REPUBLIC OF TÜRKİYE

ALTINBAŞ UNIVERSITY

Institute of Graduate Studies

Electrical and Computer Engineering

SMART CITIES: A STRATEGIC APPROACH TO URBAN SUSTAINABILITY

Walaa Qasim Sadeq AL-BARAZANCHI

Master's Thesis

Supervisor

Asst. Prof. Mesut ÇEVİK

İstanbul, 2022

SMART CITIES: A STRATEGIC APPROACH TO URBAN SUSTAINABILITY

Walaa Qasim Sadeq AL-BARAZANCHI

Electrical and Computer Engineering

Master's Thesis

ALTINBAŞ UNIVERSITY

2022

The thesis titled SMART CITIES: A STRATEGIC APPROACH TO URBAN SUSTAINABILITY prepared by WALAA QASIM SADEQ AL-BARAZANCHI and submitted on 23/12/2022 has been **accepted unanimously** for the degree of Master of Science in Electrical and Computer Engineering.

____

Asst. Prof. Dr. Mesut ÇEVİK

the Supervisor

Thesis Defense Committee Members:

Asst. Prof. Dr. Mesut ÇEVİK	Department of Electrical and Electronics Engineering, Altınbaş University	____________________
Asst. Prof. Dr. Abdullahi Abdu IBRAHIM	Department of Computer Engineering, Altınbaş University	____________________
Asst. Prof. Dr. İzzet Paruğ DURU	Department of Medical Imaging, İstanbul Gedik University	____________________

I hereby declare that this thesis meets all format and submission requirements of a Master's thesis.

Submission date of the thesis to Institute of Graduate Studies: ___/___/___

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Walaa Qasim Sadeq AL-BARAZANCHI

Signature

DEDICATION

To My wonderful parents, who never stop in giving themselves in countless ways… (my late father and my late mother) To the sources of hope, who stand by me in everything and lead me through the valley of darkness with light of hope and support… (My brothers, sisters, and all my family members) To all the people in my life who touch my heart.

ABSTRACT

SMART CITIES: A STRATEGIC APPROACH TO URBAN SUSTAINABILITY

Al-Barazanchi, Walaa Qasim Sadeq

M,Sc,. Electrical and Computer Engineering, Altınbaş University,

Supervisor: Asst. Prof. Mesut ÇEVİK

Date: 12/2022

Pages: 80

Current trends in global urbanization and pressing issues around sustainability provide cities with considerable challenges. The concept of a "smart city" had been evolved like a method of dealing with cities in terms of the reality that they are becoming systematically more complicated due to interrelated structures and more reliance on the progress of communication and information technology to fulfil the demands of people. In this research, we examine the concept of "smart city" as a potential sort of city that might address the requirements and environmental sustainability issues of modern civilization. Smart cities are distinguished by advancements in their physical and human resources, as well as their traditional and modern telecommunications networks. These cities have a better lifestyle as well as a sustainable economic growth accomplished via democratic governance and the management of natural resources. Through in-depth interviews with smart city employees and sustainability specialists, the concept's benefits and drawbacks are uncovered and then organized according to (FSSD) the Framework for Strategic Sustainable Development. Then, a strategy referred to (SSD) as Strategic Sustainable Development, which is also a methodology, is used to maximize the value of the idea and reduce any recognized limits. This dissertation presents a planning guide guided by an SSD approach with the intention of supporting smart city projects in moving strategically toward their concept of a smart city while concurrently advancing society toward sustainability.

Keywords: Citizen Participation, ICT Strategic Planning Process, Smart City, Strategic Planning Process, Sustainability.

TABLE OF CONTENTS

Pages

LIST OF FIGURES

Pages

ABBREVIATIONS

GDP :Gross Domestic Product

SSD :Strategic Sustainable Development

FSSD :Framework for Strategic Sustainable Development

1. INTRODUCTION

1.1 THE OBSTACLE OF LONG-TERM SUSTAINABILITY

When the planet Earth is seen through the prism of the "systems approach," it is evident that contemporary civilization's actions are not only ecologically unsustainable but also socially unsustainable. Our progress since the Industrialization has had significant impacts on the environment, and we're still well into an era in which the Earth's transformation can be substantially traced to widespread detrimental human behaviour. Since the Industrialization, human advancement has had enormous environmental consequences (Steffen 2011). The Earth is blocked to the transmission of material yet open to the movement of energy, particularly solar energy (Victor 1991). Within our planet's borders are subsystems such as the Lithosphere and Biosphere. which are interconnected by channels through which matter and energy flow freely. The biosphere is the ecosystem that supports life on Earth. Through natural cycles, living organisms within the biosphere exchange matter and energy with their surroundings. These cycles would continue to proceed according to their natural rhythms if human activity did not interfere with them. However, in the current day, the rise of human civilization and its destructive activities have had detrimental effects on these sub-systems, and as a result, the systemic sustainability of our society is threatened. Examples include the systematic increase of pollutants and man-made chemical products in the natural surroundings (Law2007), the rise in carbon dioxide levels in the atmosphere due to the fossil fuel burning (Canadell 2007), and the wide - spread destruction of ecosystems (Kennish 2002). In addition, the organization of society operates within a frame that does not allows all individuals to satisfy their fundamental human needs. This makes it difficult to provide the fundamental requirements of all individuals. This is shown by the prevalence of social concerns such as inequality and the breakdown of trust within the framework of our society (Gustavsson and Jordahl 2008). If these patterns of behavior are allowed to continue, the Earth will no longer be able to provide the required resources and facilities to satisfy human needs.

Clearly, this pattern of behaviour cannot continue without adversely affecting the capacity of future generations to meet their demands (O'Brien, 1999). A funnel as a metaphor for the challenge of attaining sustainability is one approach to describe the issue. This metaphor illustrates the movement of civilization into a funnel, in which the walls of the funnel reflect the decaying socio-ecological system. This degradation is caused by non-sustainable societal activities, such as the depletion of natural resources, the destruction of habitats, and social disputes. We ignore the funnel walls, and as a consequence, we create situations incapable of sustaining human life as we fail to see the continuous reduction in the ability and resources required to maintain civilization (Robert 2000). The future is unknown if civilization maintains its current pattern of activity. This is represented in the picture with a question mark. To achieve ecological sustainability, humanity must learn to function in a way that does not upset the natural equilibrium that exist in the Earth's numerous systems. Environmental and social sustainability cannot be achieved till then.

1.2 THE STRUGGLE TO ACHIEVE SUSTAINABLE DEVELOPMENT IN CITIES

It is projected that by the year 2050, seventy percent of the planet's population would live in urban regions, which is an increase from the current figure of fifty percent (UN World Prospects 2011). In Europe, 80 percent of the overall population and all of the workforce is concentrated in metropolitan regions (Correia 2011). It is anticipated that by the year 2025, 650 of the world's major cities would account for sixty percent of the total (GDP) gross domestic product of the whole planet. This reflects the reality that cities are becoming the focus of economic growth (McKinsey 2011). The majority of greenhouse gases that contribute to climate change are caused by urban areas. According to (Lazaoiu 2012), ninety percent of the world's global carbon dioxide emissions are produced by cities. This exceptional rate of urbanization growth necessitates the development of more intelligent approaches for addressing its subsequent problems (Nam 2011). However, the majority of cities do not at this time have plans in place that are adequately innovative to enable them to adjust to the unavoidable expansion in population that will occur globally. As urban areas continue to expand, a growing number of them may soon have populations that exceed the carrying capacity of their existing infrastructure, which might lead to unfavorable effects. This could have a variety of implications (Antrop 2004).

Cities naturally encounter a diverse range of challenges, each of that can only be addressed effectively via the use of a methodical strategy. Simply bringing together such a big number of individuals has a tendency to result in chaos (Johnson 2008). Recent global waves of social discontent, according to (Murray 2011), are a strong indication that our institutional structures are not interoperable with a world that is more complicated and rapidly changing. Borja (2007) notes expensive consequences such as difficulty in waste and resource management, growing air pollution, and other concerns like as traffic congestion, as well as the fact that resource systems were planned in isolation from one another, which is a primary driver of the problem (Sustainable 2010). In addition, (Washburn 2010) identifies a number of other physical and technical issues, such as the deteriorating and antiquated infrastructures that exist within cities. In addition, the high rates of diverse stakeholders, the social and political sophistication and mutuality, the continuously shifting political leadership, and the inadequate financial resources relative to the needs of cities all contribute to the amplification of these issues (Sustainable Cities International 2010).

On the other hand, due to their one-of-a-kind qualities, cities provide the perfect environment for conducting experiments and creating new concepts that are connected to future sustainability. It is possible that cities may one day be sustainable because they are education systems that can organize themselves and enable communities to connect with one another and learn from one another (Innes 2000). Cities have the potential to act as platforms for sustainable development because they have characteristics that have the potential to serve as a model for sustainable development (UN 2012). The factors that place cities in this predicament include, for example, a high population density as well as a dependence on resources that are shared. According to Murray (2011), when cities expand, they have the opportunity to modify themselves to meet the social, ecological, economic, and cultural requirements of the people who live there

1.2.1 Urban Areas Towards a More Sustainable Future

Sustainable urban development has become an essential objective for the future expansion of cities. However, there are other approaches to examine the physical characteristics of a sustainable city. Sustainable Cities International, a research group, said in 2010 that a city should employ city development plans to promote innovation and growth in infrastructure and technology, as well as to increase the city's efficiency. If a city wants to become more sustainable in general, it must also use these measures.

(Bulkeley 2005) talk about how much municipalities and their local governments can really change things when it comes to sustainability. When trying to build a sustainable city, you have to deal with a number of problems, and the different types of government affect how you define and use sustainability. This, in turn, makes it hard to keep the traditional lines between local, national, and international politics. (Bulkeley 2005) makes the case for long-term solutions that are cantered on sustainability in order to help cities better prepare for and respond to conditions that change rapidly. These methods are necessary for ensuring that cities can adapt to new circumstances.

Cities can be thought of as engines that help move the world toward sustainable development. Managing these complex systems requires new and advanced planning ideas and techniques. Sustainable development can be thought of as a way to move cities forward (Rotmans 2000). According to Nam (2012), the frameworks and concepts in use today are interrelated and overlap. This can lead to a lot of confusion about the right words to use, which can make it harder to apply and use tools and ideas like these.

Jabareen (2006) defines and explains four different types of sustainable urban forms. These are ultra-progression, urban confinement, compact city, and eco-city. He also talks about how the design principles of each of these types of cities contribute to sustainability. In 2006, Jabareen's research came out. Schatz (2007) says that the digital city, the control system, and the smart city are three types of innovations that can be found in our increasingly urbanized world. Murray (2011) came up with three ways for cities to become more sustainable: eco-cities, which focus on environmental sustainability by using a lot of renewable resources; digital cities, also called cyber-cities, which are mostly driven by alternative investments from large information and communications technology companies that want to connect a lot of people; and knowledge cities, which put a lot of emphasis on education, lifelong learning, and other things that help people learn and grow. Murray and Abdoullaev also say that a new way of planning cities, which they call the "smart city," comes about when these three different types of cities are brought together in a holistic and organized way. Batagan (2011) says that this whole-systems approach could help solve the problems that come with trying to be sustainable in a city.

1.3 IMPORTANCE OF RESEARCH

According to current urbanization trends, the majority of humanity will live in cities in the future (UN World Urbanization Prospects 2009). Understanding what makes cities sustainable is crucial if we are to build a future in which people can flourish and coexist with environment. The advent of "smart cities" is a positive indicator, since the concept already prioritizes sustainability. However, the complexity of the sustainability problem will be more manageable if individuals have a solid understanding of what it takes to be sustainable in an urban context. Consequently, the objective of our study will be to examine the concept of "smart cities" through the lens of "sustainability" in order to see whether there are any areas that may be improved by adopting an SSD strategy. The SSD method is extremely effective in resolving complex issues that need novel solutions It does this by using a systems-thinking approach based on core sustainability understanding. By evaluating the smart city idea through the lens of the FSSD, we want to discover whether this increasingly popular concept may be utilized to improve the sustainability of cities. Then, any proposed concept upgrades will be handled using SSD-centric concepts. Image: TNS Canada)

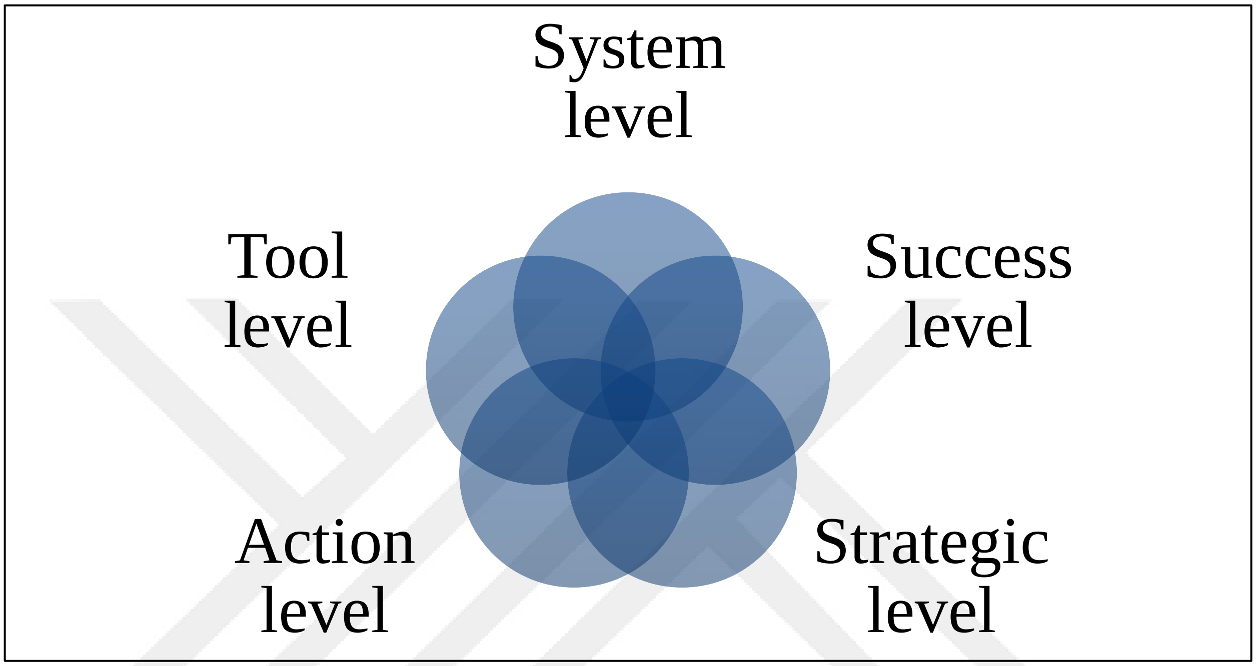

Figure 1.1: 2013 Sustainable development strategic framework.

1.3.1 Research Concerns

In this study, we attempt to respond to the following significant issue, which we shall refer to from this point on as the primary research topic: What kinds of recommendations may be made to assist smart cities in moving toward sustainability in a more expedient and efficient manner?

The purpose of our thesis is to provide a response to the primary research question by addressing the three subsidiary research questions that are listed below. What does the FSSD have to say about how the concept of a "smart city" may assist in making cities more environmentally friendly? What steps have been taken so far in the implementation of the smart city concept by those responsible for its implementation?

How exactly may those who have worked in FSSD contribute to the solution of the issues that practitioners of smart cities have brought up?

1.3.2 Purpose and Intended Audience

The smart cities of the European Union are the focus of our efforts. Our major focus will be on mid-sized and large European cities with at least one university and at least 50,000 inhabitants. Moreover, each city should have received EU funds for smart city projects. Our goal is to give smart city practitioners with suggestions for enhancing the sustainability of their smart city strategies. To do this, we will build a strategic planning approach that will enable smart city practitioners in implementing an SSD strategy in an urban setting. Consequently, people who will be interested in what we have to say are those who now work with the notion of smart cities but want to improve their planning for creating a smart and sustainable city.

1.4 RESEARCH PLAN

The panel agreed on the recognized model of theory development as a qualitative research method. In this method we used the theoretical method of FSSD as well as the Smart City Design

1.5 RESEARCH QUESTIONS

what are Suggestions for smart building managers to help them advance their towns more successfully into sustainability using an SSD strategy?

1.6 PURPOSE OF OUR STUDY

what are the effective solutions for assisting the sustainable development for smart, we predict that an SSD technique will make huge contributions to the smart city how to enhance the smart city model so that it may be achieve the sustainable concepts strategy? We believe that by analyzing the methodological framework of the smart city vision via an FSSD perspective, many aspects will fit with the framework, but variances will also appear, especially at the strategic phases of the system. We predict that our surveys with smart city developers will generate data which demonstrate the strengths and limits in practice. In response to these restrictions, FSSD specialists will offer suggestions and solutions about how to enhance the smart city model productivity so that it may be achieve the sustainable concepts.

1.7 PROCEDURES

After doing a literature analysis and exploratory surveys, we were able to produce our study questions. An FSSD gap analysis was carried out based on a theoretical knowledge of smart buildings to detect any inconsistencies between the idea and the framework's recommendations. We surveyed smart building experts about their experiences of working with smart cities to see if the observed differences were present in actuality. These data revealed distinct areas of difficulty, which influenced our discussions with FSSD professionals. Following each data gathering wave, the data was recorded and processed in order to find trends, as well as the material was pass in order to evaluate the smart urban idea and make our suggestions.

1.8 OVERCOMING OBSTACLES

For evaluating and manage premise, we combined data from several resources (triangulation) as well as continually recognized and sought to reduce obstacles.

2. GENERAL INFORMATION

2.1 THE RISE OF SMART CITIES

It is notoriously difficult to pin down and properly describe the notion of "smart cities." It is widely agreed upon that a city does not exhibit intelligent behavior when all of the following qualities are present: 1) There is an abundance of everything, including automobiles, water, and energy demand; 2) the various networks within a city are unable to communicate with one another and function as a whole-system; 3) the networks within a city are steady and inflexible; and 4) the stakeholders within a city are not engaged in all levels of decision-making. However, in order to arrive at an appropriate depiction of the scope of this thesis, it is necessary to carry out a more in-depth investigation of definitions that are relevant to the situation. Although the features that characterize a smart city are frequently based on This is because the meaning of words may change depending on the context in which they are used.

2.1.1 Definitions of a Smart City

Technology, people, and organizations are the three primary foundations where a smart city is formed, and each of these three components may be broken down further into its own different categories. According to (Dawes, 2002), a city is deemed "smart city" when investments in certain elements of urban development result in both sustained economic growth and an increase in performance of life for its citizens. In other words, a smart city is able to meet both of these criteria. According to (Toppeta 2010), a smart city is one that makes an effort to combine (ICT) Information and Communication Technologies as well as Networking sites technology with other strategies of urban planning in coming up with solutions that are innovative, intelligent, and efficient. This definition was derived from the book "Smart Cities: How Information and Communication Technologies Are Transforming Our World." This makes it possible for more people to continue living in the city in the future, which is good for the city's long-term viability. Therefore, it is vital to note that the notion of "smart cities" is not restricted to just referring to developments in technology; rather, it seeks to encourage socioeconomic growth. This is something that has to be taken into consideration. This is why it is so important to comprehend this concept. Because of this, it is necessary to acknowledge this truth (Nam 2011). According to Allwinke (2011), social inclusion is one of the most crucial components of smart cities. Furthermore, it is vital that investments in social capital be made in parallel with any potential for economic development.

To put it simply, "smart cities" are communities that exhibit creative ways of thinking in areas such as population, housing, economy, governance, environment, and transportation (Giffinger 2007). Because of this, we have come to the conclusion that the definition of "smart city" that was suggested by Caragliu, Del Bo will serve our needs for the purpose of this thesis (2011, 6). According this definition, a city is intelligent when investments in human and physical capital, as well as traditional (transportation) and modern (ICT) communications networks, drive sustainable economic growth and a good standard of living, with reasonable natural resource management through participatory government.

2.1.2 Traits of Cities that Are Considered Smart

Giffinger and his colleagues came up with the idea for the Smart City Model, and Caragliu (2011) built their notion of smart cities on top of this model (2007). This idea is a classification strategy that may be used in the process of assessing and developing smart cities via the prism of six distinct characteristics. The Smart City Model is a grading tool designed to assess medium-sized European digital infrastructure in the areas of economics, people, government, mobility, ecosystem, and lifestyle.

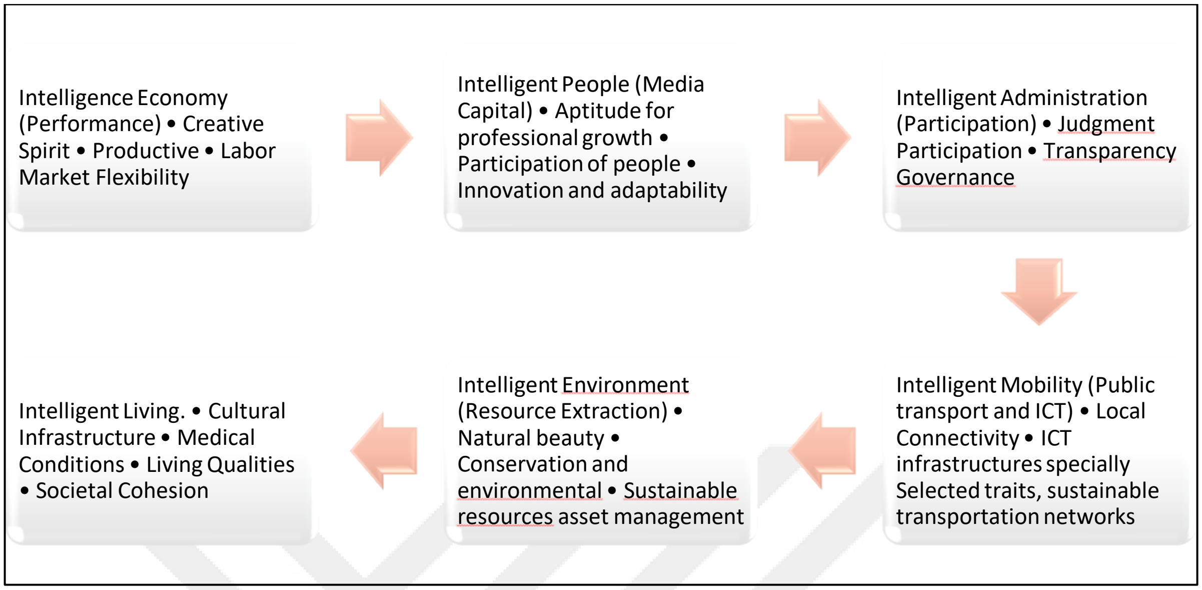

Figure 2.1: Six model smart cities (Giffinger 2007)

To achieve this objective, the Smart City System was developed and implemented. A city might take this route by first doing an analysis of its existing status and then determining the places within the city that require additional growth in order to achieve the criteria for a smart city. Because of this, the city is now able to take the first step toward becoming one (Giffinger 2007). Cities have the ability to individually design goals that are based on their own specific conditions by using this process, and those objectives may be crafted by adhering to the vision that is provided by the six attributes (Giffinger 2007; Steinert 2011).

Intelligent Governance talks about participation at the municipal level in a more specific way. The system of government is open and lets people take part in making decisions. ICT infrastructure makes it easy for customers to get data and information about how their city is run. By making the system of governance more efficient and connected, collaboration and communication problems can be solved. Intelligent Mobility promotes more efficient transportation systems (like non-motorized options) and new ways of thinking about how people use cars. It also makes sure that people have access to local and public transportation and that

ICT is used to make things even more efficient. Intelligent cities try to make it easier for people, goods, and vehicles to move around in urban areas.

Intelligent Environment stresses how important it is to manage resources well and plan cities in a way that is good for the environment. The natural beauty of the city can be improved by taking steps to reduce pollution and emissions and protect the environment. Smart cities try to get people to use less energy and use new technologies that make things run more smoothly. Smart Living tries to make people's lives better by giving them safe, healthy places to live. People residing in smart cities have convenient access to health care services, computerized health management, and a variety of social services.

2.1.3 Ways Smart Cities Can Have an Effect

According to Nam (2012), strategic strategies must be implemented in three ways for a city to flourish in accordance with the Smart City Model's six features. You can divide these into three groups: technological, human, and institutional. At this point, how actions are prioritized depends a lot on how much money is available, Therefore, academics interested in smart cities often recommend that organizations "become lean" in term of the amount of money they spend.

There is also something called the instrumental-economic approach, which refers to the technical routes (Huber 2012). They illustrate why a city requires high-quality infrastructures that are properly linked and operate efficiently. ICT networks enable cities to gather, process, and analyze data, which opens up new possibilities. The objective is to get an understanding of what will take place in the near future so that appropriate choices and actions may be taken by local leaders. According to O'Grady (2012), a smart city is one in which people move about more often, which makes virtual and omnipresent technology crucial. In order to make a smart city more technologically sophisticated, it is necessary to include new technology into its design. This technique incorporates advanced technology, methods, transport facilities, systems, and capabilities into such a sustainably growing network in such a way that it is sophisticated enough for unanticipated changing features to arise (Nam 2012). However, the mere presence of technology will not automatically result in a smart city (Hollands, 2008). In addition to this, there are things which need to be done on a human and an institutional level.

The human channels investigate the ways in which urban areas make use of human infrastructure, social connections, and educational opportunities. People in smart cities are able to be innovative, well-educated, communicative, and eager to learn from others. Smart cities are cities that use technology to improve residents' lives. This may be accomplished by dismantling knowledge silos and encouraging unrestricted information sharing among users of an open platform (Copenhagen 2012). In terms of human routes, a city's success depends on its people and how they interact with each other. People are seen as "innovative agents of change" who shape the way cities change (Huber 2012). So, it's important to put in place a strategic plan that makes it easier for everyone to get services by removing barriers like language, culture, education, developing skills, and disability (Coe Paquet 2001).

Institutional routes look at how government and non-government organizations work together. In a smart city, the main goal of the government is to create an integrated and transparent system of governance, work on marketing and strategy, and reach out to different city stakeholders to form partnerships. From this point of view, smart cities need a way to make decisions and make plans that involves a lot of people. This strategy area is about how governments, organizations, and people can work together and help each other. Also, it is important for government systems to tell the public and the right stakeholders about their smart city vision, goals (Dirks 2010), priorities, and strategic plans.

2.1.4 Smart Cities: Methods and Instruments

If smart cities want to be successful, they must do things that are in line with their own strategic goals (Nam 2012). Depending on the six parts of the Smart City Model, these activities may be done together. Most of the time, they are direct responses to strategic plans along the three ways of having an effect that were talked about in the last section. It's important to remember that ICT is used for most things in smart cities. Smart with money: All of these steps are meant to make the smart city's economy stronger and more competitive on national and international markets.

A smart city may improve its economy by creating and maintaining social network groups for entrepreneurs and by working with other stakeholders (such as universities, corporations, and non-governmental organizations) to set up "think tanks" that encourage innovation. Also, more people have access to broadband Internet, which makes it easier for people and businesses to do business online (like e-shopping and e-banking). In this way, smart cities try to attract people who are well-educated, aware of social issues, and open to different cultures. Cities can reach this goal by using computer-assisted quality learning systems, customized education-focused assistance, workshops and programs about better practices (such as sustainable practices and cultural awareness), and programs that support distance education and online courses (Steinert 2011). Government that works: Because there are so many things that can be done with this feature, the government of a smart city may become more open and inclusive. Most of these efforts are based on e-services, such as e-government, which make it easier for the city's government to work with its residents, businesses, and institutions (Steinert 2011). Establishing discussion groups for public engagement, platforms for knowledge transfer, simplification of administrative procedures, social media networking, and crowd sourcing are common components of smart governance. These elements are intended to include stakeholders in making decisions (Toppeta 2010).

Smart Mobility: Smart Mobility actions are meant to make it possible for a smart city to provide efficient transportation that has a small impact on the environment. Meeus (2011) say that cities and towns often use urban planning to help their residents move around better. This leads to a shift from individual to group transportation, stimulates the use of non-motorized road transport (like bicycles), and includes electric vehicles.

Smart Environment: Since this trait is about building cities in a way that is sustainable and taking care of natural resources in a responsible way, there are possibilities in the management of city energy and the city's building stock. In the process of managing building stock, it is common practice to retrofit older structures with cutting-edge energy technology such as the netzero principle or photovoltaics technologies in order to cut down on carbon dioxide emission. Concerning how cities manage their energy, there are ways to improve infrastructure management, such as building smart networks, switching energy carriers, and making power from renewable sources. There are other good ways to deal with trash and water (Meeus 2011).

The major objective of developing "smart cities" is to make the lives of the residents of such communities better. To accomplish this, they may initiate projects such as home automation (for example, smart home or smart construction services), create services that make it simpler for people to receive medical care (for example, e-health or documentation strategic planning), and use new technologies to access people with social services (Van Landegem, 2012). Also, there are approaches to increase public safety that make use of information and communications technology (ICT), such as monitoring systems and inter-emergency service networks, which might shorten the amount of time it takes for assistance to arrive (Toppeta 2010).

The concept of a "smart city" is being actively pursued by the European Union in conjunction with a number of different businesses, including Siemens, IBM, and Cisco. They offer initiatives that provide funding for action plans, which might be of assistance in getting smart city projects off the ground (European Commission). Internet networks, such as the European Union's Smart Cities and Communities platform, make it simpler for cities to collaborate with one another. On this platform, cities may collaborate to make other cities smarter by expressing their information, best - practice, and benchmarking data with one another (Smart Cities and Communities). The platform for European Smart Communities is equipped with tools that are useful throughout all phases of the construction of a smart city (Toppetta 2010). There are tools available to assist individuals in comprehending the concept, tools available for building infrastructure, networks, and tools available to monitor and evaluate progress. Here are a few examples of goods that fall within this category. Planners can understand the idea with the help of the following models and tools:

a. Citizen Point of View (what people want and how likely they are to use public services).

b. Lists of standards (EDS Toolkit 2011) for understanding how EU local authorities work.

Intelligent cities have their own websites and conferences.

Here are some tools and programs that can be used to build infrastructure and networks: Smart Citations by IBM - Smarter buildings and communities (Siemens 2013)

The Digital City Self-Assessment Tool is one tool that can be used to evaluate and compare things (analytical software with an integrated report generator) (Smart Cities in 2012)

c. The Wheel of Smart Cities (a tool for analyzing and judging smart cities based on their six key features)

Other technologies that are often linked to the idea of a "smart city" include:

a. Electronic governance

b. Smart Buildings - Advanced Sensor systems

c. App technologies

2.1.5 European Union Municipalities that are Intelligent

The European Union is home to a variety of programs that provide monetary assistance to urban communities in order to encourage the growth of smart city infrastructure. The Smart Cities Program and the Smart Cities and Communities European Innovation Partnership are tied for first place when it comes to the total amount of funding raised, the total number of participants, and the total area of coverage (European Union Commission 2012). These projects are supported and funded by the European Commission, which is one of the EU's principal institutions involved in the administration and distribution of funds. In 2013, the European Innovation Partnership for Smart Cities and Communities, which was established in July 2012, allocated 365 million euros to smart city initiatives. This organization of specialists from cities, the energy business, the automotive industry, as well as the data of technology sector is collaborating to offer cities with cutting-edge, eco-friendly, and well-integrated solutions. This initiative aims to enhance municipal services while reducing overall pollution, greenhouse gas emissions, energy waste, and poor resource management. The Smart Cities Program is a forward-thinking collaboration including thirteen participants from six distinct Northwest Passage European Union member states. The European Union's North Sea Region Program runs from 2007 to 2013**,** as well as the municipal and academic members, are the primary sponsors of this initiative. The purpose of the project is to bring members together in order to set up an innovation network in order to facilitate the development of eservices that are more environmentally friendly for people living in North Sea towns and businesses.

2.1.6 Smart Cities Have Been Criticized in General

According to Murray (2011), in order for a smart city to reach its full potential, it has to have a culture of innovation, learning, and cooperation that is deeply ingrained inside each of its sectors as well as across the city as a whole. People need to come from a variety of different backgrounds in order for them to be able to interact and share their expertise. Due to the fact that government regulations and organizational structures are often out of date and need to be changed, it may be challenging to attract and keep this set of people. According to Clancy (2013), many of the smart city pilot efforts have neglected to take into account the need of citizen engagement and the role that the public plays in the process of urban development. If these programs were carried out on a larger scale, there is a good chance that there would be a great deal of negative fallout. In addition, Abdoullaev and Murray (2011) state that the lack of financial resources is a significant challenge for smart cities, despite the fact that research suggests that investing in the development of human capital contributes to the promotion of economic growth.

The author Hollands (2008) disagrees with the use of the term "smart city" and refers to it as a trend of "naming cities." He argues that the phrase is vague, that it praises itself, that it leads to self-identification, and that it involves unspoken assumptions. He also contends that the term leads to self-identification. According to Abdoullaev and Murray (2011), owing to the demand for increased automation and connectivity, a smart city is more likely to have widespread failures. This is because a single mistake has the potential to propagate and put the whole system to a halt. Because of the difficulties of safeguarding such a large number of electronic devices and systems, it is believed that future cyberattacks will pose a substantial threat to smart cities. The authors also talk about the social and political risks that come with living in a smart city. The presence of more man-made structures in a city may give its residents the impression that they are less human, and the high level of control may contribute to the collapse of social order. Also, individuals may be left behind by a business-led approach to build smart cities if they are unable to keep up with technological advancements (Hollands 2008 examines this subject further). He contends that mistrust in (ICT) and the preservation of people's privacy should be given more concern because of the significance of ICT to smart cities.

The fact that not everyone will be able to benefit from the digital transformation that is taking place in cities is another criticism leveled against smart cities. It is possible that the digital divide will make inequality worse rather than better because it will widen the gap between skilled workers who are interested in moving to the city and those who already live there but are illiterate in information technology, have lower incomes, and have less education. The use of fossil fuels and chemicals to improve transportation and information and communications technology (ICT) as well as the production of a large amount of garbage due to the constant need to upgrade technology are two examples of smart city initiatives that could be harmful to the environment. Within the framework of smart cities, the research topics addressed include whether or not economic growth and environmental sustainability can coexist, and if they cannot, whether or not they can compete, and to what degree they can compete.

The rise of smart cities may be considered as a beneficial development in light of what we know about how to make the world more sustainable. It is necessity for responsible resource management, energy efficiency, and public involvement are some of the major sustainability problems that are brought up while discussing smart cities. Using the analogy of a funnel one more time, we can say that smart cities have the ability to operate well within a system that has dwindling resources but ever-increasing demands. To achieve socio-ecological sustainability, in which a city works within the natural limitations of the Earth and satisfies the needs of a long-lasting social system, the concept of the smart city must deliberately handle both its problems and its opportunities. From what we have learned so far about so-called "smart cities," it is difficult to say for certain whether or not they possess the qualities that are essential to achieve sustainable growth. If there is no overarching strategic goal, achieving sustainability in a Smart City Model community may not be possible, even if all six of the model's criteria are accomplished. Adaptations to sustainable living, for instance, might result in a dearth of resources in the event that materials are not acquired in a responsible manner. In addition, as individuals become increasingly dependent on technology, those who are unable to adapt run the risk of being left behind, which makes it more difficult for them to meet their wants in a metropolitan area. Because they are made up of enormous buildings that are linked to one another, smart cities are becoming more sophisticated systems.

In order to study this, you are going to need a method that supports analysis inside ten different complex systems. The strategy known as Strategic Sustainable Development (SSD) might be used in the construction and planning of a smart city. The feasibility of an idea may be determined using this technique by analyzing it from the perspective of several systems.

2.2 PLANNING FOR A SUSTAINABLE FUTURE

As was shown before, the funnel metaphor demonstrates that the way humans behave on Earth is becoming an increasingly unsustainable trend. For the concept of a "smart city" to become a reality, one must have a comprehensive grasp of the complexity of a city and the interplay that exists between the city's social components, its services, and its physical setting (Nam 2011). For a city to become sustainable, it has to adopt strategic steps and employ methods that deal with the complexity of a system as a whole. Only then can a city hope to achieve this goal (Robert, 2000). By employing a method known as Strategic Sustainable Development (SDD) (Robèrt 2002), actors in a system are able to coordinate their efforts to move society from its current, unsustainable state to one that is both socially and environmentally sustainable. This is possible through the use of a technique. Examples of strategic applications of sustainable development include a method known as "systems thinking," a concept of sustainable development that is based on scientifically accepted principles, and "back casting," which refers to the process of working backwards from the principles to arrive at the solution. Through the use of a process termed as the Framework for (FSSD). As a result of the fact that this framework makes it possible for the many different stakeholders to share a mental model, it becomes much easier for them to grasp the complexities of the issues that the notion of a smart city presents.

2.2.1 A Way of Thinking About Systems

A systems-thinking approach is needed to understand the conditions and factors that affect sustainability, especially in cities (Davidson 2011). (Robert 2002) From this point of view, you need to be aware of the systems and subsystems of any subject, as well as the feedbacks and behaviors that come from how the systems interact with each other. To look at cities through the lens of sustainability, you need to know how the systems that make up the city work According to the Copenhagen Cleantech Cluster (2012), "the fundamental concept for the growth of smart cities is to see the city as an advanced system, which includes data, energy infrastructure, waste disposal, infrastructure, mobility, and so on.

The component systems may or may not be very clever or intelligent, and the integration of those systems may or may not be particularly intelligent. So, looking at a smart city through the lens of systems thinking helps us understand how things are connected and how they affect each other. It also makes it possible to create inclusive and effective sustainability initiatives. Also, a systems thinking approach lets smart cities be looked at in the context of the systems around them, such as the larger social and ecological systems that work outside the city.

2.2.2 The Principles for Sustainability

Holmberg's (2000) principled definition of sustainability outlines the fundamental requirements that must be satisfied before a society can function in a manner that is considered sustainable. A rigorous scientific procedure that included peer review was used for the goal of defining what constitutes sustainability. This resulted in the formulation of four fundamental principles of sustainable design.

The following items make up what are known as the "4 principles of sustainability":

Figure 2.2: The four sustainability principles

2.2.3 Back to Principles

Backcasting from principles (Holmberg and Robert, 2000) is a technique that may be used to formulate plans and undertake acts with both short- and long-term aims in mind. into consideration. Backcasting has a different perspective than forecasting, which utilizes existing trends and paradigms to anticipate future events. This strategy is particularly useful for resolving complicated issues, such as sustainability, in which significant adjustments are required and existing systems cannot manage them all (Dreborg 1996).

Backcasting starts with a vision of the future as it should be. An SSD approach dictates that the vision must be founded on the four Sustainability Principles for its long-term implementation. As long as the vision adheres to these four criteria, more steps toward sustainability may be achieved.

2.2.4 The Sustainable Development Strategy Framework

We need a strategy that makes it easier for folks to communicate with one another by using a standardized mental model so that we can handle the problem of sustainable practices without making it more straightforward. The 5 Level Model for Management in Complicated Systems, sometimes known as the 5LF, is one approach that may be used to tackle difficult problems. It is composed of five levels that can be applied to the examination of issues and the formulation of decisions (see Figure 1.4). (Waldron et al., 2008). When this paradigm is applied to sustainability, it provides practitioners with the framework that is necessary to grasp the issues that sustainability presents in a certain setting. The five stages of the Framework for Strategic Sustainable Development (FSSD) are analyzed and discussed from the point of view of sustainability by Robert et al. (2002). At the Systems level, the many causes and effects of systems and subsystems are shown to the observer.

At this level, the issue of sustainability is examined, in addition to the manner in which the numerous systems are interrelated and the role that each system plays within the larger biosphere. Such in study of the scientific laws that control the natural world, in particular the Principles of Thermodynamics, is also required at this level. At the Success level, the four Aspects Of the environments are applied to the system that has been provided in order to determine the most important goal of sustainability. It is possible to utilize these principles for planning because they are based on a worldview that is acknowledged by science; they are necessary; they are sufficient; they are comprehensive; and they are specific enough to make a difference. In addition, for the sake of clarity, it should be noted that these Sustainability Principles cannot all be applied at the same time (Holmberg and Robert, 2000). Backcasting from fundamental beliefs serves as a strategic compass for decision-making at the strategic level. In addition, practitioners are provided with prioritization questions in order to assist them in deciding which measures to pursue. Individuals are encouraged by the FSSD to "look upstream," which means they should make an effort to treat an issue's primary cause rather than only managing the problem's consequences or symptoms. This is in contrast to the traditional approach of addressing only the effects of the problem. Then, the activities that were developed may be ranked by solving at least three strategic prioritization questions, such as the following: ii. Does this action offer an adaptive base for future investments in the same direction? iii. Is it conceivable that this change will result in a favorable return on investment (and not only in terms of money)? (Robèrt 2000).

At the Actions stage, initiatives and actions that comply with the priority criteria defined at the Strategic level are created and put into action. This level is below the Strategic level. (Robert 2002) The Instruments level provides a description of the tools that support and assess actions, which makes it easier to carry out the overall plans and goals.

3. MATERIALS AND METHODS

In this part, we outline our study's research strategy as well as the broad procedures we utilized to gather and analyze data.

3.1 METHODOLOGICAL APPROACH: MAXWELL QUANTITATIVE MODEL

We selected a directionality integrated model for our study design since it would help us not only understand the true structure of our study, but also organize and carry it out. (Maxwell 2005). This method enables us to determine how each stage could work as a whole. Our study was built on the five factors depicted in Figure 3.1. we will discuss the Fundamental purpose of our research.

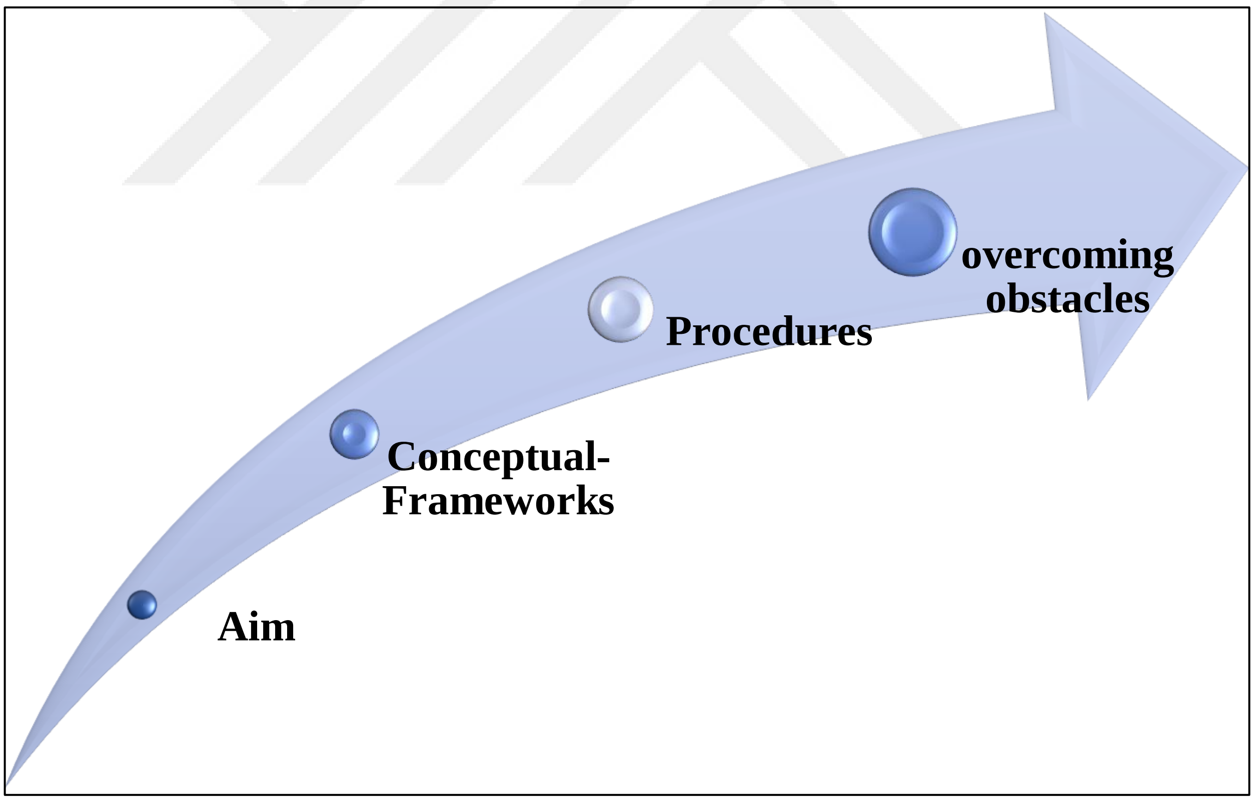

Figure 3.1 : The fundamental five factors of our research.

3.2 INTELLECTUAL FRAMEWORKS: FSSD, GROUNDED THEORY, AS WELL AS THE SMART BUILDING DESIGN

Theoretical framework is used as qualitative research throughout this investigation. We also used frameworks to help and enlighten our study in the Concept of Sustainability (Robèrt et al. 2002) as well as the Smart Building Model (Giffinger et al. 2007). Grounded theory (GT) technique, often known as appropriate methods, is a qualitative research strategy. In contrast to a hypothetico-deductive strategy, that starts with such a hypothesis that is proven by thorough investigation (Haig 1995).

Hypotheses are created by some approach which analyses and focuses on the facts obtained, allowing for the research of the phenomena they depict (Corbin and Strauss 2008). Following the generation of conceptual concepts through coding and careful examination, more theories are established (Glaser and Strauss 1967). Simply described, "grounded theory is theory discovery from evidence" (Glaser and Strauss 1967, 1).

The Framework for Strategic Sustainable Development (FSSD) (Robèrt et al. 2002) is indeed a powerful asset which enables users to create a well-organized summary of complicated challenges through the application of systems thinking. The FSSD's five levels (Services, Achievement, Strategic, Measures, and Tools) give a framework for organizing information and assumptions. When using the FSSD as a conceptual framework, the global vision of environmental protection and sustainability is taken into consideration when deciding how to best use other current tools and 16 ideas. The FSSD frames other concepts and techniques by asking how they may help society advance toward sustainability. The Smart Urban Concept (Giffinger et al. 2007) outlines six basic features that illustrate how a smart city should evolve. Each attribute is based on a set of performance goals. This model offers a unique perspective through which to assess both relative strong and weak points of smart cities. The concept was

developed mainly for standard size cities, although it is now employed in a lot of circumstances.

3.3 STUDY PROCESSES

We separated our investigation into three distinct sections (see Figure 3.2).

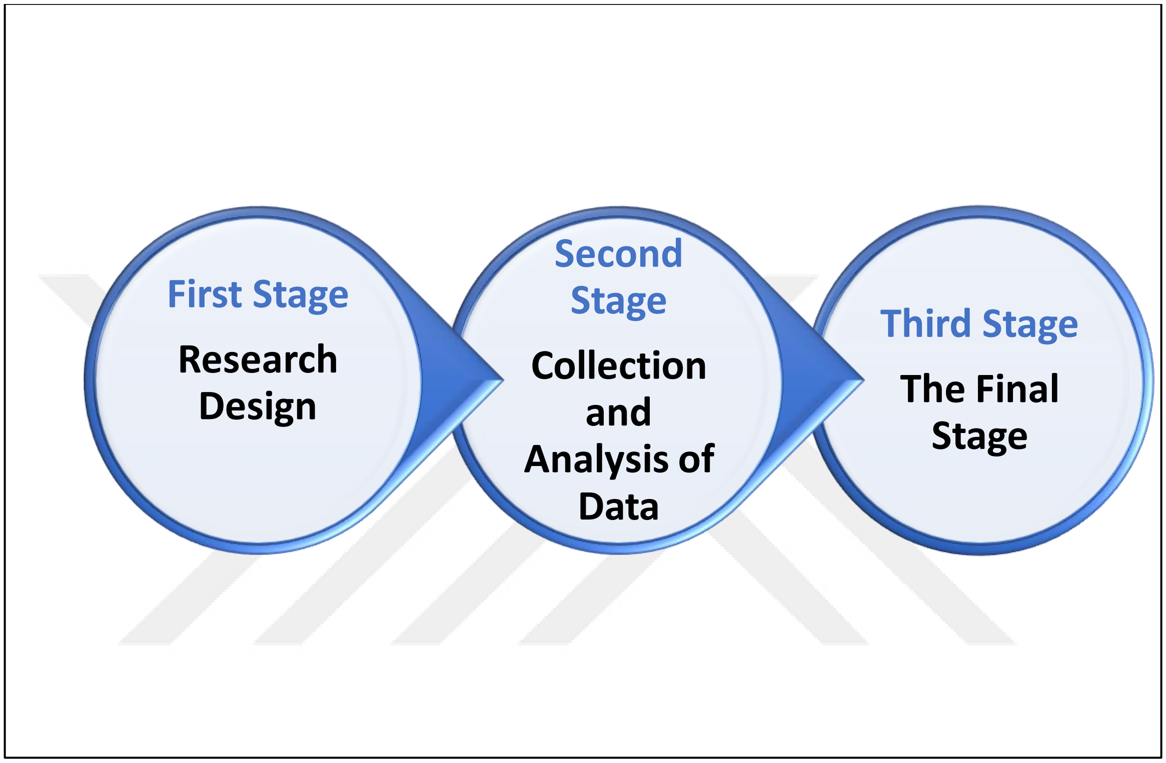

Figure 3.2: Separated our investigation into three distinct sections.

3.3.1 First Stage: Research Design

We started our study through analyzing the professional publications, previous studies, documentation, websites, books, and educational programs on the smart cities' topic. We discussed articles within the workgroup and also had discussions on the results to achieve a common perspective of the research. We identified our study questions through a literature survey. However, we improved these queries by performing experimental discussions with smart city researchers and practitioners. This has been done to better grasp the idea and to see if there were any issues in the field. We had a discussion with famous academic specialists in the subject of smart and development of cities, as well as professionals who deal with intelligent architecture.

We formulated our significant research topic, which was oriented on producing suggestions for the smart city model using an SSD method, derived from the information gained from the preliminary surveys. Some inquiries discuss what an FSSD research demonstrates the smart city concept? what are smart city experts' experiences with applying this concept? and what suggestions FSSD specialists may give in overcoming such stated issues. Using a grounded theory method, we were able to establish a data collecting strategy which supplied us with the data needed to achieve the study objectives.

3.3.2 Second Stage: Data Collection and Data Analysis

To understand the sustainability principles of smart buildings, our study initially examined the proposal via the FSSD perspective. An FSSD analysis was done to determine whether this approach could hint on the smart city idea in terms of putting cities toward sustainable development. This has been accomplished by integrating the fundamental features of the smart city (Waldron et al. 2008) and contrasting them with an assumed FSSD guided smart city, with discrepancies noted. The topics regarded as having variances between the existing smart city model and the FSSD influenced us in designing our survey for smart city specialists. starting the survey section of this stage by performing a brief examination in order to determine which components of an interview must be included in order to collect truthful and concise data. Focusing on EU-funded smart city development programs, we discovered and engaged smart city specialists across the European region.

All stages of the FSSD evaluation as well as the Smart City Design influenced by the interview questions. The FSSD, for example, recommends at least of 3 priority issues at the Strategic Level which used to determine the acceptable actions. According to the FSSD assessment, the smart building idea doesn't really give precise criteria for action prioritization, as a result, in our surveys with smart building experts, we asked some questions including "How do you emphasize smart city actions?" We interviewed 27 smart city specialists in EU cities using the deliberate sample method described by Maxwell (2005). Seven of the smart city experts contacted responded and taken part in our survey. some of the assessments were performed by video conference.

The contributions from smart city specialists were initially classified all along levels of FSSD model, then after following themes related to encountered obstacles were found. These difficulties served as the framework for the FSSD specialists' survey questionnaire. We went out to find FSSD specialists with expertise in metropolitan settings. Specialists' perspectives in smart cities were extracted using semi-structured survey questionnaire. We also asked whether they planned to overcome the problems of the urban city model that had already been addressed by smart city experts. In all, 14 FSSD specialists were approached with 8 offering to engage. Video-conferencing has been used to interview all FSSD specialists. The data gathered from the FSSD experts’ interviews was classified in accordance with common problem themes found during the smart city professional surveys.

All interviews were transcribed and recorded by the interviewers. They also were distributed throughout the workgroup to guarantee uniformity and to prevent data from becoming missed. Each participant of the research group analyzed the transcribed interviews independently, accompanied by a teamwork review and discussion to determine main conclusions and assure unanimity across the coding schema. The data collected from the interviews was classified according to the resulting by the 5 levels of the FSSD, which had already guided the interview questions. The answers were then coded again in order to find themes, structures, similarities, and differences. The coded themes were collected to show how commonly answers have been given. Answers that were very thoughtful or creative have also been emphasized. We additionally performed a regular document content assessment based on all studies or papers supplied with both smart city and FSSD specialists during this period.

3.3.3 Phase III: The Final Stage

The main themes that developed from our interviews (smart city professionals and FSSD specialists) were summarized into a report which highlighted the significant results. The questionnaires distributed supplied by smart city experts demonstrated the strong and weak points of the smart city model. The study results from FSSD specialists presented data on how well the smart city model can be further improved and how it might help to sustainable urban development when supported by an SSD strategy. In conclusion, we started to organize our information and results by developing a designed system that may assist smart city developers in optimizing the sustainability of the smart building model. We provide a planning procedure that advises how professionals might utilize the smart city model in such a strategic way by using an SSD technique.

3.4 OVERCOMING OBSTACLES

Several challenges occur in qualitative research, including such selection bias and situational reaction (Maxwell 2008). "Error created by an investigator whose assumptions about conducted experiment can be quietly transmitted to the participants in the experiment" is what researcher bias is (Merriam-Webster 2013). The circumstances related to gathered data that might possibly impact the effectiveness of results are described as the environmental [19] reactivity (Maxwell 2008). We minimized such risks in our research by applying methods to determine particular obstacles. " Triangulation", that means to "obtaining data from a wide range of participants and environments," was one of the strategic priorities used (Maxwell 2008, 245). Because triangulation "provides a more comprehensive and realistic view of the problem" (Altrichter et al. 2008, 147).

To look for themes in the data collected, we used to cross-reference the results of the FSSD evaluation, and our surveys. Furthermore, by recording the data and sharing it with participants, we verified that all of the information and data could be seen as a comprehensive overview, enhancing the reliability of our final conclusions. we asked participants for explanations on a regular basis to verify that the information we were obtaining was not being misconstrued or confused by the participants (Maxwell 2008). we worked to reduce that risk by asking some effective questions in a communicative way. Furthermore, we began each interview by clearly describing the goal of the study and providing all interviewees the option to stay private. Furthermore, all respondents were offered the option of not answering particular questions or canceling their cooperation during any moment without giving reasons.

4. RESULTS

This chapter answers the proposed research questions. The observations of the FSSD evaluation process of the smart building model, survey answers from smart city experts, plus interviews conducted by FSSD sustainable development specialists are included in the findings.

4.1 FSSD GAP ANALYSIS

The smart city model is investigated through five levels of the FSSD as just a design and analysis method to evaluate the goal, advantages, flaws, problems, and deficiencies throughout sustainability. the result of this section (included in Appendix B) intends to give details which can solve Research Objective: What could the FSSD suggest more about smart building idea in driving a city into achieving sustainable development?

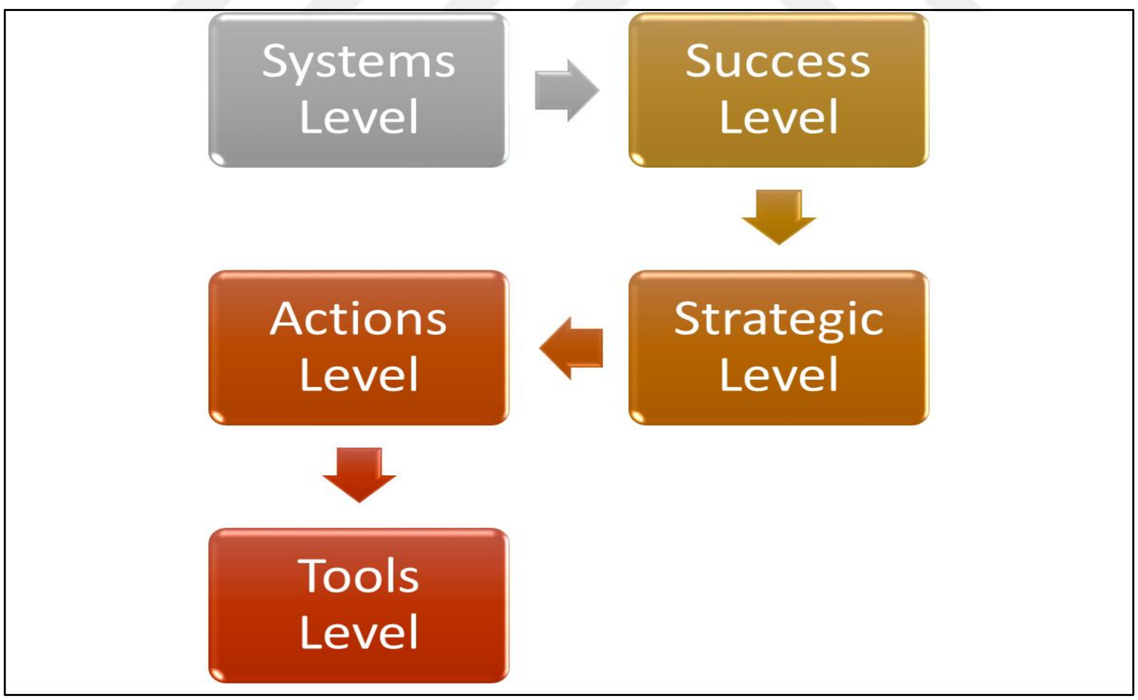

Figure 4.1: FSSD structure

4.1.1 Systems Level

We're trying to figure out how a concept fits into the larger scheme of things, including the assumptions that support it. The concept of a "smart city" considers the city as a collection of interconnected systems (Chourabi. 2012). As an "organic whole," these subsystems may function in a coordinated and intelligent manner inside the system (Mitchell 2006). In order to fully understand the "complex multi-dimensional system structure of a system of systems," the smart building model is constrained to a particular metropolitan area (Toppeta 2010). An idea from the perspective of FSSD demands an understanding of the social and economic context in which it operates.

When it comes to environmental and social sustainability, smart cities recognize the importance of both" Toppeta 2010 and Hollands 2008" but, the model fails to address or elaborate on their place in wider social and ecological systems. No proper scientific framework or hypotheses are required for the smart city concept, and this would help specialists working together in smart cities to know the risks of such an unsustainable 'business as normal' method (such as a knowledge of the system evolution, target value, temperature-dependent rules, macro- and micro-cycles, and basic necessities for humans). "Sustainable future" is seen as a strategy of constructing a smart city as a means of establishing a sustainable future, according to the model (said Sren Smidt-Jensen of the Copenhagen Cleantech Cluster).

4.1.2 Success Level

When designing a process, "the final goal must be achieved" (Robert 2010). Sustainable economic growth and high quality of life may be achieved by expenditures in human and physical capital, as well as traditional (transportation) and modern (ICT) communications networks, according to the notion of participation (Caragliu and Nijkamp 2011). According to the Smart City Model, "outperforming in six components of the Smart City Model" describes how well a city performs as smart. Among the six qualities, it does not explicitly quantify performance in order to achieve sustainable development. (Giffinger 2007)

When the six attributes of such Smart City Concept are compared towards the FSSD success criteria, several variations emerge. Generally, the smart building idea aims to broaden ICT structures throughout order to successfully suit inhabitants' demands (Topetta 2010). However, without a knowledge of product ’s life, material toxicology, and energy consumption and control of these systems, activities and efforts might weaken a city's ability to operate in a sustainable approach with in long term.

The smart economy emphasizes the importance of competitiveness via new organizations, flexible and qualified labor markets. However, sustainable growth of the sector can take place only if the economy is built on industries and enterprises that aim for competitiveness via environmental sustainability. A smart city can achieve success in the realm of clever people by offering higher educational attainment and building a framework in which inhabitants become tolerant and understanding and open-minded. According to the FSSD, satisfying these success criteria will improve citizens' quality of life, leading to an improved society inside the city. Because it is built on a representative democracy which fosters public engagement, the term called smart governance is highly associated also with FSSD criteria for success. Additionally, it creates an open governmental system which allows individuals to quickly access the information. In concept of smart mobility, smart buildings promote for effective transport systems, with a focus on non-motorized and paleontological solutions.

This sector is very much in line with FSSD philosophy, because smart mobility necessitates low-impact transportation network. Smart mobility fulfills individuals' demands for access to local and safe transportation, which matches their needs. The smart environment is ideally matched with FSSD effectiveness because it emphasizes responsible resource utilization, emissions reduction and greenhouse gases reduction, and greater ecosystem preservation. Smart living aims to improve inhabitants' quality of living by creating healthy and safe living environments. Ecological sustainability may be accomplished by modifying the existing structures to increase efficiency and establishing strong sustainability criteria for new construction. Individuals in smart cities have enough access to health care, which improves their health and quality of life of sustainability practices.

The smart building model does not provide a full understanding of sustainable success, nor provide professionals with broad, tangible, non-overlapping, adequate, required, and scientific rules. Such rules will help a city strategy for life by guiding professionals in determining which components are required to achieve sustainable development (Holberg and Robèrt 2000). An FSSD process of strategic planning for sustainable implies that there is benefit into the first comprehending a scientific study fundamental professional goal, in which one may back cast.

As a result, sustainable development should indeed be comprehended in terms of the four Sustainability Practices, which "describe what community should prevent doing something in order to protect the social economic system" (Robèrt et al. 2010, 39), and the city's view of achievement and objectives should operate inside the limitations of such concepts. Without a strategic approach based on a fundamental idea of success, activities performed risk becoming ineffective, useless, or antithetical to a city's sustainable objectives. Overall, the proposed system lacks a broad and approved concept of what it means to be sustainable (Cohen 2013).

4.1.3 Strategic Level

Strategic principles should always be implemented at the strategic level to determine activities that advance cities into performance (Robèrt 2002). When it comes to making cities more efficient and environmentally friendly, the smart building concept sees information and communications technology (ICT) as an important strategic engine (Arup 2010). Solutions for smart city development include not only technology, but also human and institutional issues, in order to function within the complexity of cities (Pardo 2012). Professionals can use back casting to achieve the necessary conditions once the six features of a smart city have been identified. The demands of the city's people are constantly taken into account while developing smart projects (Huber and Mayer 2011).

Principles including such organizational honesty, inclusivity, and involvement are implemented in all government’s levels Pardo (2012). Boyd Cohen (2012) says that while deciding which activities to prioritize, beginning actions should go lean, indicating that they'd be financially feasible and provide a substantial return early on. As a result, the smart city idea includes various aspects that are already in accordance with long term planning with an FSSD standpoint.

An issue with the smart city idea is that it lacks a structure or standards that can help cities become smart and sustainable. It is possible that this shortcoming is linked to the problems involved with the absence of a clear definition of success, as discussed before in the Success level study. When it comes to taking action to achieve success in the domains of the Smart Building Model, there isn't a single fundamental premise that can be used to create a vision or function as a springboard for further research. Differences between the two notions might lead to situations in which strategic steps are not taken. From a systems viewpoint, cities cannot prepare for sustainability without clear strategic guidelines. A smart city prioritization process is inadequate if just financial returns are taken into account, according to the FSSD's recommendations. An activity should be prioritized according to a minimum of 3 prioritization questions that also take into account whether an action is going forward in the appropriate direction and offers a flexible foundation for subsequent development (Robèrt 2000).

4.1.4 Actions Level

A city's prosperity depends on the implementation of strategic guidelines at this level. For each of the six qualities of a Smart City, there are a number of different activities that may be taken to help propel development ahead. There should be an effort to bring society toward global social economic sustainability, according to the FSSD Hardly two cities are the same in the FSSD or smart city perspectives, hence a prescriptive action plan cannot be created that fulfills the demands among all cities (Robèrt 2013). Smart cities face distinct and complicated difficulties, necessitating action adapted to each city's individual requirements (Cohen 2012).

However, there is no assurance that implementing the smart city idea would lead to a decrease in the frequency with which sustainability principles are violated in the city. As an example, the literature commonly suggests that cities should improve their ICT infrastructure in order to achieve the six qualities of becoming smarter (Graham and Marvin 2001). One of the most pressing social and environmental challenges in cities that largely depend on ICT is the fact that a digital gap exists, which may result in the exclusion of 23 percent of the population Partridge (2004). Hollands (2008).

4.1.5 Tools Level

This level's goal is to identify the tools that can be used to design a system. Stakeholders such as citizens, governmental agencies, and the corporate sector may communicate with a public language and assess and create cities according to the six attributes stated above by utilizing the Smart Urban System Giffinger (2007), Cohen (2012) as well as the Smart Urban Wheel Cohen (2012). Cohen (2012). For instance, makes it possible for smart city practitioners from throughout the EU to exchange ideas and collaborate on projects (Smart Cities and Communities 2012). A city's efforts toward global sustainability should be supported by instruments at this level, according to the FSSD, which recommends this approach. This means that the creation of strategic instruments for implementing and measuring strategic activities is done by different municipal departments and suited to their unique requirements, depending upon their conceptions of the smart city model. City leaders have a lack of tools for creating strategic development plans and building proper public involvement mechanisms, even with the current smart city technology available.

4.2 INTERVIEWS WITH SMART CITY PRACTITIONERS

We conducted interviews with five employees who work with the smart city idea in a city environment in order to get a better sense of how the concept is used in the real world. Practitioners from Denmark, Germany, Portugal, and Sweden worked on various facets of the idea (see Appendix D). Mirko Presser, from the Alexandra Institute's Smart City Lab, and Peter Larsen, from Oresund Smart City Hub, were interviewed as well. Practitioners of smart city technologies shared their knowledge with us, giving us an impartial and technical view on the idea. What are the perspectives of existing smart city practitioners? This section of our paper answers that question.

4.2.1 The Role of Context in Smart Cities

Question 2: When did [name of city] start working on how to become a smart city? Four out of the five smart city practitioners who took part in the survey said that they first became interested in the concept of smart cities somewhere between 2008 and the present. "Smart" city issues were first brought up 10 years ago, according to Stockholm's IT department manager, Stefan Svensson (2013). In response to the question "What was the reasoning and motivation for [city] to keep concentrating to become a smart city?" respondents noted that smart operations were carried out before they were labeled as such. Smart projects were already being implemented in Copenhagen before 2008, according to project manager Emilie Hvidtfeldt (2013), who stated that Lisbon's environmental project coordinator said the main inspiration for a smart city was that plans that are the foundation for such an innovation ecosystem were in the process of being developed at the time, and that we could use the conceptual methodology as an umbrella term.

Francisco (2013), the environmental project coordinator in Gonçalves, is also worth mentioning. With the smart city concept, Lisbon would "become a truly open ecosystem, where ICT solutions may be adopted at the most diversified levels of usage and include all stakeholders on the city's journey to becoming a smart, sustainable city," as stated by Gonçalves (2013) in his report. Political goals and financial considerations are also thought to have affected the acceptance of the smart city concept. According to Hvidtfeldt (2013), the word "smart city" was incorporated in their 2012 strategy as a result of other towns' success in adopting smart city programs throughout the globe. Stockholm has to be promoted as a world-class metropolis, and Svensson (2013) makes the case that MPs are willing to help make Stockholm more globally relevant. For Ulrich Dilger (2013), the Stuttgart Project Manager, this was the driving force behind the city's transformation into a "smart" metropolis. According to the Smart Cities and Communities Project, which would be a European Union-funded initiative for municipalities, Växjö began referring to its operations under "smart city projects" in 2008. (SCCI).

One of the smart city experienced professionals interviewed, Mirko Presser (2013), indicated that the desire for cities to achieve economic relevance and development is the reason for cities towards becoming smart. As a consequence of the present economic crisis, European towns view the smart city idea as a means of increasing productivity and hence save money in their city's processes, he said. In addition, he said that smart cities may be divided into three categories using a three-tiered strategy. Tier one cities are those who are prepared to take a chance on something new and see whether it succeeds or fails. Tier two cities are those that use a variety of currently available technology and design a business strategy around them. They have a robust economy, an established high-tech sector, and a high level of civic engagement. When it comes to developing a smart city, the majority of cities wait till there is a tested and proven smart solution that has been lowered in cost by broad market demand before implementing it.

4.2.2 At the System-Level

When asked, "How do you characterize a smart city?" Data or ICT usage was identified by every participant as a component of the smart city concept. Four out of five city respondents acknowledged sustainability in their definitions, and three of them included public involvement. A few instances of smart city definitions: Citizen involvement and ICT are combined in a new city model. Participation, entrepreneurialism, and sustainability may all be achieved via the use of ICT technologies. Advanced smart stakeholder integrated connections and data and technology may be used to build an "intelligent city" that is simpler to live in and better prepared to run for its residents. "Successful thinking is a long-term investment." As far as I'm aware (Hvidtfeldt, 2013). With 25 colleges and high schools, excellent access to information and quality education, well-developed environmental and social capital in addition to superb transportation, the city is a "smart city" (Svensson 2013).

Information and communication technology is critical in creating a sustainable city, according to (Dilger 2013). Is it a city that is focused on environmental sustainability, or one focused on sustainable growth via the use of IT? Johansson 2013 asked this question. According to question no five, "Has the idea of smart cities been hard for you to understand?" Some of the people we talked to said that our definitions are either too broad or too specific, making it hard to work toward a common goal (2-5). Others said that they don't have any trouble grasping the idea of a "smart city" because they already know what it is (1-5), while others said that the unique qualities of cities make it hard to understand the idea (2-5). In "the smart city idea," (Goncalves 2013) explains that each smart city has different ways to deal with its own problems.

How might a smart city idea and its activities be beneficial to a community? Interviewees agreed that better public education, a better public image of a city, and a greater focus on urban sustainability all had beneficial consequences. Goncalves (2013) says that the number of people taking part in group actions like participatory budgeting and the number of people starting their own businesses have both gone up. Climate-friendly and smart capital status has resulted in a rise in tourism, according to Hvidtfeldt (2013). She went on to say that other municipal councils were sending delegations to see their smart city initiatives. According to Svensson (2013), the city can now deliver better services to its residents and keep them fully informed about how to obtain such services thanks to the smart city idea. To Johansson (2013), the advantages that come from using the Smart City Model's indicators and elements reflect the fact that they assist address all of sustainability's facets. A smart city's advantages in terms of environmental impact, according to Dilger (2013), are "higher efficiency and reduced costs of social funding, reduction of adverse impacts associated with various areas like There will be less congestion on the roads and less damage to the environment."

Considering the definition of smart cities and the difficulties associated with its implementation from the area smart city specialists' point of view, According to Presser (2013), a smart city is one that is always assessing its existing environment and actively adapting and innovating to match the ever-changing future requirements. In his view, the term "smart city" is often employed only as a marketing ploy. If you have effective public transport system in a city, it doesn't necessarily indicate that you are clever, but you become smart if you reinvest in your organization and attempt new alliances and coinvest inside a system that is linked," he said. Peter Larsen (2013) also said that "if you solely concentrate on the organizational and environmental components of smart buildings, then no, it can't be a sustainable notion. When people and people-centered solutions are also taken into account, then yes."

4.2.3 The Level of Success

The query is, "How does [city] define sustainable development?" Two of the five smart city responders referenced the Brundtland report2's definition of sustainable development as "development that meets the demands of the present without compromising the ability of future generations to meet their own needs" (Report 1987). Two other respondents included the notion of future generations into their conception of sustainability. In his 2013 article, Johansson described sustainable development as "sustainable energy, sustainable soil and water usage, and, of course, good waste management Moreover, Johansson (2013) said that "defining a term presents complications." "The topic of sustainability, for instance, has provoked much discussion in our group. It is a complicated matter because each sector has its own notion of sustainability." In response to questions 15 and 16, is this description conveyed to the personnel of your department and the many stakeholders with whom your firm collaborates? According to all city-specific smart cities practitioners, their own department provides a core concept, but not other departments or stakeholders.

How do you evaluate the performance of the several smart city initiatives you are implementing? In none of the cities evaluated is there a single smart city department, and each agency has its own indicators and methods for measuring success. Other findings from our interviews include the development of key performance indicators (KPIs), strategic documents containing indicators and targets for measuring annual sustainability performance, and the use of energy-saving pilot programs in which stakeholders can provide feedback and smart meters can report real-time data. As highlighted by Goncalves (2013), "indicators are the municipal elections, which occur every four years." If you've performed well, people tend to vote for you more than once " Two respondents said that analyzing and evaluating the social development of their cities might be a difficult undertaking. "Some things are much more difficult to measure than others, such as an individual's level of happiness," as stated by Hvidtfeldt (2013). However, we seek to measure how residents feel about their surroundings, how they perceive the city, whether or not they are content with the way things are done and how the city looks and feels, and whether or not there are enough green areas. It was suggested by Presser (2013) that while considering the six features of a smart city, they should be considered in conjunction with one another rather than as discrete parts, and that a city can only grow through interconnecting these different parts. There has to be a thorough understanding of the city's requirements before applying the Smart City Concept to it, according to Larsen (2013). Presser (2013) went on to say that a micro or global viewpoint may be used to assess performance. For example, basic real-time data may be used to detect changes in traffic jams at the micro level. Success is evaluated on a broader scale, such as economic growth. Although benchmarking is vital, cities should concentrate on leveraging current metrics and not create their own new ones, he said.

4.2.4 Strategic Level

It's time to answer question 8: "How do you intend to make your city smart?"

What are the challenges you're facing right now? The city's detailed objectives and other directives, according to all planners, shape their work. The two most important city strategies were the Energy and Environmental design Strategy (2-5) and the Sustainable Objective Of this project (2-5) Planning is done in a group effort, according to the people interviewed, and includes input from all relevant parties as needed (4-5). According to the interviewers (2-5), the political agenda of their city had an important influence in guiding the planning and decision-making process. The city of Copenhagen uses a sustainability planning tool to analyze every project throughout of economic, social, and approach towards managing throughout the planning process. According to (Dilger 2013), their city does not have a uniform planning approach, each sector has its own distinct planning process. Here, the answer to the question "Then what's your stakeholder-engagement approach like?" is provided. Who are the primary participants and what are the greatest challenges in smart city planning? There were town hall meetings and workshops, according to everyone who attended. According to Gonçalves (2013), they use social media to arrange public meetings and workshops in a variety of areas and districts.

According to (Hvidtfeldt 2013), their technique for including stakeholders evolves throughout the course of the strategic planning, with a different set of stakeholders being included at each stage. In terms of strategic and political thinking, we tend to focus more on citizen participation than we do on the level of the technologists.

That is how (Hvidtfeldt 2013) put it in respect to public involvement. As an additional obstacle, she said that stakeholders find it hard to get on board with participating in the project without first seeing a compelling commercial rationale for doing so. According to Svensson (2013), stakeholders are allowed to attend meetings and partake in the engagement process in the same way that public service announcements are. Both Johansson (2013) and Dilger (2013) said that residents have the option to participate in city-organized workshops and meetings to voice their views and make recommendations for development initiatives. As Dilger (2013) noted, individuals must be included at all stages of a planning process, which is mandated by the law. After early meetings, it might be challenging to keep stakeholders engaged in the process, according to Johansson (2013) and Dilger (2013).

There are a number of stakeholders participating in the planning process of smart city initiatives: residents (5/5), universities (2/5), non-profits (3/5), corporations (4/5) and politicians (2/5). Other stakeholders are involved depending on the nature of a project. The political agenda of the local administration (or "what politicians want" (Gonçalves 2013) (2/5), available cash (2/2), and expert opinion (1/5), were cited by the vast majority of respondents as the primary factors in prioritizing smart city projects and initiatives. According to Johansson 2013, the local council allocates yearly money to each department. Each department's budget is allocated in accordance with the annual objectives and initiatives that have been established. Following allocation of funds, each department has the option of prioritizing their own department's priorities. Citizens in such cities, according to two respondents, may democratically select how municipal funds are allocated via a participatory budgeting process. Several respondents responded to the question What methods do you use to educate the public about your smart city projects? implying that they use a range of mediums to accomplish their goals.

Aside from e-governance platforms, e-services, and local media, there are also public events, online pages, local television, and e-services. It is important to identify and create relationships with essential stakeholders and to set up a vision and objectives that are aligned, according to regional city expert Larsen (2013). The unique problems that a city has may be discovered and addressed via this collaborative method. If the implementations are not relevant to the city, they will not be implemented. Larsen (2013) further said that the efforts adopted should develop solutions that are genuinely relevant. According to Presser and Larsen (2013), a smart city planning strategy should include input from all stakeholders, including those in industry, government, and academia. When it comes to the procedure for getting people to commit, both regional experts emphasized the significance of cross-departmental cooperation in developing new and creative ideas. A typical issue, according to Larsen (2013), is "the inability of stakeholders to communicate or comprehend one another because they do not speak the same language. Larsen (2013) proposed that smart city activities may be prioritized by looking at competences as part of the prioritization process. Analyzing a project's economic potential and the associated financial investment to determine which course of action would best serve the interests of the majority of stakeholders in the area.

4.2.5 The Level of Actions and Tools

In response to the question, "What are some projects you are presently operating on and in your city?" There was a wide range of activities to choose from. Some examples of "smart transportation" plans mentioned by respondents include upgrading metro lines, acquiring micro buses, and establishing electric motorcycle projects. E-government platforms, public data systems, and participatory budgeting initiatives were all included under the umbrella term "smart governance". Interviewees spoke about "smart environment" measures such as increasing their city's renewable energy capacity, enhancing lake water quality, and adopting CO2 emission reduction plans. Funding for start-up companies and the creative industries was a common theme across initiatives included under the umbrella term "smart economy."

It was found that "smart people" initiatives were mostly focused on fostering a sense of community and a sense of cultural diversity. As part of "smart living," methods to increase the energy effectiveness of production facilities as well as sustainable development were considered. Interviews with smart city practitioners uncovered four main issue areas based on recurring themes. Efforts to plan effectively, measure progress, engage stakeholders, and prioritize activities were considered to be lacking.

Our interview questions for the FSSD practitioners were based on these highlighted problem areas, and our goal was to gather information and thoughts on how these difficulties may be handled via the lens of SSD.

4.3 RESULTS OF EXPERT INTERVIEWS ON FSSD AND SUSTAINABILITY

Specific issues relating towards the global sustainability issue were discovered via the FSSD gap analysis and the interviews with smart city practitioners (Appendix C). FSSD professionals were asked to provide solutions to these highlighted difficulties in a series of in-depth interviews. It is our goal in this section of our report to address the third question of our research:

With regard to the problems that smart city practitioners have recognized, what kind of insights can those with FSSD expertise offer?

4.3.1 Conceptualizing a Smart City

According to the FSSD gap analysis, the smart city concept may not be able to adequately address sustainability issues. A 2013 study by TNS Canadian Senior Analyst Pong Leung found that despite the many advantages ICT may give in terms of measuring, communicating with, and monitoring a city's progress, the technology is value neutral. "[Digitization] is happening," he said. There is little we can do to stop it, but we can direct it in a manner that helps cities become more ecologically friendly (Leung 2013).

Regina Hauser, a part of TNS International's Management board, believes that sustainable city is great titles since they encourage people to take action toward sustainability. Although ICT is a great tool, she said, society has become too dependent on it. People, she says, need to express sympathy for each other and the global ecosystems in order to deal with sustainability issues effectively. When it comes to making smarter decisions for cities, TNS Canadian Senior Analyst (John 2013) argued that ICT is vital. The potential of ICT is irrelevant, according to him, as long as smart city professionals use a systems perspective and can explain what success looks like in terms of long-term viability.

An SSD method with a participation planning process, according to Sarah James, co-director of the Research center for Environmental Education and Assistance, is more effective than the smart city concept in helping cities achieve sustainability since it offers a complete strategy and a good understanding of a principled notion of sustainable development. Most importantly, the promise to enhance democracy can only be realized if technology is used in an open, meaningful, and citizen-centric manner, says Lisa (Sustainability manager for a "Dane State Board of Education). According to Monica Pohlman & Associates Environmental Strategist and Instructor, the smart city notion may include intelligent and practical strategies for saving money, reducing emissions, and enabling cities more attractive to everyone. Smart cities get the ability to improve sustainability, but this notion is still to be widely grasped and put into reality, according to the expert.

Does "the smart city notion benefit or is it channeling resources away from underprivileged groups for a love of technology? said Dave Waldron, creator of Synapse Strategies. ICT should also be used to improve the quality of life and restore natural systems in cities, he said. The danger of ICT becoming a weapon in the hands of an authoritarian regime was also emphasized by him. He suggested an open data system supplied by ICT via which individuals may cooperate and share their innovations in order to address this menace.

4.3.2 Considerations for Sustainable Urban Development

Concerns highlighted by FSSD studies and the discussions with smart city professionals concerning the sustainability of urban expansion in a smart city prompted the following remarks from FSSD practitioners. According (Leung 2013), the Smart City Model's sustainability should be seen through the perspective of the Sustainability Principles at all times. A fundamental notion of sustainable practices should be adopted through the six attributes to avoid confusion among managers and to enable the city to flourish in a sustainable manner (Hauser 2013). Smart city practitioners, according (Purkis 2013), need to define success in terms of long-term sustainability for each of six key aspects of the smart city concept. If a city has defined success, it may next create and implement suitable metrics to monitor and assess its performance. According James, a lasting development in the six criterion areas may be achieved with an SSD strategy and sufficient involvement and institutionalization (2013).

According (MacKinnon 2013), a city should have a system in place that allows it to examine projects and run options through all the 4 Main Principles filter in order to ensure sustainable growth. Achieving sustainable development requires bringing sustainable development and climate change to the attention of the broader population, as according the principal of (Duke 2013). And in order for sustainability to be taken seriously again, society must experience an emotional shift.

It was said that (Waldron 2013) was dissatisfied with six aspects of the Smart City Concept are grouped because this suggests that there is an order to the features as well as dividing the system in silos. The practitioner said that all traits should be seen as being part of a common biological process that is maintained by technical systems (which are not alive). Using this conceptual paradigm, he advocated creating an all-encompassing strategy for re - establishing the biological systems.

Sustainable development must be defined using four principles, according to most of the practitioners. Having a similar understanding of sustainability enhances communication and fosters transformational change, according to another set of researchers. It's more probable that a city's many departments and agencies will work together in harmony to solve various problems by following the same set of guiding principles, resulting in a systems approach where each department's efforts complement one another rather than compete.

4.3.3 Creating a Clear Vision and a Plan

The construction of effective planning processes and the creation of a compelling vision were revealed via discussions with smart city practitioners. Four FSSD practitioners need a systems approach, while three practitioners particularly mentioned the FSSD's applicability. According to (James 2013), "applying the FSSD process would instantly bring about a systems approach to creating (sustainable) projects," however (Castle 2013) said that "without the need for an FSSD approach, [municipal authorities] won't completely understand what sustainability is." According to James (2013), a planning strategy focusing on the Sustainability Principles results inside a network of organizations that may be developed strategically. The implementation of four sustainability practices and boundary limitations avoids the appearance of contradicting goals and actions since all municipal entities are striving toward the same purpose. Most practitioners mentioned co-created visions defined under four Sustainability Principles.

Moreover, as according experts, the most difficult aspect of the planning procedure is developing a compelling vision. According to Waldron, effective vision building requires a leadership style that focuses on and addresses the city's envisaged future. According to three FSSD practitioners, the ABCD planning process is an effective planning technique that maintains a systems viewpoint. According to Leung, this process involves educating and engaging individuals, articulating a vision, examining current realities, determining focus areas, and finally selecting and evaluating possible actions. According to James, the Sustainability Principles at every stage of the planning process "will certainly result in a systematic approach" in terms of city planning strategy. Leung encouraged smart city practitioners, focusing on the following domains and the Sustainability Principles, to build a vision for each domain that is founded in the Sustainability of smart city management.

4.3.4 Measuring Success:

The findings of the FSSD research and the interviews with practitioners show the establishment as well as deployment of metrics to monitor progress toward success is challenging. With the exception of one, all FSSD practitioners agreed that it is critical to maintain a process of assessing the activities that contribute to success in light of the established vision of the project. When it comes to measuring success and being open, honest, and transparent, (Purkis 2013) remarked that it is "extremely crucial." In MacKinnon (2013), he stated that it may be tremendously demoralizing when individuals have committed to an activity and realize that no one is keeping track of it. According to Hauser (2013), it is important to make progress measurements accessible to a broader audience, and CO2 levels are a good example.

It is not suggested as a measurement approach since it may not be meaningful to citizens and may not assist the city towards its strategic aim of success for competitive benchmarking. It is possible for cities to employ appropriate metrics to convey progress toward particular strategic objectives associated with the Sustainability Principles, which might subsequently lead to the establishment of indicators to quantify progress in respect to the goals set forth in each smart city feature.

(Purkis 2013) argues that success indicators should be tied to the vision and goals of the company. These measurements of development should, in the opinion of (Pohlmann 2013), concentrate on the numerous systems inside a town's boundaries instead. Only when an action plan has been implemented can progress metrics effectively represent the progress of the intended actions, according to (Purkis 2013). in place.

4.3.5 Involving Stakeholders in the Process

There must be an open and transparent way for stakeholders in a city's smart city plan to participate. Concerns have been made by smart city practitioners concerning the existing state of affairs in this sector. It is critical to include all stakeholders in the planning process for urban sustainability, according to three FSSD practitioners. All practitioners agree with Castle's assertion that "the most effective change comes from citizens who are involved" in their communities. MacKinnon 2013 argue that citizens should be included at every level of the planning process. In contrast to elder residents, younger people are more concerned about the long-term future, but they are also more vocal about local issues and tend to focus more on short-term matters. To put it simply, "if the firms can't recognize their involvement in the process, a city cannot move forward Purkis. According to two practitioners, stakeholder mapping is the best way to locate the proper stakeholders for a project. A study of smart city criteria, according to Leung, may be utilized to identify the appropriate stakeholders. According to Hauser, community planning should involve people who are "committed and passionate" and willing to assume responsibility for the neighborhood.

It's a two-way street, according to Pohlmann. "Letting go of control" is one of the qualities of an effective facilitator, according to Waldron (2013), who believes that open meetings, not open homes, are the best venues for peer-to-peer learning. Overall, practitioners stated that engagement processes should:

To sum it up, engagement processes, according to practitioners, should:

a. allow people to participate while also trying to make sure that stockholders who choose not to participate are aware of the decisions made.

b. not involve too many people, since this can dilute the process.

c. utilize social media mostly as an information collection tool that can then be explored further through other mediums.

d. have an accurate idea of what group(s) are being addressed.

People need to be able to participate in the engagement process without feeling pressured to do so. Professionals said that they must go to the people who matter most to them. This meant that I could empathize with them on an emotional connection since we spoke the same language.

Leung said that this means meeting people at public events rather than expecting them to show up to local council sessions. When it comes to engagement, Purkis says that it may take many forms but that people need to be included in the process at all stages, from just notifying stakeholders what's happening on to giving them genuine authority. It has been argued that a strong engagement process may develop trust and make stakeholder feel like a part of the approach and solution, which provides them a feeling that everyone is heading in the same direction.

4.3.6 Prioritization Process

The FSSD gap analysis revealed that there was no clear means to prioritize sustainability, which the smart city idea might give. Practitioners of smart cities claim to employ methods of prioritizing that are specific to each city. However, they did not specify how they would ensure that the activities adopted led to sustainability as part of their prioritizing process. When it comes to prioritizing tasks inside an organization, nearly half of FSSD practitioners believe it is best to employ the three criteria posed by the FSSD (return on investment, adaptability of the platform, and the proper path). When deciding what to undertake first, Purkis suggests asking, "Will this activity assist us deal with our largest sustainability challenges, which were uncovered during the initial evaluation?" According to Purkis, cities will have their own unique set of strategic goals.

During the prioritizing process, extra questions will need to be asked in order to account for them. However, if a city doesn't apply the three prioritizing questions of the FSSD, it should still ask questions about sustainability. One of the most significant aspects of successful prioritizing is that the framework for making choices is shared not only by the decision-makers but also with other stakeholders. According to James, the three questions for establishing priorities may be used to arrange events in chronological order. She suggested that communities should "create a one-year, five-year, and ten-year timeframe of when changes may and should be performed," precisely. Actions that don't need a lot of resources, money, or specific rules are always picked during the first year. A schedule for the action plan should be established, as well as the participation of both the department's personnel and residents. Putting long-term plans into effect is difficult, according to James, since government officials are aware of the need of looking 20 to 25 years into the future, but they can only commit to plans that last for five years. Government decision-makers are constantly thinking about the next budget; thus, they don't like programs that demand long-term financial commitments, according to MacKinnon.

Participatory budgeting, which allows individuals to assist define priorities, was denounced by three specialists. According to Pohlman, individuals prefer to take acts that benefit just themselves above those that benefit everyone. People will only express an opinion that favors themselves if they vote on how activities should be prioritized without being aware of and familiar with the concerns, according to her. Letting people are voting on many different topics is not an efficient strategy to prioritize, according to Castle.

5. DISCUSSION

5.1 STRATEGIC METHODOLOGY FOR SUSTAINING INTELLIGENT CITIES

According the FSSD needs assessment, there was no obvious way to prioritize sustainability, which the smart city notion may provide Prioritization approaches that are unique to each city are said to be used by practitioners of "smart cities." There was no mention of how they would guarantee the activities selected were sustainable as part of the prioritization process. Roughly half of FSSD practitioners say the three criteria given by the FSSD are the best way to prioritize work in a company (return on investment, adaptability of the platform, and the proper path). "Will this activity aid us in dealing with our major sustainability concerns that were revealed during the original evaluation?" Purkis advocates asking that while determining what to do initially. Purkis predicts that each city will have its own distinct set of strategic objectives.

These additional questions must be answered throughout the prioritization process. A city should still ask questions regarding sustainability even if it does not use the FSSD's three prioritized questions. For effective prioritization to function, all stakeholders must have access to the decision-making framework that guides them in making decisions. A chronological order may be established using James' three questions for setting priorities. As she put it, local communities should "establish a one-year period of when modifications may and should be undertaken," she said. It is customary to begin with actions that do not need a significant investment of time, money, or resources. The action plan should include a timeline and include both departmental staff and residents as participants. Because of their limited time horizons, government officials can only commit to plans that last five years, which makes implementing long-term strategies challenging. According to MacKinnon, since government decision-makers are always looking forward to the next budget, long-term financial commitments are unappealing to them.

Three experts have criticized the practice of participatory budgeting, which enables citizens to help establish objectives. According to Pohlmann, people prioritize their own interests above the interests of others. Those who choose on how activities should be prioritized will only offer a view that benefits them, according to her. According to Castle, allowing people to vote on a wide range of issues is a bad technique for prioritizing.

First Phase: Prepare

Second Phase: Defining a Smart City Strategy

Third Phase: Baseline Assessment

Fourth Phase: Conceive Effective Smart City Actions

Fifth Phase: Prioritization and Strategic Action Plan

Sixth Phase: Evaluation Phase

The comprehensive plan's development and implementation is an incremental method, and assessments of the city's performance toward sustainable development may be carried out using information and data gathered through progress indicators.

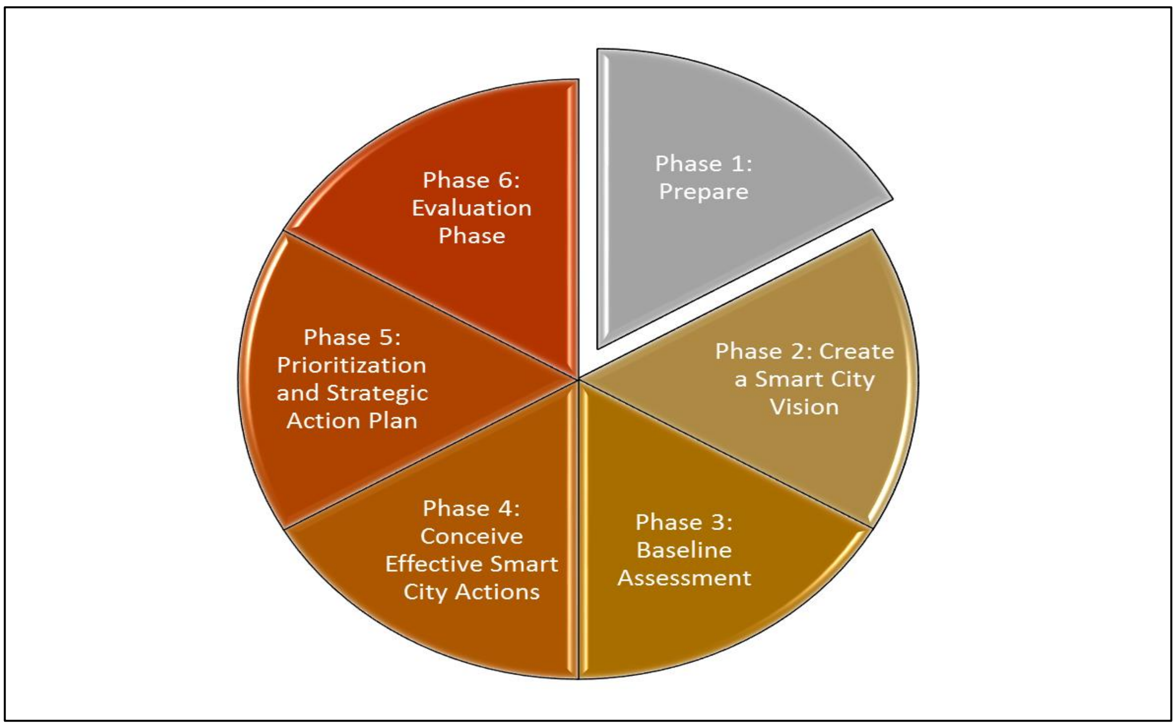

Figure 5.1: Strategic methodology for sustaining intelligent cities.

5.1.1 First Phase: Prepare

This is the first phase of the strategic planning, which aims to generate a shared understanding of the concept and the SSD approach in order to reach consensus, and to co-create principles that will be used all through the planning process. Practitioners of smart cities must first know SSD approach. Then, this knowledge and comprehension of the concept of a city of the future should be transmitted to the relevant parties.

Our results imply that a discourse regarding a comprehension of sustainable development and the smart city concept is required to allow effective communication among stakeholders. Conversations must address why sustainability is a desirable result and how the concept of the smart city may aid in accomplishing this aim. By often and continuously engaging in sustainability discussions with the diverse stakeholders, smart city specialists may raise awareness and ascertain the level of stakeholder involvement with the issues at hand. This is done to guarantee that stakeholders comprehend the need for a sustainability planning stage and how the smart city concept may assist in accomplishing the sustainability aim.

By creating an initial organizing committee comprised of members from each municipal sector and stakeholders' group, several process leaders who can assist with the planning process may be identified. Minimum engagement from the public, business, educational, and governmental sectors is necessary. It is crucial that all participants in the planning process comprehend sustainability and the concept of the smart city. This may be achieved by instructing participants on SSD technique and its application in urban contexts. In order to implement this strategic planning, the technique must be assessed and appraised depending on the needs of stakeholders. Next, the facilitators should create agreed-upon criteria for the planning process, and the members should allocate responsibilities and establish who is responsible for tasks such as communications and logistical support.

5.1.2 Phase 2: Defining a Smart City Strategy

This is the initial step of the planning process, which attempts to build a common knowledge of the idea and SSD method in order to gain agreement, as well as co-create the basic guidelines that will be used throughout the planning process. Smart city practitioners must first understand SSD strategy. Then, this understanding and knowledge of the notion of a future city should be communicated to the appropriate stakeholders.

In order for stakeholders to communicate effectively, our findings indicate that a discourse on environmental sustainability and the notion of smart cities is necessary. Conversations must cover why sustainable development is a desired outcome and how the smart city idea might contribute in achieving this objective. By often and persistently participating in sustainability talks with the various stakeholders, smart city professionals may increase awareness and assess the amount of stakeholder engagement with the problems at hand. This is done to ensure that stakeholders understand the need of a sustainability planning process and how the smart city idea may aid in achieving the sustainability objective.

By establishing an initial committee made of representatives from each municipality sector and stakeholder group, it is possible to identify a number of process leaders who may contribute to the planning process. Minimum participation is required from the public, economic, educational, and government sectors. All stakeholders in the strategic planning must have a thorough understanding of sustainability and the notion of the smart city. This may be accomplished by educating people about SSD technology and its applicability in urban settings. To accomplish these organizational strategies, the approach must be evaluated and analyzed based on the requirements of stakeholders. The facilitators should next set agreement parameters for the strategic planning, and the participants should assign roles and determine who is accountable for activities such as correspondence and logistical assistance.

5.1.3 Phase 3: Baseline Assessment

After establishing a shared professional goal for a city of the future and getting a clear understanding of how each quality is defined, participants are now able to analyze the current condition of their city. For now, current measuring techniques and signals may use it to get a better understanding of where things stand.

An internal assessment of the functioning of the city based on the characteristics of an intelligent city is conducted first. As a result of this assessment, the city will be able to see which areas and initiatives are currently meeting their sustainability goals, as well as which ones still need to be improved. Participants must examine their current negative impacts on sustainability in order to determine which areas are essential for attaining sustainability. Additional opportunities include an operational assessment that identifies the commodities and services provided to municipal systems, the valuable chains on which various departments rely and waste and byproducts generated as a consequence of these processes. As a decision-making framework, the city's long-term planning and governance procedures must also be examined.

The next step is to conduct an external analysis to determine the factors beyond the city's control that affect its ability to achieve its objective. Stakeholder interactions and external factors and trends that affect municipal operations may both be examined this way by the city. PESTLE research may be used to discover external trends in the governmental, financial, social, technological, regulatory, and environmental sectors (Cambridge 2013). Participants may also establish their connections towards other stakeholder and the impact these connections have on the city via the building of a stakeholder map. Using stakeholder mapping to identify important stakeholders in a city is a useful strategy that can be used to all smart city aspects. For example, if crucial stakeholder linkages have been overlooked, this would help to determine which relationships are powerful and which ones are weak. In addition, we encourage practitioners to look beyond their own city bounds and into the implications for other towns and rural areas.

This stage highlights the city's sustainability strengths and weaknesses, as well as potential strategic directions for the city to take in order to achieve its goals. In addition, the six characteristics of the Smart City Design help create a shared understanding of the gaps that exist between the city's current reality as well as its effective, positive future.

5.1.4 Phase 4: Conceive Effective Smart City Actions

second Phase and third Phase of a smart city's development process may have already sparked stakeholders to suggest new projects and investment opportunities. There will be an opportunity for stakeholders to collaborate on possible actions and initiatives in the fourth Phase As the smart city concept begins to take shape, participants in this phase begin to provide actionable ideas. Participants are encouraged to think outside of the box and be creative in a brainstorming activity. There should be an effort made to incorporate any new significant stakeholders that emerge throughout the mapping process. These brainstorming sessions should concentrate on the strategic emphasis areas and strategic goals for each of the Smart City Designer's six elements. To succeed in various Smart City Model sectors of development, participants are urged to "think beyond the box."

5.1.5 Phase 5: Prioritization and Strategic Action Plan

Smart city strategy plans are produced in this phase by prioritizing the previous phase's efforts.

Using the criteria set by participants, practitioners choose which actions to carry out based on the convincing list of activities they have produced.

A minimum of three prioritizing questions is proposed by the SSD technique of prioritization.

These questions provide a framework for practitioners to ensure the most suitable and efficient ways to move a city toward sustainability. According to Castle 2013 the following questions are relevant to SSD prioritization:

Efforts should take us in the correct path.

Is it helping us achieve our goals for a certain smart city characteristic?

Do the Sustainability Principles have a positive impact on it?

It is important to know whether the effort will allow for future changes (i.e., a necessary step).

Does the future of sustainability offer any realistic prospects, or are we at a stalemate?

Is it difficult to make a future transition because of the sunk costs of this activity or initiative?

Is the effort worth the money spent on it?

What are the direct costs of this action?

What kind of savings or income increases may we expect as a direct result?

What may happen if you don't take this action?

What additional sorts of "capital" or "benefits" might this activity possibly produce?

Social or political incentives, for example Our findings from discussions with smart city practitioners suggested that activities that fulfill the goals of a range of smart main are regarded "smarter" and thus more beneficial. The success criteria of many smart city features must be satisfied by actions that are synergistic determinants of satisfaction, hence special attention should be devoted to these acts. All three prioritizing questions need to be answered positively, or at the very least, an explanation of why a priority requirement isn't met, according to this theory.

The practitioners must next choose which of the priority actions will be implemented in the short term, mid-, and lengthy time frames. "Low-hanging fruit" refers to actions that can be implemented quickly or within the year, have a significant impact on an organization, and produce enough money to be put into long-term projects. As a result, medium-term projects are often conducted over a period of one to two years. Activities that last more than two years need a significant investment, which can be recouped via the return on the investment from previous acts.

An action application table may be used as a basic framework for a strategic plan plan document. Actions are characterized and categorized under the six attributes. With this table, practitioners may also record who is responsible, how much it will cost and what measures are related to each action, the implementation timeline, the current stage of the activity, and so on. The smart city's action plans are summarized in this paper for practitioners. In addition, this document contains the information necessary to make well-informed decisions that go beyond the scope of smart city strategic planning and may even be used to enhance local financial and development plans. This document must be updated, evaluated, and made available to the public on a regular basis if it is to remain relevant and useful.

5.1.6 Phase 6: Evaluation Phase

Continuously assessing and monitoring each activity's progress once the strategic improvement plan has been finished will be essential. The city's practitioners must establish a review board to monitor and evaluate the ongoing activities. There is a risk that the whole long term planning strategy may become obsolete and useless if this method is not followed. To establish whether the city is fulfilling its goals and taking the necessary steps to achieve its specified vision, this phase of assessment is conducted. This strategy allows a city to compare and assess its progress throughout time, as well as get a full grasp of its achievements. In order to keep everyone informed about the progress of the project, the review panel must keep in close contact with them on a regular basis. An accountability chain ensures that the action plan is kept on track by keeping stakeholders informed and involved. Those who participate in this review process will discover that they have a role to play in shaping the future of their community if it is performed in an open and honest manner. Future strategic decisions may be built on this review's findings, assuring that the city's overall strategic plan of action is continually improved.

The six elements of this strategic plan may help smart city practitioners optimize the capacity for social and environmental sustainability in the smart city concept. By using the SSD technique, smart city professionals would be able to prepare more effectively for sustainable development in the following areas: smart economy, people and governance; transportation; environment and lifestyle; and the economy.

6. CONCLUSION

There is an increasing strain on urban systems as a result of globalization and the problem of sustainability. These problems need a shift in thinking that emphasizes a systems perspective. At this point in time, smart cities as a concept have already shown promise in meeting some of the challenges of sustainability by encouraging citizen participation in the development of innovative and efficient sustainable solutions, increasing the efficiency of smart city applications and establishing open and inclusive governance structures. The goal of our research was to provide suggestions that might help smart cities achieve sustainability more rapidly and efficiently.

In order to determine the sustainability benefits and limitations of the smart city concept, we first looked at it through the lens of the Vision for Sustainability. This inquiry evaluated the Smart Urban System and how each region achieves sustainability by examining the six aspects of the Smart Urban Model. Many of the elements of the SSD technique may be applied to the smart city concept, and the results show that citizen-centered solutions are particularly effective. There was a lack of understanding of the political and social system in which a smart city functions and an ambiguous determination to succeed in terms of sustainability, as well as conflicting strategic proposals for attaining success. These findings compel us to interview people with smart city professionals in order to expand our study.

They interviewed smart city practitioners to learn about their difficulties in implementing the concept. In general, practitioners were excited about the smart city concept, but they cited challenges as a result of planning, assessing progress, enlisting stakeholders, and designing and implementing an action prioritization process. These problems were thought to be manageable via an SSD approach, therefore we interviewed people with FSSD practitioners in order to learn more about the best way to deal with these challenges. FSSD practitioners provided us with advice on how to conduct effective urban planning, set realistic targets with supporting evaluations, encourage and retain stakeholder group engagement, and prioritize activities while moving cities toward sustainability. In spite of the innovative and forward-looking nature of the smart city concept's method to city planning, it does not absolutely necessary for communities to grow in a sustainable manner. Consequently, the planning process for smart cities was designed to implement a Strategic Integrated Development model while giving municipal agencies the opportunity to collaborate, stakeholders to be completely included in the planning process and people to be informed. "Strategic Planning Method for Sustainability Smart Cities" is designed to help smart city practitioners plan in a way that will help their city grow toward sustainability more quickly and effectively. To help make the smart city concept more viable in our expanding urban society, we think this thesis is a valuable addition. It advances the exciting field of smart cities research.

REFERENCES

[1] Anthopoulos, L. G. (2017). Understanding smart cities: A tool for smart government or an industrial trick? (Vol. 22, p. 293). Cham, Switzerland: Springer International Publishing.

[2] Allwinkle, S., & Cruickshank, P. (2011). Creating smart-er cities: An overview. Journal of urban technology, 18(2), 1-16.

[3] Antrop, M. (2004). Landscape change and the urbanization process in Europe. Landscape and urban planning, 67(1-4), 9-26.

[4] Cities, S. (2010). Transforming 21st Century city via the creative use of technology. ARUP, London, September.–2010.

[5] Bătăgan, L. (2011). Smart cities and sustainability models. Informatica Economică, 15(3), 80-87.

[6] Borja, J. (2007). Counterpoint: Intelligent cities and innovative cities. Universitat Oberta de Catalunya (UOC) Papers: E-Journal on the Knowledge Society, 5, 10-11.

[7] Bulkeley, H., & Betsill, M. (2005). Rethinking sustainable cities: Multilevel governance and the'urban'politics of climate change. Environmental politics, 14(1), 42-63.

[8] Canadell, J. G., Le Quéré, C., Raupach, M. R., Field, C. B., Buitenhuis, E. T., Ciais, P., ... & Marland, G. (2007). Contributions to accelerating atmospheric CO2 growth from economic activity, carbon intensity, and efficiency of natural sinks. Proceedings of the national academy of sciences, 104(47), 18866-18870.

[9] Colldahl, C., Frey, S., & Kelemen, J. E. (2013). Smart cities: Strategic sustainable development for an urban world.

[10] Caragliu, A., Del Bo, C., & Nijkamp, P. (2011). Smart cities in Europe. Journal of urban technology, 18(2), 65-82.

[11] Castle, D. (2013). Skype interview by authors. Portland, Oregon, USA. April, 12, 2013.

[12] Colldahl, C., Frey, S., & Kelemen, J. E. (2013). Smart cities: Strategic sustainable development for an urban world.

[13] Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J. R., Mellouli, S., Nahon, K., ... & Scholl, H. J. (2012, January). Understanding smart cities: An integrative framework. In 2012 45th Hawaii international conference on system sciences (pp. 2289-2297). IEEE.

[14] Clancy, H. (2013). Smart city spending to reach $20 billion by 2020. GreenBiz. com, 6.

[15] Coe, A., Paquet, G., & Roy, J. (2001). E-governance and smart communities: a social learning challenge. Social science computer review, 19(1), 80-93.

[16] Cohen, Boyd. 2012. What exactly is a smart city? http://www.fastcoexist.com/1680538/what- exactly-is-a-smart-city (accessed on 21 January 2013).

[17] Copenhagen Cleantech Cluster. 2012. Danish Smart Cities: Sustainable Living in an Urban World. Copenhagen Cleantech Cluster: 2-41.

[18] Corbin, Juliet and Anselm Strauss. 2008. Basics of qualitative research: techniques and procedures for developing grounded theory (3rd ed.). Thousand Oaks, CA: Sage.

[19] Correia, Luis M. and Klaus Wunstel. 2011. Smart City Application and Requirement. Networks European Technology Platform. http://www.networks-etp.eu/fileadmin/user_upload/Publications/Position_White_Papers/White_Paper_Smart_Citie s_Applications.pdf (accessed 3 February 2013).

[20] Davidson, Kathryn and Jane Venning. 2011. Sustainability decision-making frameworks and the application of systems thinking: An urban context. Local Environment 16: 213 – 228.

[21] Dawes, Sharon S. and Theresa A. Pardo. 2002. Building collaborative digital government systems. In Advances in Digital Government: Technology, Human Factors, and Policy, eds.

[22] W. J. McIver and A. K. Elmagarmid, Norwell, 110-138. Boston, MA: Kluwer Academic Publishers.

[23] Dilger, Ulrich. 2013. Phone-interview by authors. Stuttgart, Germany. March 21, 2013.

[24] Dirks, Susanne, Constantin Gurdgiev and Mary Keeling. 2010. Smarter cities for smarter growth. IBM Global Business Services Executive Report. http://public.dhe.ibm.com/common/ssi/ecm/en/gbe03348usen/GBE03348USEN.PDF (accessed 17 April 2013).

[25] Dreborg, Karl Henrik. 1996. The essence of backcasting. Futures 28: 813 – 828. EDS Toolkit. 2011. EDS Toolkit. http://esd-toolkit.eu (accessed 24 February 2013).

[26] Eger, John M. 2009. Smart growth, smart cities, and the crisis at the pump: A worldwide phenomenon. Journal of E-Government Policy and Regulation 32: 47 – 53.

[27] European Commission. 2012. Smart Cities and their Communities – European Innovation Partnership.http://ec.europa.eu/energy/technology/initiatives/doc/2012_4701_smart_cities_en pdf (Accessed 10 February 2013).

[28] Kaczynski, R. (2013). Transnational Internal Security, Democracy and the Role of the State. In Examining State and Evil: Authoritarian Slips, Past and Present (pp. 23-33). Brill.

[29] Giffinger, Rudolph, Christian Fertner, Hans Kramar, Robert Kalasek, Natasa Pichler-Milanović and Evert Meijers. 2007. Smart Cities: Ranking of European Medium-Sized Cities. Vienna, Austria: Centre of Regional Science (SRF), Vienna University of Technology. http://www.smart- cities.eu/download/smart_cities_final_report.pdf (accessed 2 February 2013).

[30] Glaser, Barney and Anselm Strauss. 1967. The Discovery of Grounded Theory: Strategies for Qualitative Research. Chicago: Aldine Publishing Company.

[31] Gleeson, Brendan and Nicholas Low. 2000. Revaluing planning: Rolling back neo-liberalism in Australia. Progress in Planning 53: 83 – 164.

[32] Goncalves, Francisco. 2013. Skype interview by the authors. Lisbon, Portugal. March 22, 2013.

[33] Graham, Stephen. 2002. Bridging urban digital dividers: urban polarization and information and communication technologies. Urban Studies 39: 33 – 56.

[34] Gustavsson, Magnus and Henrik Jordahl. 2008. Inequality and trust in Sweden: Some inequalities are more harmful than others. Journal of Public Economics 673: 348 – 365.

[35] Haig, Brian. 1995. Grounded theory as scientific method. Philosophy of Education Website. http://jan.ucc.nau.edu/~pms/cj355/readings/Haig%20Grounded%20Theory%20as%20Scientific%20Method.pdf (accessed 18 April 2013)

[36] Hauser, Regina. 2013. Skype interview by authors. Portland, USA. April 11, 2013.

[37] Hegmann, George, Chris Cocklin, Roger Creasey, Sylvie Dupuis, Alan Kennedy, Louise Kingsley, William Ross, Harry Spaling and Don Stalker. 1999. Cumulative Effects Assessment Practitioners Guide. Hull, Quebec: Canadian Environmental Assessment Agency.

[38] Hollands, Robert G. 2008. Will the real smart city please stand up? City: Analysis of Urban trends, culture, theory, policy, action 12: 303-320.

[39] Holmberg, John and Karl-Henrik Robèrt. 2000. Backcasting from non-overlapping sustainability principles--a framework for strategic planning. International Journal of Sustainable Development and World Ecology, no. 7: 291-308.

[40] Huber, Andreas, and Ines Mayer. 2011. Smart Cities: an emerging city concept to frame sustainable transitions? European Institute for Energy Research. http://www.eifer.uni-karlsruhe.de/IMG/pdf/215_Huber_Mayer_Smart_Cities_An_emerging_city_concept_to_frame_sustainable_transitions.pdf (accessed 13 March 2013).

[41] Hvidtfeldt, Emilie. 2013. In-person interview with authors. Copenhagen, Denmark. March 25, 2013.

[42] ICAAP (International Consortium for the Advancement of Academic Publication). 2013. Online Dictionary of the Social Sciences. http://bitbucket.icaap.org/dict.pl (assessed 11 May 2013).

[43] nnes, Judith E. and David E. Booher. 2000. Collaborative Dialogue as a Policy Making Strategy. IURD Working Paper Series, Institute of Urban and Development, UC Berkley: 1 32. http://www.escholarship.org/uc/item/8523r5zt (access March 5 2013).

[44] Jabareen, Yosef Rafeq. 2006. Sustainable Urban Forms: Their Typologies, Models, and Concepts. Journal of Planning Education and Research 26: 38-52.

[45] Johnson, Bjorn. 2008. Cities, systems of innovation and economic development. Innovation: Management, Policy & Practice, 10(2-3): 146-155.

[46] Kennish, Michael J. 2002. Environmental threats and environmental future of estuaries. Environmental Conservation 29: 78 – 107.

[47] Lazaoiu, George C., and Mariacristina Roscia. 2012. Definition methodology for the smart city model. Energy 47: 326 – 332.

[48] Leung, Pong. 2013. Skype interview by authors. Vancouver, Canada. April 13, 2013.

[49] MacKinnon, Lisa. 2013. Skype interview by authors. Madison, WI, USA. April 13, 2013.

[50] Maxwell, Joseph A. 2005. Qualitative Research Design: An Interactive Approach. Applied Social Research Methods Series. Thousand Oaks, CA: Sage Publications.

[51] Maxwell, Joseph A. 2008. Designing a Qualitative Study. In SAGE Handbook of Applied Social Science Research Methods. 2nd, ed. Leonard Bickman and Debra J. Roger, 214-253. Thousand Oaks, CA: Sage.

[52] McKinsey Global Institute. 2011. Urban world: Mapping the economic power of cities. http://www.mckinsey.com/insights/mgi/research/urbanization/urban_world (Accessed January 2013).

[53] Meeus, Leonardo, Erik Delarue, Isabel Azevedo, Jean-Michel Glachant, Vitor Leal, and Eduardo de Oliveira Fernandez. 2011. Smart City Initiatives: How to Foster a Quick Transition towards Local Sustainable Energy System Final Report. Seventh Framework Program. http://cadmus.eui.eu/handle/1814/14619 (accessed 17 April 2013).

[54] Merriam-Webster Online. 2013. Merriam-Webster Online. Data. http://www.merriam-webster.com/dictionary/data (assessed 11 May 2013)

[55] Merriam-Webster Online. 2013. Merriam-Webster Online. Measure. http://www.merriam- webster.com/dictionary/measure (assessed 11 May 2013)

[56] Murray, Art, Mark Minevich and Azamat Abdoullaev. 2011. Being Smart and Smart Cities. The Future of the Future October 2011: 20-23.

[57] Newman, Peter and Jeffrey Kenworthy. 1999. Sustainability and Cities: Overcoming Automobile Dependency. Washington DC: Island Press.

[58] HS Benchmarking. 2009. Benchmarking. Finding and implementing best practice. http://www.nhsbenchmarking.nhs.uk/Benchmarking/default.aspx (accessed 12 May 2013)

[59] Nriago, Jerome O. 1990. Global Metal Pollution: Poisoning the Biosphere? Environment: Science and Policy for Sustainable 32: 7 – 33.

[60] Ny, Henrik, Jamie MacDonald, Göran Broman, Ryoichi Yamamoto, and Karl-Henrik Robèrt. 2006. Sustainability constraints as system boundaries. An approach to making life-cycle management strategic. Journal of Industrial Ecology 10, no. 1-2: 61-77.

[61] Larsen, Peter. 2013. In-person interview by authors. Copenhagen, Denmark. March 21, 2013. Law, Kathy and Andreas Stohl. 2007. Article Air Pollution: Origins and Impacts. Science 315: 1537 – 1540.

[62] O’Brien, Christopher. 1999. Sustainable production – a new paradigm for a new millennium. International Journal of Production Economics 60: 1 – 7.

[63] O’Grady, Michael and Gregory O’Hare. 2012. How smart is your city? Science 335: 1581- 1582.

[64] Oxford Dictionaries Online. 2013. Oxford Dictionaries Online. Community. http://oxforddictionaries.com/definition/english/community (accessed 11 May 2013).

[65] Oxford Dictionaries Online. 2013. Oxford Dictionaries Online. Governance. http://oxforddictionaries.com/definition/english/governance (accessed 11 May 2013)

[66] PC Magazine. 2013. Encyclopedia. Platform. http://www.pcmag.com/encyclopedia/term/49362/platform (assessed 11 May 2013)

[67] Peck, Jamie. 2005. Struggling with the creative class. International Journal of Urban and Regional Research 29: 740 – 770.

[68] Pohlmann, Monica. 2013. Skype interview by authors. Victoria, BC, Canada. April 12, 2013.

[69] Presser, Mirko. 2013. Phone-interview by authors. Aarhus, Denmark. April 12, 2013. Purkis, John. 2013. Skype interview by authors. Ottawa, Canada. April 10, 2013.

[70] Robèrt, Karl-Henrik. 2000. Tools and concepts for sustainable development, how do they relate to a general framework for sustainable development, and to each other? Journal of Cleaner Production 8, no. 3: 243-254.

[71] Robèrt, Karl-Henrik. 2012. Class Lecture. Blekinge Institute of Technology. 8 September.

[72] Robèrt, Karl-Henrik, Goran Broman, David Waldron, Henrik Ny, Sophie Byggeth, David Cook, Lena Johansson, Jonas Oldmark, George Basile, Hordur Haraldsson, Jamie MacDonald, Brendon Moore, Tamara Connell and Merlina Missimer. 2010. Strategic Leadership towards Sustainability. 6 ed. Karlskrona, Sweden: Psilanders grafiska.

[73] Robèrt, Karl-Henrik, B. Schmidt-Bleek, J. Aloisi de Larderel, G. Basile, J. L. Jansen, R. Kuehr, P. Price Thomas, M. Suzuki, P. Hawken, and M. Wackernagel. 2002. Strategic sustainable development - selection, design and synergies of applied tools. Journal of Cleaner Production 10, no. 3: 197-214.

[74] Rotmans, Jan, Marjolein van Asselt, and Pier Vellinga. 2000. Assessment methodologies for urban infrastructure: An integrated planning tool for sustainable cities. Environmental Impact Assessment review 20: 265 – 276.

[75] Roumet, Claire. 2010. Speaker at Workshop: Smart sustainable cities and regions on October 5, 2010.

[76] Sample, Ian. 2004. PCs: the latest waste mountain. The Guardian UK, 8 March. http://www.guardian.co.uk/science/2004/mar/08/sciencenews.theguardianlifesupplement (accessed March 30 2013).

[77] Scott, William Richard. 2000. Institutions and Organisations. Thousand Oaks, CA: Safe Publications.

[78] Senge, Peter, Charlotte Roberts, Richard B. Ross, Bryan Smith and Art Klenier. 1994. The Fifth Discipline Fieldbook: strategies and tools for building a learning organization. Nicholas Brealey Publishing: London.

[79] Smart Cities. 2012. Digital City Self-Assessment Tool. http://www.smartcities.info/video (accessed 14 February 2013).

[80] Smart Cities. 2013. DANS cluster kick-off conference “Implementing the Digital Agenda in the North Sea Region. http://www.smartcities.info/dans-cluster-kick-

conference- “implementing-digital-agenda-north-sea-region (Accessed on February 19, 2013).

[81] Steffen, Will, Jaques Grinevald, Paul Critzen and John McNeill. 2011. The Anthropocene: conceptual and historical perpective. Philosophical Transactions of the Royal Society 369: 842 – 867.

[82] Steinert, Kurt, Revital Marom, Phillippe Richard, Gaspar Veiga and Louis Witterns. 2011. Making Cities Smart and Sustainable. The Global Innovation Index 2011 Report. http://www.globalinnovationindex.org/gii/main/previous/2010-11/FullReport_10-11.pdf (accessed 14 March 2013).

[83] Sustainable Cities International. 2010. Our Work. http://sustainablecities.net/our-work (accessed 18 January 2013).

[84] Svensson, Stefan. 2013. Skype interview by the authors. Stockholm, Sweden. April 3, 2013.

[85] Tech Terms. 2010. ICT. http://www.techterms.com/definition/ict (accessed 11 May 2013)

[86] Tilbury, Daniella and David Wortman. 2004. Engaging People in Sustainability. Commission of Education and Communication. The World Conservation Union: Switzerland.

[87] TNS Canada 2013a. 2013. Our Approach – The Framework for Strategic Sustainable Development. http://www.naturalstep.org/our-approach (accessed on 3 March 2013).

[88] TNS Canada. 2013b. The Four System Conditions. http://www.naturalstep.org/the-system- conditions (accessed on 3 March 2013).

[89] TNS Canada. 2013c. The Funnel. http://www.naturalstep.org/ (accessed on 3 March 2013).

[90] UN World Urbanization Prospects. 2011. World Urbanization Prospects: The 2011 Revision. United Nations: New York.

[91] US Department of Energy. 2013. Office of Electricity Delivery and Energy Reliability. Technology and Development. Smart Grid. http://energy.gov/oe/technology-development/smart-grid (assessed 11 May 2013).

APPENDIX

Appendix A

Tips for Smart City Practitioners Interviews

	Smart City	**FSSD**	**Gaps**
Systems Level	Cities are composed of subsystems.	•Knowledge of social and environmental systems •Scientific comprehension of natural principles	• No discussion of the link between the city and its socioecological systems • No scientific foundation
Success Level	• Success Equals establishment of six smart city features • Smart = Sustainable • No obvious smart city	•Principle-based sustainability definition	•Absence of a consistent conceptual understanding • Absence of a unified definition of achievement
Systems Level	• Strategies along three routes • Prioritization based on economic efficiency	• Retransmissions via SPs • Prioritization Questions	• Uncertain strategy guidelines and planning framework • Incomplete prioritisation questions
Actions Level	•Actions aligned with the six attributes • Dependence on ICT	• Actions that do not contradict the four SPs and that assist communities in moving strategically toward sustainability	•Actions do not ensure that SP breaches will be minimized or prevented (lack of framework)
Tools Level	• Smart City model / Smart City Wheel / ICT instruments (such as smart grid)	• Instruments that aid in achieving sustainability	• Diverse instruments exist; however, they may not lead to strategic growth.

Appendix B

Questions for Interviews with Professionals Working in Smart Cities.

a	**What are your responsibilities at the company?**
b	**What was the city's first step into being a smart city?**
c	**Why did [city name] decide to work on becoming a smart city in the first place?** **In your opinion, what makes a city "smart?"**
d	**The idea of "smart cities" might be difficult to grasp for certain people?**
e	**There are now initiatives in [your city] that you're involved with in the following categories: Which of the below has been found to be the hardest to achieve?** **Having a place to call home entails developing a city that is both healthy and safe, as well as one that is rich in cultural diversity.** **Affluence - having a wide variety of transportation options.** **financial markets - increasing rates of entrepreneurial, worldwide interconnectedness - human - capital expansion.**
f	**What metrics do you use to evaluate the performance of your smart city initiatives?**
g	**In order to make your city smart, what is the strategic planning? What are the difficulties you'll face throughout this procedure?**
h	**What methods do you use to keep the public informed about your numerous smart city projects?**
i	**What are your top priorities for implementing smart city initiatives?**
j	**The smart city planning process includes a wide range of stakeholders. How do you go about getting others involved? Are there any major obstacles to overcome in this field?**

Appendix C

Sustainability Obstacles Identified by Smart City Practitioners.

	Difficulties Identified by Smart City Professionals
Systems	**Definitions of a "smart city" are too broad and long; each city will have its own definition of a smart city; the idea is unduly dependent on energy and technology; and the term is not shared even at the departmental level.**
Success	**ICT alone is not enough to ensure the long-term viability of a smart city.** **• There is a lack of consensus among stakeholders on the definition of sustainability. It's not clear how to define "smart," therefore how can we define "sustainable?"** **A wide range of sustainability definitions and tools are used by the various departments.**
Strategic	**To be comprehensive, SC activities must engage a wide range of stakeholders and use a variety of technologies, which necessitates a systems approach including many stakeholders (inclusive)** **• Cities prioritize transportation, governance, and the environment above social sustainability goals because these are easier to quantify.** **• Various departments have different objectives, making it impossible to coordinate without a clear common aim and the engagement of stakeholders. In terms of smart city operations and development, there is no specific department. As a result, SC solutions are significantly dependent on the budget. • Rules that are not established by law are more difficult to enforce.** **a lack of effective methods for assessing success Short-term political cycles lead to short-term objectives due to a lack of aims and indicators (internal).** **• each department has its own set of metrics for measuring performance**
Approaches and Equipment	**ICT compatibility is a problem for ICT;** **• there are no specific smart city instruments to measure progress; and** **• the economic crisis, citizen mistrust, expanding social need, aging population, transportation, and sustainability are all challenges that must be overcome before large-scale implementation of an activity can begin.**