sullivan, 2016). London implemented a freight program which provides a good basis for future development. They also implemented a couple of private programs for low impact logistics, but those are not as advanced in Amsterdam. London scores high on real-time data for enabling modal shifts because they have a combination of bus, tube, cycling and cross rail which all provide up-to-date and real time data. Amsterdam scores high on this point as well, however Amsterdam scores much higher on re-allocating space to pedestrians and focusing on cyclists. Lastly, they both score a little less (medium) on a 'vision zero focus'. This concept is about involving an approach that does not accept any loss of life as a result of the transportation systems (City of London, 2018).

#### 4. The Open Integration Layer

Both Amsterdam and London have multiple available platforms which provide access for their visitors. London has for example its Datastore (data.london.gov.uk) which provides actual data of several fields, such like jobs, transport, environment, health and performance of London. This is an open application accessible for every Londoner. Starting from the Datastore, several applications are opened. The most recent applications are 'London's economic outlook' (Douglass, 2018) and the 'labor Market update' (Cominetti, 2018). The datastore gives an outlook on predicitions for the future based on all its data as well, which makes it, in my eyes, a smart datastore. The GLA has also been investigating opportunities for cross-sector 'data cooperations' for sharing data possibilities, called the Sharing Cities Programme (Clifton, 2017). Despite the UK leaving the EU, they work together with EU cities in datasharing (GLA, 2013)

Amsterdam provides a similar platform like the Datastore, called City Data (data.amsterdam.nl). besides this, they have another platform called DataLab. DataLab is a knowledge institution for reliable and innovative data usage. They combine all the statistics (like in Datastore) with much possibilities for the public (citizens) to add and discuss about data. All the (raw) information as discussed in the instrumentation layer is processed and analyzed in the DataLab. The data that is processed is also shared in the meantime with the public and different systems are added to the DataLab where intercommunication finds place. Furthermore, Amsterdam started, together with Barcelona in 2017 a new project called DECODE (Decentralized Citizens Owned Data Ecosystem). This is an European project, where pilots in Amsterdam are worked out to show that decentralized solutions on the internet, based on Block chain technology: a digital ledger of economic transactions, which is not corruptible and can be programmed to record any kind of data. Information that is processed with block chain exists of a shared and continuous reconciled database (Tapscott, 2016). Accessibility and openness are characteristics of Block chain. Decentralizing the power of the internet to private users has many advantaged for freedom, privacy and online rights of people (Waag, 2017).

#### 5. The Application Layer

Both cities applicate the open data as discussed in layer 1 till 4. They both offer a number of applications which make use of the information provided on the data platforms. For example parking and transport applications (like Uber or City mapper) (Zyrgiaris, 2012). Also both cities are continuously looking for city-solutions with the use of open-data. London made use of open-data for the Olympics in 2012, where cameras and sensors throughout the entire city formed a digital infrastructure to ensure everyone's safety. But they use it for an efficient as possible road network as well. Not only for cyclist, as discussed before, but also for automobilists, where applications are used to reduce driving time and congestion. Furthermore, applications on smartphones have been developed to improve health and environmental services for Londoners. Lastly, London is implementing applications to support its growing leading technology business position in the world. Doing this, London works from a top-down strategy but drives citizens engagement.

Amsterdam has a focus on sustainable solutions for alternatives for cars, such like electric vehicles. They have several charging stations throughout the city where electric car drivers can charge electricity for their cars. They make use of parking sensors, smart street lighting and navigation applications. Amsterdam is taking possibilities for applications even a step further, where they applied an 'App to the Future' (van den Bosch, 2017), an application where citizens can predict the future, where the entire public space is connected. The Dutch railways (NS) also implemented a new application in their app called 'Treinenradar' (train radar). With this app, everyone can see live information about the trains of the Dutch railways (treinenradar.nl). Amsterdam is aiming for a top 3 position of most innovative urban environments in 2025. Their aim is to make the city livable by using open data and mobility solutions (Elferink, 2018).

#### 6. The Innovation Layer

London and Amsterdam are both cities suitable to grow as a smart city. They both provide enough opportunities for initiatives to find place within their cities. Amsterdam for example, focusses mainly on start-up businesses and the opportunity for them to grow. Doing so, all kind of institutions and governments on different institutional levels are involved in the growing processes of the start-up companies, mainly through their Amsterdam City Platform (ASC). At the same time, Amsterdam is an attractive city to do business because of its growing economic climate (Kuyper, 2016). London on the other hand, focusses mainly on the technology businesses scene, with for example its Silicon Roundabout in East London. This is recognized as one of the biggest start-up clusters in the world (after New York City and San Francisco) (Lawdonut, 2017). Amsterdam has a similar start-up area, but much smaller than in London, called Startup Village at Amsterdam Science Park.

London has over 40 tech and science clusters. And, as discussed before, has the highest capacity of private datalinks in the world (159 terabytes per second). Currently, London has over 47.000 digital companies where more than 240.000 people are employed. Foresights are that these number will grow with 45.000 jobs in 2026 (Mayor of London, 2017). Although, London is the most innovative city in Europe, according to Hub spot, Amsterdam has the best tech business working conditions, which makes it an attractive innovation hub as well. This is due to a high standard of living, high success rate and high salaries (Pieters, 2017).

The biggest differences could be distracted due to the possible political instability of Great Britain since they left the European Union. On the first day of the Brexit, London lost around 10.500 finance jobs on the first day of the Brexit and the biggest treat could be that UK companies are unable to service European clients after March 2019 (Musaddique, 2017). Although, this treat is according to major Sadiq Khan probably not present, because of London's dynamic industry that is resilient to change (Giles, 2018). The Amsterdam Institute for Advanced Metropolitan Solutions (AMS) is a notable development. This is a collaboration between several universities. AMS works together with different societal partners (like the Amsterdam Smart City platform) and companies like Alliander and KPN. They continuously work on big projects using available open data from within the city and analyzing it for functions to improve the city.

#### 4.5 Strategy, approach and conceptual model comparison

#### How are their approaches and strategies different and how are they similar?

In this paragraph a summary is given of the differences and similarities between both cities on the researched aspects as displayed in table 3. This is the last step before the conclusions for both cities can be worked out, based on Griffingers framework (2010). This summary forms a conclusion of the approach, strategy and conceptual-layout of both case studies as well.

	London	Amsterdam
Basis definition	"A place where people want to work,	"A smarter Amsterdam is a city where
	live and play. It fosters talent and	sustainable growth is facilitated and
	supports and accommodates	accelerated by social and technological
	population growth. In a smarter	infrastructures. Technology plays an
	London, data as a service is employed.	important role in this city's development,
	It allows business as usual, but easier,	but it is not a goal itself" (amsterdamsmartcity,
	faster and cheaper. It is not a single	2016).
	definitive solution but a series of	
	interventions as response to its	
	changing needs" (GLA, 2013).	
Main focus	World-class connectivity, status of	Start-up companies, livability and digital
	smartest economy in the world, big	innovation. Importance of quality of life
	technology business scene.	and public-private partnerships. Focus on
	Importance of quality of life.	small enterprises.
Challenges	Growing pressure on healthcare,	Growing popularity, growing need for
	pollution management, maintaining	mobility.
	status	

Strategy direction	Mainly top-down based with city wide	Bottom-up approach and strategies.
	collaboration. Improving the life of	Worked out from its Amsterdam Smart City
	Londoners as core element from top-	platform (ASC). Driven by sustainability
	down based strategy.	goals.
Government aims	More and better collaboration	
	between organizations and the cities	In transformation to be able to support and
	government	include smaller parties

#### Approach

Strategy approach	Local strategy. Hard-side oriented with	Local strategy. A good balance between
	soft focusses. Focus on everyday life	hard- and soft oriented strategies. Focus on
	enhancing socio-economic aspects.	everyday life enhancing socio-economic
		aspects. Specific attention for historic
		center.
Technology	Digital technology used to meet the	Amsterdam uses technology to improve the
	diverse needs of the citizens and create	quality of life of their citizens.
	social and digital inclusion. Focus is on	
	tech start-up scene.	
Human	Londoners are the core. Plans aim to	City government works together with
	involve citizens in smart city plans.	citizens, where their main focus is on a
		public-private partnership. Citizens shape
		their smart city.
Institutional	Technological innovations made by	Cooperation of different institutions with
	collaboration between governments	much citizen participation
	and big companies.	

## SMART Strategy

Strategy	Being and becoming the world leader in	Being the startup capital of Europe.
	the market for smart city technology.	Amsterdam is driven by EU sustainability
	Digital technology is used to make	goals. Focus on public-private partnerships
	London a better place to invest, work	with guidance from city government.
	and live in. Smart London is about how	Innovation within the Amsterdam Smart
	the capital works as a result of	City is built upon its citizens through

interplay between its many systems.collaboration. Bottom-up initiatives fill theLinks are used to better understand thecity as an living experiment platform.systems and digital technology is usedto integrate these systems. LOTIfocusses on encouraging partnershipswith the private sector.MultidisciplinaryBoroughs with their own council. PerInvolvement through its platform. Platformcouncil, citizens are involved in pilotserves as a connection place whereproject and initiatives.Citizenseveryone can launch projects. Big variety ininvolved in an advisory way.backgrounds of involved players.

#### **Conceptual Lay-out**

The city	Big Urban Renewal Projects (docks	Historic center which needs big investments
	transports and business district).	to be able to transform. Big urban renewal
	Opportunities for absorbing tech-	projects as well. Opportunities for start-up
	based smart city features.	companies.
The green city	Sustainability goals worked out in	Driven by EU and sustainability as one of its
	policies as agreed on Paris Agreement.	main goals. Many projects aimed on
	Priority on building strong and	reaching these goals. Goals are set out in
	sustainable economy. Climate change	several policy documents.
	adaption strategy.	
	Superfast broadband for companies in	
Interconnection	London. Highest capacity of private	Outstanding digital foundation due to AMS
	datalinks in the world.	IX. Biggest fiber (ftth/glasvezel) network in
		the Netherlands. Glasvezel is however, an
	Adaptive-traffic system and real-time	issue. (Public-private partnership)
Instrumentation	data management. Freight programme	Electric vehicle infrastructure and
	and private programs implemented.	optimized traffic flows. Leading in
	Leading in real-time data for modal	pedestrian and cyclist programs. Smart
	shifts.	lighting is implemented. (Public-private
	DataStore provides actual and real-	partnership).
Open integration	time data accessible for everyone.	DataLab, similar as DataStore. DataLab
		takes the data a step further where raw

	Opportunities for cross-sector data	data is processed for new applications.
	cooperation's are researched by GLA.	DECODE project, with pilots in Amsterdam.
		A shift to decentralized block chain
	Cameras and sensors form a digital	technology.
Application	infrastructure, applicable on different	Application for sustainable solutions for car
	fields. Applications on smartphones	usage. Charging stations for electric
	are implemented to improve the	vehicles. Train radar for actual and real-time
	health of Londoners.	train information (for Dutch Railways).
	Innovation in tech business scene.	Making the city livable by using open data.
Innovation	Innovation in tech business scene. Third biggest tech start-up cluster in	Making the city livable by using open data. Growing economic climate. AMS is a
Innovation	Innovation in tech business scene. Third biggest tech start-up cluster in the world. Very attractive business and	Making the city livable by using open data. Growing economic climate. AMS is a notable development. Using big data,
Innovation	Innovation in tech business scene. Third biggest tech start-up cluster in the world. Very attractive business and innovation hub, despite Brexit,	Making the city livable by using open data. Growing economic climate. AMS is a notable development. Using big data, functions are developed for improving the
Innovation	Innovation in tech business scene. Third biggest tech start-up cluster in the world. Very attractive business and innovation hub, despite Brexit, because of dynamic tech industry.	Making the city livable by using open data. Growing economic climate. AMS is a notable development. Using big data, functions are developed for improving the city's business climate. Very attractive start-
Innovation	Innovation in tech business scene. Third biggest tech start-up cluster in the world. Very attractive business and innovation hub, despite Brexit, because of dynamic tech industry.	Making the city livable by using open data. Growing economic climate. AMS is a notable development. Using big data, functions are developed for improving the city's business climate. Very attractive start- up climate.

Table 3: Defining London and Amsterdam

# Chapter 5- Conclusions and Discussion

This final chapter discusses the findings as represented in chapter 4. The discussion is done based on the four sub-questions which are used to answer the main research question:

"How did London and Amsterdam approach and strategize the smart city concept and how can their cities be best defined?"

Paragraph 5.1 'Definitions' first gives a summary of the findings as discussed in chapter 4. The definitions as found in this research are therefore a summary of the approach, strategy and conceptual lay-out as conducted from the results of chapter 4, described using the starting definition from Caragliu, Del Bo, & Nijkamp (2011).

#### 5.1 Conclusions and definitions

The results as found in this research have an inductive nature. This means that this research gives definitions which are not necessarily the truth, but describes a certain phenomenon. Based on three frameworks and two starting definitions from Amsterdam and London, as stated in paragraph 2.3 (table 1), better suitable definitions have been found. These definitions are found by analyzing recent literature and more important, very recent opinions, policy documents, websites and more important initiatives and experiences on for example the Amsterdam Smart City platform. The goal of this research was to describe two smart cities and demonstrate that one standard definition, is not applicable to every single city due to different institutions, approached and strategies. However, there is one starting definition that describes a smart city in a holistic way, as shown in figure 6. The six variables are translated into this definition. Human and social capital is the translation of smart people, smart mobility is transformed into traditional and modern infrastructure, smart environment now reads wise management of national resources, smart economy is translated into sustainable economic growth, Quality of life was smart living before and a smart governance should be a participatory governance.

"[...] 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, Del Bo, & Nijkamp, 2011)

Figure 6: starting definition

This starting definition is a combination of the six variables from Griffingers framework (2010), added with three dimensions (technology, human and organization) from Nam and Pardo (2011). The

definitions for London and Amsterdam are therefore a combination of this starting definition filled in with elements of the completed frameworks.

#### Approach, strategy and conceptual layout combined

London and Amsterdam can both be described as a 'smart city', yet they approach and strategize their concepts in very different ways, due to different sizes and contexts of the cities. Based on very different challenges to start with, a different focus has been set. The city is a combination of institutions, citizens and governments. London for example tries to become and maintain the smartest city in the world for the technology business scene. Amsterdam on the other hand wants to be the start-up capital of the world. They both adjusted their approaches and strategies on this main focus. London works with a top-down strategy where city governments make policies and they inform citizens and ask for citizen participation. Amsterdam works the other way around, they took a bottom-up approach, mainly focusing on and working from their Amsterdam Smart City (ASC) platform. The combination of technology, people and institutions is in both case studies present. In London there is mainly cooperation between the city government (and its boroughs) and big institutions and companies. Furthermore digital technology is used to meet the diverse needs of its citizens to create inclusion and digital exclusion is tackled by promoting the creation of digital technologies. Smart people (human and social capital) contribute to London's vision as being the smart technology leader in the world. In Amsterdam there is a balanced cooperation between its citizens, institutions and city government in smart city projects where they all contribute to their smart city. Technology forms a supportive role, where it is a primary role in London. Both cities have much human and social capital. Amsterdam strategizes itself with public-private partnerships where the government adapts itself to the needs of that initiative at that time. They create a very attractive climate for start-ups to settle and grow there. London, on the other hand, faces big challenges in congestion and population growth for example, but uses its cutting-edge technologies to tackle these challenges. Smart London is about how the capital as a whole functions as a result of the interplay between its 'systems' - from local labor markets to financial markets, from local government to education, healthcare, transportation and utilities. Amsterdam is driven by sustainability goals as set by the EU. Their platform was set-up in the first place to tackle environmental problems and reach their sustainability goals. Amsterdam focusses a lot on renewable energy by, among other actions, building rooftop solar generators. London also has sustainability as one of its main priorities, but they translated it mostly into building a strong and stable economy. The city government opened consultancy firms that give free advice to (start-up) companies on how to wisely manage their resources and reduce waste. Amsterdam gives on average the best working conditions for start-ups, which makes it a very attractive innovation hub. London on the other hand, has the biggest number of private datalinks of 159 terabytes per second, in the world. This shows

its attractive character for doing business. Amsterdam's economic climate is not as big as in London, but they are growing. Finally, in both case studies, the governments (on different institutional levels) are involved in the smart city processes. The national government of Great Britain provides superfast broadband internet for its businesses so the economic climate in London is able to grow. In the Netherlands, governmental institutions on multiple levels (National, provincial and city) are working together to make sure the road networks function as best as possible. London's city government works together with its 33 boroughs and big companies to implement its smart city strategy. In all of its 33 boroughs, approximately 1000 people are included in smart city initiatives. The city government of Amsterdam works together with its citizens, companies and institutions through the Amsterdam Smart City platform. They have all an equal voice and the government adjusts their role at what is needed for that particular project at that time. Therefor Amsterdam is a living experiments lab where they all cocreate their city. Table 4 shows the most important points of the approach, strategy and conceptual layout together with the six variables.

	Amsterdam	London
Human and social	Bottom-up approach where citizens come	Digital technology is used to meet the
capital	up with initiatives. The creative class of	diverse needs of its citizens to create
	Amsterdam forms the base of its smart	inclusion and digital exclusion is tackled
	city, where the city is a living lab for start-	by promoting the creation of digital
	up companies. The EC granted Amsterdam	technologies.
	the prize of European Capital of	
	Innovation of 2016 with the motto	
	'Amsterdam: Built by smart citizens'	
Traditional and	Amsterdam invests in alternative	London uses sensors and cameras
modern infrastructure	transport models for cars and it has a	throughout the city as a digital
	virtual traffic manager. They have projects	infrastructure and on the roads, London
	implementing smart lighting and solar	is using real-time data to manage traffic
	panels into bike lines.	flows.
Wise management of	Amsterdam's primary focus is on a	London holds sustainability as one of its
natural resources	sustainable environment. Their platform	main priorities. Their main priority is to
	was in the first place set up to reach the	build a strong and sustainable economy.
	sustainability goals as set out by the EU.	London achieves this by opening several

	Amsterdam tries to have as much	consultancy firms that help companies
	emission free traffic by 2025 as possible.	with free advice and support on for
	They focus on renewable energy by	example waste management and use of
	rooftop solar generators.	resources.
Sustainable economic	All kind of institutions and governments	To ensure their digital economy position,
growth	on different institutional levels are	the national government provides
	involved in the growing processes of start-	superfast broadband access for over
	up companies. Amsterdam is an attractive	42000 businesses throughout the United
	city to do business because of its growing	Kingdom. London focusses mainly on the
	economic climate. Amsterdam has a start-	technology businesses scene, with for
	up area, called Startup Village at	example its Silicon Roundabout in East
	Amsterdam Science Park. Amsterdam has	London. London has over 40 tech and
	Europe's best start-up working conditions.	science clusters with over 47000 digital
		companies.
Quality of life	By using open data, Amsterdam tries to	London conducted it more as a top-
	make its city more livable. Quality of Life is	down plan where the national
	one of Amsterdam's main themes on their	government and mainly the city
	Amsterdam Smart City platform.	government state the importancy of
		citizen and organization participation.
Participatory	The Amsterdam Smart City platform is a	London focusses on city-wide
governance	public-private partnership. The city	collaboration between public
	government is not always leading its	institutions and tech communities.
	projects but for fills different roles, what	Participation finds place through its 33
	suits the projects most.	boroughs.

Table 4: Starting definition filled in with elements from the approach, strategy and conceptual layout

Two definitions have been formed. The definitions are the most holistic definition as possible. The approach, strategy and conceptual layout form, based on the definition as shown in figure 6, the definitions for the case studies.

For the city of London, the following definition has been composed:

"London Invests in digital inclusion and diverse needs for its citizens by promoting its digital technologies in multiple ways. A digital infrastructure is created to manage traffic congestion, advice is given to (tech) start-ups and a very attractive economic climate is created to maintain its position the smartest city in the world for the technology business scene. Doing this, London focusses on citywide collaboration between public institutions and tech communities."

For the city of Amsterdam, the next definition is formed:

"Amsterdam Smart City is formed by its citizens who co-create the city. Amsterdam invests in a sustainable environments for its citizens by investing in emission free traffic, renewable energy, fast internet and optimized traffic flows. Amsterdam invests in small enterprises and start-up companies by offering the best working conditions and block chain technology. ASC is a public-private partnership, where the city government is one of its partners."

#### 5.2 Discussion

This paragraph evaluates this research. Results will be discussed, the subject of this research is evaluated and limitations and suggestions for follow-up research are discussed.

#### Research design

This research is filled with mostly desk research. This means, the results that are found in this research are mostly conducted with secondary data. This research has a descriptive nature. It describes two smart cities with all the relevant information that exists about the case studies that were researched. When designing this research, I knew that answering qualitative research questions with only secondary data is difficult. That is why the case studies of this research as discussed in chapter 4 (approach, strategy and conceptual layout) are formed with mostly sources not written before 2016. Doing this, the research gained validity. However, with more primary data (interviews for example) could give more insight in experiences of different institutions, that were possible not found by doing mostly desk research. The three frameworks (approach, strategy, conceptual layout) are conducted out of over 25 well citated and well known theories, wherefore these frameworks formed, in my opinion, the best basis to be able to eventually define the two cases.

For this thesis the choice is made to use Zygiaris (2012) model to define the conceptual lay-out of two smart cities, where it is used as the last model to give a definition for both cases. However, the model could be used as a starting point for a smart city masterplan as well. The the model showed inconsistencies and characteristics of the two smart cities.

The SMART framework is translated into Strategy and Multidisciplinary. The last three steps of the framework explain smart city initiatives more detailed. Therefor by focusing more on the first two steps, insights in the cities strategies could be found.

By searching results, important smart city aspects like a smart mentality and a cooperative governance were taken into results.

Eventually the frameworks were linked back to the starting definition. Doing this, an accessible, understandable definition for the cases could be given. The starting definition shows a theoretical 'ultimate smart city', with the most important aspects. At the same time, the six variables (Human and social capital, Traditional and modern infrastructure, Wise management of natural resources, Sustainable economic growth, Quality of life and a Participatory governance) give a pretty detailed definition of a smart city. To make the combination with an approach, strategy and conceptual layout, not just a definition for both cities is given, but also the strategy to-, the underlying meaning- and the innovative character of the cities were discussed.

#### Results

The results of this research meet my expectations partly. The conceptual layout gave many insights in the ability to eventually define the two cases. The eventual results are not only two definitions of two very different smart cities with different institutions and contexts, but also insights in different strategies taken by different cities. This is derivable from the definitions as shown in the conclusions.

"London Invests in digital inclusion and diverse needs for its citizens by promoting its digital technologies in multiple ways. A digital infrastructure is created to manage traffic congestion, advice is given to (tech) start-ups and a very attractive economic climate is created to maintain its position the smartest city in the world for the technology business scene. Doing this, London focuses on citywide collaboration between public institutions and tech communities."

This definition clearly shows that London works with a top-down structured vision. The city government wants London to maintain its tech leading position. This is understandable since a bottomup approach would in my opinion not be sufficient for this strategy. London chooses for city-wide collaboration between public institutions (boroughs) and companies & communities. For Amsterdam it is almost the other way around:

"Amsterdam Smart City is formed by its citizens who co-create the city. Amsterdam invests in a sustainable environments for its citizens by investing in emission free traffic, renewable energy, fast internet and optimized traffic flows. Amsterdam invests in small enterprises and start-up companies by offering the best working conditions and block chain technology. ASC is a public-private partnership, where the city government is one of its partners."

Amsterdam chooses for a bottom-up approach where its smart citizens have the opportunity create their city in a way they would like it. This brings its risks for Amsterdam, but the city government ensures the quality of life, where they are in almost every pilot project and initiative a project partner. Amsterdam is much smaller than London so it more obvious and easier for them to choose for a bottom-up approach. This shows in my opinion the startup character of the city.

The results as discussed in chapter 4 do not extend to all the expectations that I wished. For example, by using these three frameworks, there was not much space to talk about citizen inclusion and participation, where this was not suitable. Also, some of the results in the approach and strategy overlap each other, where it was not always very clear what the differences where between the approach and strategy. I am pleased about my expectations that London and Amsterdam were not comparable with each other as two smart cities. For example London strategizes itself as maintaining its role as world leader in the market for smart city tech and London strategizes itself as the startup

capital of Europe. The way how they worked out these strategies (top-down, bottom-up) really suits. The Amsterdam Smart City platform perfectly fits their strategy where it shows its open and transparent character.

#### Insights

Most of what is researches in this research is, because of its descriptive nature, already known. However this research tries to combine different studies and insights to create new theories. These new theories were applied to two case studies wherefore new definitions have been found. The theoretical framework shows the definitions Amsterdam and London currently work with and the definitions that were eventually found in this research provide a holistic, new insight. This research was not meant to upgrade two cities into smart cities and give handles to be able to upgrade them. Initiators of the two smart cities that are discussed have more insights in the totality of their city, because insights of different angles are used to find results. However, based on the definitions as researched in this thesis, further research could be conducted.

Eventually, I have shown that different smart cities need different approaches and strategies. Where it is just not possible to define 'a' smart city. Every city has so many different stories to tell and outcomes in the different cities are due to the different contexts they operate in.

I was in the understanding that I did not need interviews to be able to answer the main research question. But writing this thesis, at certain points, interviews would have been sufficient instead of already existing sources. Through interviews deeper experiences could have been conducted, where I choose to gather information from documents, which could give better insights for conducting an eventual definition for both cities, so I thought. I detect myself in being able to find more detailed information about Amsterdam than for London. This could be because Amsterdam has more detailed projects and pilots to talk about but this is probably because of more pre-knowledge about Amsterdam and the different languages to find sources for. For London, only English language sources have been found and for Amsterdam both English and Dutch language sources have been used.

#### 5.3 Reflection

In this final paragraph, I reflect upon writing this thesis. I reflect on the thesis itself but also on the process while writing this thesis.

The process of writing this thesis turned out to be a difficult one. In first instance to really get grip on the matter. Since I knew practically nothing about the subject of this research and I had no definitive research goal, I was not sure how to start writing this thesis. So I decided to just start writing and see how and where it ends. I gathered as much information as I could and put in on paper, with still not really knowing what to do and where to go. Eventually, I found out that smart cities is a discussable phenomenon and there is not a single definition findable and suitable. That is how I got to the main research question. When I finally got to a good research question, things went more smoothly. I could fill in the frameworks, which were the results at the same time. I decided that interviews (which I wanted to do in the first place) were unnecessary and that profound desk research within the case studies should give enough input to answer the research question. Most resources for the results (chapter 4) are from 2017 and 2018, as shown in appendix III. This shows the actuality of these sources and in my opinion the usability of them.

Once again, I would like to thank Ary Samsura for, even though I did not always keep my promises, always wanting to help. Especially in the beginning of this research he helped me on the right track by outlining the thesis together and giving tips what theories I should look at.

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# Appendix I: Conceptual layout Amsterdam



