Smart Safe Cities Technology Architecture to Assure Citizens' Happiness and Future Foresight to Achieve United Arab Emirates 100 Year Vision: Response Readiness, National Resilience and Future Accelerations

المدينة الآمنة الذكية والبنية التقنية اللازمة من أجل ضمان سعادة المواطنين لإستشراف المستقبل ولتحقيق الرؤية المؤوية لدولة الامارات العربية المتحدة: الجاهزية، الكوارث والأزمات والأحداث الكبرى، مسرعات المستقبل

by

MOHAMMAD KHALED AL HASSAN

A thesis submitted in fulfilment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY in COMPUTER SCIENCE
at
The British University in Dubai

Thesis Supervisor
Professor Khaled Shaalan

July 2017

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Date: 4 October 2017

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Abstract

Smart cities have emerged quite rapidly across the globe, be it the Masdar City in partuclar Abu Dhabi the capital of UAE, or in London, or Washington irrespective of the economy being developed, developing or emerging. This is primarily given the usefulness of such cities to enable transparency and efficiency within the city functions. In this research, the focus on the 'safety' aspect within smart cities, bringing forth the implementations requirement to transform a smart city into safety city for UAE. The aim of this research is to build a conceptual framework to enable the transformation of smart city into SSC, supporting citizen happiness, future accelerations and sharing future governments. Over the years, various models and theories were proposed to enable organizations into smart organizations, with one such being the institutional theory. The theory has been utilized extensively, in collaboration with other theories such as the Lewin's model of 3-stage or the barrier-driver model developed for e-governments. The case considered for this research was Abu Dhabi Government in UAE, with the research questions and objectives set out and achieved through the aid of a quantitative survey questionnaire. The sample selected for the research was public sector of Abu Dhabi. With a detailed review of the factors (internal and external) of smart cities and e-government (as the base), the study reviewed the benefits, barriers as well as risks that entail the transformation of smart cities to SSC within the context of UAE. Based on the findings of the data analysis, the conceptual framework developed was validated followed by a re-conceptualization to suit the Abu Dhabi Government. Recommendations were built to support the extension of the framework to smart city models in other countries to focus and build on the safety aspect, thus achieving citizen happiness and boost future development.

Keywords: ***Smart City, Smart Safe City, Smart City Technology Adoption, Citizen Happiness, Smart Government***

Abstract (Arabic)

لقد برزت المدن الذكية بسرعة كبيرة في جميع أنحاء العالم، سواء كانت مدينة مصدر الموجودة في العاصمة الحبيبة إمارة أبوظبي عاصمة دولة الإمارات العربية المتحدة، أو في لندن، أو واشنطن. وفي هذا البحث، قد تم التركيز على جانب "الأمن" لتحقيق المدينة الآمنة والذكية مع الوقوف على جميع المتطلبات لتحقيق التحول من المدينة الذكية إلى المدينة الآمنة والذكية.

والهدف من هذا البحث هو بناء إطار مفاهيمي لتمكين التحول من المدينة الذكية إلى مدينة آمنة وذكية مع البنية التقنية اللازمة من أجل الجاهزية للتعامل مع الكوارث والأزمات والأحداث الكبرى للتعافي منها من أجل ضمان سعادة المواطنين والعمل على مسرعات المستقبل لإستشراف المستقبل ولتحقيق الرؤية المؤوية لدولة الامارات العربية المتحدة.

على مر السنين، تم اقتراح نماذج ونظريات مختلفة لتمكين الجهات المختلفة من تحقيق التحول الرقمي والتطوير المؤسسي من خلال النظرية المؤسسية وقد استخدمت هذه النظرية على نطاق واسع، وبالتعاون مع نظريات أخرى مثل نموذج ليوين المكون من 3 مراحل أو نموذج حاجز السائق التي وضعت للحكومات الإلكترونية بحيث كانت الحالة التي تم بحثها في هذا البحث في سياق دولة الإمارات العربية المتحدة كونها تعتبر نموذجأ يحتذى به في شتى المجالات ومن الدول السباقة في بناء منظومة المدينة الآمنة، مع تحديد أسئلة وأهداف البحث وتحقيقها من خلال المقابلات مع الخبراء في هذا المجال بحيث تم استعراض مفصل لجميع العوامل الداخلية والخارجية للمدن الذكية والآمنة كقاعدة وقد تم استعراض الدراسة لجميع الفوائد والحواجز والمخاطر التي تنطوي على التحول الى المدن الذكية والإستفادة من خبرة دولة الإمارات العربية المتحدة. واستنادا إلى نتائج تحليل البيانات، تم التحقق من الاطار المفاهيمي الذي تم تطويره، وقد تم بناء توصيات لدعم توسيع نطاق الاطار بحيث يكون نموذج دولة الإمارات العربية المتحدة كمرجع لجميع المدن التي ترغب في تحقيق المدينة الآمنة والذكية كون دولة الإمارات سباقة في جميع الميادين والمحافل والتطور التقني. ومن خلال الوصول للمدينة الآمنة الذكية يتم تحقيق سعادة المواطنين وتعزيز التنمية المستقبلية والعمل على تسريع عجلة المستقبل واستشرافه.

Acknowledgements

Firstly, Thanks to God for guiding and supporting me in the completion of my PhD thesis.

I would like to express my sincere gratitude to my parents for their continuous support throughout my academic and professional career till where I have reached now. Where also I would like to thanks my sisters Linda and Lina as well.

My sincere thanks also goes to the United Arab Emirates where I was born and in which I have been given such a strong and respected education.

Thanks goes to the father and builder of the UAE Sheikh Zayed bin Sultan Al Nahyan and mercy upon him for building the foundations of the UAE, which has become the dream of people all across the world. Thanks also to H.H. Khalifa bin Zayed bin Sultan Al Nahyan the President of the, H.E Sheikh Mohammed bin Rashid Al Maktoum the Vice President and Prime Minister of UAE and H.E. Sheikh Mohammed bin Zayed bin Sultan Al-Nahyan the Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces for continuing the journey of UAE success which became model and reference for all the countries across the world.

I would like to thank my advisor Professor Khaled Shaalan for his continuous support of my PhD study and related research and for his patience, motivation, and immense knowledge. His guidance helped me in all aspects of my research and the writing of this thesis. I could not have imagined having a better advisor and mentor for my PhD study. I would also like to thank Professor Cornelius Ncube, for his insightful comments and encouragement, and for asking the hard questions which led me to widen my research from various perspectives.

My sincere thanks also goes my wife for her support on my PhD journey, and also my son Khaled and my daughter Ibtisam whom I hope will continue this journey of exploration and learning that I have started.

A special thanks goes to Mr. Harshul Joshi the Senior Vice President, Cyber Advisory Services and Mr. Alan J. White the Vice President of Cyber Advisory Services at DarkMatter for their outstanding support and family spirit.

Finally I would like to remember Chuck Dolejs who gave me the inspiration concept to base my thesis on crisis management to protect the nations of the world and to enable the development of smart safe cities.

I have decided to complete this thesis by December 2 which coincides with the National Day anniversary of the UAE and to highlight the need to spread safety and happiness across all nations.

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List of Abbreviations

AAA	:	Authentication, Authorisation and Accounting
ANPR	:	Automatic Number Plate Recognitions
API	:	Application programming interface
AST	:	Adaptive Structuration Theory
BRTS	:	Bus Rapid Transit/ Transport System
CCTV	:	Closed-circuit television
CEO	:	Chief Executive Officer
CM	:	Change management
CMON	:	Collaborative monitoring
CVC	:	Command Viewing Centres
DB	:	Database
DID	:	Digital Information Display
DLP	:	Digital Light Processing
DVR	:	Digital video recorder
ERM	:	Enterprise Risk Management.
G2B	:	Government and business
G2C	:	Government and citizen
G2E	:	Government and employee
GCC	:	Gulf Cooperation Council
GDP	:	Gross Domestic Product
GIS	:	Geographic Information System
G-KBP	:	Government Key Business Process
GUI	:	Graphical User Interface
ICT	:	Information communication and technology
IoT	:	Internet of Things
IP	:	Internet Protocol
IP	:	Internet Protocol
IS	:	Information Security
IT	:	Information Technology
ITS	:	Intelligent Transport Systems
KBP	:	Key Business Process
MCC	:	Monitoring and control centre
NLOS	:	non-line of sight

NVR	:	Network video recorder
OAN	:	Overlay Area Network
ONVIF	:	Open Network Video Interface Forum
P2PM	:	point-to-multipoint
PBA	:	Problem Based Analysis
PDCA	:	Plan-Do-Check-Act
PO	:	Purchase Order
PPP	:	Public private partnership
RQ	:	Research question
SDK	:	Software development kit
SSC	:	Smart Safe City
TPB	:	Theory of Planned Behaviour
TRA	:	Theory of reasoned action
TRAPB	:	Theory of Reasoned Action and Planned Behaviour
TRM	:	Triangular Relation Model
UAE	:	United Arab Emirates
UAT	:	User Acceptance Test
U-city	:	Ubiquitous city
UK	:	United Kingdom
VA	:	Video analytic
VMS	:	Video management software

1 INTRODUCTION

1.1 Research Background

In the 21st Century more and more people across the globe are living in urban centres than at any time in history. This extensive and universal urbanisation is also accelerating and it is estimated that by 2050 the vast majority of the world's population will live in urban environments (KPMG 2016). The United Arab Emirates (UAE) is no exception to this trend and the rate of urbanisation across the Emirates has been incredibly transformative in the last few decades. Indeed, the UAE is one of the most urbanised nations on earth with almost all of its citizens and expatriate residents residing in urban areas.

In order to address the challenges of such rapid and extreme urbanisation, as well as to capitalise on its benefits, the UAE government has targeted a number of strategic approaches. In February 2016, the Ministry of Cabinet Affairs changed its name to the Ministry of Cabinet Affairs and Future, in a formalisation of this forward vision of shaping future government (UAE Cabinet 2016). One of the central pillars to this new strategic direction of managing urbanisation in the UAE is that of establishing a truly smart and safe urban environment across the country.

As part of this national agenda, the government issued a manifesto designed to pursue a "***Safe Public and Fair Judiciary***" (UAE Cabinet 2016), which is intended to regulate and support the establishment and governance of truly safe and smart cities across the UAE.

In addition, the individual emirates also have their own specific economic and development agendas, which are typically formulated within the context of formal published plans. In Abu Dhabi, the capital of the UAE, the government has adopted the ***Abu Dhabi Economic Vision 2030***, which defines the key economic and development milestones the government wishes to achieve by 2030. This vision is based on diversifying the economy away from reliance on oil and gas, establishing an efficient and modern urban landscape and reinforcing effective government.

In order to achieve the Economic Vision 2030, the Abu Dhabi government has adopted a current 5-year plan that was designed using the input of 65 government entities in the emirate through extensive workshops. The plan identifies 25 goals distributed across five strategically important sectors, which will ensure Abu Dhabi's continued growth and success. One of these sectors is defined as "Security, Justice and Safety" (Abu Dhabi Government 2016). All of the remaining 24 sectors and 83 associated programmes intersect with the Security, Justice and Safety sector, which can be described as acting as a horizontal lane through the other 24 vertical agendas, providing regulatory guidance on how these other sectors are defined and operate (Abu Dhabi Government 2016). A series of Key Performance Indicators (KPIs) monitor progress across the schemes and are used to redirect tactics to achieve the overall programme objectives (Abu Dhabi Government 2016).

In 2016, the UAE cabinet stressed the importance of ensuring a happy community throughout the country, which it published in a positivity charter, that created a CEO and Council for Happiness in all Federal Government Entities (UAE Cabinet 2016). This initiative included officially setting up CEO's for Happiness in all UAE government entities in order to entrench the notion and tangible approach to achieving a positive environment for all employees across the federal employment sector.

Directed by the Positivity Charter, the Economic Vision 2030 and the Safe Public and Fair Judiciary-linked Security, Justice and Safety directive, the current Abu Dhabi 5-year Plan seeks to advance the safe city concept. In 1970, Sheikh Khalifa bin Zayed Al Nahyan, ruler of Abu Dhabi and President of the UAE, said "***My country will become one of the most prestigious countries in culture and prosperity***" (Our Abu Dhabi 2015), and the current set of initiatives to establish safe and smart urban landscapes across the UAE aspire to further this vision.

This research examines the strategy and tactics used to support this national vision of achieving truly smart and safe cities across the UAE. The government and private-sector stakeholders have been working closely for some time now towards achieving this vision. Likewise, the government and police force in Dubai has also been pursuing a very similar set of programmes aimed at supporting the achievement of the national vision for future urbanisation. By exploring the associated body of literature, drawing upon a comparative analysis between smart and safe city initiatives in Abu Dhabi and Dubai.

The purpose of this research is to show how technology is a vital component in any initiative to establish a smart and safe city. This research will also explore how factors of public safety are absolutely central to the fulfilment of any smart city, wherein the two concepts of being smart and safe are inseparable. In order to achieve the safety and intelligence factors required for a successful smart city, the right mix of technologies is essential for the proper set up and establishment of a smart and safe city. As noted above, the UAE, at the federal government level, has adopted a national agenda that includes the "Safe Public and Fair Judiciary" concept. Furthermore, the government has also defined the concepts of future government and future accelerations as central elements of this national agenda, and both are based on technology.

In addition, the government also defined its happiness strategy, which this study explores to propose a conceptual framework to assess governmental entities participating in smart city and safe city initiatives from the perspective of technology adoptions, how will these achieve happiness for citizens, and how a smart and safe city will help to shape future governments and future accelerations.

Initiatives for the smart city have been explored in many research studies. Scholars have investigated how best to provision for an insight about how a smart and safe city framework can be implemented, in order to impact future acceleration, as well as for reshaping the government structural hierarchy and influencing citizens' happiness. However, these studies have failed to establish a consensus on this topic.

This study is conducted to examine the role of technology adoption required for the endorsement of a safe and smart city framework, scrutinising the significance of the technological adoptions in the smart and safe city framework, and for enacting rational standpoints about the most effective strategies which can incorporate the framework in the real-world context.

Respective academic papers have indicated the substantiality of citizen happiness on the specifics of technological adoptions. The smart and safe city framework is the optimal solution for managing people's happiness and upgrading the benchmark of the state (Ranjit Rajan 2016). With such new adoptions, the citizens are able to access numerous advantages, such as efficiency and productivity improvements, which are an integral part of success. The smart and safe city framework is equipped with the technological alterations which can boost the competency of the work and can secure the success of citizens in managing their work proficiently (S. 2012).

The collateral advantage of implementing the smart and safe city framework is found in amplifying the notion of transparent communication with the citizen, which can assist in developing democracy and building a strong relationship between the government and citizens (Silcock 2000). The concepts of happiness and future government are not studied in the body of literature because of the abstract and anticipated concepts, which this study addresses.

The study will also incorporate the point that the UAE is one of the few states that has opted for a technical approach to establishing safe and smart cities by establishing this objective in a national agenda (Cocchia 2014). The smartness of cities is inter-dependent with the technological advancements that are happening within and outside of the city; therefore, the role of government in terms of technology based future accelerations will be critically analysed in this research (Hall 2014).

By adopting the implementation of the smart and safe city framework, future government is expected to be transparent and democratic (Cocchia 2014). This research will also canvass how people's happiness and reconstruction of a future government can be achieved by creating a platform for the citizens to enjoy better delivery of government services. With time, the developed and developing cities/countries globally are struggling to transform themselves into future cities or smart cities. With the plans to rapidly transform into smart cities, Eastern Europe, the Middle East, Africa, Asia and particularly the Gulf states are functioning to accomplish the implementation of the smart and safe city framework, though each case offers a unique approach (Sutton 2016).

The government must investigate the issues that might emerge in the near future and also the anticipations of the esteemed citizens of the city. The imagined city can only be developed with the aid of optimum leadership, commitment to the vision of the smart and safe city framework and the assistance of citizens through immense support (Kokkala & Airaksinen 2015). For the establishment of more imperative occupant affiliation, the government should inform the citizens about the future city's goals and changes (Komninos 2009).

1.2 Defining a smart and safe city

Globally, urbanisation is taking place at a very rapid pace. According to PWC, 40% of the world's population will reside in urban environments by 2030, up from 31% in 2015 (PWC, 2015). Cities are also seen as drivers of economic growth, with over 60% of global Gross Domestic Product (GDP) currently generated from urban centres, which is forecast to grow to around 75% by 2030. This higher rate of productivity as opposed to the rural environment is of particular relevance to emerging economies that are also home to larger rural population rates than more mature economies. In contrast to this presumed prosperity, however, urban centres are actually heavily saturated and in many cases drivers of low quality of life as a result of inadequate infrastructure, governance and systems. Hence, in the face of growing urbanisation and with the aspiration for bettering the living standards of an ever-increasing mass of people, the concept of smart cities is perceived as the solution.

A smart city is an urban space designed and modified to a network of Information Communication and Technology (ICT) systems to govern the cityscape and achieve effective public safety as well as prosperity (Musa, 2015). The departments and systems typically included in the smart city framework can include local government agencies, schools, transportation, power plants, water supply networks, hospitals, law enforcement and councils. Within a smart city, the ICT architecture allows governments and citizens to communicate directly and in real time, as well as allowing governments and in some cases citizens and other agents, to interact seamlessly with the city's infrastructure. The ability to effectively use information to address inefficiencies and to ensure the smooth operation of the city's infrastructure through the use of data acquisition and management is a critical factor in defining a smart city (Nicos, 2013).

By achieving this flow of information and leveraging it to reduce inefficiencies in the cityscape, it can be argued that the smart city is therefore better prepared to manage the challenges of urbanisation than a 'transaction city', which lacks the technology infrastructure to acquire and process data on the same scale. Leading examples of smart cities include Milton Keynes (UK), Amsterdam (Netherlands), Barcelona (Spain), Madrid (Spain), Stockholm (Sweden), and Southampton (UK), though this is not an exhaustive list (Paskaleva, 2009).

Smart cities need to be conceived, designed and implemented using very detailed and rigorous processes. The robustness of these projects in dealing with the constantly changing urban landscape, as well as the exponential growth in resource demands, is paramount and particularly relevant in the conceptual phase. The sustainability of such smart cities is also crucial to their success, as once a city is modified into the smart landscape or built from scratch as a smart city, changing its infrastructure and dynamics will be extremely costly and difficult (Deakin, 2013).

The characteristics of a smart city include themes that provide solutions to a range of urban problems using IS / IT technologies that are connected in a framework of urban infrastructure. The goal of such infrastructure is to revitalise existing urban structures, create a more sustainable and enhanced urban landscape that improves qualify of life and provides greater and more sustainable economic prospects. Some examples of this type of connected infrastructure, or technology hardware, might include road traffic sensing and incident management systems, smart public services (such as e-accessible municipal authorities), smart and intelligent lighting, smart public parking systems and environment / infra-sensing systems, amongst others.

In order to deliver these smart systems, transforming a city requires an approach that adopts the organic integration of IT, based on a clearly defined framework to implement a clear vision of advanced urbanisation, which achieves social equitability and sustainable economic prosperity (ASOCCHAM, 2016). Essentially, this process can arguably only be successful when the right mix of technologies are leveraged for optimum resource consumption and maximised improvements to the standard of living of the smart city's residents.

There are a number of key principles in planning a smart city, which dictate that a truly smart city must empower its residents to make informed decisions about their city by leveraging data, resource planning and efficient processes. Smart cities should also offer world-class educational and learning environments to foster skills and human resource talent. In addition, the smart city should promote private sector investment and active partnerships between government (public sector) entities and private enterprise. Smart cities also encourage the best use of physical space and stimulate the evolution of architectural solutions to urban requirements in a way that is both functional and aesthetic. Such cities, must also be inclusive of all residents, for instance, in terms of disability access, tailoring facilities to the mix of uses for all demographic groups as well as lifestyle choices. Finally, a truly smart city should offer extensive channels between residents and authorities (Huawei, 2016).

Establishing the above in a coherent and effective framework requires a certain critical mass of urban infrastructure, financing, operations and governance systems that can deliver the smart city ecosystem. This ecosystem is comprised of a number of complex and interlinking components that include economic character, utilities, transport system, residential features, safety systems, gateways (e.g., airports, sea ports, rail and road links), ICT and local governance bodies. Underpinning this are certain enablers that must be present and functional, which include audits, taxation, regulations, analytics, municipal networks, integration platforms, cyber security, sensors and hardware, utility tunnels, and utility control centres.

1.3 Statement of the Problem

Rapid urbanisation brings with it many economic, social and political benefits; however, it also results in increasing pressures on infrastructure, governance and resources. These pressures result in increased safety and security risks, including growth in crime rates, road accidents, terrorism, extremism, public disorder, critical incidents, natural and artificial disasters, and cyber attacks, amongst others. Governments need to invest now in public safety mechanisms to address these risks if they are to establish smart and safe cities for future generations.

Establishing public safety in the smart and safe city context is about preventing, reducing and solving crimes efficiently, as well as preventing the loss of life, property and citizen well-being. Ultimately, it is about preventing the disruption to life, which requires proper implementation of public safety initiatives combined with the technology architecture required to achieve such objectives efficiently. This technology architecture should be capable of detecting, preventing, responding to and recovering from the unique risks presented by rapid urbanisation.

Specifically, the unique technology challenges presented by rapid urbanisation include a lack of onsite surveillance, slow emergency response and inefficient inter-department collaboration. In addition, the existing technology and organisational structures in place amongst public safety departments present their own challenges to achieving an efficient technology architecture across the cityscape. For example, these internal challenges include multiple units or agencies, different devices and networks across these agencies, a lack of awareness across departments of technology requirements and solutions and finally public network outages. In addition, there a number of external obstacles to achieving a smart and safe city, which include public abuse of technology-based services, such as prank and repeat calls, social media that can often conflict with the official governance architecture and complicate the flow of accurate information as well as government responses and situation management. In addition, there is the external risk of one incident affecting multiple scenes, which can be further complicated by congestion of physical infrastructure (roads, buildings, utilities etc.) by the process of rapid urbanisation.

Although urbanisation is a well-understood phenomenon, defining the optimum technology architecture to address the safety risks it presents is a very difficult task to complete. There is a clear gap in the existing literature to guide governments and relevant stakeholders on how to develop frameworks to employ in this process.

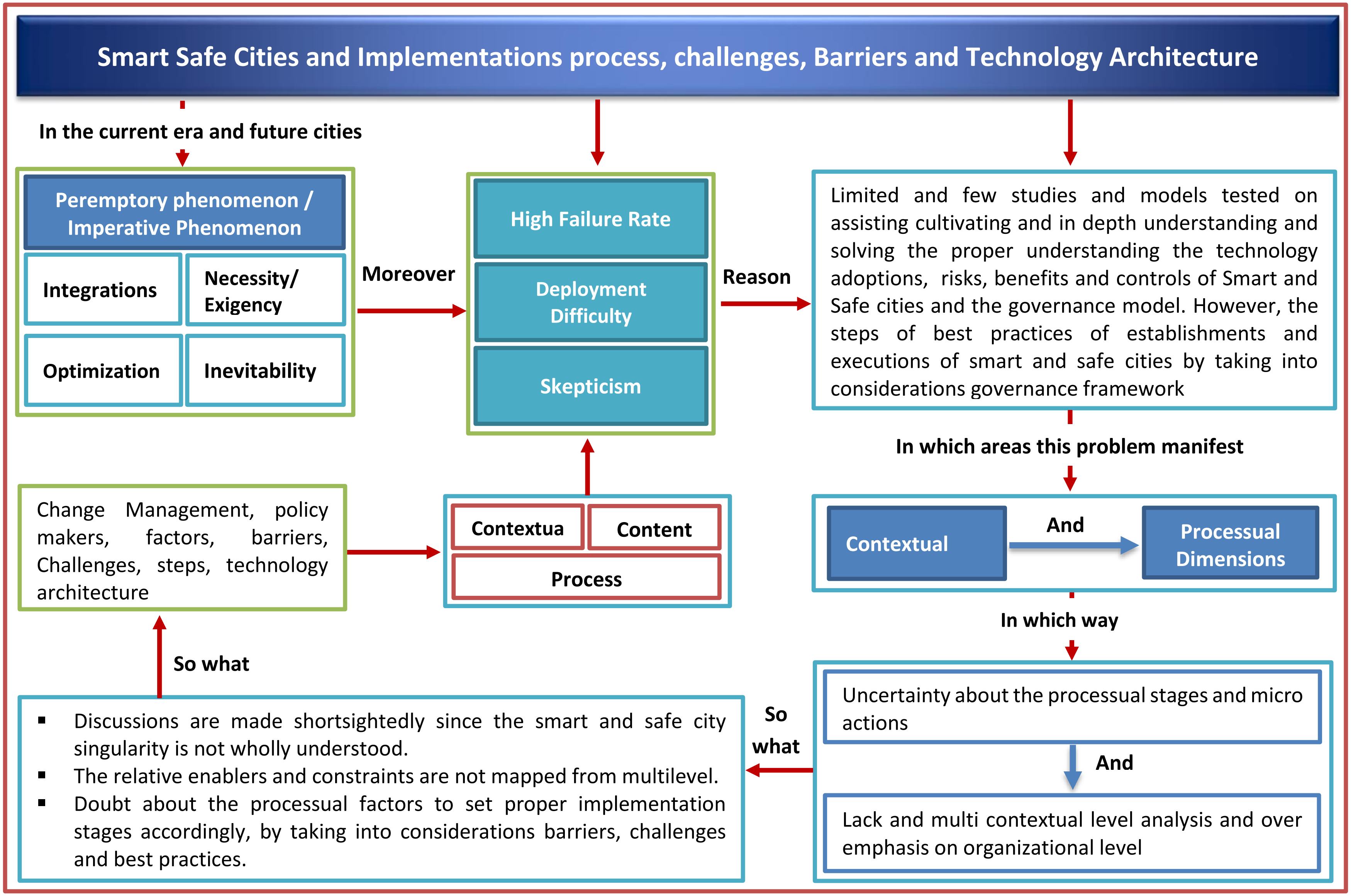

Figure 1-1: Roadmap Identification of the Problem Statement

1.4 Purpose of the study

The purpose of the study undertaken is to render a comprehensive view of the successful endorsement of the SSC framework while being economically competitive for future accelerations, compelling citizen happiness and reshaping government structure. The body of literature advocates that the familiarity with these notions requires measuring the failure or success of such cities but the literature only reflects on a single component of the research topic (Hajer 2014). The settings required to accomplish these goals may require modifications with respect to the context of the SSC framework. Accordingly, the initiatives required to attain such objectives need to be aligned with the main drivers and facets of the SSC framework (Campbell 2009). To enrich the proceedings of framing smart and safe city initiatives, citizen happiness, reshaping the structure of government and the future accelerations, this study will help inform governments on how best to establish the smart and safe city development framework. The concept of the smart and safe city was developed after the establishment of the digital city in 1994 (Kogan 2014). The smart city is equipped with communication networks and smartphones to make the city efficient and competent. This study is conducted to scrutinise the concept and determinants of the smart and safe city. However, the former research conducted to explore the concept of the smart and safe city have only focused on the singular perspective of the research topic, which is either future accelerations or e-government (Kumar 2014). Thus, it provides incomplete knowledge regarding citizen happiness, the correlation among these determinants and the core research topic, which is the smart and safe city framework. Citizen happiness and future accelerations are the productive determinants and outcomes of endorsing the SSC (Borja 2007). The technological adoptions can secure the reconstruction of the government mechanism to satisfy the aforementioned two determinants and will also provide an intellectual underpinning to the study. This study provides the foundation for academic practitioners, whereby the research analyses the determinants and its consequences on the SSC framework, and bridges the literature gap about the interdependency of public safety, future accelerations, technological adoptions and citizen happiness. The study will also render information about the implications and recommendations for the SSC framework. The models that expound the smart and safe city discipline of future government, citizen happiness, and future accelerations remain under development. The objective of this study is to provide recommendations for establishing the foundations on how the SSC framework can be integrated with technology infrastructure in order to best secure future accelerations and citizen happiness.

1.5 Significance of the Study

Furthermore, considering the technological revolution in the contemporary world, the Information Technology (IT) demands are increasing globally. The smart and safe city faces technological barriers during its implementation, but developments in technology can also provide solutions; for instance, IT can help in boosting efficiency and productivity, this study is relevant because it provides a conceptual framework for developing a smart and safe city and the influence of this concept on the happiness of citizens, future accelerations and e-government (Cocchia 2014).

This research must be carried out to determine the most realistic and optimal framework and requirements in the endorsement of the smart and safe city project. The objectives of the research are designed to aid in the development of the rationale and providing an objective result. The UAE is struggling to introduce and integrate IT solutions in local firms and in using it to raise their economic status (Hall 2014). The research will analytically evaluate the framework of the IT implementation of the project to develop a consensus and anticipate benefits which will help the city in transforming the legislative bodies and introduce e-government. Introducing e-government has many benefits, perhaps chief among them is the concept of transparent communication and democracy (taking the citizen's point of view into consideration) (Kogan 2014).

The study will scrutinise the influences and benefactors of implementing the smart and safe city project in the UAE and how best to launch it. It will also critically analyse the financial resources and other IT requirements for the proper execution of this project. Additionally, during the implementation there will be an enormous amount of advantages to the government, and it will also elaborate the role of government before, throughout and after the process. The study focuses on three notions, which are how this IT revolution is going to help and transform the government structure, future accelerations and influence people's happiness. Thus, the study will create new knowledge and address the literature gap, with original and unique research that has not been conducted to date and which has significant practical, as well as theoretical, application. The main significant of this study is:

Cities around the world are thinking extensively either to establish Smart Safe City or enhance their current implementations of the public safety. The lack of attempted studies for establishing Smart Safe City and enhancing the public safety for readiness on any national resilience to assure citizens happiness, future accelerations and shaping future is the study significance.

This is an indicator to outspread the exploration and the investigations on the domain of smart cities on specific smart safe cities to support the public safety. So the research is motivating due to the uniqueness and this uniqueness comes from the (**twelve points**) summarised as the following:

1. The Safe City concept has not investigated with specific respect to Smart City.
2. The technology architecture of SSC has not examined on previous researches.
3. The role of SSC in response to national resilience, citizen happiness, future accelerations and shaping future has not studded yet.
4. Safe Cities and Smart Cities were not important and much adoptions by many governments around the world as today.
5. On previous researches; SSC were not examined along with the technology architecture.
6. The adoptions and implementations stage of SSC along with technology architecture has not examined as case studies from government pioneers on smart city, safe city and technology adoptions and confirmed by expert views to see how SSC will enhance the level of the public safety, response to national resilience, citizen happiness, future accelerations and shaping future.
7. Benefits, barriers and risk of founding SSC with the architected technology to support public safety has not tested yet.
8. Supporting public safety, citizen happiness, future accelerations and shaping future are achieved from SSC which has not considered as research.
9. All the researches related to Smart City or Safe City are theoretical and based on the scholars view were they not examined as case study to see the best practices of executions.
10. Technology is the backbone for any successful SSC implementation which require closer look by research.
11. Capitalizing the public safety, readiness for any national resilience, citizen happiness, future accelerations and shaping future government are the contributions of this research.
12. The modern cities around the world are increasing collectively, where the framework for Smart and Safe City adoption, implementation and technology architecture is required to minimize the failure rate by getting the best practices from mature and pioneer country such as UAE.

1.6 Research gaps

Rapid urbanisation and growth of the population have posed threats and problems to the areas that offer opportunities and transforming a city into a smart and safe city is a comprehensive response to such challenges (Komninos 2013). However, this has been considered in very few academic studies. The gap has been increasing and this research attempts to bridge this gap related to smart and safe cities and their growing variables. This paper seeks to propose a critical framework that could help to understand the concept of the smart and safe city and its influence on citizen happiness, future acceleration and e-government. Based upon the analysis of various existing research the research will identify the critical factors of a smart and safe city based upon technological advancements, the policy context, natural environment, built infrastructure, economy and people and communities (Neirotti 2014). The integrative framework is based upon the factors that the government are using and developing in order to establish truly smart and safe cities across the UAE (Chourabi et al. 2012).

This research will suggest an agenda, implications and recommendations for academic practitioners to conduct further studies and develop practical outlines to achieve the smart and safe city framework. One of the vital determinants for the integration of the smart and safe city framework is financial and monetary circumstances (KPMG 2015). Global finance is now integrated across economies, linking cities and countries in a way that inevitably means change in one will result in an impact on others (Ercoskun 2015).

The reason behind this can be found in how smart and safe cities attract global business, which results in these cities becoming hubs in the global economy. In turn, this economic and commercial alignment with the global political-economy, results in these cities being able to act with freedom and power at both the local and international level (TeMA 2014).

Smart cities profoundly depend upon the quality and availability of ICT infrastructure and undoubtedly it can be mentioned that the smart networks and technological advancements will play an essential role in turning the smart cities project into realities in areas such as the UAE.

With so little literature on the research topic this research will not only try to enrich the academic practitioners on this research but will also emphasize the above-mentioned factors. These include government initiatives, dependence upon different factors and the implementations of technological advancements critically with respect to the state, culture and conditions of the UAE, to transform it into a landscape of smart and safe cities (Cocchia 2014).

The research gaps have significantly affected the research methodology as a result of the limited information available; as such the study had to face numerous barriers and has no former threshold to compare the accuracy of the thesis with.

1.7 Research aim

The SSC implementations stages, mechanisms and required technologies for adoptions are supreme in the growth of SSC. This research is based on the:

(1) Examine the implementations phases of the SSC covering the benefits, risks and barriers.

(2) The required technologies to be adopted by government entities participating on SSC along with the architecture of the adopted technologies to avoid any failure.

(3) The complexity technology integrations within the government and among the governmental entities for the purpose of SSC (Kamal and Alsudairi, 2009; Klievink and Janssen, 2008).

Based on the above points, this research is aiming to:

> ***"To propose a conceptual framework for Smart Safe City implementations and technology architecture on the government entities responsible for public safety for safety for readiness on any national resilience, Citizen's happiness, future accelerations and shaping future".***

This proposed framework will provide a unique contribution to the body of knowledge and practice exploring SSC initiatives in governmental agencies, in addition to the implications and recommendations for theoretical and practical applications and recommendations for future research.

1.8 Research Objectives

In order to attain the research aim; examine the outspread amount SSC implementations, the required technology to be adopted and how to be architected to achieve citizen happiness, future accelerations and shaping future governments. In addition to that; socio-technical framework necessity underlining of various influencing factors and relevant to SSC participation is important. Albeit; due to the new approach there is an absence of established framework in the literature and been verified. Yet, there is a necessity to study, examine and explain them in the context of SSC. SSC officials will be supported by a framework for their strategic planning and decision-making processes regarding involvement in SSC establishments. Furthermore, this research attempts to:

(1) The implementations phase of SSC and segments of participation.

(2) Identify the required technologies and the architecture for the success of SSC as well as identify the interrelationships among them.

This study can be shortened and grounded as the following objectives:

Objective 1: Critically review the SSC and the approach of technology architecture for the success of the SSC, readiness to any national resilience, achieving citizen's happiness, future accelerations and the shaping of future government.

Objective 2: Explore the driving factors behind technology adoption by governmental agencies in the context of the SSC, by defining and categorising their advantages, underlying requirements and the key drivers behind them.

Objective 3: Critically assess and analyse the stages at which governmental agencies choose IT through participating in SSC initiatives.

Objective 4: Reveal the methods, stages and influential aspects of technology adoption and architecture, such as the impacts of and alignment with SSC in governmental agencies.

Objective 5: Develop a conceptual framework for SSC implementations along with technology architecture to be adopted by governmental agencies participating on SSC.

Objective 6: Analyse the data collected from different case studies and field studies in order to test the developed conceptual framework.

Objective 7: Provide a unique contribution to the domain of the smart safe city in governmental authorities, as well as implications of developments for the theory and practice and future research directions.

1.9 Primary research questions

Research Questions (RQ's) been designed to cover the study aspects to achieve SSC based on the background and the gap on literature by highlight what is the SSC and needs of the governments to have SSC. Nature of the technology and the architecture of SSC is another question. Strategical actions to be adopted to overcome the challenges and barriers of establishing SSC. In this way; the gaps will be filled of having SSC implementations and technology architecture, meeting the study aim and objectives. Figure 1-2 presents how RQ's were designed, in order to have proper study for SSC from all aspects; Sub RQ were emerged to some of the RQ to cover ***citizen's happiness, future foresight, future accelerations and strategic actions to be adopted*** as per the following:

RQ1: What is a Smart Safe City?

RQ2: Why does government around the world needs to adopt Smart Safe City?

RQ2.1: How Smart Safe City will assure the readiness to response for any national resilience?

RQ2.2: How Smart Safe City will enhance citizen's happiness?

RQ2.3: How Smart Safe City will support future foresight?

RQ2.4: How Smart Safe City will help in future accelerations?

RQ3: What is the type and nature of the technology to be adopted for smart safe city?

RQ3.1: What is the architecture of smart safe city in terms of technology?

RQ4: What are the strategic actions to be adopted by governments participating in Smart Safe City to have maturity on the safety and security aspects?

RQ4.1: What are the roles played by the stakeholders in successful smart safe city?

RQ5: What are the emerging challenges for effective smart safe city implementation?

RQ6: What are the emerging barriers for effective smart safe city implementation?

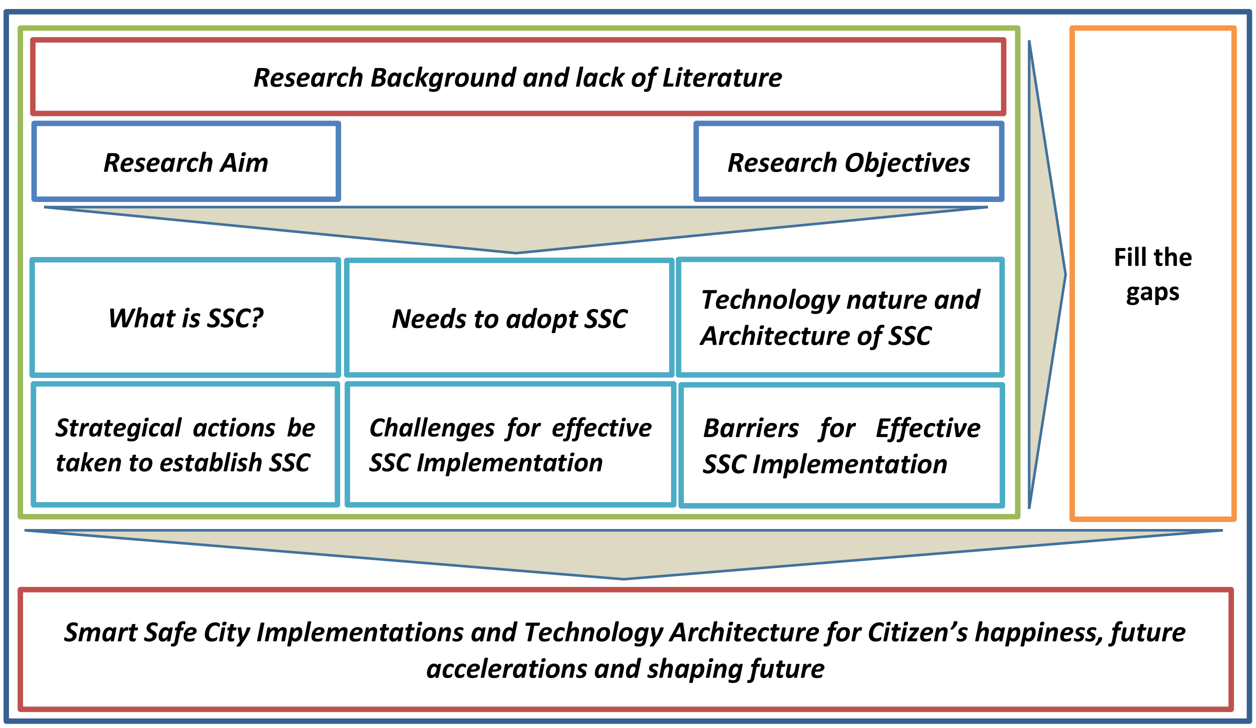

Figure 1-2: Research Questions Design and Structure

1.10 Research Outline

As per the proposed methodology proposed by Phillips and Pugh (2010); the structure contains four elements as structure according to the following table:

Thesis Elements	*Chapter Structure*
Background Theory	**Chapter 1**: Introduction
	Chapter 2: Literature Review
Focal Theory	**Chapter 3**: Conceptual Framework
Data Theory	**Chapter 4**: Methodology
	Chapter 5: Data Analysis
	Chapter 6: Discussion and Framework Revisions
Contribution	**Chapter 7**: Research Conclusions, Contributions and Future Work

Table 1-1 Thesis Elements

- ***Chapter 1: Introduction***

It an introduction to the research issues addressed in this thesis by focusing on Smart Safe city implementations along with technology architecture for citizen happiness and shaping future governments. The problem statement, aim, objectives and research questions been identified and addressed to be answered through the research.

- ***Chapter 2: Literature Review***

It explores the existing body of literature related to the smart and safe city framework. The study is supported by the theories related to the implementation of the smart and safe city framework and analysing the appropriate lens to study.

- ***Chapter 3: Conceptual Framework***

Provides an overview of the conceptual framework, and will continue the conclusion of the literature review and provide a conceptual brainstorming for the further study of the research topic. This chapter tends to explain the theoretical aspects of the topic such as happiness of the citizens, future accelerations and reshaping of government under the light of well-developed and literary theories. It will also provide the underpinning for the research methodology that is which approach will be used by the practitioner to elaborate the research profoundly.

- ***Chapter 4: Methodology***

Following the background of the research topic provided in the former chapter, chapter 4 provides the research methodology approach which has been adopted to attain the aims and objectives of this study. This section also gives an overview of the implications and limitations of major paradigms of the research. The reasons for adopting the respective research approach will be discussed. The chapter defines the pros and cons of the qualitative method used within the research. The inclusion and exclusion criteria of the research will also be elaborated upon. The last part of this chapter defines the research design, methods of data collection and analysis.

- ***Chapter 5: Analysis and finding of the research***

Chapter 5 analyses the findings of the areas chosen enclosing the importance of smart and safe city for the happiness of the people, future accelerations and role of future government. The objectives of chapter 5 are (a) analysing the importance of the smart and safe city (b) exploring the factors involved in the future accelerations and (c) methods of shaping the future government. With the help of these explorations, the study will be able to highlight the gaps in the knowledge and solutions for predefined concerns in transforming a 'conventional' city into a truly smart and safe city.

- ***Chapter 6: Discussions and Revisiting of the Conceptual Framework***

Chapter 6 presents the revisiting of the conceptual framework, presenting a detailed review of the findings and discussion. Post review of the lessons learnt, the revised conceptual framework was presented along with a frame reference, discussing the new characteristics and the contribution made by this research.

- ***Chapter 7: Study Conclusion, Limitations, Contributions and Future Research***

Chapter 7 is the final section in this study and provides a round-up of the research drawing conclusions from the considerations and discussions made in the previous chapters. The findings of the research will be summed up to show how the study contributes to the research as well as to practical application. Furthermore, a number of recommendations regarding the improvement in the practices of establishing a smart and safe city are provided. Finally, this chapter will list the limitations faced during this study in detail.

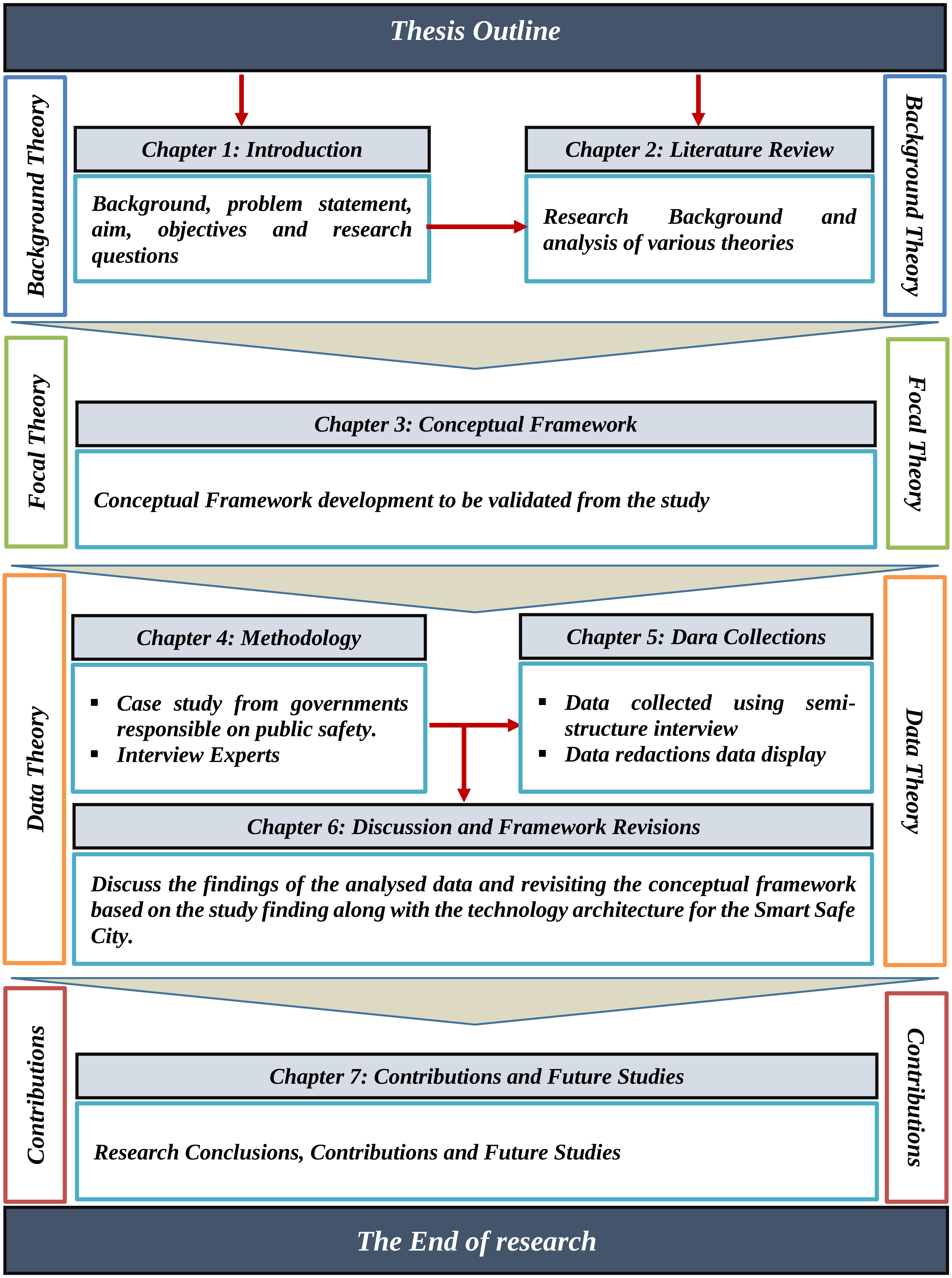

Figure 1-3: Thesis Outline

2 LITERATURE REVIEW

2.1 Introduction

Growth and urbanization has led to an increase in population reflecting on the need for to meet basic amenities. Cities are marred by deteriorating infrastructure and associated problems such as air and noise pollution, scarcity of resources, traffic congestion and various other issues. To meet the issues of the growing population, governments emerged as e-governments and later, as smart government. However, the transformation of the government or in the direct sense, the city, in order to combat the above problems needs a better and deeper understanding of the smart city concept. A smart city will be able to implement solutions and build an infrastructure that has the ability to undertake the mounting pressure of urbanization. However, with the focus of the smart city model on integrating of various elements of the government into one, safety has been identified as the missing link. This chapter aims to first identify and define what a smart city is, what its requirements are and what factors drive a smart city. Further review of literature helps to identify what factors act as barriers while implementing the SSC concept while analysing the importance of 'safety' in being smart. This chapter also delves into the various smart city models, identifying their strengths and weaknesses and also the limitations in adapting the proposed models. These models, while present a practical solution, are solely based on developed countries and therefore adopting these models can pose problems. Based on the literature at hand, the researcher aims to build a conceptual framework. The researcher has dissected the issues into elaborative thematic references. Based on this, it will be possible to gauge various factors such as obstacles, risks and benefits of implementing SSC concept in developed countries. This proposed framework will constitute of various factors which includes the implementation factors, characteristics, actors and activities, and at last, the stages of development along with required technology for the architecture of the conceptual framework.

2.2 Theoretical Framework of Safe City

2.2.1 Definitional Issues of SSC

The concept of smart city can be related to the growth in urbanization, causing a dramatic rise in the need for basic amenities (Dameri, 2013). At present, a total of 54% of the world's population is dwelling in urban areas and an additional 2.5 billion people will be migrating to cities by 2050, creating more challenges for the government (Curry, 2016). The infrastructure is underdeveloped to accommodate the basic needs of the rising population putting a strain on the city resources. The shift from rural to primarily urban areas is projected to continue for many more decades. In cities, there are various issues that emerge with time be it difficulty in human health concerns, traffic congestion, waste management, air and water pollution, scarcity or resources and inadequate and deteriorating infrastructure (Borja, 2007). In addition to these technical, physical, and material problems, urbanization has also led to other social and organizational problems such as diversified stake holders who are highly interdependent (Chourabi, Nan and Walker, 2012). Grounded on the concept of ensuring habitable and functional conditions for a rapidly growing urban population is the smart city concept, which requires a better and deeper understanding. The urgency of the matter has triggered many cities across the world to understand the concept better and to find smarter ways to manage the issues. Those cities which are able to implement solutions and formulate infrastructure, are increasingly termed as 'smart cities' (Chourabi, Nan and Walker, 2012). At the core, a smart city that reflects closely on the factor 'safety' is rather called as smart 'safe' city (Belanche et al., 2016). When it comes to defining smart cities, there are various definitions that exist with different variants. The main aim of a smart city is to provide digital means to support social needs in daily transactions, to make citizens adept to the idea of information society and to gather important information from the citizens as well as public departments to aid the city in its sustainable growth (Chourabi et al., 2012; Albino et al., 2015). Above all these factors, a smart city provides an administration that is citizen-centric wherein corruption and time-consuming bureaucratic procedures are excluded completely (Chourabi et al., 2012; Giffinger and Pichler-Milanović, 2007). Many different definitions, frameworks and implementations of smart city have been proposed by researchers (Giffinger et al., 2007; Bowerman et al., 2000; Harrison et al., 2010; Hanter et al., 2009; Alawadhi et al., 2012; Marsal-Llacuna et al., 2014; Renata et al., 2015). As seen in the table 2.1, various definitions are presented for a smart city. This includes the widely accepted definition provided by Giffinger et al (2007) focussing on the six elements that govern a smart city model. The central theme of the reviewed literature on the definition of a smart city revolved around formulating a strategy wherein the problems caused by urban growth can be mitigated by making use of information and communication technology to improve the quality of life of the citizens in the smart cities. A review of the definitions also provides the needed background on the factors that contribute towards the development of a smart city, as discussed in the next section.

Definition	Focus	Source
"A smart city is the one where the citizens and the businesses are continuously striving to improve their natural, built and cultural environments at the regional as well as neighbourhood level while working in a manner that always supports the goal of sustainable development globally."	Smart Government Sustainable Development	Haughton *et al*. (1994)
"A smart city is the one wherein the community has decided and agreed upon a set of sustainability principles which they pursue. These principles mainly provide the citizens with a good quality of life in a good city with affordable housing, health care, education and transportation."	Sustainability Smart Citizens Affordable Amenities Smart Community	Munier (2007)
"A city is termed as a smart city when it performs well in the following 6 characteristics, and is built on the 'smart' combination of activities of the self-reliant, aware citizens and endowments, These characteristics include, 1) Mobility, 2) Economy, 3) People, 4) Environment, 5) Governance, 6) Living."	Smart Mobility Smart Economy Smart People Smart Environment Smart Governance Smart Living	Giffinger *et al*. (2007)
"A smart city is the integration of ICT in a city government to enable smart citizen's access to various amenities such as logistics and infrastructure, innovative transport and efficient energy systems in everyday urban life."	Smart Government Innovation Urban Development	Lombardi (2011)
A sustainable city is defined as "one that has put in place action plans and policies that aim to ensure adequate resource availability and (re)utilization, social comfort and equity and economic development, and prosperity for future generations".	Smart Strategy Smart Resource Smart Management Smart Economic Development	Jingzhu (2011)
"A smart city is defined as a city wherein there is a merger of ICT with traditional infrastructure which is co-ordinated as well as integrated by making use of technology."	Smart Technology	Batty *et al*. (2012)

Definition	***Focus***	***Source***
"It is defined as a smart usage and consumption of energy, water and other resources with consideration on equipping people a high quality of life, achieving prosperity of the city with a sustainable foundation."	Smart Utilities Management	Dixon (2012)
	Smart Life	
	Sustainability	
"We believe a city to be smart when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance."	Smart Investment	Meijer *et al*. (2013)
	Sustainability	
	Smart Management	
	Smart Resources	
	Smart Resources Management	
"Smart cities converge the way information, data, information technology are used to improve the life of the citizens, optimize infrastructure to build collaboration amongst actors, and most importantly, build innovation-based business models."	Smart Technology	Marsal-Llacuna et al. (2014)
	Smart Infrastructure	
	Smart Communication	
	Innovation	
"Smart cities aims to improve the quality of life of the citizens while leveraging the application of innovation and modern technologies to solve urbanization related issues."	Smart Technology	Renata et al., (2015)
	Smart Innovation	
	Urbanization	

Table 2-1: Definitions of Smart City

Post review of the various definitions of smart cities, it is found that a smart city is basically an extension of a smart government that connects various entities (departments) of the government to function in a smart way. In the past, smart city was attributed to specific elements such as smart development (Haughton et al., 1994) or smart mobility (Giffinger et al., 2007). However, today it is a represented of smart services needed to improve the lives of the people of the city.

2.2.2 Factors Driving Smart City

The view of a smart city, in literature, is rather diversified with different researchers reviewing it under different requirements. As per international literature, a smart city is identified as a digital city (Ishida, 2002), IT City (Dameri and Cocchia, 2013), knowledge city (Yigitcanlar et al., 2008; Ergazakis et al., 2004) and many other names. These labels can be closely categorized into 3 dimensions; technology (hardware and software infrastructure), institution (policy and governance) and people (creativity, diversity and education) as seen in the figure 2.1 / table 2.2. The conceptual variants are connected to each other mutually and thus its definition leads to confusion and complications in usage rather than being independent of each other. Based on the inter-connection of these factors, one can conclude that a smart city is termed such when human and social capital investments along with IT infrastructure provide for sustainable growth and thus enhance the quality of life via participatory governance (Caragliu et al., 2009). In the following sections, each of the three fundamental components of a smart city are examined in detail.

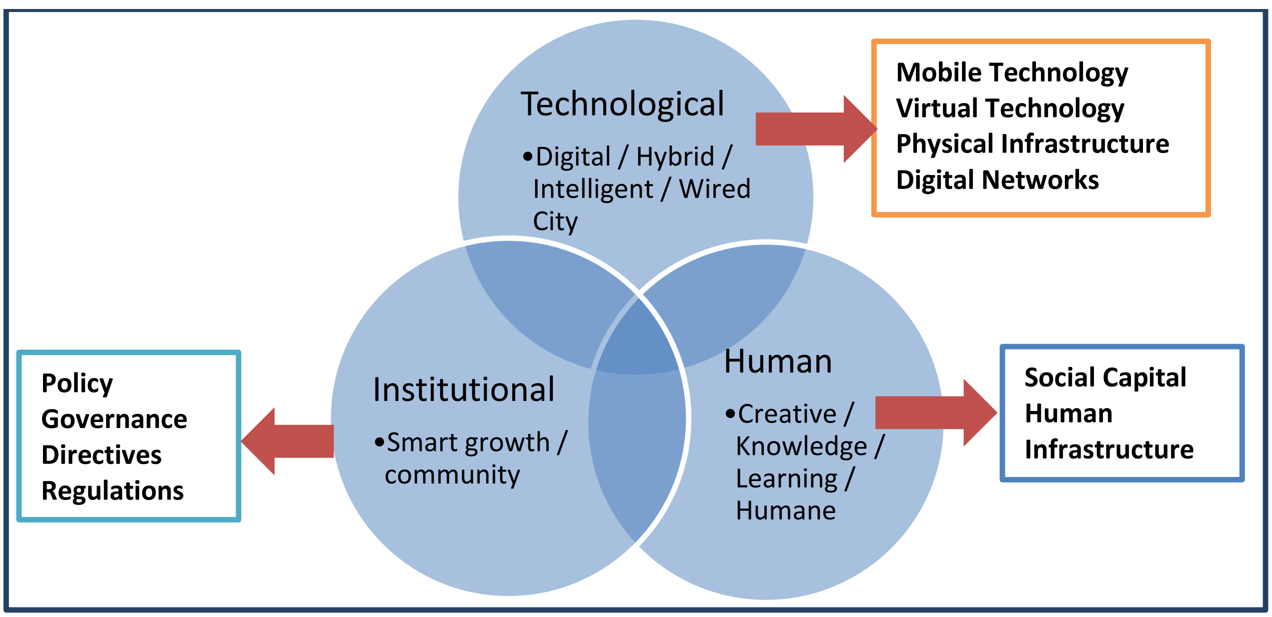

Figure 2-1: Fundamental Components for Smart City

Source: (Dameri and Cocchia, 2013; Yigitcanlar et al., 2008)

Components of Smart City	*Focus*	*Sources*
Technological	The technological component of smart city focuses on hardware and software infrastructure.	Dameri and Cocchia, 2013; Ishida, 2002
Institutional	The institutional component of smart city is based on smart growth / community	Yigitcanlar et al., 2008; Ergazakis et al., 2004
People (Human)	The human component of smart city is based on	Ishida, 2002; Yigitcanlar et al., 2008

Table 2-2: Components of Smart City

2.2.2.1 Technology Dimension

Numerous different correspondents of the smart city concept are originated from the technological perspective, one of them being a digitized smart city. A list of constituents is required to design and develop a smart city that is digitally empowered. Constituents such as a service-centric, flexible computing infrastructure developed on open industry standards, broadband connections, and service innovations for catering to the needs of the government, employees, businesses, and citizens (Yovanof & Hazapis, 2009; Dameri, 2013). Technology is the most important component for a smart city, as ICT is comprehensively used to facilitate changes in daily life and work in the basic ways within a city (IBM 2010). Even if well-functioning infrastructure is important, it isn't enough to become a smart city. Similarly.

Even though IT infrastructure and applications are mandatories, the lack of actual interactivity and willingness to cooperate and collaborate amidst public sector outlets and private sector bodies, makes it difficult for a smart city to come into being and thrive (Lindskog, 2004). The main aim is to initiate an environment wherein it is possible to collaborate, share information, interoperate and provide an overall seamless experience for everyone residing anywhere within the city. In the opinion of Williams, it is sharing of networks (Williams, 2010). By making use of digital technologies along with an array of infrastructures and applications, networks are able to connect to social groups, organizations and enterprises that are located within the city (Anthopoulos & Fitsilis, 2010). In the opinion of Widmayer (1999), Large networks are the highlight of Chicago, which a digital city. For building a smart city, having a computing infrastructure that is universal is the most important and required technological component (Yovanof & Hazapis, 2009). A digitally-equipped smart city is endowed with comprehensive and interoperable internet facilities for government services that facilitate in pervasive connectivity which is important to remodel and modify the primary government functions, internally (which is at department level and manpower level) and externally (at citizen level & business level). An extension of such a city (keeping in the ubiquitous nature of it being accessible and supported with sound infrastructure) is a ubiquitous city (U-city) (Anthopoulos & Fitsilis, 2010a and 2010b). People, building, open spaces and infrastructures are able to access to ubiquitous computing in such a ubiquitous city (Lee, Han, Leem & Yigitcanlar, 2008). The main aim of such a city is to build an environment wherein people can access any service anywhere and anytime via their device.

Unlike a digital smart city, an intelligent smart city is defined as a city which has a combination of knowledge society (Komninos et al. 2013; Woods, 2013). In this city, knowledge and creativity are extremely important while human and social capital, which are intangible, are considered as the most valuable assets (Moser, 2001). Malek (2009), on the other hand, defined an intelligent city which constitutes infrastructure and infostructure of IT along with the latest technology in mechanical, electronic and telecommunications. Intelligent cities consciously make use of the available IT for significantly and fundamentally transforming lives and works (Komninos & Sefertzi 2009). The difference between an intelligent city and a digital city is both, conceptual as well as practical. A city that has the required infrastructure to support learning, innovation procedures and technological development is labeled as an intelligent city. With respect to this fact, every intelligent city has the required components to be a digital city but not every digital city can be an intelligent city. All the important functions of a city such as housing, work, recreation, environment etc. are present in a digital city. In case of an intelligent city, it primarily constitutes functions of product development, research, technology transfer and technological innovations for innovative cities; similar to knowledge city (Komninos & Sefertzi, 2009; Capdevila and Zarlenga, 2015; Houston et al., 2015).

A technology based smart city is also referred to as a ‘virtual smart city’ wherein implementation of the city functions is in a cyberspace (Boulton, Brunn & Devriendt, n.d). It differs greatly from the ubiquitous city. Due to the blurring of cyberspace and material space, this smart city concept comprises of a concept of ‘hybrid city’ with two parallel cities (Zook & Graham, 2007; Streitz, 2009) - one, the reality of the city with the physical surroundings and real inhabitants and the other, a virtual city of counterparts of the actual entities and people. Today, many cities are constituted as well as experienced within the realm of virtuality as well as material spaces. However, it is important to consider physical distance and location while drawing out the parallel cities (Martin et al., 2010). The hyperbolic claim that distance will lose the relevance soon ignores a very important paradox present in cyberspace research (Paroutis et al., 2014; John-Green and Watson, 2014). A world without distance is not fully explored yet. For practical purposes, the pervasive cloud of communication is made possible by the presence of a huge physical IT infrastructure consisting of data centers, cables and exchanges (Hollands, 2015). Place still holds a lot of importance, however virtualization in cities is growing rapidly. In a virtual city, the facets of the urban sphere are reproduced through a visualization virtually, but in case of a ubiquitous city, which is created by means of the sensors and smart ships that are inserted within the urban elements (Zhuhadar et al., 2017; Bifulco et al., 2016).

An information centric smart city is the digital environment wherein information is gathered via local communities, from websites, and information is distributed publicly (Anthopoulos & Fitsilis, 2010b; Townsend, 2013; Sproull & Patterson, 2004; Sairamesh, Lee & Anania, 2004; Widmayer, 1999). Dwellers residing in an information city utilize the Internet for daily life functions and work-related tasks. Information city can be described as the urban hub for civil and social services, commercial and social communications between people, government bodies and business outlets (Sproull & Patterson, 2004; Sairamesh et al., 2004).

In the table 2.3, the different models of smart cities based on the technology dimension are shared. As observed, there are two classifications: device based and environment based (Yovanof & Hazapis, 2009; Giffinger & Gudrun, 2010). Virtual, mobile and ubiquitous technologies gain more importance as they offer advantages to the city dwellers living a mobile lifestyle (Anthopoulos & Fitsilis, 2010b; Martin et al. 2010). Although the wireless infrastructure is one of the main fundamentals of digital city infrastructure, it is just the first step (Al-Hader et al., 2009a; 2009b). Some of the prerequisites for smart city includes equipment (which includes wifi and fiber optics), points of access (kiosks/ hotspots), & information systems that are service oriented (Anthopoulos & Fitsilis, 2010). Most of the studies conducted on the practices of smart city address the issues that are faced in technological infrastructure and based on enabling technologies (Lindskog, 2004; Streitz, 2009; Dameri, 2013). This aspect of focus on infrastructure and technology stresses about the accessibility and availability of systems (Giffinger et al., 2007; Giffinger & Gudrun, 2010). Technological infrastructure, in contrast to human infrastructure, are prevalent by synonyms such as technoware or physical infrastructure (Malek. 2009). In view of Washburn et al. (2010) a technology focused smart city comprises of a technology of smart computing paired together and applied the critical infrastructure at components & service level. Smart computing, as defined as academicians, is a new integrated hardware, paired with suitable software as well as networking technologies. Such as system renders IT systems with awareness at real-time and is enriched with advanced analytics in order to aid decision makers in better decisions on alternatives/actions which are geared towards optimization of business processes thereby bringing in balanced results" (Washburn et al. 2010). Some scholars discuss specific elements referring to the smart city development pyramid model: smart interface equipped with dashboard, integrated web facilities and one platform for operations, smart control systems which comprise of a local operating network, automatic control network; and smart database resources which contain database as well as the database server (Al-Hader et al., 2009a & 2009b). In the following section, the human dimension of smart city is elaborated upon.

Technology Dimension focused smart cities	*Description*	*Authors*
Digital Smart City	"Is a digitally well-connected city combines broadband communications, infrastructure; a service-oriented computing infrastructure; and, innovative services"	Lindskog, 2004; Yovanof & Hazapis, 2009; Dameri, 2013
Intelligent Smart City	"Is a city which has a combination of knowledge society (knowledge and creativity) paired with human and social capital as the most valuable assets"	Moser, 2001; Malek, 2009; Komninos & Sefertzi, 2009
Virtual Smart City	"is based on a hybrid city model with two parallel cities, one in reality and one virtually"	Zook & Graham, 2007; Streitz, 2009; Martin et al., 2010; Dameri, 2013
Ubiquitous City	"a city environment wherein people can access any service anywhere and anytime via their device"	Anthopoulos & Fitsilis, 2010a; Anthopoulos & Fitsilis, 2010b
Information City	"is a digital environment that collects information from the local communities and via web portals, disseminates the information to the public"	Sairamesh et al., 2004; Anthopoulos & Fitsilis, 2010b; Dameri, 2013

Table 2-3: Different Technology based Smart City Models and their Definitions

Having examined the dependency of smart cities on technology component, in the next section, the human component is examined. The aim of this examination is to understand and critically review the role of human (people) in the development of smart cities.

2.2.2.2 Human Dimension

The key driver to a smart city is creativity and therefore factors such as people, learning, education and knowledge are vital (Al-Nuaimi et al., 2015; Kuttab, 2016). For the expansion of a smart city it is imperative to create a climate that is suitable for the emerging creative class (Zubizarreta, Seravalli and Arrizabalaga, 2016; Boulton et al., n.d; Gaffney and Robertson, 2016). Presence of good quality IT infrastructure isn't the only component defining a smart city (Caragliu, Del Bo & Nijkamp, 2009; Hajduk, 2016). Many definitions of smart city stress on the significant role played by human infrastructure, manpower and education respectively in modern development as represented in the table 24.

As mentioned earlier, people is the component missing in the technology dimension (Albino et al., 2015; Bifulco et al., 2016). Smart people are vital for a smart city and one of the visions of a smart city is a creative city. The concept of smart people encompasses many factors such as readiness for life-long learning, ethnic and social plurality, creativity, flexibility, open-mindedness and public participation (Albino et al., 2015). The problems faced by the people dwelling in urban areas can be solved with the help of human capital, creativity, and co-operation amongst stakeholders for bright scientific ideas thus leading to 'smart solutions' (Caragliu, Del Bo & Nijkamp, 2009; Hajduk, 2016). Human infrastructure which includes creative occupations, workforce, voluntary organizations, knowledge networks, after-dark entertainment economy and crime-free environments is extremely crucial for the development of a smart city (Florida, 2002). On the other hand, human infrastructure is supported by social infrastructure which includes social as well as intellectual capital (Albino et al., 2015). It is a crucial benefaction to smart cities. That kind of infrastructure involves people and their relationship (Gaffney and Robertson, 2016; Ibrahim and Morsy, 2016). It is the smart people who are able to generate and consequently benefit from the social capital (Ergazakis et al., 2004; Dameri and Cocchia, 2013).

Smart city is proper mix of business and commerce, culture and arts and education and training (Bartlett, 2005; Gaffney and Robertson, 2016) along with a hybrid balance of elements - social, economic & cultural. A city that is smart is also a humane city wherein there are ample opportunities for exploiting the human potential for leading a creatively fulfilled life (Ergazakis et al., 2004; Komninos et al., 2013). Winters (2010) in his study, focusing more on education, analyzed what has prompted the growth of smart cities. As per the author, such a city is a source for high education thereby creating well educated people. Furthermore, a smart city constitutes of skilled workforce (Glaeser & Berry, 2006; Albino et al., 2015). Migration of knowledge workers and high-quality industries that are knowledge-sensitive into liveable communities is observed (Eger, 2000; Hajduk, 2016). It is worthwhile to note that the smartness of the workforce deviates between cities (Woods, 2013; Anthopoulos and Fitsilis, 2010a). Smart cities upgrade to become much smarter while other places remain less smart since smart places are nothing but a magnate, attracting creative people (Malanga, 2004). The emergence of a new creative culture, driven by the inflow of smart people helps in urban development (Neirotti et al., 2014). The outcome of urban development is praiseworthy as it goes beyond the quality of diversity & creativity to social tolerance and achieving economic growth (Švob-Đokiæ, 2007; Townsend, 2013).

There are two concepts closely relevant to human dimension based smart city: learning city and knowledge city (Zubizarreta, Seravalli and Arrizabalaga, 2016), as observed in the table 4. Smart cities are learning cities which enhance the competitiveness of urban context in the worldwide knowledge economy (Plumb, Leverman & McGray, 2007; Hajduk, 2016). Learning cities play an active part in the building of a skilled information economy workforce (Moser, 2001). A

A taxonomy of cities has been prepared which are equipping themselves with the learning tools to become smart, city cluster, separate cities, cities that are linked one-to-one and networked. On the contrary, with in the knowledge city context, such a city is developed to encourage knowledge and to nurture it for grwoth (Edvinsson, 2006). Previous explications pertaining to knowledge city; technopolis and ideapolis, have presently changes into intelligent, digital or smart city (Dvir & Pasher, 2004; Gaffney and Robertson, 2016). This was enabled owing to technological dimension and human dimension of the smart city getting integrated. A knowledge city is based on knowledge economy wherein the stress is majorly on innovation (Dirks, Gurdgiev & Keeling, 2010; Albino et al., 2015). Knowledge based urban development is dependent on some of its key components such as being clever and smart, skillful and creative along with being well connected and competitive (Yigitcanlar & McCartney, 2010; Bartlet, t 2005). Therefore, smart city is nothing but clever solutions offered by creative people. It is the center where there is presence of higher education along with a smart workforce (Glaeser & Berry, 2006; Winters, 2010).

Malek (2009) and Zubizarreta, Seravalli and Arrizabalaga (2016) emphasizes the importance of 'human-ware' for smart city since it embodies human skills and cognitive/creative capability. Creative environment is further boosted in smart cities (Yigitcanlar & Velibeyoglu, 2008; Neirotti et al, 2014). A city is made attractive by the level of education that is offered and is prevalent. It acts as a magnet as organizations, businesses and individuals from all walks of life gravitate towards an environment of dynamic learning (Borja 2007). Singapore became an intelligent island thanks to the IT education prevalent in the country (Mahizhnan, 1999; Thite, 2011). It is the collective intelligence along with social learning that makes a city smarter (Coe, Paquet & Roy, 2001; Hajduk, 2016). Hence, a human dimension focused smart community can be referred to a position wherein networked intelligence is embedded while continuous learning is encouraged (Alawadhi, 2012; Borja, 2007). Such a smart city initiative includes an integrated approach of connecting communities (people, government, business and organizations, schools etc.), formulating specific and targeted services which address the objectives of the city and advancing the skills and capacities of the community collectively (Chourabi et al., 2012; Giffinger et al., 2007).

Human Dimension focused smart cities	*Description*	*Authors*
Learning city	Smart cities are learning cities which enhance the competitiveness of urban context in the worldwide knowledge economy.	Moser, 2001; Plumb, Leverman & McGray, 2007; Hajduk, 2016
	Learning cities play an active part in the building of a skilled information economy workforce	
Knowledge city	A knowledge city is a city that was purposefully designed to encourage the nurturing of knowledge.	Edvinsson, 2006; Dvir & Pasher, 2004; Gaffney and Robertson, 2016
	Knowledge cities have now evolved into intelligent, digital or smart city.	

Table 2-4: Human dimension based smart cities

2.2.2.3 Institutional Dimension

For the development & implementation of SC activities, support of the government is essential with a policy in place for governance (Zubizarreta, Seravalli and Arrizabalaga, 2016). This category constitutes of a number institutional factors which have been drawn from the smart community and smart growth initiatives discussions (Hajduk, 2016). It was in 1990 that the SC movement developed in the form of a scheme aimed to boost the users in IT (Zubizarreta et al, 2016; Moser, 2001). Such as city is known as a community at the scale of a small neighbourhood or at a larger scale known as a nation-wide community (Glaeser and Berry, 2006). It is in this community that members share a common interest and where the people, businesses and the government are working in a manner that makes use of IT for significant manner to transform their circumstances (Industry Canada, 1998). This concept is further elaborated by California Institute for Smart Communities (2001), "*a community wherein the entities i.e. the government, businesses,* *as well as the residents acknowledge the true potential of IT and assist in the decision of using the technology in the transformation of life & work in a positive way*." It does not only include the supportive policies but also about the government's role, relationship between non-government bodies and government outlets and their administration. Setting up an administrative environment (structure, initiatives and interactivity) that is auxiliary for smart city is very important (Yigitcanlar & Velibeyoglu, 2008). Other factors such as integrated and transparent governance, networking and partnership, strategic and promotional activities (Zubizarreta, Seravalli and Arrizabalaga, 2016; Odendaal, 2003) also ought to be contemplated upon to aid smart city endeavours.

Referring in a universal sense, a smart community comprises of not just of a 'whole' which is integrative in nature, and also, collaborative & inclusive in element comprising of neighbourhoods and communities (Kanter & Litow 2009; Lindskog 2004). A smart community is one that consciously decides to employ technological tools as a stimulus for catering to social and business needs respectively (Eger, 2000; 2009). Technological expansion should not be seen as end in itself rather it is the means for reinventing cities, readying them for a new economy and society (Meijer et al., 2013; Kanter et al., 2009; Harrison et al., 2010). For the success of SC initiatives, there is a mandatory need for governance at community level institutional level. For smart growth, building and planning a smart community is required (Moser, 2001). Smart growth movement has been prevalent since 1990's; as a strong reaction to the deteriorating trends in traffic, air pollution, overcrowding and loss of open space, decreasing importance of historic places and ever-increasing cost of public health facilities (Freilich, 1999; Ingram, Carbonell, Hong & Flint, 2009; Meijer et al., 2013). It was poorly planned, coordinated and developed that led to the movement of smart growth (Beatley & Collins, 2000). Since urban planning is based on governance wherein several stakeholders are important for smart growth, the initiatives of SC require governance for successful operation (Lee et al., 2008; Lombardi, 2011).

A smart government will go beyond regulation of output of societal and economic systems. It forms dynamic bonds with the citizens, communities and businesses in real time which in turn leads to innovation, growth and overall progress (Zubizarreta, Seravalli and Arrizabalaga, 2016). A range of challenges may be experienced, right from lack of transparency and accountability to delays and departmental slackness (Novotný et al., 2014). In case of smarter governments, there is proper collaboration across departments and communities so that there is better transparency and accountability, resources are well managed and information that affects their life is made accessible to citizens (Thite, 2011). Leading governments across the globe are integrating their service delivery, founding offices that support manifold operations, offer citizen-centric services (Sairamesh et al., 2004; Elmaghraby and Losavio, 2014). However, for a city to transform into a smart city, it requires interaction of institutional component as much as it needs technological, political and transitional components (Mauher & Smokvina, 2006; Al-Rashidi, 2009).

Political components constitute of political elements that are endogenous in nature such as the city council, government, etc. which are harmonized by elements that are exogenous such as international pressure, projects and agendas, strategies etc., all verified by best practices (Carr and Hayes, 2015; Belanche et al., 2016). Similarly, institutional components are a prerequisite as well. It is important the city have institutional readiness in terms of the removing of regulatory and legal barriers (Houston et al., 2015; Letaifa, 2015). In case of transitional components, it includes elements such as visions, leadership and organizational transition in structure (Capdevila and Zarlenga, 2015). Smart governance, which is the cornerstone of a smart city, ensures that the different stakeholders (citizens especially), have a say in decision making along with the social and public service (Giffinger & Gudrun, 2010; Glaeser & Berry, 2006).

E-governance, which is also known as IT-enabled governance, is noted as the success point for a SC. It leads the citizens to SC initiatives being within the framework of the decision & implementation with transparency (Paskaleva, 2009). Such governance is noted to be citizen centric with the key elements noted as the stakeholder consideration i.e. the end users, IT experts, domain experts, etc. (Gaffney and Robertson, 2016; Anthopoulos & Fitsilis, 2010; Lepouras et al., 2007). Successful initiatives happen when there is an alliance of business, education, citizens and government (Lindskog, 2004). While a successful SC may be developed through a bottom-up/top-down approach, it is necessary to achieve active involvement from every community. When there are united efforts, it creates synergy that helps individual projects to grow leading to progress (Paroutis et al., 2014; Al-Nuaimi et al., 2015). This in turn results in the informed and well-trained critical mass that is informed, and required to achieve the SC transformation.

2.3 Crucial Factors Affecting Smart City Development

As a smart city is a large-scale technological integration of information system comprising of a number of sub- systems, it poses many challenges and difficulties (Albino et al, 2015). Fundamentally, initiatives of a smart city are based on is ICT. In the development of smart city, some of the technologies which will be useful include Internet of Things (IoT), cloud computing, semantic web, open data and other future internet technologies (Bifulco et al., 2016). All these technologies combined provide the necessary infrastructure, applications and turn-key solutions which offer a range of services. There is a lot of potential in ICT for improving the management as well as functioning of a city which ultimately benefits the citizens (Giannakoulias, 2016; Hajduk, 2016). However, it is important to note that all these technologies are ridden with their own set of challenges as well as limitations. To form a complex system like smart city, these technologies need to be combined which in turn will greatly increase the amplitude of the challenges associated with them. These factors are IT infrastructure; security and privacy; big data management; cost; heterogeneous environment and interoperability; efficiency, availability and scalability; and social adoption (Chourabi et al., 2012; Alghamdi et al., 2011; Bifulco et al., 2016). Each of these factors is further examined in the following sections, and detailed in figure 2.2.

IT Infrastructure: One of the biggest barriers in taking the initiatives for a smart city is the development of IT infrastructure. Right from the channels of communication to sensors and actuators in physical space; they all remain a challenge. It is the lack of infrastructure which poses a major obstacle in the achievement of smart city objectives (Chourabi et al., 2012; Suresh, 2011; Dillon and Pelgrin 2002; Alghamdi et al., 2011; Giffinger et al., 2007; Vasseur, Jean-Philippe, and Adam Dunkels, 2010). The foundation for integration of information systems across the city includes factors such as high-speed network connectivity which is reliable and scalable along with proper infrastructure (Alghamdi et al., 2011). However, it is important that the infrastructure should be in place before the services of smart city are offered to stake holders. Subsequently, it is the reliable IT infrastructure which is usually scalable that poses to be a major challenge for the implementation of smart city (Chourabi et al., 2012).

Security and Privacy: As the trend for smart cities catch up, an array of gadgets is integrated in everyday use which may in turn cause collection of personal data and therefore pose a major privacy issue (Chourabi et al., 2012). To cite an example, a smart traffic management application that gives the user updates about traffic situations will collect the location of the user. One of the fundamental challenges of a smart city system is to meet the security and privacy requirements since a large amount of sensitive data processing is involved (Chourabi et al., 2012; Laplante and Phillip, 2013; Suresh, 2011; Alghamdi et al., 2011; Wan, Jiafu, et al., 2013; Sanchez, Aurora, et al., 2003). Services can be greatly disrupted, bringing the whole system down and resulting in losses when there are threats from viruses, Trojans, intruders, worms and hackers (Alghamdi et al., 2011). Therefore, extensive security steps are essential for securing the sensitive data at each levels of collection, processing, storage and disseminating (Albino et al., 2015; Gaffney and Robertson, 2016). Security and privacy are not only important for making the data and services available but also for building the trust and belief of citizens in using these systems (Giannakoulias, 2016; Komninos et al., 2015).

Big Data Management: It is rather obvious that from these smart city systems, large amount of data will be generated. To handle the incoming data at differing velocity, big data management is important (Alghamdi et al., 2011; Bifulco et al., 2016; Chourabi et al., 2012). The system used for the same needs to be not only reliable but also scalable without any downtime. When it comes to continuous collection and processing along with storage of such enormous heterogeneous data from a number of smart city sensors, they pose their own challenges (Bifulco et al., 2016). However, the big data collected from across the smart city sensors can be extremely useful for achieving the smart city objectives (Townsend, 2013; Gartner, 2012). For example, the GPS sensors which are present on vehicles are a source of invaluable information with respect to the flow of traffic; however, it will also lead to the generation of big amounts of high velocity data (Al-Nuaimi et al., 2015).

Cost: The basic requirement of a smart city is smart IT infrastructure (Bifulco et al., 2016). In order to put such a system in place, massive financial investment is required. Large numbers of sensors, networking equipment and computing devices will be required in order to get end-to-end connectivity in a smart city (Zubizarreta, Seravalli and Arrizabalaga, 2016). Apart from the items, manpower such as IT professionals and consultants will be also needed, which will make up for a considerable expense. Furthermore, this expense is not just one time, the cost of operations and maintenance is also very huge. To meet the reliability and efficiency requirements, more resources will need to be added which in turn will increase the expenses (Alghamdi et al., 2011). For example, for smart traffic management systems, all the cars will need to be installed with sensors along with many road-side units (Barba et al., 2012). Such a system cannot have a downtime and has to be extremely reliable and efficient. For application of such a system in an urban get-up, the cost could be well around millions of dollars (Barba et al., 2012; Caragliu et al., 2011).

Heterogeneous environment and Interoperability: The architecture of a SC is noted by heterogeneity of applications, networks, platforms, devices, etc. (Alghamdi et al., 2011; Bifulco et al., 2016). For example, for vehicular networks, adhoc networks such as Vehicular Ad Hoc Networks (VANETs[1]) are required while for close range wireless devices, Zigbee would be adequate (Barba et al., 2012; Ferrari et al., 2011). Integration of legacy applications with new emerging technologies can also pose a challenge (Ferrari et al., 2011).

Efficiency, Availability and Scalability: Important and critical systems can in no circumstances experience a downtime and thus they require high availability (Neirotti et al., 2014; Bakıcı et al., 2013). The challenges posed by meeting of the tough requirements of availability are directly in proportion to the complexity as well as size of the system (Bifulco et al., 2016). Once operational, a smart city will not just have a big infrastructure but its size and complexity will keep increasing tremendously (Nam and Pardo, 2011; Jin et al., 2014). Due to the huge amounts of generated data, availability, scalability and efficiency will be a huge challenge (Giannakoulias, 2016). It is absolutely necessary to maintain the efficiency of the enormous system (Alizadeh, 2017). Some of the key benefits of such a smart city include performance optimization of every system, efficient use of resources, proficient planning and immediate answers to queries (Al-Hader and Rodzi, 2009; Snieška and Zykiene, 2014).

Social Adoption: The present problems plaguing urban population can be ideally solved by smart city systems (Hajduk, 2016; Nam and Pardo, 2011). However, researchers have identified certain challenges such as digital divide, inequality and changing cultural habits in SCs (Chourabi et al., 2012). Changing social habits of the people and city management is required for proper social adoption of such a system (Jin et al., 2014; Alghamdi et al., 2011).

[1] VANETS facilitate communication between vehicles, and with infrastructure of smart cities

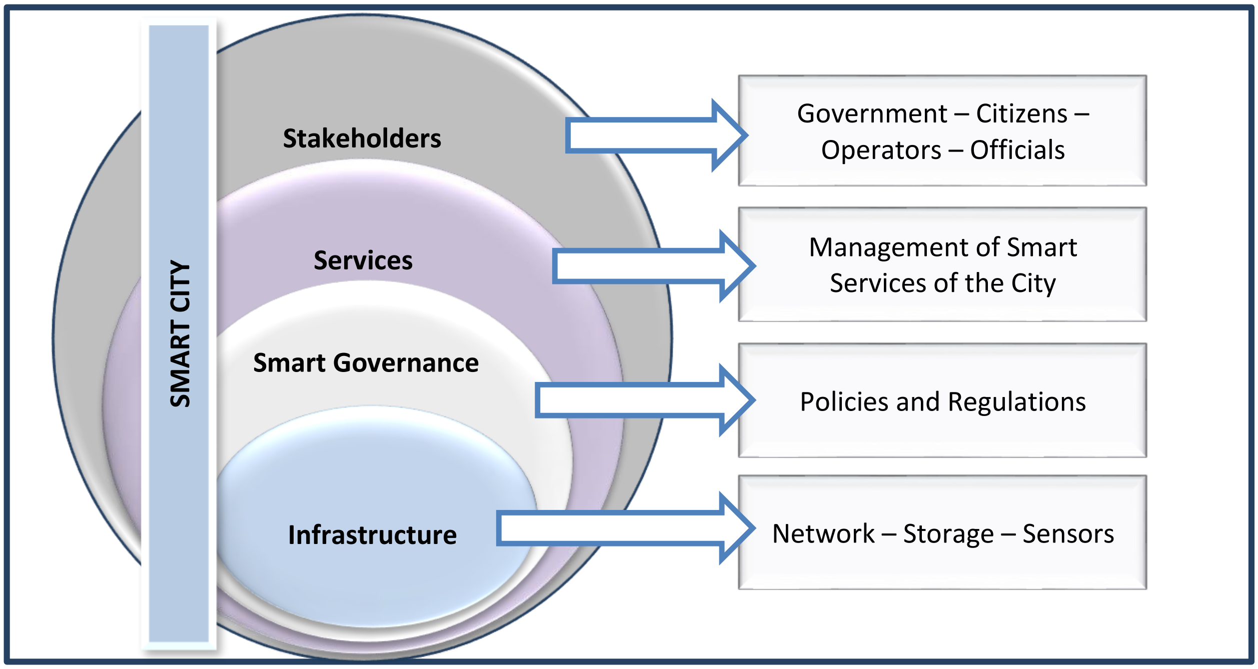

Figure 2-2: Smart City Technology Architecture

Source: (Chourabi et al., 2012)

For the citizens to take advantage of the data that is collected, quick development of innovative applications is necessary (Rodríguez-Bolívar, 2015). If only the city management is in charge of developing application, there are chances that the development of the application will be slow and people will be disappointed (Shichiyakh et al., 2016; Yarosh, 2014). To cite an example, the main reason Android is successful and is widely adopted is because of its Play Store which is a huge base for unlimited paid and free apps uploaded by developers almost every day (Ribina, 2015; Snieška and Zykiene 2014). Considering the above factors that affect the development of a smart city, in the next step, it is important to identify the layers that constitute a smart city (Alizadeh, 2017). As observed in the figure 2, there are primarily 4 layers of a smart city: Stakeholders, Services, Smart Governance and Infrastructure (Chourabi et al., 2012). As examined earlier in the technology dimension in section 2.2.2.1, infrastructure forms the essential elements that connect through the various layers of a smart city. This is a holistic approach which involves the creation of required infrastructure, increased government participation and governance, usage of technology and the integration of smart infrastructure management systems with the collaboration of citizens (Chourabi et al., 2012; Alizadeh, 2017). Some of the widely acknowledged uses of this concept include predictive analysis, information availability, and smart infrastructure development (Bifulco et al., 2016; Jin et al., 2014).

Predictive analysis: is an application of modern statistical techniques, data mining of the facts which maybe current as well as historical and machine based learning in order to make future predictions about events (Bifulco et al., 2016). In business modelling, predictive analytics has become a very important tool (Jin et al., 2014; Al-Hader and Rodzi, 2009). Such models make use of the historical and transactional data for developing a better understanding of the behavioural pattern which are in turn used for business purposes (Ribina, 2015; Shichiyakh et al., 2016). To cite an example, if there is constant sharing of data, it would help to identify immediate warning signs about any of the fragile water pipelines, which is transmitted to the relevant departments immediately for action (Gaffney and Robertson, 2016). Similarly, mobile applications help to identify the traffic routes which should be avoided (Bakıcı et al., 2013). Therefore, a smart city is a 'predictive city' wherein specific incidents, scenarios or events can be predicted and the city can be prepared accordingly, thus resulting in an improved quality of life and enhanced safety (Dam, 2013). It allows citizens to make more informed decisions regarding what actions should be taken next (Jin et al., 2014; Neirotti et al., 2014).

Information Availability: for the functioning of any smart city, is important. Under any circumstances, access to data should be made possible so that it enables the city officials to take corresponding actions (Giannakoulias, 2016). Using ICTs as platforms, cross-scale information sharing helps policy makers and officials from various sectors to make their decisions based on the received information and thus commence co-ordinated actions (Zubizarreta, Seravalli and Arrizabalaga, 2016; Nam and Pardo, 2011a). Such an exchange of data not only helps in collaborative efforts between sectors but can also become a vital part for the critical assessment and forecasting of emergencies (Chourabi et al., 2012; Caragliu, 2011). It also optimizes the smart solutions that are implemented in the city (Zubizarreta et al, 2016; Nam and Pardo, 2011). Thus city managers are recommended to make use of smart solutions on proper policies and governance structures which are able to sustain these efforts in short/long run (Lombardi et al., 2012; Caragliu et al., 2011).

Smart Infrastructure Development: This includes Smart energy, Smart water and waste management, Smart buildings, Smart transportation, Smart education, Smart physical safety and security and Smart health care, which are the most essential elements of a city (Bifulco et al., 2016; Barba et al., 2012). In this section, each of these elements have been reviewed.

- Smart energy management employ the use of a grid operation that ensure that everyone one in the city, from the authorities to the citizens, are kept aware and up to date with the latest technology (Zubizarreta, Seravalli and Arrizabalaga, 2016). These processes allow for real-time analytical data to be put into immediate effect.
- With the help of smart management systems buildings can effectively reduce the emission numbers, reduce the amount of waste being produced and also optimize water usage, without having the occupant compromise on comfortable living (Ibrahim and Morsy, 2016). These changes can be applied on old buildings as well as new since the architecture does not necessarily have to be adaptive. In doing so buildings can save up to 50% of energy use and energy costs through these programs (*Retrofit for commercial program*, 2017).
- In order for managements to make the most out of the urban landscape, it is important for the government to employ Intelligent Transport Systems (ITS) to be implemented on the large scale (Giannakoulias, 2016). ITS can effectively collect data about the mobility that happens in a city and improve upon its workings, through algorithms. It provides suggestions to the city corporation for improving the infrastructure without incurring much cost. This results in safer, cleaner and faster transport.
- Smart water management solutions employ the applications of ICT in the development and the eventual delivery of safe water for human use, including managing the supply and the demand for water along with developing a pricing table that is agreeable to everyone (Zubizarreta, Seravalli and Arrizabalaga, 2016).
- The increase in the consumption of consumer goods is directly linked to the increase in waste produce, which raises the need for smart waste management. This system allows the smart city officials to analyse and identify waste segregation and usage, bring it back into the consumer cycle through recycling (Hajduk, 2016). Smart waste tracking involves implementation of waste-tracking systems to build effective solutions.
- ICT in physical security involves the use of analytical tools which can easily sense, respond and resolve any incident that should arise (Paul et al., 2011; Giannakoulias, 2016). It will also use face recognition to identify criminals using criminal patterns and prediction.
- Smart health care's main objective is to take in the data taken from health-related inputs and converting them to clinical and business analytics (Hajduk, 2016). Some of the ways that smart health care can be utilized, is by making use of remote treatment, remote alternative diagnoses,

tele-assistance, online medical services in the form of creating appointments online or storing digital records be sent digitally across the health management systems, for fast access of information amongst others.

- Smart education is the most crucial part of the development of smart cities for both adults and children, which support globalization by extending and expanding the knowledge base, acquired only through education (Ibrahim and Morsy, 2016). Hence, when designing the structure for the smart education programs, it is important to include schools and universities as part of the solution.

After reviewing the various factors that have an effect on the smart city dimensions and post evaluation of the role of technology in smart city development, it can be ascertained that a dominant role is played by technology in security feature of the smart city initiative. In the following sections, the components that transform a smart city in to a SSC are evaluated and reflected.

2.4 SSC Components

Safety and public safety in general in a smart city model is characterized through the application of ICT to predict, identify, prevent and reduce crime, improve resource allocation, control future threats, reduce operational costs and provide support in terms of an emergency (Zubizarreta, Seravalli and Arrizabalaga, 2016; Komninos et al., 2015). In order to be a successful model, it is vital that smart city authorities understand the importance of the communications systems to not only predict the data into identifiable patterns, but also, to make strong decisions in real time (Bifulco et al., 2016; Schaffers et al., 2011; Chourabi et al., 2012). With urbanization, cities are re-looking at their current public safety solutions in city management and moving towards a '*one command control system*' (Girtelschmid et al., 2014). This requires a well-integrated infrastructure support. Similarly, when public safety is reviewed as a matter of emergency, voice services are no longer viable as seamless connectivity is the emerging trend with broadband network playing a prominent role (Ibrahim and Morsy, 2016; Piro et al., 2014). An extensive range of technology driven sub-systems are assimilated in safe city solutions (Bélissent, 2010). In order to gather better intelligence from the numerous sources and sensors, integration as well as interoperability of these sub-systems is vital (Komninos et al., 2015; Hernández-Muñoz et al., 2011). Right from centres for crisis management to CCTV operations, technology will help emergency services, law enforcement agencies and local governments immensely (Meijer and Bolívar, 2016). This will enable them to be ready and improve their response to any unexpected or expected episode. Some of the basic components which form the foundation of safe city architecture are as follows and outlined in table 2.5 (Meijer and Bolívar, 2016; Dameri, 2013; Giannakoulias, 2016; Girtelschmid et al., 2014).

Surveillance Systems / Equipment: The main aim of a safe city program is to provide its first responders along with officers a shared security presence along with better awareness by making use of a system that is fortified with video surveillance cameras (Meijer and Bolívar, 2016). Data is collected via this network of cameras in the form of images and videos which not only help to identify risks but also helps in responding to emergency situations (Manville et al., 2014; Hernández-Muñoz et al., 2011). Over time, the technology of CCTV cameras has evolved greatly; in the start they were 100% analog systems however now they are completely digitised (Giffinger and Gudrun, 2010). This has been made possible due to the network cameras and PC servers that are utilized for video recording (Hancke and Hancke Jr, 2012).

IP Cameras: also known as network cameras, include a networked digital video camera which transmits data over an Ethernet link (Dameri, 2013; Manville et al., 2014). It is nothing but a digitised version of a CCTV camera (Ribinal, 2015). Some of the standard cameras that are used for surveillance systems include fixed dome, fixed camera, IR, PTZ and thermal imaging cameras (Rodríguez-Bolívar, 2015; Yarosh, 2014).

Video Analytics (VA): also, commonly known as intelligent video surveillance, make use of certain software which helps to readily identify particular objects and behaviours in the given video footage (Hernández-Muñoz et al., 2011; Snieška and Zykiene, 2014). In a number of domains, including security and surveillance, many powerful and intelligent video analysis methods and tools are used (Meijer and Bolívar, 2016). The video analytics capability of surveillance defines its effectiveness and efficiency (Ribina, 2015). Some of the features of VA such as object removal and abandonment, motion detection, license plate recognition, trip wires etc. (Giannakoulias, 2016). All help video surveillances to become a monitoring tool that is more proactive and helps to send signals to authorities such as guards, police etc. whenever immediate intervention is required (Alizadeh, 2017; Nam and Pardo, 2011a). A safe city that is based on video surveillance will include the above-mentioned VA tools along with a number of other equipment which help in identifying gun shots, crowd alerts and fire alerts apart from other occurrences which might disrupt the peace of the city (Girtelschmid et al., 2014; Al-Hader and Rodzi, 2009).

Network Connectivity: Amongst the various other components of a safe city project, network connectivity is of utmost importance (Jin et al., 2014; Bakıcı et al., 2013). It requires proper assessment, planning and implementation of the same (Albino et al., 2015). This is the main point in the system via which data travels right from the surveillance system to the data centres and lastly to the viewing centres (Lombardi et al., 2012; Ferrari et al., 2011). However, it important to note that the connectivity provided is secure as well as reliable. It should not be afflicted with issues such as jitter, latency, packet loss and performance problems (Khansari et al., 2013; Al-Rashidi, 2009). In order to provide seamless connectivity, a wide array of network technologies maybe used such as OFC network, wireless broadband, terrestrial networks, leased lines, mobile networks and VSat (Girtelschmid et al., 2014; Belanche et al., 2016). Furthermore, keeping future expansion in mind, the connectivity provided to control rooms and data centres should be of scalable capacities, so that the expansion is seamless and without any issues (Masrek et al., 2014; Paroutis et al., 2014).

Data centres: Just as network connectivity forms the backbone of a surveillance based safe city, data centres form its root (Bifulco et al., 2016; John-Green and Watson, 2014). They are nothing but warehouses wherein the collected data is stored from surveillance sensors (Al-Nuaimi et al., 2015). They are also responsible for seamless, real-time data transmission to the designated command viewing centres which in turn help in efficient and effective operations (Gaffney and Robertson, 2016; Hajduk, 2016). In order to ensure efficiency, primary and secondary data centres are established in case one of them is down (Ibrahim and Morsy, 2016; Giannakoulias, 2016). The centres are responsible for hosting of all the vital applications which are required by agencies in order to operate important systems such as Video Management Software (VMS) and VA, automatic vehicle classification system, automated number plate recognition application etc. (Komninos et al., 2015; Girtelschmid et al., 2014). Space is also provided for accurate storage and retrieval of data that is captured by the system (Zubizarreta, Seravalli and Arrizabalaga, 2016; Ergazakis et al., 2004). When it comes to the design of the data centre, it is mainly based on the kind of operations that will be carried out by the security agency (Dameri, 2013). Also, it is based on the kind of processing which will be required on the incoming feeds such as pattern analysis, matching in DB, indexing, facial recognition, GIS mapping and VA amongst others (Yigitcanlar, O'Connor and Westerman, 2008; Marsal-Llacuna et al., 2014).

Command Viewing Centres (CVC): A command viewing centre in nothing but an infrastructure wherein access to integrated information is made available at the designated data centres (Neirotti et al., 2014; Woods, 2013). It assists in the organization of information, which in turn helps in quick analysis for decision making purposes (Anthopoulos and Fitsilis, 2010a; Alawadhi et al., 2012). For the ease of agencies to prepare, co-ordinate and manage responses while also enhancing the efforts for efficiency, the CVCs will be armed with high operations capabilities that will ensure real-time collaboration, integrated data visualization and better analytics (Bifulco et al., 2016). It will become possible for the users to take decisions based on real-time and integrated view of operations thanks to the Graphical User Interface (GUI) made available at CVC (Girtelschmid et al., 2014; Bowerman, 2000). It will become easier and faster for cities to share information across agencies so as to hasten problem solving and also progress on project co-ordination (Curry, 2016; Eger, 2009; Gartner, 2012).

A CVC helps to make information available easily to all the agencies within the city, which helps the management to take quick, well-informed decisions (Giannakoulias, 2016; Harrison et al., 2010). It further helps to identify the challenges and thus helps in minimizing the impact caused by disruptions (Haughton and Hunter, 1994; Hollands, 2008). A city-wide GUI will be made available via the CVC that will depict the video feeds along with other sensor data that needs to be transmitted (Girtelschmid et al., 2014). For operational users and decision makers, the drill down capability of the dashboard will allow them to explore detailed status information that is relevant to their role (Schaffers et al., 2011; Girtelschmid et al., 2014). Furthermore, the viewing centre will be equipped with a GIS map of the city that allows to monitor and provide status of particular area to the agency (Ribina, 2015; Alizadeh, 2017). Several layered maps will showcase important information pertaining to the city such the weather, equipment, resources within the city and their position, and boundaries amongst others (Kanter et al., 2009; Malek, 2009). Cross agency collaboration allows sending messages in-between the operators at the control centre, quickly sending of response units at the site of incident (Bifulco et al., 2016). This helps in reducing the response time and enables easy and swift sharing of information which in turn helps in collaborative decision making (Girtelschmid et al., 2014). It will include a set of tools such as call dispatch systems and emergency call response systems which will allow for immediate and urgent communication between all users and supporting agencies (Caragliu et al., 2011). Those tools which enable detection as well as management of incidents will help in better incident management (Jin et al., 2014; Bakıcı et al., 2013). All aspects of security are managed effectively by commanders and staff with the help of the toolset as these tools provides incident detection, correlation and response in real time (Barba et al., 2012; Elmaghraby and Losavio, 2014). When the capabilities of CVC are put together such as user interface, GIS maps, application data integration, incident management and advanced analytics, it provides the much-required shared situational awareness (Novotný et al., 2014). It helps the operation staff and the supporting agencies of the city to not just synchronize but also prioritise their responses (Girtelschmid et al., 2014; Al-Rashidi, 2009). To ensure effective crisis management, the operator will be provided with sufficient training regarding the standard operating procedures for responses to emergency situations and incidents (Letaifa, 2015; Hollands, 2015). Furthermore, the back-office operations will be handled by the control centre that will be integrated within the command and control centre operations (Belanche et al., 2016; Masrek et al., 2014).

Collaborative Monitoring: A very important feature which will enable safe city is collaborative monitoring (Chourabi et al., 2012; Bélissent, 2010). Globally, most establishments whether private or government have realized the importance to have a proper infrastructure in place that will enable surveillance, incident response systems and monitoring (Bifulco et al., 2016). However, it is also imperative that the agencies share the data that is gathered amongst themselves (Rodríguez-Bolívar, 2015; Snieška and Zykiene, 2014). Taking cue, some of the government agencies such as the transportation and aviation have installed on-board surveillance systems in the form of CCTV cameras in all the major areas such as railway stations, buses and bus stands, metro stations and airports (Al-Hader and Rodzi, 2009). Under collaborative monitoring, all the data can be shared between agencies easily in real-time (Giffinger and Gudrun, 2010; Hancke and Hancke Jr., 2012). Likewise, CCTV system live feeds from private establishments such as malls, entertainment homes, and business areas can be made available to the CVC which in turn can enable security agencies of the city to maintain law and order by effectively using the information received (Manville et al., 2014; Girtelschmid et al., 2014). Across the globe, in many cities, many public and private establishments have set up surveillance systems. By making use of the collaborative framework, these cities receive the video feeds and use it for effective real-time responses (Giannakoulias, 2016).

Components	*Importance*	*Implications*	*Citations*
Surveillance System and Equipment	Provides real time data for surveillance in the city, thereby strengthening safety and security of the public.	City safety can be strengthening by layering surveillance system with IP integration, with consideration of live vs cost for long term deployment.	Meijer and Bolívar, 2016; Komninos et al., 2015
IP Cameras	Enhance and improve video data for monitoring and surveillance of the city elements on a day to day basis.	Inclusion of IP cameras in SSC framework can monitor threat detection with real time action in the city.	Dameri, 2013
Video Analytics	Provides intelligent video surveillance and analysis with high efficiency and effectiveness for quick action in case of an event.	Integration of VA in the safe city framework allows automatic detection of security threats, with automation of situational analysis to reduce delay or lapse in action.	Giannakoulias, 2016; Girtelschmid et al., 2014
Network Connectivity	Connects the components of the smart city together to work in tandem, thereby improving the overall surveillance system efficiency.	SSC operations are reliant on network connectivity, and any lapse in connection can cause critical issues in action taking.	Albino et al., 2015; Girtelschmid et al., 2014
Data Centre	Collects and stores data related to all smart city application and makes it available to all agencies with seamless and real-time data transmission to the command centres.	Physical infrastructure in the form of data centers is crucial in the functioning of smart cities, hence, should have the capability to handle large quantities of data with backup and threat protection.	Bifulco et al., 2016; Giannakoulias, 2016; Girtelschmid et al., 2014
Command Viewing Centres	Allows the smart city officials to access the collected and analysed data for decision making, and improve operations capabilities and reduce disruption in smart city services.	Command center operations rely on the data center and network connectivity to access data and take appropriate action. They should be feasible to access by all elements of the SSC, with the provision to share information in real time for swift action.	Bifulco et al., 2016; Giannakoulias, 2016; Girtelschmid et al., 2014
Collaborative monitoring	Allows the smart city agencies to work together efficiently, enabling city surveillance, incident response and effective monitoring.	SSC can sustain only through collaborative monitoring across all its elements.	Bifulco et al., 2016; Komninos et al., 2015

Table 2-5: Components of a Safe City

2.4.1 Drivers of Safe Cities

The concept of a smart city, which is globally being implemented, is a complex challenge which involves developing an integrated approach based on certain essential drivers (John-Green and Watson, 2014; Giffinger and Gudrun, 2010). In order to transform a smart city into a smart 'safe' city, there is a need to address the decision-making approach while focussing on security challenge with a well-illustrative framework supporting successful adoption of safe city model (Hollands, 2015; Rodríguez-Bolívar, 2015). This will lead to securing the safety of the city, with reducing crime as well as faster response. The implementation of smart 'safe' city needs to be evaluated based on various parameters (Snieška and Zykiene, 2014). These range from urbanization, terrorism threats to crime rates and political significance (Alizadeh, 2017; Zhuhadar et al., 2017). Amongst these, for the adoption of the smart 'safe' city, technology related factors play the most important role within the model (Al-Hader and Rodzi, 2009; Al-Nuaimi et al., 2015; John-Green and Watson, 2014). Some of the key drivers that necessitate the need for a smart 'safe' city are outlined below:

Urbanization: The population of UAE has witnessed a steady growth over the years, recording a population of 9.37 million as of 2017 from approximately 5 million in 2000 (Worldometers.info, 2017). This expansion is primarily observed to contribute from urban population, extending pressure on the present civic infrastructure and competition in the provision of everyday resources. Amongst the seven emirates, Dubai is found to have the highest population density of 2,698,600 as of 2016 against 862,387 as of 2000 (Dsc.gov.ae, 2017). From the population growth, there are two trends reported: (1) Immediate measures to support emirates such as Abu Dhabi witnessing fast urbanization, and (2) Developing a well-planned framework for emirates that are emerging.

Crime Rate: The aim of developing a safe city is to control the instances of crime and securing a feeling of 'safety' amongst the city residents. When developing a smart 'safe' city model, it is essential to include crime rate. The number of crimes in UAE decreased from 119.8 per 100,000 population as of 2011 to 83.8 in 2015, which reflects a clear drop in the crime rate (Kuttab, 2016). However, every country suffers from crime is certain form. While UAE is noted to have a low crime rate (in comparison to similar countries) and considered safest city around the world, it is always better to ensure safety of the city and its residents through standard protocols. A safe city is strengthened through a strong surveillance system providing security consultants to monitor and control crimes in real time (Hollands, 2015).

Security and Safety Threat: In this day and age, the threat of terrorism is a tangible one and looms large over any major city. It is a major security risk and is hence taken into consideration while designing and implementing Safe city projects (John-Green and Watson, 2014). These threats can be internal or external and drives the demand for more effective implementations of the surveillance apparatus (Al-Nuaimi et al., 2015). The crime rate is probably the most important factor which drives the people to demand better security from the city. This demand is fulfilled by the use of various elements of the safer city projects. These measures are capable of instilling a sense of safety and security among the citizen.

Natural Disasters: Natural Disasters can strike at any time and pose a threat to the city. In case of such an emergency, the swiftness of action is a major factor that minimises loss and ensures success of the operation (Bifulco et al., 2016). The first response team is absolutely critical in a scenario like this, and the use of emergency communication and disaster management system vital to curtail the loss of life and economic loss. Some cities are more prone to such disasters by virtue of their geographic position or prevailing weather anomalies and hence are more probable to use safer city projects to keep the loss at check (Hollands, 2015).

Strong City Economies: The global cities play a major role in the adaptation of safer city projects as the pace and need for technological advancements are greater for cities witnessing a steady growth (Nam and Pardo, 2009; Neirotti et al., 2014). It is seen that larger and economically stronger cities tend to adapt the newer methods of surveillance and security devices at a faster rate (Chourabi et al., 2012; John-Green and Watson, 2014). Faster growth and a newer economy of the city, which are positive about further growth in the future ensure that the city is more likely to invest in newer solutions (Bifulco et al., 2016). This will lead to an added enhancement and coordination among the existing security apparatus. Urbanisation and fast-growing cities need the rapidity of infrastructure development to keep pace (Hollands, 2015). They need to make sure that newer and better integrated systems are put in place at this stage to make certain that they are able to reap the benefits of it (Caragliu, Del Bo, and Nijkamp, 2011; Ferrari et al., 2011). Building smarter systems instead of trying to overhaul obsolete systems is the best bet in the aim to have a better integrated system (Komninos et al., 2015; Giannakoulias, 2016). Bigger and more urbanised cities tend to award a certain degree of anonymity to people and tend to have increased crime rates. This necessitates the need for integrated security and surveillance systems as a part of the city infrastructure to deter crime and take action against those who indulge in it (Lombardi et al., 2012; Elmaghraby and Losavio, 2014). Hence there is a direct correlation between urbanisation and the integration of safer city projects.

Internet Protocol: One of the key factors to the convergence in safer city projects is Internet Protocol (IP) (Bifulco et al., 2016; Khansari, Mostashari and Mansouri, 2013). Connectivity using high speed internet is the way of the future as it is being increasingly used for connecting the various systems (Guleria, 2014). Setting up an IP infrastructure will make sure that cities are ready to incorporate the latest advancements in the field (Al-Nuaimi et al., 2015). It goes a long way to enable all the components to work together using wire or wireless networks (Al-Rashidi, 2009). Cities need to make an effort and spend money on the development of said infrastructure. Utilisation of the opportunity to adopt the latest technologies and get the most out of their budget for creating a smarter safer city is very important (Meijer and Bolivar, 2016). Technology today evolves at an astonishing pace, so it is essential that there is scope and swiftness in upgrading existing IP infrastructure (Da Cunha and Costa, 2004; Masrek et al., 2014).

Improved PPP and Cooperation: A social problem like crime needs a dedicated and coordinated effort from the agencies as well as from the people at large to help eliminate and curtail it (Haiduk, 2016; Schaffers et al., 2011). It is essentially a community problem, and the society has to unite as one, and cooperate with the city services to tackle it (Chourabi et al., 2012). It is only the unity of the society which can be effective and can be brought about by creating public awareness (John-Green and Watson, 2014; Piro et al., 2014). There is need to involve the private sector and coordinate with them to gather and share vital data towards the bigger goal of the betterment of the society (Bélissent, 2010). This helps by enabling faster and more targeted action and efficient apprehension of the culprits (Al-Nuaimi et al., 2015; Hernández-Muñoz et al., 2011). An aware public makes an effort to be a part of the system in place, recognises threats and feels more involved in the whole process and hence motivates them to take active part in improving their community (Gaffney and Robertson, 2016). The increased adoption of security systems by them will in turn lead to increased chances of collaboration with city security systems and hence lead to more Safer City projects (Manville et al., 2014).

Across the globe, smart cities are politicized as a response to globalization, urbanization, climate change and various other factors (Giffinger and Gudrun, 2010; Dameri and Cocchia, 2013). However, the main questions is ‘who is in charge of the data collected through the vast processes in smart cities’. While it is acknowledged that smart cities are state-level functions (as part of surveillance, policing, resident control, etc) and citizens in the state understand that their sensitive data to be held by the concerned authority (Rodríguez-Bolívar, 2015; Bifulco et al., 2016; Albino et al., 2015). However, with the growing public-private partnership in smart city models, there is a likelihood that such senstive data is either non-exclusively or partitially in the private control (Al-Nuaimi et al., 2015; Shichiyakh et al., 2016). Examples of such control include private parties that are used for city applications such as mapping, or taxi system, which are known to be public, but build through a Public Private Partnership (PPP) model (Yarosh, 2014; Snieška and Zykiene, 2014). In the following sections, an examination fo the building blocks for smart ‘safe’ city is conducted along with a review of its life cycle and following by review of the available models in this area.

Drivers	*Description*	*Challenge*	*Sources*
Urbanization	Urbanization in UAE has witnessed a steady growth, with a rise in population of 5 million in 15 years.	High pressure on the present civic infrastructure and competition in the provision of everyday resources. Need for a well-planned framework development to support city operations in fast growing emirates.	(Dsc.gov.ae, 2017)
Crime Rate	Developing a safe city is to control the instances of crime and securing a feeling of 'safety' amongst the city residents.	It requires a strong surveillance system providing security consultants to monitor and control crimes in real time.	(Kuttab, 2016; Hollands, 2015)
Security and Safety Threat	The threat of terrorism is a major security risk and forms an important component of SSC.	Crime rate is the main driver for the people to demand better security from the city.	(Al-Nuaimi et al., 2015; John-Green and Watson, 2014)
Natural Disasters	Natural Disasters pose a threat to the city due to their unpredictable nature.	Developing a first response team and the use of emergency communication and disaster management system is vital to curtail the loss of life and economic loss.	(Bifulco et al., 2016; Hollands, 2015)
Strong City Economies	The adaptation of safer city projects is based on technological advancements. Larger and economically stronger cities tend to adapt the newer methods of surveillance and security devices at a faster rate.	Building smarter systems instead of trying to overhaul obsolete systems requires a well-integrated framework with capability of integrated security and surveillance.	(Neirotti et al., 2014; Chourabi et al., 2012; Nam and Pardo, 2009)
Internet Protocol	Connectivity using high speed internet and IP infrastructure allow cities to adopt smart channels of management.	Heavy financial requirement for the development of IT infrastructure to support IP operations for smart city components. Lower availability of technology to meet futuristic vision of SSC.	(Bifulco et al., 2016; Masrek et al., 2014; Khansari, Mostashari and Mansouri, 2013)
Improved Private/Public Partnership and Cooperation	Increased adoption of security systems the government leads to increased chances of collaboration with city security systems and hence lead to Safer City projects in PPP.	Current regulations in PPPs can hinder collaboration with the private sector in SSC development.	(Haiduk, 2016; John-Green and Watson, 2014; Schaffers et al., 2011)

Table 2-6: Drivers of SSC

2.5 Safe City Implementation

Across the globe, an important function for governments which has been identified is Public safety (Lombardi et al., 2012; Alizadeh, 2017). It refers to the government's duty and function to ensure that its citizens along with the organizations in it are safe from threats and in adherence to law & order (Dameri, 2013). Today, a majority of the world population residing in urban areas, the concept of SC is increasingly necessary to ensure a secure living as well as prosperity. A significant challenge is posed by the crime, violence and fear in cities (Ishida, 2002; Meijer and Bolivar, 2016). The basic principles of good governance must find a direct application in any urban safety strategy that aims at reducing and preventing common problems of crime and insecurity (Giffinger and Gudrun, 2010).

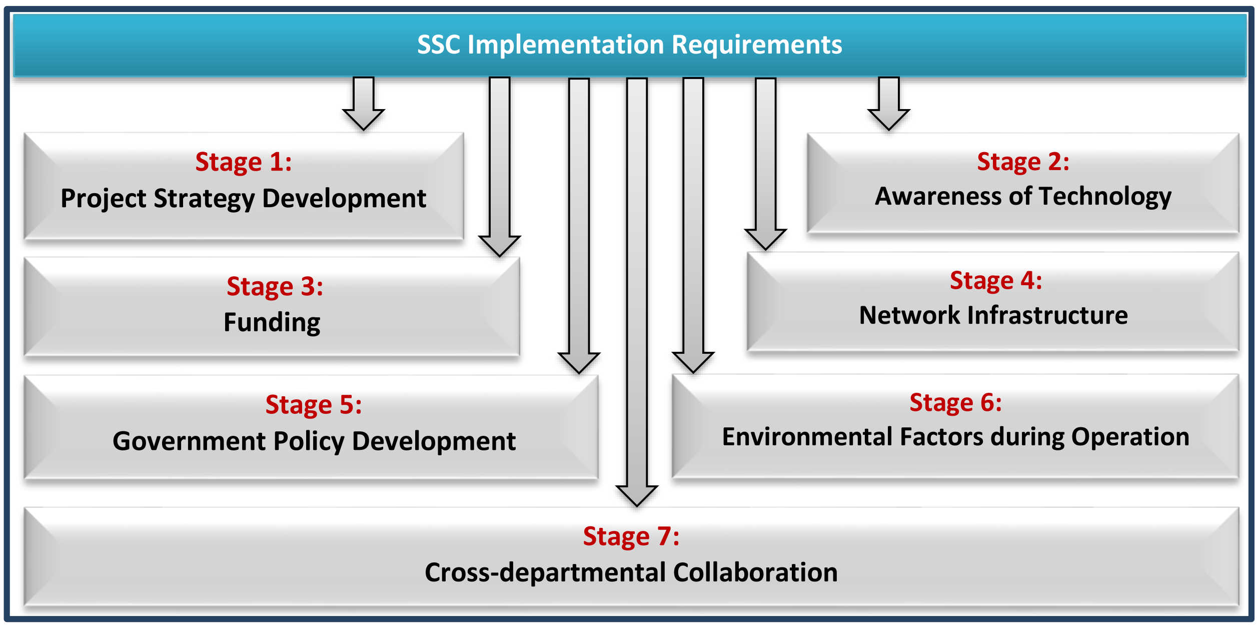

Figure 2-3: SSC Implementation

Source: (Meijer and Bolivar, 2016)

The idea surrounding a safe city is still new and slowly being adapted into different forms of governance (Hancke and Hancke Jr., 2012; Nam and Pardo, 2011b). Understanding the concept of a safe city, means knowing its limitations as well as the various obstacles it faces in its functioning (Chourabi et al., 2012; Barba et al., 2012). Although there is a rising market for this concept and the need for such an idea is growing in acceptance, knowing the key factors that make a city safe is important (Ferrari et al., 2011; Zygiaris, 2013). Research and studies are being take up by various key government and non-governmental bodies that try to understand the pre-requisites for having a smart city (Su, Li and Fu, 2011; Söderström et al., 2014). Also, they talk about how to adopt the concept in a way that is swift and does poses no immediate discrepancy when being initiated, for example, during instances of crime, terrorism and other anti-social elements (Meijer and Bolivar, 2016; Ishida, 2002; Neirotti et al., 2014). Governments need to take into account the various possibilities as in uncontrolled environments, anything can happen (Letaifa, 2015; Chourabi et al., 2012). The implementation of a smart 'safe' city concept can be divided into seven stages as outlined in figure 2.3. Each of the stages is examined in detail.

Stage 1: Project Strategy Development

Certain key factors have to be taken into consideration for the effective utilization of smart city planning (Meijer and Bolivar, 2016). They involve ensuring that the implementation comes under the distinct laws set up by the government of that city and that the ultimate desired result is achieved throughout its implementation. There are many obstacles that officials and government bodies will face during the executions of such a project (Meijer and Bolivar, 2016; Al-Rashidi, 2009; Letaifa, 2015); where these obstacles are: **(1)** A dire lack of the fundamental knowledge surrounding safe cities and their applications' **(2)** Pointing out the expected outcomes from such a system is sometimes difficult to assess; **(3)** A lack co-operation among policy-makers in establishing safe cities throughout the nation; **(4)** Not all bodies will be co-operating with the development of the safe city programs. In maintaining ordinance as well as establishing policies for state and municipal corporations, the department of public works and other local bodies need to be involved further in the discussions in order to execute an effective plan of action (Paroutis et al., 2014; John-Green and Watson, 2014). Each of these obstacles can be overcome by setting up a team that is focused primarily at the start for easier co-ordination between the government and non-governmental bodies (Letaifa, 2015; Meijer and Bolivar, 2016). Decision-making must be met with in a straight-forward manner with the executing team consisting of notable influencing powers (Bifulco et al., 2016). The team will focus primarily on establishing the need for the smart city, its expected application and results as well as the technical requirements to be fulfilled during its tenure (Schaffers et al., 2011; Vilajosana et al., 2013).

Stage 2: Awareness of Technology

It is important for there to be an understanding of the kind of technologies to be used for implementation of a safe city project as technology forms the basis for its activation and function (Meijer and Bolivar, 2016). If this is not achieved, unrealistic and sometimes misplaced expectations can arise from the operational heads. If the system then does not adhere to these made-up expectations, then the project will either shelved or scrapped, not being able to fully utilize its potential (Elmaghraby and Losavio, 2014; Novotný et al., 2014). There is a need for establishing workshops that provide insight on the technicalities of a project such as this that can prove the advantages in real-world application, especially in the international market, which allows stakeholders to properly understand what kind of technology is more apt for the situation (Shelton, Zook and Wiig, 2015; Cosgrave et al., 2013)

Stage 3: Funding

Investing in a safe city consists of 40 to 50 percent of the investment being the capital investment while operational and maintenance costs make-up the remainder of the key investments (Meijer and Bolivar, 2016; Szabó et al., 2013). As such, these projects require a large sum of money and are considered to be high-value commodities or undertakings (Söderström et al., 2014; Schaffers et al., 2011). Each stage's funding is important to ensure that the project's progress moves on smoothly (Piro et al., 2014). There are certain protocols that need to be followed for proper establishment of the key criteria for funding, as shared in the table 2.7:

Protocols	*Purpose*	*Challenge*
Planning Development	Effective planning needs to be made for appropriate fund allocation towards the specific targets of progress.	Prioritization of the projects will need effective consideration for fund allocation and project development
Funding	Finding the funds from the central as well as the local governments.	Current streams of funding to support SSC developments may restrict futuristic development.
Documentation	Receiving the necessary funds from private bodies as well, including institutions and NGOs.	Regulations imposed by the private sector may slow down documentation processes in SSC, leading to delays.
Creative Resource Utilization	Make creative use of existing schemes in order to fund the project at hand.	Development of a creative unit to propose and develop new initiatives to meet the funding requirements of the SSC without affecting the current operations.
PPP Development	Encouraging Public Private Partnership or consider a new operate transfer (or BOOT) that can be implemented upon upcoming projects as well	Existing regulations in the PPP can affect the way private firms contribute in the SSC development.

Table 2-7: Protocols to be followed for SSC funding

Source: (Meijer and Bolivar, 2016; Piro et al., 2014; Szabó et al., 2013; Sairamesh et al., 2004)

Stage 4: Network Infrastructure

The architecture that the safe city will be composed is necessary to evaluate as it will create the platforms required to install the specific instruments required for the effective enabling of the safe city project (Meijer and Bolivar, 2016; Bélissent, 2010). An example for this is the requirement of high bandwidth cameras that are used for monitoring and control function purposes apart from being used for surveillance (Manville et al., 2014; Giffinger and Gudrun, 2010). A strong and robust network architecture is also required to ensure that all systems remain online at all times (Rodríguez-Bolívar, 2015). To achieve the above aim, the government will have to partner with the service providers to create a better, more effective connection method and enhance the quality and availability of its services (Dirks et al., 2010; Dixon, 2012). Significant research should be made in bandwidth allocation procedures as networking operatives are crucial to the proper functioning of the safe city, especially in the design-phases of the project as quality of the videos, the bit-rate and compression rate are factors that need to be considered before beginning the primary functions (Edvinsson, 2006; Gartner, 2012; Sartori, 2013).

Stage 5: Government Policy Development

There are numerous obstacles that pose threats to the government at the state as well as the local level in the case of the implementation of the safe city project (Meijer and Bolivar, 2016). A few of the challenges which emerge during the process need to be taken care of immediately such shared in the following table 2.8.

<table>
<tr><th>Challenge</th><th colspan="2">Implication and action</th><th>Sources</th></tr>
<tr><td rowspan="2">Imposing high value taxes on incoming security instruments; initiating the funding for the project by the state and the central government</td><td>Implication</td><td>Reduced investment from private sector to participate in the SSC projects, thereby increase financial liability on the government.</td><td rowspan="2">Meijer and Bolivar, 2016; Shelton et al., 2015; Letaifa, 2015</td></tr>
<tr><td>Action</td><td>Enforce tax reduction on the import of security tools for the project and cover the costs of involving additional man-power; encouraging either the PPP or BOOT method of funding that will be required for funding the upcoming projects even at the foreseeable stages</td></tr>
</table>

Challenge	Implication and action		Sources
A shortage of support staff and police that are trained in conducting the proper protocols required for such an endeavour	**Implication**	Inability of the government to manage smart city projects with perceived efficiency, thereby cause lapse in service, threat to public information, delayed response and risk of failure in ensuring public safety.	Meijer and Bolivar, 2016; Szabó et al., 2013
	Action	Enforcing awareness programs to invite participating of young manpower to be a part of the team. Secure performance through training and development activities.	

Table 2-8: Challenges in government policy development for safe city

Stage 6: Environmental Factors during Operation

During the setting up process, various instruments are kept in an open environment such as outdoor cameras, network devices and poles that are used to establish a seamless functioning space for development (Meijer and Bolivar, 2016). Since they are kept open, it is imperative that they receive a regular and reliable source of power and protection; especially against theft and further potential for damages by the public or nature (Chourabi et al., 2012; Curry, 2016). This may be possible through the following methods by providing awareness to the public so that there is mass appeal regarding the safe city projects and its understanding (Al-Hader and Rodzi, 2009). Also, finding alternative power sources such as solar power using devices like sensors that find any abnormal movements that may cause the theft of the devices and track them across the field can be helpful (Shichiyakh et al., 2016; Ribina, 2015).

Stage 7: Cross-departmental Collaboration

Connecting the CCTVs across the city in various governmental infrastructures can be a daunting task in order to provide effective surveillance (Meijer and Bolivar, 2016). Knowledge transfer and exchange of data is also important among the agencies. One of the foremost challenges which arise out of the new-age implementation of equipment is the existing legacy system, which is already being implemented by agencies (Alawadhi et al., 2012; Bartlett, 2005). In some places, there is no presence of a security system at all. All of these challenges can be made redundant through specific solutions which help in scalability as well as offer the right convenience at different locations using standardised and proven methods (Chourabi et al., 2012). There needs to be infrastructure set up for the supervision of these collaborative models as well to explore scope for further improvement (Curry, 2016; Hernández-Muñoz et al., 2011).

2.5.1 Benefits of SSC Implementation

The concept of SSC incorporates the enhancement of efficiencies throughout the management process as well as implement transparency during its implementation (Rodríguez-Bolívar, 2015; Chourabi et al., 2012; Nam and Pardo, 2011b). Owing to a number of applications, increase in revenue collection as well as facilitation of new reforms have been achieved (Alizadeh, 2017; Snieška and Zykiene, 2014). Hypothetically, one such model that can be adapted to governments worldwide would be the stakeholder model, which necessitates change of power between administrations through the different relationships shared, along with identifying the unique stakeholders (Yarosh, 2014; Hancke and Hancke Jr, 2012).

According to Rodríguez-Bolívar (2015), having a SSC can allow for complementing both the operational and strategic sectors by bringing together information systems which are hosted by the government. He digresses that in order to meet the on-going demand for increased effectiveness, efficiency of the process, information quality, and improved interaction mechanisms, efforts can be focused on to provide better tools for administration and governance (Hernández-Muñoz et al., 2011; Söderström et al., 2014). Added, SSC which operate with the help of ICT, tend to provide more efficient and cost-effective means of governance, allowing for better access to information and making the government more answerable to the public (Schaffers et al., 2011; Vilajosana et al., 2013).

With the implementation of SSC, governments can reduce corruption, increase the transparency of the operations conducted, promote reduction of costs and increase revenue considerably (Szabó et al., 2013; Shelton, Zook and Wiig, 2015). The IT sector also witnesses benefits from SSC which have been well adapted by the citizens, businesses and other governmental bodies (Rodríguez-Bolívar, 2015; Alizadeh, 2015). This form of government also makes government servants more susceptible to be accountable, while at the same time reducing the discretion and flexibility enjoyed by them otherwise (Al-Hader and Rodzi, 2009; Nam and Pardo, 2011a). Transparency in the form of easier access to information online for every citizen to view provides knowledge to the public about the government's employees, making the hierarchy brought down to a single plain (Jin et al., 2014; Neirotti et al., 2014).

Chourabi et al., (2012) felt a need to support exploring the facets of SSC by speaking of increasing efficiency while reducing costs and level of service quality offered to both the business and the customer. The authors along with other researchers such as Lombardi et al. (2012) and Barba et al. (2012) highlight the importance of controlling the transparency, promoting anti-corruption and giving due accountability to those in need and to make the government capable of making actionable decisions. Also, creation of networks and strengthening communication; significantly improving the decision-making process and encourage the use of ICT applications in other sectors in the society is promoted (Ferrari et al., 2011; Khansari et al., 2013; Guleria, 2014). For developing countries, the priorities met with the governments include transparency, fighting corruption, taking accountability, reducing costs, improving on efficiency and spreading the use of ICT (Carr and Hayes, 2015). Although the benefits are many, dissecting them and departmentalizing each of the elements could enable researchers to introduce new formulas that can be carried out in practice after extensive testing and validation through data analysis and surveys (Letaifa, 2015; Paroutis et al., 2014). The benefits of a Safe City can be divided into the following aspects, brought forth by the literature [see table 2-9]:

Internal: One of the core elements that drive the organization are the internal benefits and include a number of factors that affect the organization (Al-Nuaimi et al., 2015; Komninos et al., 2013). This includes providing return on investment based on analysis on the cost-benefit (Al-Nuaimi et al., 2015); increasing productivity and providing transparency in the processes incurred by the organization (Masrek et al., 2014); providing a smoother hierarchical line of authority, to simplify the otherwise complex organizational structure and delegate responsibilities effectively (Komninos et al., 2013); managing the internal data and other information of the organization is considerably improved qualitatively, owing to efficient service; ensuring quality through monitoring and helping in the making major decisions throughout the process, along with applying necessary workflow systems to better facilitate the business process. (Komninos et al., 2013; Letaifa, 2015).

External: Although internal improvements in the public sector is facilitated by the application of Safe smart cities, applying this form of governance for external affairs with agencies and partners also brings in a considerable number of advantages (Letaifa, 2015; Capdevila and Zarlenga, 2015). This includes streamlining communications between industries and businesses (Paroutis et al., 2014); bringing together ministries digitally in order to broadcast and share information (Capdevila and Zarlenga, 2015) and providing access to a universal portal for companies and the general to avail government services and perform transactions through the electrical systems (John-Green and Watson, 2014; Ifinedo, 2006). Among the above-mentioned benefits, others include interaction with government departments without the public having to wait in long queues; setting up faster procurement services between businesses to allow for better governance as well as promoting foreign direct investment projects (Muoka, 2010; Hollands, 2015; Zhuhadar et al., 2017).

Operational: In optimizing the efficiency and time taken in order to fulfil transactions, scholars recommend applying the SSC's policies that will allow for faster completion of transactions, fulfilled within minutes instead of days (Bifulco et al., 2016; Lombardi et al., 2012). For gauging the levels of performance and monitoring government functions, SSC establish a better framework of these processes, greatly diminishing the pressure incurred such as setting allotments, queues and wait-times (Zhuhadar et al., 2017; Su, Li, and Fu, 2011). Given the flexible nature of this type of governance positively affects the efficiency in operations and boosts public favour towards the government. (Cosgrave et al., 2013; Bifulco et al., 2016)

***Organizational*:** By providing better precision of directives towards the workforce and significantly reducing the number of personnel required for administrative management, SSC can provide openness towards innovation of bringing in new techniques (Szabó et al., 2013; Shelton, Zook and Wiig, 2015). Also, it can allow more creative means to increase efficiency in the systems and labour departments (Vilajosana et al., 2013).

Technical: SSC will bridge the gap between traditional and modern modes of governance (Letaifa, 2015; Söderström et al., 2014). It will allow for the public to be open to have more streamlined access to their government; allow for existing services to be optimized and provide a better delivery system for the public; provide better digital support to everyone (Chourabi et al., 2012; Hernández-Muñoz et al., 2011). It also includes familiarizing the public with easy access points to services by means of portable applications (Manville et al., 2014); Providing safe and trustworthy means of sharing data (Giffinger and Gudrun, 2010); and reducing data dumping and collection of information (Rodríguez-Bolívar, 2015). Other benefits include to inspire organizations to take part in networking with each other through the ICT infrastructure, are some of the other benefits of applying SSC in governments. (Shichiyakh et al., 2016; Yarosh, 2014; Martin & Reddington, 2009).

Benefit	Description	Implications	Sources
Internal	SSC bring various internal benefits from increasing productivity and providing transparency to effective management of data	Increase safety and security of the city by strengthening internal development.	Al-Nuaimi et al., 2015; Komninos et al., 2013; Ma et al, 2005
External	The application of Safe smart cities enables governance for external affairs with agencies and partners	Improves performance of SSC components to adhere to the strategic objectives.	Muoka, 2010; Ifinedo, 2006; Carbo & Williams, 2004
Operational	SSC offer the efficiency and time taken in order to fulfil transactions, with better performance and monitoring of government functions	Lowers decision making time and delays in action during emergencies	Zhuhadar et al., 2017; Bifulco et al., 2016; Chandler & Emanuels, 2002
Organizational	SSC offer openness towards innovation through smart organization of all its departments	Promotes a sense of security and safety among the city users.	Buccoliero et al, 2008; Ifinedo, 2006
Technical	SSC enable public to be open to have more streamlined access to their government through smart applications	Improved collaboration with the public, thereby increasing safety and security of the city elements.	Martin & Reddington 2009; Hamed et al, 2008a; Kaliontzoglou et al, 2005

Table 2-9: Benefits of SSC Implementation

2.5.2 Challenges of Safe City Implementation

Challenges arising from implementation of SSC are expected to be established due to the high level of organization and labour required to execute the process in a successful manner (Novotný et al., 2014). Based on the reviewed literature, the following factors have been identified as challenges toward the development of SSC (Guleria, 2014; Paroutis et al., 2014). They are shared in the table 2-10:

Challenges	Solution	Sources
Deficiency in technology and technical support staff	Engage in capability building capable to handle new technology of smart city projects with consistency.	Hajduk, 2016; Elmaghraby and Losavio, 2014; Liu and Peng, 2013
Deficiency in funds	Joint planning by all agencies involved in SSC planning can allow appropriate strategy development for capital intensive elements.	Meijer and Bolívar, 2016; Dameri, 2013; Galdon-Clavell, 2013; Ishida, 2011
Underdeveloped ICT infrastructure, readiness to adopt electrical processes, lack of computer literacy and communication equipment	Increasing awareness of new technology capable to improve SSC projects, conducting technical workshops, and implementing best practices	Gaffney and Robertson, 2016; Snieška and Zykiene, 2014; Aoun, 2013; Roscia et al., 2013
Security concerns, as well as outdated IT issues	Encouraging deployment of updated IT infrastructure across all projects of SSC.	Curry, 2016; Jin et al., 2014; Clohessy et al., 2014; Lombardi, 2011
Improper policies legislated by the government	Rethinking on policies that effect smart city projects, such as import of security equipment, implementing tax duties reduction, building awareness on private collaboration.	Albino et al., 2015; Neirotti et al., 2014; Alawadhi, 2012; Asimakopoulou and Bessis, 2011
Human development skills along with education and learning	Conduct training and development programs to encourage learning and knowledge development of the existing staff to improve performance and operating efficiency.	Bifulco et al., 2016; Elmaghraby and Losavio, 2014; Szabó et al., 2013
Capital procurement	Assisting organizations involved in procurement of SSC infrastructure, with support in policy planning.	Kitchin, 2016; Shelton et al., 2015; Clohessy et al., 2014; Giffinger and Gudrun, 2010
Culture clash and management openness to access change	Engage in change on an on-going basis, encouraging and supporting staff in innovation and development, thereby improving acceptance to change and openness to innovate.	Capdevila and Zarlenga, 2015; Yarosh, 2014; Schaffers et al., 2011

Table 2-10: Challenges of SSC Implementation

Apart from the above mentioned challenges, there exist other challenges which include pooling in collaborative efforts from public and private sectors for networking and community creation (Snieška and Zykiene, 2014); developing a strategy with strong vision and mission statements and necessitating leadership to encourage progress, build support and influence the public to adopt the SSC program (Yarosh, 2014; Alizadeh, 2017)

While the points mentioned highlight the barriers against the facilitation of the SSC, Nam and Pardo (2011a) have pointed out notable challenges that arise out of the SSC. While the application will be available to the general public, it will not be exclusive to customers alone, allowing for persons of lower income and disabilities to be eligible for accessing the services provided by SSC (Jin et al., 2014; Bakıcı, Almirall and Wareham, 2013). Decision making becomes a hindrance to the formation of newly applied governmental services since the decision-making authority is less unified in government bodies (Neirotti et al., 2014). Democratic governmental bodies will have to contend with allocation of resources that are in the best interests of the public, hence accountability will pose as a challenge while allocating specific budgets (John-Green and Watson, 2014; Chourabi et al., 2012).

In terms of management, Anderson (2006) suggests that the management should adopt strategic views and replace the transactional view currently being practiced in the government. As the IT sector provides faster pay-back time as opposed to the private sector, Caragliu et al. (2011) implies that the strategic challenges faced by the management compose of five key highlights: demand and supply needs of a SSC and keeping street-level bureaucrats in check so as to not disrupt the flow of the gate-keeping process of SSC. Also, diminishing labour intensive jobs in the public sector by adopting the use of IT and re-assessing and analysing the workforce's readiness in adapting to a SSC will strengthen smart city implementation (Ferrari et al., 2011). On the other hand, creating competent relationships with the government to make sure application of IT is made use of effectively (Elmaghraby and Losavio, 2014).

2.5.2.1 Classification of Safe City Challenges

Developing countries face harsh criticism and are thought of being economically incapable, politically underdeveloped, corrupted and illiterate for the success of SSC (Khansari et al., 2013; Novotný et al., 2014). As such, many researchers and IT managers argue that these issues will prevent the scaling of smart cities in these under-developed countries (Guleria, 2014; Al-Rashidi, 2009; Carr and Hayes, 2015). It is preferred that this type of government model be implemented on modern cities that are not subjected to societal or political pressure/turmoil (Houston et al., 2015). For making the classification easier for researchers to select which cities are capable or not, barriers of development have been established to ensure that the cities being considered are not within these challenges, as shared in the table 2.11 (Mundy & Musa, 2010; Nkohkwo & Islam, 2013). They are: Advancement of IT/Technology, Privacy and security features, Literacy in the field of IT, ability to pool in organizational as well as operational resources along with sound finance capabilities (Letaifa, 2015; Capdevila and Zarlenga, 2015).

Technological/IT Infrastructure: Essentially, lack of a basic framework of communication to establish basic technological conditions required for growth and development are a prime reason for cities falling short of reaching technological competence (Paroutis et al., 2014; Mundy & Musa, 2010). Underdeveloped countries suffer from having outdated networks or poorly optimized systems to cater to the growing consumer need (John-Green and Watson, 2014; Nkohkwo & Islam, 2013). Hence there is a need for a strong telecommunication network, defining proper communication policies and establishing access to ICT (Al-Nuaimi et al., 2015). There is also a need to integrate collaborative networks in order for government websites to function serve the general public (Lombardi et al., 2012; Zygiaris, 2013). Because of the outdated systems being used, new firmware requirements require those systems to be upgraded or are otherwise incompatible with the older framework (Szabó et al., 2013; Vilajosana et al., 2013). This often arises due to lack of sufficient funds to regularly service and add functionality to these systems for the department of communication. (Letaifa, 2015; Schaffers et al., 2011)

Trust and Security: Software infrastructure of a government body should be rigid and well optimized to face any threats that could compromise relevant data and risk leakage of personal and private information in the wrong hands (Rana *et al*, 2013; Lambrinoudakis *et al*, 2003). For this reason, researchers stress that sufficient quality checks and assurances are necessary for the safety of public records and prevent cyber-attacks in the form of Trojans, viruses, worms and other harmful means of extraction (Joia, 2004; Beynon-Davies, 2005). If such an event occurs, it lessens the faith of the public towards the government, making it difficult to analyse and provide support. Government bodies should have a hierarchy and a proper protocol in place to make valid transactions, check for fraud and also vet the personnel behind these operations (Joshi *et al*, 2001; Nkohkwo & Islam, 2013). It is important to have necessary hardware and software infrastructure in order to reduce the frequency and effectiveness of the risks incurred. (Alshehri *et al,* 2012; Gilbert *et al*, 2004)

IT Literacy and Skills: In order to manage the functions of complex technical systems to bring orderliness and efficiency to the process (Chourabi et al, 2012; Manville et al., 2014). Only competent staff with the necessary technical knowledge will be able to accomplish the tasks set forth in order to manage a government that is based on the SSC model (Rodríguez-Bolívar, 2015; Al-Rashid, 2009). The challenges arising in this department are: technical aptitude of the hardware and software used; sufficient training; lack of employees to manage the workload; lack of up-to-date IT infrastructure for the smooth functioning of the programs needed (Yarosh, 2014; Snieška and Zykiene, 2014).

Organisational/Operations: In order for the process to run in a smooth manner, necessary steps have to be taken in order to employ and train the personnel involved in the process (Alizadeh, 2017; Al-Hader and Rodzi, 2009; Enyon & Dutton 2007). Organisation is an important factor that helps effectiveness of government processes and imparts qualities such as accountability, leadership and implementation of rules (Nam and Pardo, 2011b). Some of the difficulties faced under this department are primarily inadequate number of ICT personnel recruited into the workforce (Lombardi et al., 2012); lack of motivation for performing (Caragliu et al., 2011); and absence or lack of relevant guidance in the form of implementation in SSC; improper explanation of the governmental protocols (Elmaghraby and Losavio, 2014). Other issues include transparency (Khansari et al., 2013); societal and political issues; closed-mindedness of existing employees to adapt to newer forms; restructuring the business format and simplifying the business process (Novotný et al., 2014; Belanche et al., 2014; Da Cunha and Costa, 2004).

Economic/Financial Resource: Financial burden poses a heavy risk to the development of the SSC (Lombardi et al., 2012; Nkohkwo & Islam, 2013). Due to insufficient financial capital, implementation of the necessary projects involved in erecting such a government will be impossible (Belanche et al., 2016). Some of the obstacles which hinder financial growth are classified based on the following factors: Amount of foreign and local investment, networking opportunities to build funds for the economy, unavailability of internet, issues with supply and demand of commodities; the lack of proper knowledge and the lack of data to deal with different economies; expensiveness of IT professionals and consulting organizations; expensive maintenance owing to ICT systems; increased costs of conducting training programs for system development (Houston et al., 2015; Novotný et al., 2014).

Challenges	*Description*	*Implications*	*Sources*
Technological/IT Infrastructure	SSC implementation is hindered by the lack of a basic framework of communication to establish basic technological conditions	Applying the usage of latest technologies in development of safe city services.	Nkohkwo & Islam, 2013; Mundy & Musa, 2010; Guleria, 2014
Trust and Security	Software infrastructure plays a crucial role in SSC to face any threats related to security of the data.	Boosting trust and security by strengthening the deployment of up to date technologies, with focus on privacy and security threats.	Nkohkwo & Islam, 2013; Rana *et al*, 2013; Alshehri *et al*, 2012; Beynon-Davies, 2005
IT Literacy and Skills	SSC implementation is dependent on technical systems to bring orderliness and efficiency to the process	Enabling human capital development to be part of the safe city framework and contribute on an effective basis with lower hindrances.	Al-Rashid, 2009; Ebrahim, 2005
Organisational/Operations	The successful implementation of the SSC model depends on organization and operations capacity to employ and train the personnel involved in the process	Promote innovation, change and openness to accept and contribute as a part of the smart city framework at operational and managerial level.	Enyon & Dutton, 2007; Hu *et* al, 2006
Economic/Financial Resource	Financial barrier restricts the development of SSC, as lack of funds hinder IT deployment, manpower allocation and cost management	Strengthen financial resources to deploy up to date and latest technology in development of safe city projects.	Nkohkwo & Islam, 2013; Guleria, 2014; Carbo & Williams, 2004

Table 2-11: Classification of the challenges of SSC Implementation

More on the implementation and classification of the above-mentioned barriers are explained based on previous reviews of research (Alshehri *et al, 2012*; Nkohkwo & Islam, 2013). Some of the other hindrances that arise against the development of the SSC include, but not limited to:

- Sizeable development and infrastructure by developing countries' governments that are currently unobtainable in order to facilitate the mode of work required (Belanche et al., 2016; Letaifa, 2015).
- Officials in the higher end of the government spectrum are more aged and have a partiality for traditional means, meaning they will not be open to accepting newer forms of economic improvement that use technology (John-Green and Watson, 2014; Bifulco et al., 2016)
- Government initiatives are far too expensive and require a big budget to execute; developing countries mostly suffer from terrorist threats and politically motivated attacks, which cause unrest and hinder the process of development (Letaifa, 2015; Paroutis et al., 2014).
- Owing to slower economic growth, the rate of growth for technological progress also becomes much slower, forming an atmosphere of relative unfamiliarity with ICT;
- There has to be a legislative guidance to help the framework take certain actions so that no step is met with contest, especially with developing countries that are unaware of most laws that occur while business transactions take place (Mundy & Musa, 2010; Al-Nuaimi et al., 2015).

It is however a thought for researchers to consider of the risks that having a SSC would derive (Lombardi et al., 2012; Zygiaris, 2013). The existing literature in this area indicates only the obstacles against the SSC' implementation or the benefits of its implementation (Cosgrave et al., 2013; Szabó et al., 2013). This is mostly because the risk involved will only depend on the habitat which this form of government is being implemented in, and of the processes undertaken, which will only then be able to gauge the level of risk or uncertainty that SSC cause to a nation (Shelton, Zook and Wiig, 2015; Söderström et al., 2014).

2.5.3 Risks of Safe City Implementation

While the topic is up for argument, it is widely considered by researchers that although there are significant benefits to be appreciated by the implementation of this model, the knowledge sharing among the scholars have posed certain results that establish risks which SSC can incorporate

(Clohessy et al., 2014; Knapp and Samani, 2013). One of the biggest risks is that running a government with the already prevailing social, cultural and political backwardness can stunt the level of development of such a governmental system as not all parties included in the system will be comfortable with the transition, understandably (Lombardi et al., 2012; Cosgrave et al., 2013). Those values are far more ingrained in the society than analytical, data-driven facts which prove the possible gains (Szabó et al., 2013). Rampant corruption spreads throughout public services at all the levels of hierarchy, most prominently in developing countries (Shelton et al., 2015; Vilajosana et al., 2013). This is why the existing staff will be resistive towards this implementation, since it brings with it transparency and automation (Söderström et al., 2014). Some existing staff also prefers the form of physical directories or paperwork, which help in personal interaction, owing to making side-deals/offerings and other such corruptive opportunities (Schaffers et al., 2011).

2.5.3.1 Classification of Safe City Risks

As per the OECFD (2001, pp.2), "***The identification of risk and its management are the main features for a successful IT-based project management***". In many economies, dedicated guidelines and practices are developed for such a system while many are still learning more about the same (Letaifa, 2015; Vilajosana et al., 2013). However, it should be noted that many failures are caused due to issues such as poor compliance to well-developed guidelines and/or good practice (Schaffers et al., 2011). In this section, an overview of the classification of SSC risks is provided based on the review of various literature (Weerakkody *et al*, 2013; Choudrie *et al*, 2009; Abdallah & Fan, 2012; Nijaz & Moon, 2009), and it is presented in table 2-12.

Technological: Since the technology will not be made in the host country, it will be brought in from outside, foreign sources, thus putting the responsibility of handling important data and processes in the hands of those systems (Elmaghraby and Losavio, 2014). This also means the staff will need to be technically knowledgeable in the functioning and operation of those systems (Vanolo, 2014; Batty et al., 2012). In terms of service and maintenance, the Foreign Service provider will get to have the final word in terms of the price (Liu and Peng, 2013). Governments which have to overcome their own issues have to first be able to facilitate the change and the resistance that usually is accompanied with it (Paroutis et al., 2014; Hollands, 2015). This effects how the government will function in its full capacity (Schaffers et al., 2011). Sudden turn-key events could trigger unfavourable results while the government is in the process of re-initiating its framework and organization (Brenna et al., 2012; Lombardi et al., 2012). Emergency situations could make key personnel migrate or defect outside. Often times when new technology and systems are adopted, certain problems occur in terms of compatibility with the mainframe as well as with the personnel (Branchi, Fernández-Valdivielso and Matias, 2014). If acquiring and adopting these new methods fail, the government will no use for such innovations, delaying progress and ultimately resulting in poor service to the public (Zhuhadar et a., 2017). Other risks could occur as well, such as duplication and privacy which are not uncommon entities in developing countries especially. Even on the basis of service, based on cheap offerings but unreliable quality (Al-Nuaimi et al., 2015; Asimakopoulou and Bessis, 2011).

Process: Processes are formed in order for there to be orderliness and control over a department and making tasks easier to manage and handover to the necessary personnel (Choudrie *et al*, 2009). Since people form these processes, their experience in the transformational sequence between the transition of a traditional government to a SSC model will prove crucial in the long run (Al-Rashidi, 2009; Brenna et al., 2012). Improper delegation, lack of leadership and initiative and other factors could result in poor performance and service quality (Cosgrave, Arbuthnot and Tryfonas, 2013).

People: Running the processes and keeping a smooth transition happening often requires harmony among those employed to function in each department (Szabó et al., 2013; Bélissent, 2010). Challenges that could be incurred during this time would involve lack of sufficient manpower (Hernández-Muñoz et al., 2011); unemployment factor in the nation (Hancke and Hancke Jr, 2012); prevailing corruption, owing to the usage of third-party suppliers and co-ordinators who do not fall under the system and as such, are more likely to be indulging in corruption (Giffinger and Gudrun, 2010; West, 2004). This also means a lack of transparency and accountability as well. (Rodríguez-Bolívar, 2015)

Organisational: Lack of leadership qualities among the personnel, negligence and improper usage of the government services and resources affect the performance and the effectiveness of the government (Shichiyakh et al., 2016; Alizadeh, 2017).

Financial: The success or failure of SSC will be dependent on the availability of funds that are utilized for its development (Al-Hader and Rodzi, 2009; Bakıcı et al., 2013). Since this model is a machine that continuously requires maintenance and is subjective to the economic climate of the nation, certain government projects could be left or abandoned as the influx of money reduces (Neirotti et al., 2014; Guleria, 2014). The more financially sound, the better the performance and implementation of the SSC.

Security and Privacy: Privacy, defined by Kessler *et al* (2011) is '*the absence of unreasonable and potentially intrusive, collection and use of personal information* (pp.3).' With respect to privacy, it is observed as a social concern, on the other hand security noted as technical subject (Choudrie *et al*, 2009). Scholars thus stress that it is important to conduct different levels of trust in the form of confidentiality, a certain level of integrity and availability of these security features (Chourabi et al., 2012; Caragliu et al., 2011). These when requested by users whether they are fluent in the technical lingo or whether they have the means to access advanced forms of IT or not (Hector, 2012; Robins, 2000). More importantly, this is to prevent identity theft and also to regulate content so that cyber-attacks do not cause a breakdown to the entire system (Abdallah & Fan, 2012; Nijaz & Moon, 2009; Weerakkody *et al*, 2013).

Risks	*Implication*	*Sources*
Technological	Technology needed for SSC is usually imported and not based in host country, thereby leading to issues of change and resistance from existing departments and training and development to adopt to the new technology	Zhuhadar et al., 2017; Elmaghraby and Losavio, 2014; Paroutis et al., 2014
Process	The transition of the smart city model into a safe city model is affected by the existing process and leadership	Al-Rashidi, 2009; Choudrie *et al*, 2009
People	SSC implementation rests of manpower, unemployment and corruption that may exist while dealing with private contractors	Kessler *et al.*, 2011; Choudrie *et al*, 2009
Organisational	Organisational risks relate to leadership primarily on how the people, process and technological resources are utilized to meet the transition	(Weerakkody *et al*, 2013; Palvia *et al*, 2001)
Financial	The success or failure of the SSC rests of the financial position as it drives how different resources are utilized in cohesion	Abdallah & Fan, 2012; Guleria, 2014; Palvia *et al*, 2001
Security and Privacy	These form an essential part of SSC implementation to ensure confidentiality, integrity and available of security of the user information and regular theft and breakdown of the system	Weerakkody *et al*, 2013; Abdallah & Fan, 2012; Kessler *et al.*, 2011; Choudrie *et al*, 2009

Table 2-12: Risks of SSC Implementation

2.5.4 *Benefits, Risks and Barriers - Presentation of SSC*

As evidenced by the previous literatures reviewed, researchers and analysts have concluded that the factors or characterizations that leads the SSC implementation can be broadly distinguished into being the benefits of a SSC, the barriers preventing the rise of the SSC and the risks of implementation of a SSC (as reviewed in section 2.5.2 and 2.5.3). They are further classified into six different categories: Technology, Processes, people involved, and the organizational aptitude, the level of financial resources available as well as security and privacy, as shared earlier in table 2.13 (Novotný et al., 2014; Letaifa, 2015; Albino et al., 2015). These different categories will provide a much clear and concise definition to provide complete informational and analytical analysis on the subject of SSC.

<u>Technology:</u> The three main determinants for gauging the technological aptitude of the SSC and its services are primarily, the encouragement of implementation of ICT; data accuracy and reliable sources for data (Abdallah & Fan, 2012; Matavire, 2010; Mundy & Musa, 2010). The obstacles coming in the way of successful integration of technology infrastructure are the deficit of IT skills among the personnel and the shortage of actual networking modes for communication, owing to a deficiency in upgradation of traditional methods (Eddowes, 2004; West, 2004; Hamed *et al*, 2008a). The primary risk to be acknowledged here is the imminent failure of new technology as well as the cost of fragmentation of services, making the process rigid and incompatible for users to apply in the SSC model (Bifulco et al., 2016; Martin & Reddington, 2009; Nkohkwo & Islam, 2013)

<u>Processes:</u> The questionable quality of services, lack of management of the information and data along with corruption owing to the outsourcing of the front-end offices, as is display in figure 4, can be assumed to be the main risks for practicing the SSC model (Weerakkody *et al*, 2013). At the same time, it should be noted that if implemented properly, the success rate of the model will considerable, due to the following: accurate and efficient service delivery, zero margin for error, transparency and diminishing of any corruption activities (Ibrahim and Morsy, 2016; Meijer and Bolívar, 2016). More-over, the system is far convenient than conventional means and saves time for personnel and the public involved (Zubizarreta et al., 2016; Bhatnagar, 2004). Apart from the positives, there are a few concerns regarding the issues faced while implementation such as continuous maintenance for quality purposes, a deficiency in the process of bringing about awareness and promotion, resources remaining insufficient along with communication and architecture definitions that adhere to a strict policy and are made through certain definitions (bdallah & Fan, 2012; Thite, 2011).

People: Management of people is an integral part of keeping the process alive, ensuring that through maintaining e-learning activities for the employees, and encouraging the knowledge sharing among personnel and peers (Komninos et al., 2015; Ibrahim and Morsy, 2016). This is to ensure so that the process remains holistic and inspired better actionable methods to achieve goals, along with maintaining harmony and ensuring a sense of unity among the personnel involved (Dameri and Cocchia, 2013; Ergazakis, Metaxiotis and Psarras, 2004). This way, the public will have their needs met more efficiently and accurately. According to the reviewed literature, the demerits that could arise out of this form of management could also be a staff resistance towards the processes, a lack of commitment by the staff members and their level of acceptance of the model (Komninos et al., 2013; Liu & Zhou, 2010). Risks that could be derived from this include background checks, the reduction in manpower as well as the possibility of an increase in unemployment (Liu & Zhou, 2010)

***Organisational (Structure and Culture)*:** There are two ways of defining the organisational dynamic, and that is in relation its structure and the culture being employed (Ghapanchi *et al*, 2008; Anderson, 2006). The benefits of having organisation methods in SSC are: the effective transfer of information and the intercommunication that arises with a change in management among the agencies affiliated to the government as well as for the services that are employed by the government (Lombardi et al., 2012; Zygiaris, 2013; Buccoliero *et al*, 2008). The demerits that may arise would be in relation to socio-economic, issues of culture, visibility of institutional framework or architecture, organisational priorities, as well as misunderstanding and misrepresentation of the SSC services (Su, Li and Fu, 2011; Cosgrave et al., 2013). A poor reception by agencies and the public, imparting harmful critical analysis upon the implementation of the SSC model can also be expected. (Szabó et al., 2013; Shelton et al., 2015; Enyon & Dutton 2007)

Financial Resource: Implementation of the services and its extent, along with maintenance and regular servicing of different facets of the model will only be possible with the presence of sufficient financial aid (Abdallah & Fan, 2012; Nkohkwo & Islam, 2013). It will allow for the government to take bigger risk for improved economical state and also allow for better assessment of the cost-benefit scenarios (Vilajosana et al., 2013; Letaifa, 2015). In assisted literature taken up for review, the demerits of lack of financial resources result in having sufficient resource allocation, incurring costs for the training to facilitate the management and development of internal systems (Schaffers et al., 2011; Bélissent, 2010; Rodríguez-Bolívar, 2015). Hence, many researchers and experts explain that due deficiency in proper funding, sustainability and financial position are affected greatly and pose as major risks down the road to building SSC. (Shichiyakh et al., 2016; Alizadeh, 2017; Jin et al., 2014; Liu & Zhou, 2010)

Security and Privacy: Security and privacy are treated as two sides to the same kind in this form of government as they could either act as catalysts or elements to deter the course and progress of building the SSC (Nam and Pardo, 2011a, Bakıcı, Almirall and Wareham, 2013). Benefits that arise out of this feature include confidentiality and accuracy with regard to important data being stored or shared among people, especially in the event of sharing significant amounts of data (Lombardi et al., 2012; Chourabi et al., 2012;). Issues faced in applying this feature are the imminent threat of a loss of data and infection of viruses, non-credible sources getting access to important files that risk management programs and make the government model prone to penetration on the internal level (Caragliu et al., 2011; Ferrari et al., 2011; Khansari, Mostashari, and Mansouri, 2011). The risks of implementing this feature also include the susceptibility of criminal activities such as identity theft and cyber-attacks to be carried out, that can cause a system breakdown and demolish the entire architecture of the government model (Guleria, 2014; Kessler, 2011; Hector, 2012).

Characteristics	*Description*	*Implications*	*Sources*
Technological	Technology is the prime characteristic of SSC (and recognized as driver, risk and barrier). It is gauged as the technological aptitude through encouragement of implementation of ICT; data accuracy and reliable sources for data	Lack of up to date technology can restrict the SSC authorities to review, monitor and control safety and security aspects of the city elements.	Elmaghraby & Losavio, 2014; Nkohkwo & Islam, 2013; Abdallah & Fan, 2012; Hamed *et al*, 2008a
People	The development of a SSC rests on the people involved, to achieve a holistic approach undertaken to achieve goals	Lack of training people with up to date knowledge on smart city technology and process can increase operational issues and response time.	Liu & Zhou, 2010; Lan, 2005; West, 2004
Organisational	Through a well-defined structure and culture, SSC can lead to effective transfer of information and communication, achieving the desired change in the system with lower resistance	Lack of support at organizational level can restrict change and lead operational issues caused due to resistance to the change.	Ghapanchi *et al*, 2008; Enyon & Dutton 2007
Financial	To apply, maintain and sustain SSC services, the financial aspect is highly crucial, allowing the government to manage risks and promote training and development for the transition	Lack of financial resources to support future operations can lower the capability of the SSC authorities to take the required development as perceived.	Nkohkwo & Islam, 2013; Abdallah & Fan, 2012; Liu & Zhou, 2010
Security and Privacy	The successful transition from a smart city to a SSC is achieved through these elements. This ensures confidentiality and accuracy of the data, prevents data loss/theft, and improves monitoring and control	Lower focus on safety, security and privacy in SSC can lead to technology threats, loss of vital city data and more importantly, endangerment of public information.	Hector, 2012; Kessler, 2011; Nijaz & Moon, 2009

Table 2-13: Characteristics of SSC Model

2.6 SSC Development Life-Cycle

More and more cities are becoming open to the idea of adopting SSC planning, which emerged with the e-government model (Al-Rashidi, 2009; Belanche et al., 2016). The key element that determines its success is the implementation of the technology used (Guleria, 2014). More and more cities are in the need of higher level security features that the program provides and also makes management easier for the handling government agencies (Houston et al., 2015; Masrek et al., 2014). Just like other industries and sectors are coming together to be merged as one entity, such as the energy and transportation sectors, this connection between different industries provides for numerous opportunities for growth (Letaifa, 2015; John-Green and Watson, 2014). Video surveillance methods, biometric scanning, encryption and other types of security features are developing and help improve the way that information is being accessed and approved in a safe manner (Zhuhadar et al., 2017; Al-Rashidi, 2009). It is because of technology such as CCTVs that the public can be monitored and be helped in preventing acts of injustice or criminal behaviour (Al-Nuaimi et al., 2015; Bifulco et al., 2016). Thanks to the convergence of different forms of technology from different sectors, the way that intelligence is being handled at the most fundamental level (Belanche et al, 2016; Letaifa, 2015). These features will be the catalysts to ensure that stringent security measures are being maintained throughout the city under the authority of the practicing government model (Vanolo, 2014; Brenna et al., 2012). Services such as emergency response services, communication between local aggregators will be able to improve the level of response time in a more immediate and efficient manner, especially during times of sudden collapse or unexpected happenings (Paroutis et al., 2014; John-Green and Watson, 2014). As technology improves, so does the security level that strengthens the foundations of the technology.

2.6.1 SSC Project Life- Cycle: Four Phases

The life-cycle of a SSC model has been represented as a continuous circle of activities, according to the ‘Auditing of SSC’ Report (2010) [See figure 2.4]. The activities that take place in this circle are divided into the following phases: Initiation, planning and implementation, operations and monitoring. The main question being asked by researchers is whether this life-cycle is now still relevant and important to be executed.

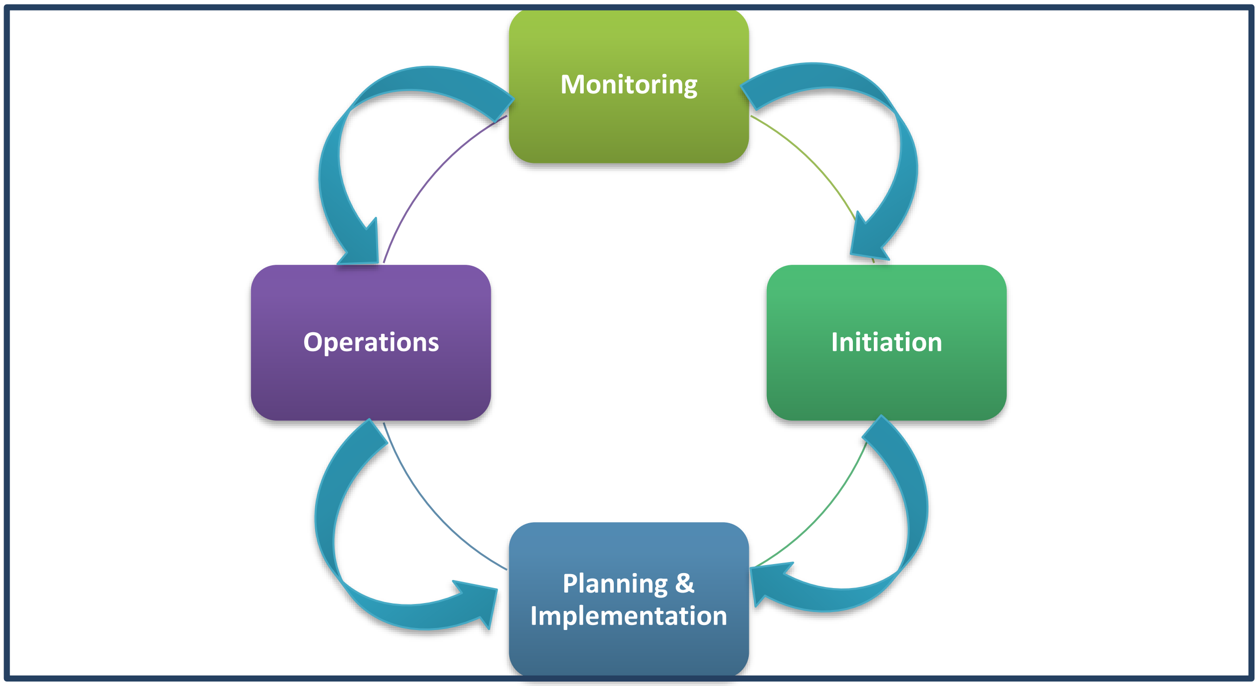

Figure 2-4: Project life cycle

Source: (Auditing of SSC' Report, 2010)

Initiation: Initiation is regarded as the first phase that smart city model for the government that brings to clarity the defined objectives and the vision which has to implemented and practiced upon to promote the transformation of service (Zhuhadar et al., 2017; Girtelschmid et al., 2014). As the outcome is transformation, keeping in line with the vision statement the government will be actively pursuing this interest (Knapp and Samani, 2013). This is thus considered the most important phase than the others as they are largely depended upon the rules established and the concise reason that the first phase talks about (Lombardi et al., 2012; Su, Li and Fu, 2011).

Planning and implementation: Human resource and financial stability are what make this model of government a success (Szabó et al., 2013; Schaffers et al., 2011). Certain applications and certain management of transition needs to be taken into effect so as to provide the services that have been stated in the government's initial phase (Hajduk, 2016; Komninos et al., 2015). The government will work towards gathering credible information, sharing it amongst personnel and removing any silos that prevail (Hernández-Muñoz et al., 2011; Giffinger and Gudrun, 2010). Obstacles faced in this feature include the co-ordination between personnel of different government agencies or sectors, the level of technology being used, the level of user-friendliness, availability and scalability of certain elements required for implementation, ownership and accountability as well as cost of the given services (Thite, 2011; Alizadeh, 2017). Developing the processes, running and maintaining them, and ultimately delivering them to the destination required are the main risks that may arise out of this phase (Rodríguez-Bolívar, 2015; Ribina, 2015).

<u>Operations:</u> In order to achieve the service transformation that the government is aiming for, this particular phase will involve two primary objectives (Thite, 2011; Girtelschmid et al., 2014). They are: proper integration of the required systems and reliable day-to-day operations.

<u>Monitoring:</u> This particular phase essentially involves the optimization of services, although taking a considerable amount of time to reflect in terms of implementation (Neirotti et al., 2014; Nam and Pardo, 2011b). The transactions that take place require daily monitoring as there has to be an establishment of confidence that users should have while negotiating with impersonal machines (Thite, 2011; Dameri, 2013). Making sure that the service is streamlined to suit the needs of the user and effectively capturing data and transmitting as well as receiving the feedback of the customer are some concerns that will arise out of this phase (Lombardi et al, 2012; Ferrari et al., 2011).

In conclusion, the development life cycle will not seem appropriate for the modern day SSC as the technology being implemented is fairly high-level and continuously changes at a faster pace.

2.6.2 SSC Development Cycle

Traditionally considered to have four phases, the life cycle of SSC are completely different (Caragliu et al., 2011; Novotný, Kuchta and Kadlec, 2014, Heeks, 2006). The life cycle is derived on the based on the e-government model considering the similarities that exist within its complex structure and usage pattern (Da Cunha and Costa, 2004). According to this theory there are not four, but five stages in the cycle, as seen in Figure 2.5 and table 2.14:

Stages of SSC Development Cycle		Resources
Stage	**Description**	
Stage # 1: Project assessment	Here is where the parameters of the project are taken into consideration and a decision is made, of whether the project should be proceeded with or not.	Novotný, Kuchta and Kadlec, 2014, Heeks, 2006; Da Cunha and Costa, 2004
Stage # 2 Analysis of current reality	To make sense of the project, this stage incorporates soft and hard techniques in the form of IS audit, IS analysis, problem / context analysis, and other analysing methods to ensure that the requirements are made clear	Novotný, Kuchta and Kadlec, 2014; Dameri, 2013
Stage # 3 Designing a new system	Objective establishment and binding them in a way that the new system can process them	Novotný, Kuchta and Kadlec, 2014; Thite, 2011; Heeks, 2006
Stage # 4 System construction	In this phase, development activities such as acquiring new IT modules, detailing the design incorporated by the current SSC system (such as installation of the system), building the system, testing it rigorously, documenting the construction and the findings, along with the final step being.	Novotný, Kuchta and Kadlec, 2014; Heeks, 2006; Da Cunha and Costa, 2004
Stage # 5 Implementation and beyond	This stage brings together the previous phases and undergoes the implementation of the processes that were defined.	Novotný, Kuchta and Kadlec, 2014; Caragliu et al., 2011; Heeks, 2006

Table 2-14: Stages of SSC development cycle

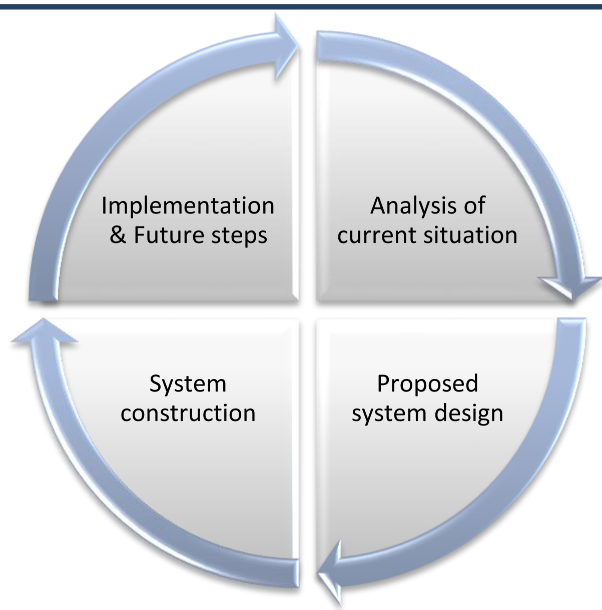

Figure 2-5: System Development life cycle for smart government
Source: (Heeks, 2006; Caragliu et al., 2011)

2.6.3 SSC Development Life-Cycle

According to the literature available, there are three main phases of initiative implementation. These stages extend much beyond the identification factors which have been prescribed in a SSC (Capdevila and Zarlenga, 2015; Belanche, Casaló and Orús, 2016). This is considered an important aspect as they enable for proper implementation and identify the main roles and responsibilities of the active stakeholders (Al-Nuaimi et al., 2015; Hollands, 2015). The phases are described in the following table:

Development life cycle	*Phases*
Pre-Implementation	Design Phase
Implementation	Development Phase
Post-Implementation	Deployment Phase

Table 2-15: Life Cycle and Phases

The project will began with the Pre-implementation and then proceeds to the post-implemented stage after a series of changes and considerations (Shelton et al., 2015; Vanolo, 2014; Al-Rashid, 2012).

There is no one view regarding the development of the life-cycle of a SSC while implementing projects, but rather focused on e-government life cycle development. Different experts and scholars have shared different ideas regarding the implementation (Vilajosana et al., 2013; Letaifa, 2015; Schaffers et al., 2011). As classified by Heeks (2006) there are five stages **(1)** Assessment of Project, **(2)** analysis of current reality, **(3)** proposed system design, **(4)** system construction and **(5)** implementation. Similarly, as defined in the Auditing SSC (2010), there are 4 stages which include: **(1)** Initiation, **(2)** planning and implementation, **(3)** operations and **(4)** monitoring, each valid in both the governmental level and state level, as well as the departmental level in Norway. E-government or smart city described by Al-Rashidi (2012), researchers have preferred his development life-cycle, owing to its simplicity (Rodríguez-Bolívar, 2015; Yarosh, 2015). Each of these stages provide their own critical success factor, allowing them to be accommodated easily into studies and it allows for researchers to clearly establish the stakeholder roles/responsibilities in each development stage with determination of the vital activities which are undertaken during every stage. These stages are shown in Figure 2-6 below.

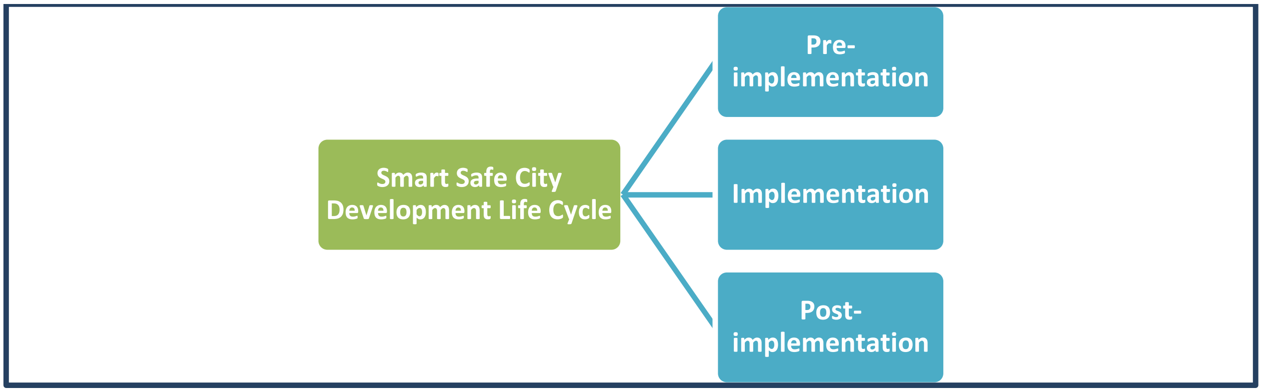

Figure 2-6: Smart city development life cycle

Source: (Al-Rashidi, 2012)

The classifications made in Al-Rashidi's (2012) model indicated factors [as seen in the figure 2.6] that influence stakeholders in the SSC implementation on all the stages of implementation. This includes the pre-stage, the during-stage and the post-implementation stage, made into three primary stakeholders, ***(1) political stakeholders, (2) organisational stakeholders and (3) technical stakeholders*** (Alizadeh, 2017; Nam and Pardo, 2011b). According to the associated literature under review, no evidence was found in the existence of these stakeholders (Jin et al., 2014; Chourabi et al., 2012). Most other literature only identifies them as being stakeholders. It is of utmost importance that researchers can understand which of these stakeholders and activities are considered as critical to the stages in the development life-cycles (Lombardi et al., 2012; Caragliu et al., 2011). This would greatly help in serving as a reference for decision making and help in the implementation for any new changes that are required in specifically, the organisations pertaining to the public sector.

2.7 Potential Models Identified for SSC Application

The literature review brought to light the fact that a majority of the government agencies across the world are in the process of bringing about a paradigm shift in their phase of development, from a more conventional structure to a more horizontally and vertically integrated one (Shichiyakh et al., 2016; Ribina, 2015). There are a number of such models of integrations which are relevant to the study at hand, and shall be discussed below. A point to note is that the models are relevant to e-government theories and no new theories were found to associate with smart and safe cities or smart government, with the latter being a new concept. Hence, the stud theories and concepts discussed in this section related to e-government and IT adoption. Some of these are: Government Key

Business Process (G-KBP), Growth Stage Model, Institutional Theory & Drivers-Barriers Model. After going through the nature of the structure of the various models and the components that comprise it, there will be an attempt to adopt one or more of the models and the theories with their numerous applicants that would suitably fit into the nature of the studies chosen.

2.7.1 G-KBP Government Key Business Processes

G-KBP is based on the technologies of process modelling and the notions of contemporary public administration (Guleria, 2014). This model can be utilized to develop a structure to the numerous e-government schemes. This directs to a thorough amalgamation of the services that have been provided. This model, as compared to the private bodies' KBP varies in a couple of key simplifications; it does not encompass the payment and the final outcome that is conveyed to the customer is always a service.

Budd & Harris (2004) studied the model and came to the conclusion that some of the advantages of this model are that it provides the individual customer with the ability to recognize the services that are liable to him/her in a timely manner and that the sum total of all the services that are provided by the G-KBPs are relatively more efficient than the current disjointed ones. Despite this model being designed and implemented with a top-down approach, there is still the necessity for a large part of human knowledge to attain the required results. However, additional research in the topic and its implementation is required, along with the optimum utilization of ICT to augment the e-Government structure, especially in the developing countries. One of the key takeaways outlined from G-KBP model is the assembly directive and it's safeguarding of portal for e-Government (Budd & Harris, 2004; Lamersdorf, 2004).

For G-KBP, the most important concern for the execution of e-Government is its capability to explain the services to the customers in terms of delivery (Guleria, 2014). It is often noted that the personnel in charge of application of the e-Government is not authorized for the implemented service. Bureaucracy in the public sectors organisations is a key deterrent to the implementation and the smooth functioning of this model as it poses one of the numerous challenges that have to deal with to find a solution and to execute the implementation of the G-KBP (Al-Rashidi, 2009; Da Cunha and Costa, 2004). This has led to its deselection as a potential model to be considered for SSC implementation. However, the G-KBP model is capable of efficiently and impartially handling the issues pertaining to the implementation by the government (Budd & Harris, 2004; Lamersdorf *et al*, 2004).

2.7.2 *Adaptive Structuration Theory*

The AST (or Adaptive Structuration Theory) stems from the structuration theory presented by Anthony Giddens and aimed for the utilization/interaction of the rules and means of the adopting members to construct and/or reconstruct the social systems (Giddens, 1984). As depicted by scholars, AST is believed to be compiled based on a set of concepts such as appropriation moves, the general outlook towards technology, the spirit, etc., which are designed to be broadly applied in the study of IS execution and use, along with other contexts (Sewell, 1992; Kontopoulos, 1993). Another set of scholars have tailored the theory to scrutinize the way the various groups and organizations intermingle with IT (DeSanctis & Poole, 1984; Jones & Karsten, 2008).

The AST lays more emphasis on the social facets of the utilization of technology and is critical of the techno-centric view. The various originations that use IT for their work generate insight with dynamism about the important function that the said technology plays and how it can be further utilized to their actions (Carr & Hayes, 2015). These perceptions are diverse in nature across the various groups and they play a role in swaying the method by which technology is made use of and as a result arbitrate its influence on group results. The AST is also considered as a lucrative method to scrutinize the role that highly developed information technologies play in bringing about a transformation in the organization (Jones & Karsten, 2008). Instead of restricting itself to ethnographic approaches, this theory permits the prompt use of survey and archival data. As a result, the AST is proficient at exploring the transformation for two facets: 1) The structures category on the availability of advanced technologies and 2) the human action present within the structures due to interaction between technologies and people.

There have been attempts made by scholars in the past for the application of the AST in areas pertaining to decision-making with technology engineering as the main focus (Pinfield, 1986; Jarvenpaa, 1989); social technologies developed from the perspective of social and technology structure (Orlikowski, 1992); and lastly, institutional based on the social structure (Walther, 1992). In result, the AST depicts the IT, social and human interactions ideally (DeSanctis& Poole, 1994). Also, AST facilitates to disclose the inherent intricacy of technology-organization relationship and provides a much superior grasp of the methods by which technology might be put into practice. There has been some dispute in this, with some scholars and practitioners claiming that in spite of the advantages of the AST, the recent developments in computer technology have not been able to being about a paradigm shift in the efficacy of organizations. The AST is unable to thoroughly establish results such as a change in the organization as technology may act as technology could serve as a prompt for such results. With change being a key enabler for a SC to transform into a SSC, AST was not selected as a potential model for SSC implementation.

2.7.3 Growth Model

It was Janssen & van Veensra (2005) who pioneered the Growth Stage Model, and it aims to help the public managers to come up with policy approaches that are perfect to achieve the aims of the organization. Public decision-makers are utilized as a guide for development of the architecture of this model. Also, this model can be well utilized for architectural development and could also be employed to diminish the difficulty of succession of initiatives of e-Government. The Growth model was implemented to bring about effective communication with the rest of the organization (Sagheb-Tehrani, 2010). Additionally, it would provide a target-based architecture which in turn would help the organization to impede and get a grip on the price of architectural development and the application of this model to other e-government services like land administration would bode well. The stage adoption of this model is heavily affected by the environment and the ability to adapt to it in comparison to other models, and hence it acts as a learning model.

When it comes to the strategies governing the organizational changes, the Growth Model is suitable to plan the said changes in order to lay down the aims and to judge the evolution in the direction of achieving these aims (Sagheb-Tehrani, 2010; Guleria, 2014). These growth models are constructed on the belief that the development of IT systems is one. This involves going through a number of growth stages and with the increasing familiarity of the organization with the utilization of technologies, the greater is its advancement to higher stages. Despite the relative infancy of the e-Government concepts, it is maturing at a steady pace and there is no conventional and widely-believed structure of the stages of growth (Hachigian, 2002). Countries all over the world differ a lot in their circumstances; they have their individual goals, their priorities to the achievement of the goals, the resources available to put into the exercise (Guleria, 2014). This makes the countries unique in their outlook and hence tends to have their own models which are suitable to their needs. Additionally, the execution of e-government based initiatives across different countries is different and each recognizes the emphasis of the need for all the agencies of the government to work together in tandem in their aim to provide e-services (Moon, 2002; Basu, 2004). In lieu of the imposing size of the e-government projects, it is imperative that the responsibilities and roles of the various stakeholders to be clearly defined (Sagheb-Tehrani, 2010;

Im & Seo, 2005). Given the development of the growth model as a learning model and its implication in development of technology in organizations, the model is still underdeveloped to be capable of being applied for a SSC framework.

2.7.4 Reasoned Action and Planned Behaviour Theory

When it comes to studies with respect to studies associated with attitude behaviour, the behavioural theory, put forward by Ajzen and Fishbein in 1980, is extensively utilized in research concerning academic & business fields (Ajzen and Fishbein, 1980) see figure 2.7. The two identified determinants of Theory of Reasoned Action (TRA) include attitude of intention toward behaviour & subjective norms relevant to behaviour. To clarify as well as predict the human behaviour, the usage of the research intention theory was made. Suh and Han (2003) puts this forwards in theory on information systems to investigate the factors which determine the IT innovation-usage behaviour. Research and text regarding technology acceptance start with the Reasoned Action theory. In the opinion of Madden *et al* (1992), the validity of Theory of Reasoned Action is based on the behaviour under consideration as a volitional control, whereas the Theory of Planned Behaviour is considered better and more relevant.

While on the other hand, the Theory of Planned Behaviour (TPB) that was proposed by Ajzen (1985), which was considered as an extension to the TRA. With the TRA mentioning about two determinants, a third independent factor of intention was introduced by the Theory of Planned Behaviour. This was called perceived behaviour control (Ajzen, 1985, 1991). The addition of this third factor was added as it influences behaviour, along with attitudes, subjective norms, toward use, & behavioural patterns (tha are perceived). According to Chau and Hu (2002), The Theory of Planned Behaviour in its purest form envisages intentional behaviour, and as claimed, it is considered to be more universal than the Theory of Reasoned Action especially due to the added third factor, perceived behaviour control. This theory offers a valuable theoretical structure to rationalize and explain the intricacies of the social behaviour of humans. Additionally, it explains the sciences of social and behaviour nature that allows prediction & leads the examination of the behaviour in precise situations. According to a few scholars, the majority of the discrepancy in behaviour is a product of intentions and perceived behavioural control (Masrek et al., 2014; Houston et al., 2015; Belanche et al., 2016). On the other hand, one of the most widely held critique of the Theory of Planned Behaviour is the existence of ambiguity in the depiction of the precise nature of the relationship between ideas like the difference between behaviour beliefs and attitudes;

between subjective norms & normative belief, and lastly, between observation of behavioural control and its beliefs. Although there are benefits and it helps to gain information regarding the understanding of behaviours in certain areas, there is still scope for more improvement.

To sum up, both the TRA and the TPB are efficient models that can be utilized for management of change and the study of organized behaviour in information systems. However, the justification of the deselection of these models is their misalignment in the current research study on SSC and their inability to contribute in analysing the factors of SSC or SC implementation to identify the main players, as compared to the study of their behaviour and intentions (Schlegel *et al,* 1990; Van Ryn & Vinokur, 1990; Ajzen, 1991).

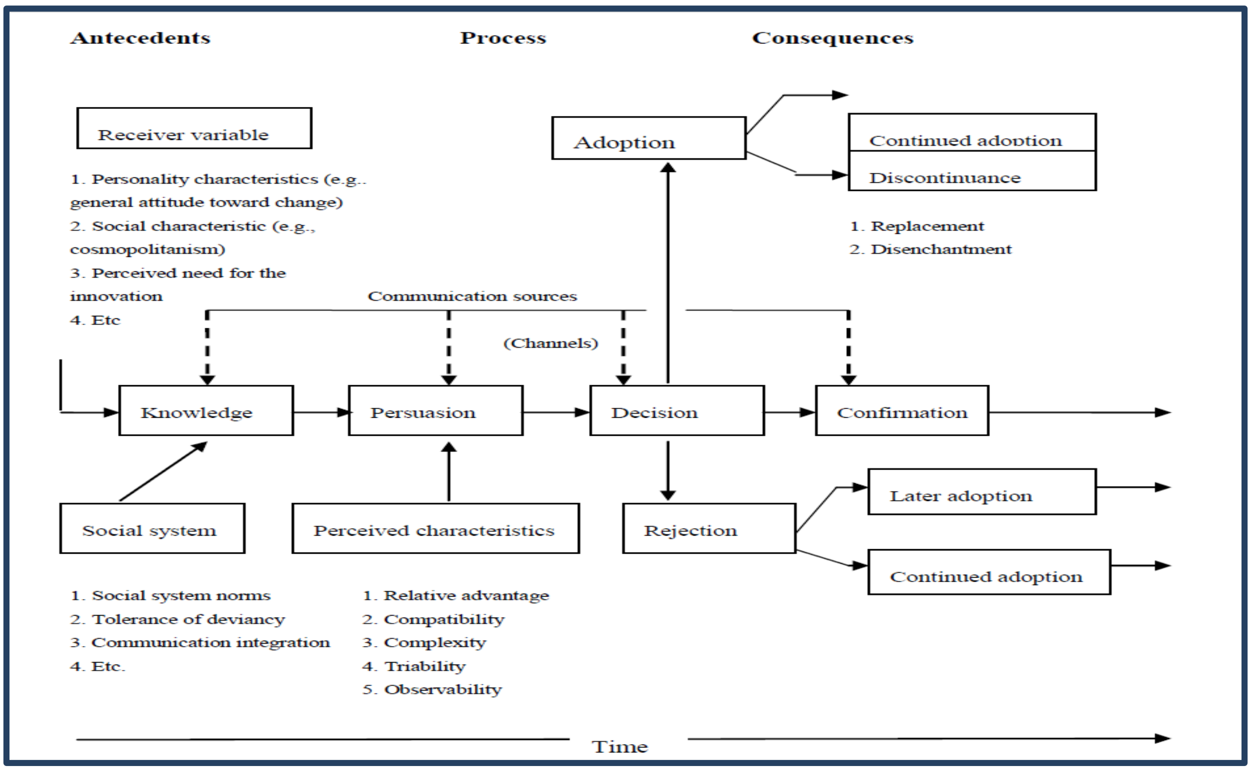

Figure 2-7: Reasoned Action and Planned Behaviour Theory

Source: (Ajzen and Fishbein, 1980)

2.7.5 Triangulation Model

An argument put forward by academicians' states that e-Commerce & e-Business are both subdivisions of e-Government concept since more extensive functions are present in e-Government than in e-Business and e-Commerce (Fang, 2002; Capdevila and Zarlenga, 2015). The knowledge society proposes that the government & businesses work in sync to serve clients, which in this case is the civil society. This is the rationale behind the greater drive that e-

Government provides to the government to realize the goal of achieving the advancements in technology of the twenty first century. The e-government initiatives provide effectual and proficient services of superior quality with timely delivery, and as a result endorse a healthier association between the government and its citizens.

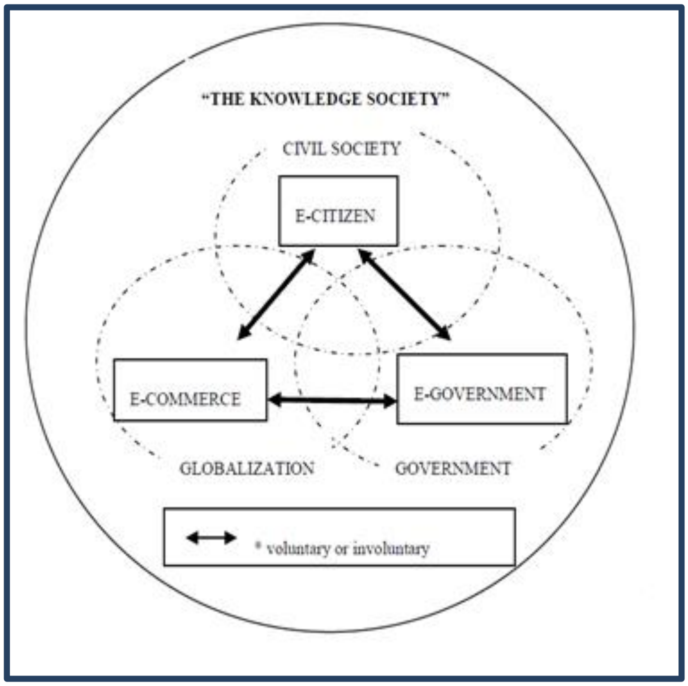

Figure 2-8: Triangle Relationship Model for smart government

(Source: CEG on IMT, 1999; Fang, 2002)

The Figure 2.8 presents the fact that e-Commerce constitutes of the purchase and sale of products and services on the internet (Fang, 2002; CEG, 1999). While on the other hand, the electronic Business (e-Business) encompasses different services such as the delivery of services to the customer and maintaining a close relationship and executing collaborative work with stakeholders to ensure smooth transactions, devoid of hitches (Capdevila and Zarlenga, 2015). This also brings to light on the reason behind the e-Government & the e-Commerce being considered as an introduction of modernization in the latest technology, while e-Government facilitates the delivery of enhanced services with regard to terms of information and the sharing of data (Letaifa, 2015). It encompasses the transactions that exist between Government-Business (G2B), Government-Citizen (G2C), government-employee (G2E), in addition to the various departments of the government. Since there is a resemblance between many of the functions of e-Business and e-Commerce, there is an emphasis on the application of the models to be developed and included with the two concepts (i.e. e-Business or e-Commerce), within the developing and developed economies. The triangulation model was not selected as a potential model for SSC implementation due to limited research in its application to smart cities or e-government to be specific, which questions its reliability when applied for SSC development.

2.7.6 Institutional Theory

There are many views on the institutional theories of organizations that have been adapted and referred to (Zucker, 1987). Bj¨orck (2004) suggested a different method to apply in the institutional theory in management of IS/IT security with regard to organizations. The method proposed, provided the following: a. It will help establish in the differences between formal and actual security behaviours; b. It will bring to light why organizations establish formal security measures, but not entirely; and c. It helps understand the grounds upon which the control of security is performed. In many streams such as sociology, Institutional theory has always been mentioned (Jepperson, 1991), including political science field (Miranda & Kim, 2006) and literature on economics (Williamson, 1985; Hodgson, 1995). Authors Davis and North (1971) citing the need for organizations to exist, noted that it would have to be controlled and adhere to a specific set of economic, social, legal and political opinions. To develop an IS/IT security management structure being cost effective, it is vital to address these issues in organizations, as suggested by numerous practitioners and scholars, who would be engaging in this model. The prime observations maintained here are how the institutions are being conducted, created, transferred, and also dissolved. Considered as the three pillars within this theory being Normative, Cognitive (Mimetic) and Regulative, the institutional carriers are noted as being social structures, symbolic systems, routines and artefacts, as explained in the table below:

Pillars	*Descriptions*
Regulatory	correlates the pressure, either formal or informal that follows the government, who makes specific actions and laws;
Normative	Due to factors such as culture, the managers and administrators are put under pressure to function in the organization. The normalcy is maintained to ensure that there is no lack of competency by the main auctioning authority.
Mimetic	As its name suggests, this occurs when some organizations develop the need to imitate other organizations, depending on the situations in order to reduce the level of risk. Meaning that one organization will closely resemble the functioning and operation of another organization

Table 2-16: Theory Pillars and Descriptions

Source: (Kim et al., 2009, Currie and Guah, 2007; Scott 2005).

In order to know the relation between the organizational transformation and information systems development, Avgerou (2000) had to adopt his own institutional theory to study the application and process in other fields. He maintained that the IT department and its capabilities are self-sustaining, despite any contributions being made by other departments towards this department. This particular theory can also be mended with other theories like Jense et al (2008) had adopted while exploring the possibilities of the Sense Making theory and the institutional theory. This was done with the setting being made under the pretext of health care in the case study. The advantages of merging two theories together bring about a new, more explainable form of analysis with each theory relating to itself. Its interpretation of the adaptation of IS is thus richer and more comprehensive.

Certain literature exists which suggests that there have been quite a few studies where institutions have been the basis for exploring organizations and how they are controlled through political, economic, legal and cultural backgrounds. Currie (2009), while studying the information system, considered the usage of the institutional theory. Its findings are that institutionalists, during the information system research, adopt organizational unit of analysis, when compared to the multiple-layered approach which incorporates both the societal needs as well as the individual's needs.

Currie (2009) elaborates the advantages of a multi-method (level) and wide approach towards an existing narrow approach, by adopting the theory being used by the IS community. Some people have said that there still needs to be more debate on the matter within the IS team itself, considering the theory literature and research. As it is considered to be somewhat an ambiguous project, the conceptuality and its practicality are deemed questionable as this theory cannot be over-simplified or practiced in full capacity just yet (Currie & Guah, 2007). A means which adopts a strict method of practice is thus required.

The above research points to the fact that it can be used for SSC applications since there is a reasonable understanding of the various dynamics involved. Some of the factors which can affect this are political, organizational, legal, critical mass and economic (Currie, 2009). This particular approach is relevant to the SSC initiative and its implementation as has been evidenced with studies (Scott, 2005; Al-Shafi, 2009). It is due this reason that the institutional theory has been chosen as a measure of perspective through which the theory can be better viewed and used as a frame of reference while distinguishing the various environmental force which may be external forces as well as internal forces, along with their impact on the SSC policies and their application.

2.7.7 Three Quarter Moon Model

Developed by Author Hamed (2009), the Three-Quarter Moon model (TQMM) states that e-Commerce can be a driver-barrier for an economy as there is no specific organization that is responsible for the planning and implementation of e-Commerce. Furthermore, there was clear strategy formulated by the government for the adoption of e-Commerce. Hamed (2009) also observed that there are a few drivers which were obvious and resent in developed nations but were not observed in developing nations. Thus, he took it upon himself to change and improve the Driver-Barrier model. Thus, the new model was developed by Hamed et al. (2008a). Furthermore, he also added security & knowledge of e-Commerce as two new issues. Thus, in the quest to answer the question *'**How can e-Commeerce be adopted?**'* a strategy as developed by Hamed (2009) which was mainly focussed on infrastructure as being an important factor for the adoption of e-Commerce.

According to this model, once agreement is reached by the government & countries of technology advancement on the type of technology to be adopted, a collaborative effort needs to be undertaken by the two parties to provide the essential technology required and also train employees as well as people to accurately use and adopt the technology. A crucial role is played by the third actor in this model which includes the public and private companies. They help in enhanced the users through the provision of the needed online services. The fourth actor in this model is the users themselves enabling in the gaining of benefits out of the investments made. It is important to note that the involvement of users is dependent on other actors too. Furthermore, the fact is that technology is evolving at a rapid rate and therefore it is important that the government invests in research and development along with educational programs are necessary for being up-to-date with the rapidly changing technology. In order to successfully adopt this model for smart safe city project, it is important that adopters undergo the three stages (i.e. before, during and post) of adoption, which are noted as 'an adoption life cycle' and it must include all the 4 actors as discussed.

2.7.8 Drivers – Barriers Model

Hamed (2009) developed The Drivers-Barriers Model while researching about development of e-commerce. This model recognized a number of barriers which are experienced within the public sector organization, thus making it difficult for the realization of the potential benefits and also made it difficult for the implementation of smart safe city initiatives. While a number of benefits have been identified from the smart city and safe city literature, these help in promoting the implementation of the initiative amongst the top management.

In the opinion of Hamed (2009), there are twelve correlated factors which could be considered as drivers or barriers since there is a difference in factors from country to country. For example, certain factors in developed countries haven't been acknowledged in other countries. Hence, divers of developed countries would seem as barriers in developing nations. A factor that provides economic development to the nation is termed as a driver. Thus, drivers and barriers are not static and are depended on the stage of smart safe city implementation. The 12 drivers and barrier factors which influence the adoption of SSC adoption are as follows:

▪ **Cost**: Cost of implementation as well as establishment of infrastructure	▪ **Competition**: High quality of services creating competition amongst providers
▪ **Culture and Religion**: Cultural and religious atmosphere	▪ **Economic Activity**: Due to increased activity, an increase in economic activity
▪ **Infrastructure**: ICT infrastructure	▪ **Government**: Playing an important role in the SSC initiative
▪ **Knowledge**	▪ **Security**
▪ **Employment**	▪ **Traditional Businesses**
▪ **Legislations and Regulations**	▪ **Payment Systems**

Hamed (2009) studied a developing country and observed that the barriers such as culture and competition were not faced by the country since the concept of e-commerce was yet emerging in the country. Furthermore, the model helps in the identification of gaps which can be studied and issues can be dealt by the government do that these gaps can be closed. For example, Hamed (2009) observed that the country faced issues such as infrastructure, payment systems etc. These issues would need to be reviewed by the government as suggested by Hamed (2009). Hamed (2009) also suggests that it is vital to ensure that in no condition should the cost of implementation and infrastructure be higher over the returns of investment returns ensuring successful implementation of the model. The researcher has adopted this model along with other models as the institutional theory has made it easy to combine it with other theories and models in order to achieve the results. Thus, only certain elements have adopted by the researcher and not the entire structure.

2.7.9 Comparative analysis of SSC theories and models

The growth model stages have seen some favour in terms of being useful in implementing IT innovation in organization and IT adoption. This model is also relevant as it can also address the organizational and cultural changes which come out due the resistance among existing stakeholders of the public-sector organization, taken at the different stages of implementation in the SSC model. This model helps to create goals for the planners and also the steps required towards reaching those goals. This particular model is more catered towards evolutionary processes rather than an organizational one, which study explicitly focuses on. Here, the researchers analyze on the organizational validity rather than the citizen adoption perspective, which is the government to employee model (G2E). The stage of growth or the readiness to start a SSC cannot be established with this research. Hence it may not produce fruitful findings towards this cause. G-KBP is a good model to use for elaborating how complete services can be rendered and real customers can be established. This is also important in order to incorporate a structure or a framework that creates a better integration of services which can be delivered, through the initiatives started by the SSC model. There are numerous challenges, in theory and practicality that have been criticized, and should be overcome before the implementation for this model is required. One such challenge is that the bureaucratic influence often occurs in the public-sector organization, and this particular model does not take that factor into consideration. This model does accommodate itself with the notions of the public, when speaking of their acceptance and adoption of the SSC model.

To examine the functions of inventions (i.e. internet, the radio, electricity, the telephone and others) the AST can be used. Using this as a form of structure or framework allows to invade these societies by influencing their flow of thought and engaging them with content that adjusts the social structure currently in place. This model has been proven in much of the previous studies undertaken. It is owing to this infiltration, that the society then changes the purpose and the use of these inventions, otherwise intended for other usage. Hence, while the AST is a good base for understanding the technological perspective of the society, it does not correlate the compatibility of the structure when employing IT functions. There are also some structures that take place outside of existing structures and are practiced without knowledge. This is considered to be an important issue by many researchers.

This is why the application of the AST model is entirely dependent on where it is being applied. Bhattacherjee & Harris (2009) have created their own IT adaptation model through the Technology Acceptance Model (TAM) and the AST. It indicates that the AST approach would not be recommended in determining whether the SSC model can be implemented. Previously, it has been said that other researchers would have preferred there to be extensive analysis carried out in order to elongate the research that was taken up by information systems. As such, the quantitative method is regarded as being a good approach towards this theory (Bhattacherjee & Harris, 2009; Griffin, 2000)

Attraction-Selection-Attrition Framework (ASA) makes it easier for usage and surveying of data archived that is rather stored and kept for reference. The ASA models are considered to be a personnel selection enterprise. Although it is considered as a newer form of organization, it is not necessarily considered a new way of technique or an entirely new application of technology altogether. This particular model is capable of practicing the researcher's hypothesis, and enable the researcher to ascertain the decision of going forward with the implementation of the SSC model or not based on the key structural layout of the framework. This theory also does not consider the top management and its association to the organization. The personality traits of the top management are considered to be important to learn and understand, as is derived from this theory. This is because it defines the role, the structure and the culture that is associated with the organization (Schneider et al, 1995; Edwards & Parry, 1993).

The theory of Triangular Relation Model (TRM) maintains that the e-Commerce and the SSC model work together in order to serve their customers. It should not pose any challenge to the SSC governance, when applying this format, especially with the help of the institutional theory, since it helps the combination of multiple theories and their functionality. This model is supposed to lay out the right guidelines for action-makers to adhere towards, but it has not been elaborated whether this model is also flexible enough to be combined with other theories at the same time.

It has been a topic of debate as to how the institutional theory has survived, considering that it was in consideration of the values and contained human elements that formed interaction and acceptance (Scott, 1995; Robey & Boudreau, 1999). This is why more scholars today encourage the combination of the institution theory with other theories. At the same time, this calls for a better understanding of behavioral changes and organization since the institutional theory is composed of the necessary practical guidelines in order to help the change-makers make the right decisions (Currie, 2009; Jensen *et al,* 2008; Peter, 2000).

The Institution theory claims that institutions arise due the inconsistencies of the human behaviour. While this theory is convenient in providing a singular analytical perspective, it can be applied to study the historical and structural factors that make up the Information System (IS). But some scholars claim that this theory does not account for the actions of organization and explain how they factor into the equation, thus not providing sufficient matter in understanding how the IS works. This makes it difficult to particularly understand the current political scenario. It also makes it difficult analysing and providing insight towards various companies (Jensen *et al,* 2008; Bj¨orck, 2004).

Although the institutional theory can be combined with other theories, it can also measure the level of change at which small margins can affect the state of institutions. It can be used for developing theoretical perspectives so as to magnify and to accentuate the finding of empirical researches (Tolbert & Zucker, 1996; Peter, 2000). It was assumed that since the institutional theory would be able to adapt to other theories in understanding the factors affecting the Information System, that this research would be greatly benefitted. As such in defining the questions mentioned in chapter 1, the use of the institutional theory was selected by the researcher while establishing factors to implement the SSC model. In support to the institutional theory, the three-quarter moon model and the drivers and barriers were selected too. The three-quarter moon presents a logical way of implementation i.e. pre, during and post that allows effective collaboration between the various agencies/departments within SSC. Similarly, the drivers and barriers model present the researcher with a set of tested variables that are correlated with e-government and hence, can be applied for SSC model.

Theory	*Characteristics*	*Advantages*	*Drawbacks*	*Selection*
Government Key Business Process Model (G-KBP)	A good model to use for elaborating how complete services can be rendered and real customers can be established.	Allows to incorporate a structure or a framework that creates a better integration of services for SSC model	Bureaucratic influence often occurs in the public-sector organization, and this particular model does not take that factor into consideration	**Not Selected**
Adaptation Structuration Theory (AST)	Used for examination of known inventions (i.e. internet, electricity, radio, telephone, etc) using these as a sort of structure or framework for a comprehensive social structure development	Is a good base for understanding the technological perspective of the society	It does not correlate the compatibility of the structure when employing IT functions	**Not Selected**
Growth Model	Aims to help the public managers to come up with policy approaches that are perfect to achieve the aims of the organization.	It is beneficial for architectural development and could also be employed to diminish the difficulty of succession of initiatives of e-Government. Also, it is heavily affected by the environment and the ability to adapt to it in comparison to other models, and hence it acts as a learning model	Countries all over the world differ a lot in their circumstances of implementing SSC, and hence, limits the growth model adoption	**Not Selected**
Reasoned Action and Planned Behaviour Theory (TRA and TPB)	It is a combination of two theories – theory of reasoned action (attitude of intention toward behaviour & subjective norms relevant to behaviour) and the theory of planned behaviour (an extension of research action theory with addition of perceived behaviour control)	TRA and the TPB are efficient models that can be utilized for management of change and the study of organized behaviour in information systems.	These models are not a proper fit into the research studies in analysing the factors in implementation of e-government schemes and recognizing the major players, as compared to the study of their behaviour and intentions	**Not Selected**
Triangular Relation Model (TRM)	Proposed that the e-Commerce and the SSC model work together in order to serve their customers	Helps the combination of multiple theories such as AST and their functionality by laying down guidelines for decision makers.	Flexibility of this model is unverified in combination usage with other theories	**Not Selected**

Theory	*Characteristics*	*Advantages*	*Drawbacks*	*Selection*
Drivers – Barriers Model	The model recognized a number of barriers which are experienced within the public sector organization, thus making it difficult for the realization of the potential benefits and also made it difficult for the implementation of smart safe city initiatives.	The model presents twelve correlated factors which could be considered as drivers or barriers for SSC implementation.	The model was tested based on developing country and not on a developed or emerging country.	**Selected**
Three Quarter Moon Model	States that e-Commerce can be a driver-barrier for an economy as there is no specific organization that is responsible for the planning and implementation of e-Commerce. Extension of this model includes new actors in the form of public and private companies, and users.	Stresses on a collaborative effort to be undertaken by the two parties to provide the essential technology required and also train employees as well as people to accurately use and adopt the technology.	Successful adoption of this model is based on its implementation in three stages, i.e. pre, during and post	**Selected**
Institutional theory	Claims that institutions arise due the inconsistencies of the human behaviour. It provides a singular analytical perspective to study the historical and structural factors that make up the Information System (IS).	Works in combination with other theories, leading to better understanding of behavioral changes. Provides practical guidelines in order to help the change-makers make the right decisions.	Difficult in analysing and providing insight towards various institutions	**Selected**

Table 2-17: Comparison of the theories on SSC

2.8 Towards proposing a framework for Safe City implementation

Information Studies being adapted and applied on using the SSC model across developing countries and its implementation is quite limited. IT instead concentrates on what obstacles are faced and what are the driving forces of implementation. It has not been clarified whether these factors are external or internal factors (Weerakkody & Choudrie, 2005; Kessler, 2011). As per the literature review, it is examined that the research has mostly discussed in the obstacles and the driving factors (Scott, 2005, Heeks, 2006). The researcher will then apply a combined approach by taking into consideration a number of models and theories so that it is easy to develop the conceptual model for the implementation of the SSC model. This is because no frameworks currently stand that put these concepts in motion. The need of the hour is also for factoring in a holistic approach and not an analytical one. Along with this is the need to develop a guideline that allows the researchers to follow and refer to in the case of the implementation. These are not available unfortunately, and must be clearly defined and mapped out. Because of the lack of any kind of system or framework, there is no established correlation as to the merits, the obstacles and risks taken as they could be considered along the same challenges that are linked towards costs and other factors (West, 2004; Ebrahim, 2005). The evaluation basis of the SSC model should be done on the basis of risk, which include factors such as political, technological, organizational, people, security, privacy and financial.

According to the review of the given literature, it has been revealed that there is no unified approach to deciphering the obstacles or the merits of a SSC (West 2004; Eddowes, 2004; Al-Shafi, 2009; Al-Rashidi, 2012). Hence, it is imperative that the definition of risks, be emphasised in order for practitioners to be clear and make the process of transition simpler (Ndow, 2004; Rana *et al,* 2012). The list of obstacles would differ greatly from country to country based on cultural, geographical, adoption and other factors, according to researchers. In the next chapter, the researcher will propose a framework to provide orderliness and identifying the key factors to map out benefits, barriers and risk (Layne & Lee, 2001; Bhatnagar, 2004; Lam, 2005; Hector, 2012). Most of the existing studies, despite being few in number are based on just general distinction (Minzberg, 1996; Scholl, 2004; Orange *et al,* 2006). There are also those that have held a special purpose of distinction (Heeks, 2003; Al-Rashidi, 2012). There has so far, not been any particular factor to identify the primary actors in the process who are also no the stakeholders at the same time (Flak & Nordheim, 2006). Due to the lack of literature towards this understanding, the researcher has to develop a framework for encompassing the model of e-Commerce as explained by Hamed *et al.* (2008). This will categorize the factors into different branches – government, countries (that are technologically advanced), firms as well as users. This can then be used by others in order to understand the factors of implementation towards a SSC. More importantly, it will answer the long-standing question of whether e-Government and e-Commerce are both equally transferrable and applicable while moving to different methodologies.

Owing to the progress and collaboration with the institutional framework, the research study will develop a framework for clearly analysing the information taken from studies (Currie, 2009; Jensen *et al*, 2008). While the institutional theory comprises of factors that are regulative, cognitive, normative and mimetic, they have all been easily adapted into IS and SSC perspectives (Al-Shafi, 2009). The institutional theory will thus be successful in being a combination of multiple theories that will help in the development of a completely new framework for conceptual purposes (Avgerou, 2000; Al-Rashidi, 2012). It is due to this, that the researcher has dissected these issues into elaborative thematic references or the next chapter while reviewing the relevant literature and its framework. Through this, the researcher will be able to understand the factors such as risk, obstacles faced and benefits of implementation of the SSC in the developing countries (Guleria, 2014; Hamed, 2009). Different factors such as, implementation factors, characteristics and key actors and activities and the stages of development (pre, during and post implementation) all form a part of the conceptual framework (Al-Shafi, 2009; Heeks 2003; Ndou 2004). Subsequently, most of these factors are different depending on the locality, there is no definite answer for defining these factors as accurately. If not appropriately studied and factored in, there could be an improper impact on how the SSC model is conducted (Ajayi, 2007; Adeyemo, 2011; Al-Rashid, 2012).

2.9 Conclusion

After explaining the smart city concept and characteristics while also reviewing the existing literature of smart city, it is observed that there is limited literature available upon how to go about with the implementation of smart city services since most of the literature available has been about smart city concept adoption with the main focus on developed countries. It is possible to identify the lack of theoretical models through research that have been tested as well as validated for smart city execution factors, while also identifying the key factors. Therefore, this leads to confusion as well as lack of support in the form of theory/models developed till date.

In this study, the researcher discusses universal motivating factors for adoption of SSC services. Upon reviewing and analysing the theories and models that are present currently, the researcher was successful in identifying the factors influencing SSC infrastructure and its implementation. Also, the drivers/barriers model was reviewed leading to identification of the gaps was done within the model. For example, while the model was well developed, it was applied to the smart city environment related to a specific country. However, Hamed (2009) did develop an improvised version of the drive-barrier model known as The Quarter Moon model. It was a strategy based model that suggested infrastructure was a necessity for the adoption of SSC concept. While this was again specific to the economy he did come up with a generalized version which yet remains to be validated by IT managers and researchers. In the ensuing chapters, the researcher has proposed a conceptual framework as per the limitations that were identified in the existing models and theories. In the opinion of Lam (2005) there are four major barriers to development of smart city services- strategic, technology, organizational and policy. These factors make the perceived barriers that have been inculcated in the framework developed in the next chapter. Furthermore, model of Three Quarter Moon model was thoroughly discussed and applied which although was adopted for SSC planning, it was to be amended to be more general so that it can be adopted by developing nations across the globe. The researcher based on these observations argues that there are no models in place for the adoption and implementation of smart city initiative. The institutional theory has been explained by the researcher in order to gain an understanding of SSC system with respect to organizational change, which is highly influenced by organizational, economic, political and legal factors. This theory can be used as the main point of reference while categorizing the internal and external environmental forces that have an impact of the implementation of SSC (Curry, 2009; Al-Shafi, 2009; Currie and Guah, 2007).

The researcher thus proposes a framework that mainly focuses on the improvisation of the existing models of evaluating SSC systems by making use of many components for determining the level of smart city with safety concern from the environment. The researcher has identified one major gap with the models such driver-barriers and others that they fail to highlight the internal and external insinuating factors that can have a major impact on the smart city implementation with focus on safety.

3 CONCEPTUAL FRAMEWORK

3.1 Introduction

The purpose of this chapter is the development of a framework to implement smart safe city in the UAE. Within this chapter, the four mail elements of the framework i.e. the implementation factors, characteristics, actors and activities, and the life cycle development will be added while being in line with the institutional theory scope. The internal and external factors are examined in this chapter along with the perceived benefits, risks and barriers of SSC as identified in the literature review chapter and it results in the development of a theoretical framework that conceptualizes the SSC implementation. For better understanding, the researcher has presented a taxonomy of SSC factors, characteristics, key actors role & activities. Furthermore, the researcher also identified and mapped the key elements leading to the justification of the adoption of the theory utilized in the new framework development.

Facts have been presented by the researcher in this chapter which aids in the justification of the development of the conceptual framework. However, the researcher also insists that it is needed to test as well as validate the new model due to the presence of very little research in SSC implementation, primarily when it comes to the identification of key actors and the crucial activities conducted at each development stage. Therefore, based on this identification of gap in literature, along with the review of various other theories and models, the researcher proposed a framework in this chapter for identification of those factors which influence the successful implementation of SSC in the UAE, with the context of institutional theory. For the development of the conceptual framework, the researcher has used different models and theories namely the Three-Quarter Moon, Driver-Barrier theory and Comprehensive Barrier framework due to the flexibility offered by the institutional theory. These models and theories have helped in the identification of factors which influence SSC implementation. It is expected that the conceptual framework presented by the researcher in this chapter will be utilized by academicians and managers to analyse and explore the implementation aspects and elements of SSC.

3.2 SSC Implementation Framework – Justification of Theories and Models

When an organization undergoes transformation, it leads to organizational change; it relates to the fact that there is an increasing improvement in current organizational capabilities (Vanolo, 2014).

When there is modification of strategies and within the important sections of the organization, organizational change occurs, this is also termed as restructuring, re-organization or turnaround of the organization. Due to the evolving technology, organizations need to constantly re-strategize and bring about changes in people and processes. Due to this, the importance of ICT has come to the fore in the public sector organizations wherein business managers along with other key decision makers are focussing on improving their business processes, strategies and performances via smart city implementation (Hancke and Hancke Jr, 2012). The ensuing changes are beneficial for everyone, stakeholders as well as end users. Therefore, in the opinion of the researcher, the conceptual framework devised would act as a reference frame and a practice guide for decisions makers within the public sector.

There is very limited literature available in the public domain along with few conceptual frameworks with regards to Information Systems (IS) in the SSC implementation concept (Ndou, 2004; Rana et al, 2012). While there are a few frameworks developed by researchers (Bhatnager, 2004; Ojo, Curry and Zeleti, 2015) on Geographical information systems, not many have discussed or analysed the barriers, risks and drivers of smart city which includes the implementation factors. It is important to note that a majority of the models which have been developed on the generalized implementation factors, without categorizing them as per internal/external. It is therefore essential that along with the drivers and barriers, there is a need to review risk factors of smart city implementation such as technological, organizational, political, financial, people, privacy and security (Rana et al, 2012; Neirotti et al., 2014).

Institutional theory is aimed at explaining the differences which occur amongst the various types of institutions rather than elucidating about the development of individual institution; thus, it is termed as variance theory (Wooten and Hoffman, 2016). When structures are instilled with values, it is termed as institutionalisation and it is advantageous for public servants because of a number of features such as adaptability, autonomy, coherence and complexity. It is these factors which enable in measuring institutions as well as measuring the institutionalisation levels. The theory ties together individual behaviour and the different effects on decision making process. The robustness of the institutional analysis according to researchers lies in the fact that it is useful for determining the institutional homogeneity and heterogeneity forces along with the various processes within the fields in institutions (Wooten and Hoffman, 2016). Therefore, this theory is a perfect fit for identification of internal and external factors and the various concepts which influence the SSC initiative and implementation within the context of UAE (Rana et al, 2012; Powell, 2007).

Review of literature shows that the UAE is pioneer on public safety and rated as the safest country; thus it is important for this framework to identify and address the factors and categorise them into internal and external factors which impact the SSC implementation (Madakam and Ramaswamy, 2016). Furthermore, the various concepts of SSC were grouped in terms of benefits, risks and barriers. For the public sector professionals, it is important to identify the difference between risks and challenges as they are not the same. Risks point towards the potential difference between expectation and realisation (Hector, 2012; Al-Rashidi, 2012). Barriers on the other hand are described as those obstacles which can be overcome when a concentrated effort is made in that direction; it requires creative management, prioritization, and change in outlook and shift in resources (Reckien et al., 2015).

After the literature review and reviewing the pilot studies, many limitations have been highlighted which prompted the need to develop a framework that provides support to key decision makers and implementers while implementing the safe city systems. Organization change is significantly affected due to issues which include change resistance, unfamiliarity to IT systems which will require awareness as well as regular training (Chourabi et al., 2012). Some of the other factors which have an effect on the organizational change include low awareness regarding intangible costs that could lead to the failure of the SSC initiative in various projects around the world; these factors are often not ignored and thus they need to be addressed urgently by proposing a framework which highlights the vital drivers as well as barriers while also ranking the factors via mapping according to their importance (Wallace, 2009; Madakam and Ramaswamy, 2016). Although researchers have done studies on SSC and stakeholders, the categorization is general (Heeks, 2006; Scholl, 2004). Heeks (2003) and Al-Rashidi (2012) have done research with special purpose categorisations, but there isn't any research that specifically identifies the key actors apart from the stakeholders. Due to this literature gap, the conceptual framework is developed by the researcher incorporating the e-Commerce model within the SSC systems. This will help to determine whether the concepts of SSC and e-commerce have any similarity with respect to applications and methodologies and whether they are transferable.

For this research study, the main aim is to develop a new theoretical framework which is grounded on the literature review that has been collected from past studies. Furthermore, for the purpose of this study, Institutional framework has been used as the perspective for the critical review of the past researches. The institutional theory which includes cognitive, normative and regulative theories have been successfully applied to SSC systems (Wooten and Hoffman 2016). Furthermore, most of the research studies have adopted a single organizational unit in place of a multilevel and multi-method approach; it is here that the institutional theory will prove to be beneficial for the research as it would allow the usage of a combination of theories and models while developing the conceptual framework (Al-Rashidi 2012). It is due to these reasons that the researcher has chosen to categorize the issues into themes, presented in the ensuing chapter wherein all the relevant literature and framework has been reviewed. This was made so as to be able to propose an appropriate framework which can incorporate the benefits, barriers and risks along with the institutional factors that influence the implementation of SSC initiative for cities planned for smart and safe city and looking to UAE pioneer experience eon this domain. The framework will be essentially divided as follows: implementation factors, implementation features, development stages (pre, during & post), key actors- technology, government, users and organizations and main activities. All previous studies in this sphere have not concentrated on these concepts exclusively mainly because these factors vary depending on the SSC and if not considered with care, could have impact on the SSC initiatives (Al-Rashidi 2012; Al-Shafi 2009). Reviewing the literature has shown that factors which influence the smart city implementation tend to undergo change over time. Therefore, this calls for new research to support the area for testing and validating the framework proposed and to identify new factors and their importance from the case study confirmed with expert’s view (Hamed, 2009; Al-Rashidi, 2012).

A holistic view of smart city has been presented in this section. The researcher is of the view that the new model adoption (which is developed from a combination of different theories/models) can assist in the development of a framework that is well-structured and can be used to achieve the research aim and questions. In this attempt, the model of diver-barrier along with the TQM model were reviewed (Hamed et al, 2009). In support, it is important for the identification of factors (internal/external) for the framework impacting the SSC implementation. The internal factors are specifically about the organization while the external are regarding the environmental factors. The TQM developed by Hamed (2009) is developed for the adoption of e-commerce specifically for the economy but then formulated an extended version which was applicable to other countries as well. The researcher in the present study will therefore modify the model according to the success of the UAE on SSC and how other ca benefit from the UAE experience.

The Barriers-Drivers model stresses on the fact that an issue might be considered a driver in one country while it may seem to be a barrier in the other which makes it difficult to apply the model in fieldwork. This therefore confirms that there is a need to develop a framework which helps in the classification of factors as internal and external factors. By making use of the case study approach- there have been very little research studies with respect to the application of SSC. Most of the studies are concentrated in the adoption of smart city and its implementation from the perspective of the citizens. Hence, the researcher in this present study aims to adopt a detailed approach which covers a number of factors and is not concentrated on a single perspective as observed in previous studies.

In the present study, the aim of the researcher is to develop a conceptual framework which can be used for the implementation of SSC; were also anticipated that the proposed conceptual framework will help not just researchers but also decision maker, government officials and IT managers. It will help them to achieve a wider understanding on SSC implementation process along with an understanding of the key factors which may be internal as well as external as well as the barriers, risks and benefits of implementation which influence the SSC environment. It is vital to develop SSC systems that not just support but also enhance the effectiveness of the activities of the government while providing important e-services to the citizens of that government. Establishing a concept of SC would be a core step towards the formation of a widely accepted framework which is more transparent and acceptable along with being more accountable. It is however essential to test and validate it via research survey and further research.

At this stage, it is important to note that there is not enough literature which would help to identify the important role played by key stakeholders within the implementation of SSC. Therefore the researcher resorted to adopting the model (Three Quarter Moon) of e-Commerce that established that in the implementation of SSC initiative, similar actors play an important role. According to the Three-Quarter Moon model, the key actors of e-Commerce are government, companies, countries (that are technologically advanced) and last, the users. The applicability of concepts is yet to be gauged for the SSC initiative which will be conducted via research survey and analysis of the findings.

3.3 The Need for Public Sector SSC Implementation Framework

3.3.1 Factor Influencing SSC Implementation Framework

The issue in the implementation of the SSC initiative is that it is imperative for the government to take into consideration the complex problems which impact it. According to the literature review, the issues include economics, policy, organizational, political or legal. The researcher aims to develop a framework for SSC implementation that can be used by IT practitioners and primarily, key decision makers to evaluate and standardise the development stage with respect to organizational change caused due to the SSC implementation. Furthermore, the proposed framework should also aide IT practitioners and SSC practitioners in the public sector organizations to gain more knowledge about the implementation process while also re-enforcing the impact of the ensuing organizational change on the environment and thus the need for organizational readiness. By integrating the various theories evaluated in the previous chapter which includes the Institution theory, Three Quarter Moon theory, Drivers-Barriers theory and Comprehensive Barrier model, the researcher was able to propose a holistic framework for SSC implementation (Hamed, 2009; Reckien et al., 2015). For the determination of factors that influence the SSC implementation framework, environmental factors have been taken into consideration which impact organizational change and organizational behaviour (Wooten and Hoffman, 2016). For this purpose, institutional theory will be applied as the emphasis of the theory is based on social, legal, political and economic perspective for the existence of any organization. In order to determine the formal structure and functions of the organization and its related aspects, the researcher argues that it is important to focus on the environment on the organization (Al-Busaidy, 2011).Using the three main pillars of the theory (i.e. regulative, formal & informal pressure) created by the regulations of the government; normative- proficiency and aptitude of the key actors within the organization and cognitive/mimetic- the ability of an organization to mimic and emulate other organizations, the researcher aims to use the institutional theory that will help to define the internal and external factors which impact the SSC implementation (Al-Busaidy, 2011; Harfouche and Robbin, 2012; Luna-Reyes and Gil-García, 2011; Kim et al., 2009).

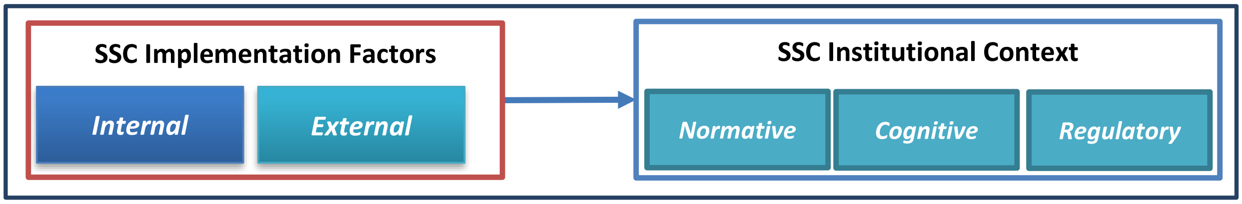

Figure 3-1: Institutional Context of SSC Implementation Factor

Source: (Bernhard, 2014; Al-Busaidy, 2011; Harfouche and Robbin, 2012; Luna-Reyes and Gil-García, 2011)

As seen in Figure 3-1 above, the current study focuses on both aspects, internal as well as external factors which influence the SSC implementation. These environmental forces drive changes in the institutional context. From the previous literature review, the internal factors identified by the researcher include funding, managerial capability/ leadership skills, network collaboration, attitude and strategic goals of the organization (Bernhard, 2014; Martin & Reddington, 2009). While the external factors include, political, organizational, critical mass, legal, technological and economic (Al-Busaidy, 2011; Bernhard, 2014; Neirotti et al., 2014).

3.3.1.1 Internal

The following themes have been identified under internal factors affecting the implementation of SSC initiative; funding, leadership, attitude, network collaboration and strategic goals of the organization.

***Funding**:* Prior to the implementation of the SSC initiative, it is imperative that there is proper budgeting and planning, especially considering the dwindling economy. In order to provide excellent services, securing proper funding is essential (Khanh, 2014). The success of SSC initiative is highly dependent on funding. When there are internal financial issues, due to lack of funding, it leads to projects that are left unfinished and thus result in increased maintenance costs (Bernhard, 2014).

***Leadership**:* According to the researcher, leadership is a vital implementation factor that should be considered for organizational change. In order to avoid challenges, it is vital to have key management support and robust governance. In the opinion of Khanh (2014) to management support as well as acceptance is vital for application of a new technology. Many smart city projects tend to fail due to lack of understanding of the initiative by the leaders and inconsistency in the implementation process. Scholars such as Khanh (2014) and Song (2006) argue that leadership and awareness are factors that are vital to the implementation of smart city concept and therefore they should be considered before the implementation. Heeks (2002) also points out that leadership is a critical pre-condition before the adoption of the SSC initiative and a strong leadership is the one that comes with a vision for the future, which is vital for the implementation of SSC concept.

Attitude*:* The basis of intention is described as attitude which could be directed towards an object or service or it may be towards the evaluation of the employee to a specific behaviour. In a SSC initiative, technology plays an important role and thus when the workforce is introduced to these technological innovations, the resulting attitude may be of acceptance or rejection (Aurigi, 2006). Aurigi (2006) further states that it can be challenging for town planners, project managers, urban designers and city dwellers need to find their way through a number of complications with respect to the interpretation of governance, urban space and citizenship within the SC framework. Since the SSC concept is yet in its initial stages across cities around the world, the workforce may resist change; therefore, according to researchers Suki and Ramayah (2010) cultural issues along with behavioural intentions are important factors in the implementation of SSC concept.

Network Collaboration*:* Organizations work towards indulging in activities and make use of relevant tactics to effectively forge more collaborations, sponsorship and partner participation (Wooten and Hoffman, 2016). Network collaboration has a profound effect on a number of SSC initiative such as infrastructure of telecommunication, IT systems, penetration of telecommunication etc. It is important to note that the SSC initiative offers many opportunities for companies to get into beneficial collaborations. Apart from technology driven sectors there are many domains that can be covered such as education, transport, energy, governance etc. (André and Crutzen, 2015). In order to develop the concept of SSC, it is vital that there are collaborations from various industries apart from technology. Thus, there exists collaboration between stakeholders and government in a SSC initiative wherein both the agencies are making a positive collaboration.

Strategic Goals*:* The vision of a SSC needs to be stated clearly while also be simplified so that the goals and objectives are clear and the strategies for the implementation of the initiative is feasible. Vision of the city can act as a strong pulling force that helps in the alignment of organization with the goals of the smart city framework. Vision of a SSC includes simplification of the market economy, enhancing the competitiveness and reduction of failures by the government so that it benefits the employees, managers and end users while improving their quality of life (Neirotti et al., 2014). Strategic goals and vision also enable key decision makers to have a ready reference for their project proposal and priority systems (Sang et al, 2009).

3.3.1.2 *External*

The main external factors include legal, economic, political, organizational, critical mass and technological factors.

***Legal**:* While it is imperative to create the right economic conditions that would enable the adoption of ICT infrastructure, there is also a need to develop a proper legislative infrastructure so that the information exchange is secure between governmental agencies, companies, organizations and citizens (Van den Bergh and Viaene, 2015). On the other hand, it is vital to remove any legal barriers that might pose to be an issue in the adoption of the smart city initiative (Chourabi et al., 2012). An innovative city requires the government to formulate policies that support the initiative and address the legal risks. The policies and frameworks must encompass security standards, legality of transactions and privacy. Often regulatory bodies are set up by governments to formulate policies as well as to monitor & evaluate ICT implementation within the smart city framework (Agunloye, 2007).

***Economic**:* The economic factor which influence externally the implementation of the SSC initiative are the external funding sources as well as the access to capital markets. It is important that the cost of and time for service delivery be reduced. Some of the economic factors that have an effect on SSC framework implementation include; national income, resource allocation, access to alternative financing, partnership with other organizations and financial resources (Khanh, 2014).

***Political**:* These factors are classified as internal and external factors, however in the context of the current research the researcher has chosen to concentrate on only the external factors which are outside the scope of organization. The political components entail a number of elements such as city councils, government, local legislative etc. This especially relates to the political will of the government and decision makers as well as the participation of the decision makers during policy making. The political atmosphere largely affects the implementation of SSC initiative. Therefore the political conditions require the know-how of the political value of smart city initiative, commitment of the government towards a SSC and having good governance initiatives that promote leadership skills (Saebo et al., 2008).

***Organizational**:* There are few studies which dwell into the organizational factors affecting the smart city concept. However, Gil-Garcia & Pardo (2005) have identified a list of organizational factors which act as success factors as well as challenges in an e-government initiative. These factors can be considered for the SSC initiative since there are a lot of common characteristics between both types of initiatives since a lot of SSC initiatives executed by governments and are there is an extensive use of ICT for serving the citizens better. These organizational factors as discussed and supported by other authors are discussed in Table 3-1.

Challenges	*Strategies*	*Sources*
Size of the project	Team expertise and skills	Van den Bergh and Viaene, 2015; Khanh, 2014; Li et al., 2012; Saebo et al., 2008; Komninos et al., 2013; Gil-Garcia and Pardo, 2005
Organizational diversity	Identification of relevant stakeholders	
Lack of alignment of the organizational goals	Clear identification of goals that are realistic	
Conflicting goals	Milestones with measurable deliverables	
Resistance to change	Improvement of business processes	

Table 3-1: Organizational factors affect smart city concept

***Critical Mass**:* Researchers are of the opinion that when the government takes a positive step, it results in the generation of critical mass for SSC while also reducing the opposition to organizational change (Komninos, Pallot and Schaffers, 2013). Critical mass enables organizations to outline and construct the internet strategy as well as presence which thus ensures efficiency. A united effort by the government and organizations leads to synergy which further enables for the individual projects within the smart city framework to develop which result in an informed and involved critical mass (Nam and Pardo, 2011).

***Technological**:* The key to being a SSC is the adoption of technology since the use of ICT will be responsible for transforming the life and work in a significant manner (Kitchin, 2016). For a safe city to thrive, a well-functioning city infrastructure is absolutely important. However, it is important that while IT infrastructure is a vital component, without engagement and willingness to collaborate, it is rendered useless. According to Washburn et al., (2010), a SSC is the collection of a number of smart computing technologies which are used in within the city infrastructure. However, it is important to note that ICT is vulnerable to threats, hacks and other mishandlings and therefore it is important that these threats be kept at bay with the necessary security procedures in check (Li, Chao and Ping, 2012). The IT/IS components within the SSC framework include; smart control systems (local operating network, automatic control network), smart interface (integrated systems, dashboard) and smart database (database and server). Thus, it is the responsibility of the SSC implementers as well as key decision makers to understand the influence of the various internal and external factors on the smart city initiative. Figure 3.2 illustrates the internal and external factors which influence the SSC implementation process from the perspective of institutional theory. The table 3.2 below explains the SSC implementation factors taxonomy.

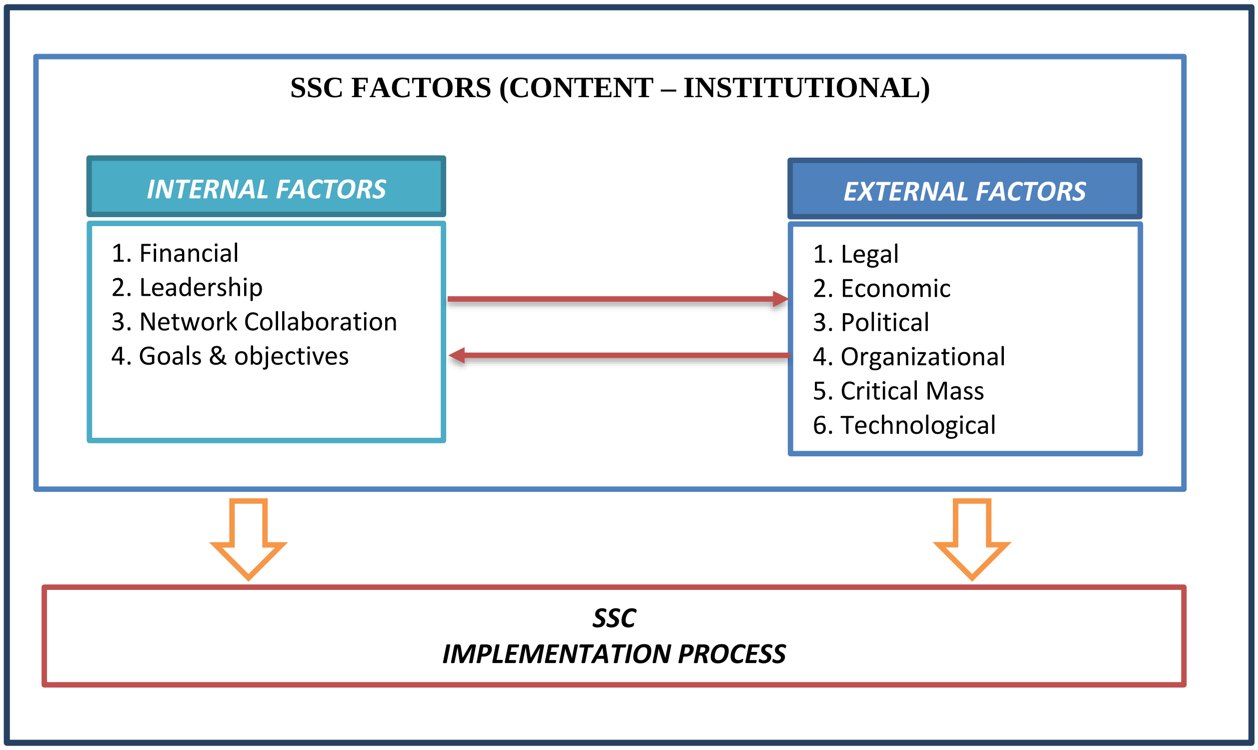

Figure 3-2: SSC Implementation with factors

Source: (Chourabi et al., 2012)

As summary to the above table 3-2 is listing all the factors which related to Internal and External Factors which influencing the implementation of SSC along with the summary discerptions.

Themes	*Factors*	*Description*	*References*
Internal Themes	Leadership	To avoid challenges, top management support required along with strong leadership	Khanh (2014); Song (2006); Heeks (2002)
	Funding	Funding support, proper budgeting and inflation taken into account	Bernhard (2014); Khanh (2014);
	Network Collaboration	Positive contribution by stakeholders and government, Lack of trust between government and employees can hamper the implementation of SSC.	Wooten and Hoffman (2016); André and Crutzen (2015)
	Attitude	Cultural issues along with behavioural intentions. Ability to manage while facing resistance to change.	Aurigi (2006); Suki and Ramayah (2010)
	Strategic Goals	Visions of strategic decision makers and key actors for plans and strategies for implementation.	Neirotti et al. (2014); Sang et al, (2009).
External Themes	Political	Will of the decision makers and government and the political participation during policy making.	Saebo et al., 2008.
	Organizational	The pressures faced by the organization in terms of competition and regulation.	Gil-Garcia and Pardo (2005)
	Legal	Policies and regulations formulated by the government that can affect the implementation of SSC initiative. Removal of legal barriers.	Van den Bergh and Viaene (2015); Chourabi et al., (2012); Agunloye (2007)
	Critical Mass	Knowledge about other organizations and agencies participating in a similar initiative.	(Komninos, Pallot and Schaffers (2013); Nam and Pardo (2011)
	Technological	Adoption of ICT for a well-structured infrastructure. Security and privacy threat.	Kitchin (2016); Washburn et al., (2010); Li, Chao and Ping, (2012)
	Economic	Reduction of time and cost for service deliverables. External funding	Khanh (2014)

Table 3-2: Factors Influences SSC Implementation

3.3.2 Development Life Cycle

Upon doing the literature review, it became known that different authors propose different project development life cycle. For example, according to Heeks (2006), there are five stages while Auditing e-Government (2010) has mentioned only four stages in development life cycle. Therefore, the present research has taken into a consideration the life cycle with a contemporary view which includes the stages shared in Fig 3.3. These stages include implementation during pre, during and post stages i.e. in development, design and deployment stage. It has been determined according to research that the three-stage development life cycle is valuable for implementers so as to determine the stakeholders' role and responsibility (Al-Rashidi, 2012). Additionally, there are critical success factors of each stage of development that are fitting the current study as identifying the roles/responsibilities of the key actors is the aim of the research, achieved at each stage of implementation. Further, the guidelines of good practice will be presented through the life cycle thereby enabling the decision makers and implementers of change to adopt while implementing the SSC initiative (Al-Rashidi, 2012; Sharif & Manian, 2010).

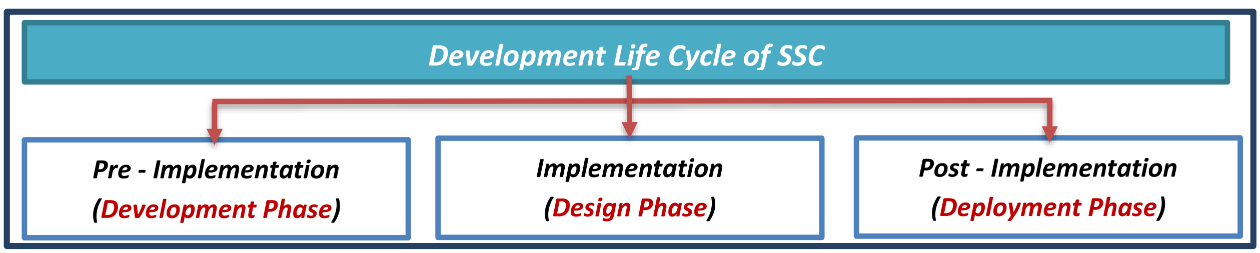

Figure 3-3: SSC Development Life Cycle – Three Stages
Source: (Heeks, 2006)

The three main stages of SSC implementation in term of development life cycle constitute of three phases as observed from literature review (Angelidou, 2014). Pre-implementation phase is the first phase, which is the starting stage wherein the government makes the intentions, vision and goals clear. It is one of the most significant phases of the cycle. The second phase constitutes of the implementation stage wherein all the planning and subsequent implementation takes place. In this phase, the success of the cycle is dependent on the financial and human resources along with change management. Change management relates to the opposition and resistance to change, requirements and approach of SSC. The third and the last phase is the post implementation phase which is termed by scholars as the operating and monitoring stage (Batty et al., 2012). Operation is in terms of the daily operations carried out along with the integration of systems for the achievement of service transformation. On the other hand, monitoring refers to the optimization of the services. An attempt has been made by the researcher to link the factos of SSC implementation with the activities within the lifecycle development stages, as seen Table 3.3 while illustrating it in Fig 3-4.

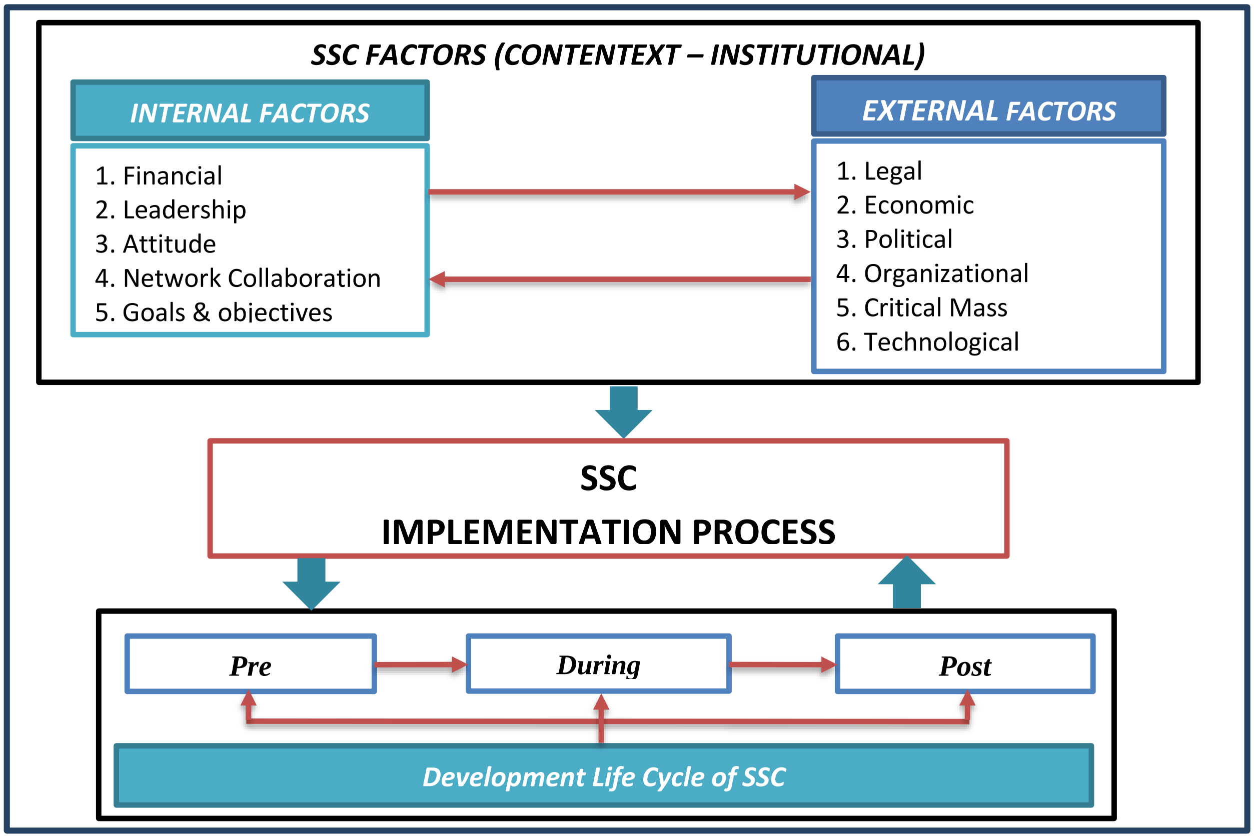

Figure 3-4: SSC Life Cycle with Implementation and Development

3.4 Characteristics of SSC Implementation – Advantages, Risks and Barriers

Becoming a SSC enables governments to enhance and improve their efficiency as well as transparency of services so that they can contest internationally with other smart city nations (Dada, 2006). There are a number of advantages associated with SSC such as improved productivity, improved service quality, better capacity of the government, reduction in overall costs, better decision making capabilities, transparency and accountability, enhanced use of ICT, anti-corruption and reduced paperwork (Muoka, 2010). Scholars have also pointed out a number of challenges that are faced which could lead to adverse impact on the SSC implementation. Although a number of classifications can be made in the implementation of the SSC framework, Lam (2005) classifies these barriers into the following four main categories: technological, organizational, strategy and policy. In the opinion of Neirotti et al., (2014) barriers may also be related to poor infrastructure, lack of awareness, low literacy of ICT compliancy, and attitude of governmental authorities towards change bought about by SSC implementation (Rana et al, 2013; Nkohkwo & Islam, 2013). In SSC implementation, the main risks have been described by Evangalidis et al (2002) as- legal, social or human related, technological, financial and security. Other scholars have also pointed out a few more risks such as information accessibility by other organizations, identity theft and reduction of control over shared information (Weerakkody et al, 2013; Hector, 2012). A taxonomy of the characteristics of SSC implementation with respect to benefits, barriers and risks has been presented in Table 3.3 and the Figure 3.5 illustrates the implementation process structure.

Figure 3-5: SSC Implementation Process – Advantages, Barriers and Risks

The following figure shows the SSC charcterestic within the SSC implementation process

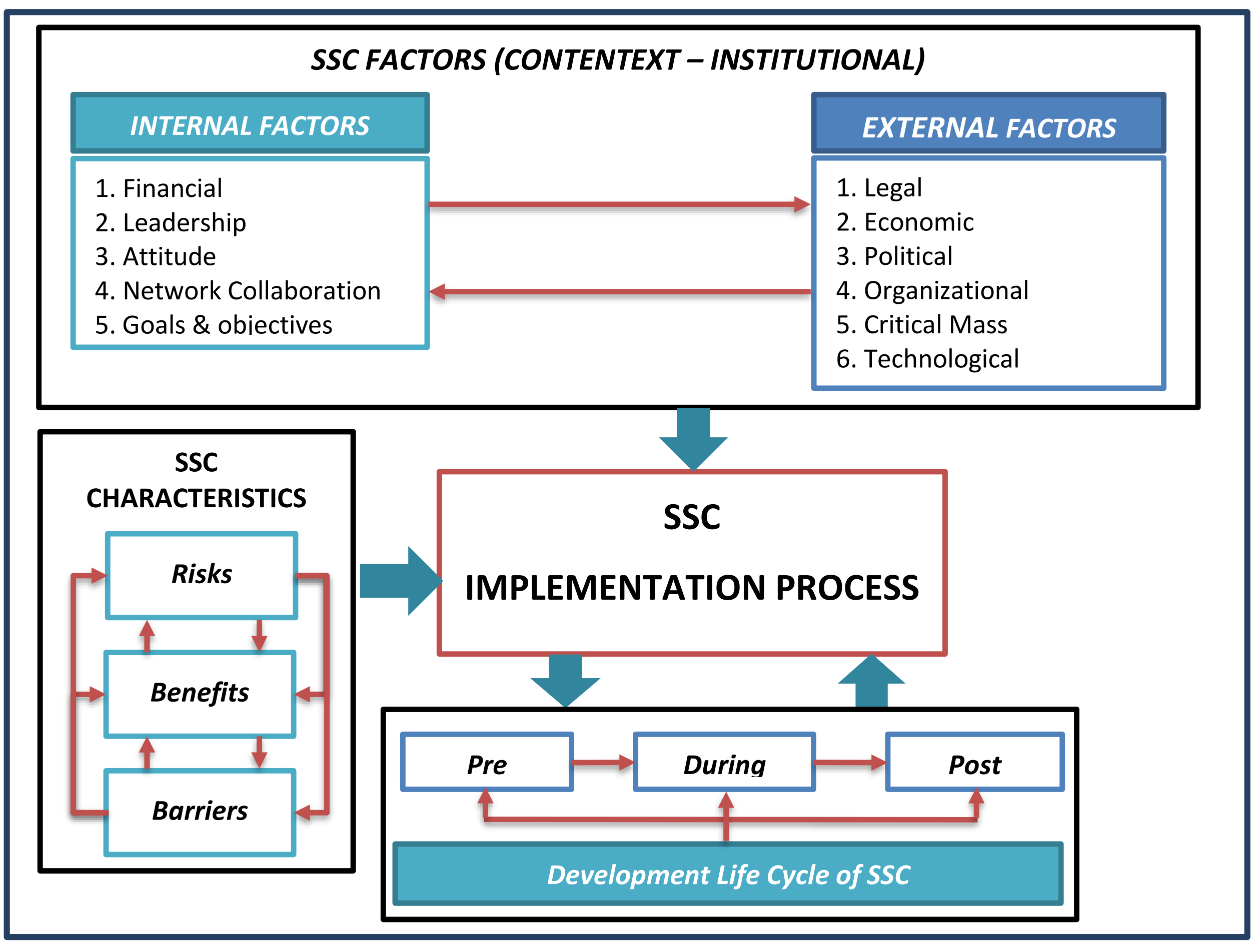

Figure 3-6: Benefits, Barriers and Risks as part of SSC implementation process

Drivers-Barriers Model	***Benefits***	***Description***	***References***
	Process, People, Technology, Organizational, Privacy, Financial, Security and Resources	▪ Improved efficiency of the government ▪ Transparency ▪ Improved productivity ▪ Improved service quality ▪ Better capacity of the government ▪ Reduction in overall costs ▪ Better decision making capabilities ▪ Transparency and accountability ▪ Enhanced use of ICT ▪ Reduced paperwork	Muoka, 2010; Dada, 2006
	Barriers	***Description***	***References***
	Comprehensive Framework Barrier	▪ Poor infrastructure ▪ High investment ▪ Lack of cultural awareness ▪ Low literacy of ICT compliancy ▪ Unfavorable attitude of governmental authorities towards change bought about by smart city implementation ▪ Lack of security and privacy ▪ Leadership issues	Lam (2005); Neirotti et al., (2014) Nkohkwo & Islam, 2013; Rana et al, 2013
	Risks	***Description***	***References***
	Process, People. Technology, Organizational, Privacy, Financial, Security and Resources	▪ Information accessibility by other organizations ▪ Identity theft ▪ Reduction of control over shared information ▪ Financial and legal risks ▪ Misuse and misinterpretation of services ▪ Inferior quality of service	Evangalidis et al (2002); Weerakkody et al, 2013; Hector, 2012

Table 3-3: Taxonomy of SSC: Benefits, Barriers and Risks

3.5 Good Practice for SSC Implementation

It is imperative for implementers and key decision makers of SSC to follow the guidelines of good practice while planning for SSC implementation (Consoli, 2015). Furthermore, these good practice factors are also utilized prior and post execution of projects. This study thus intends on identifying and identifying the value of these factors based on their order of importance; this is an important aspect of this current research. With the factors, eventually, the framework will be completed. The aim of the framework is also to identify the key actors of SSC framework and the role these actors play in each phase of the implementation cycle. As discussed earlier, the framework has adopted the TQM by Hamed (2009) for a developing economy that was generalized later for adoption for any country, however scholarly validation was suggested. The researcher was of the opinion that it would be fitting to test as well as validate the model with respect to SSC concept. Hence, the proposed framework will be studied and reviewed grounded as per the research findings & to find other relevant factors (See figure 3-6).

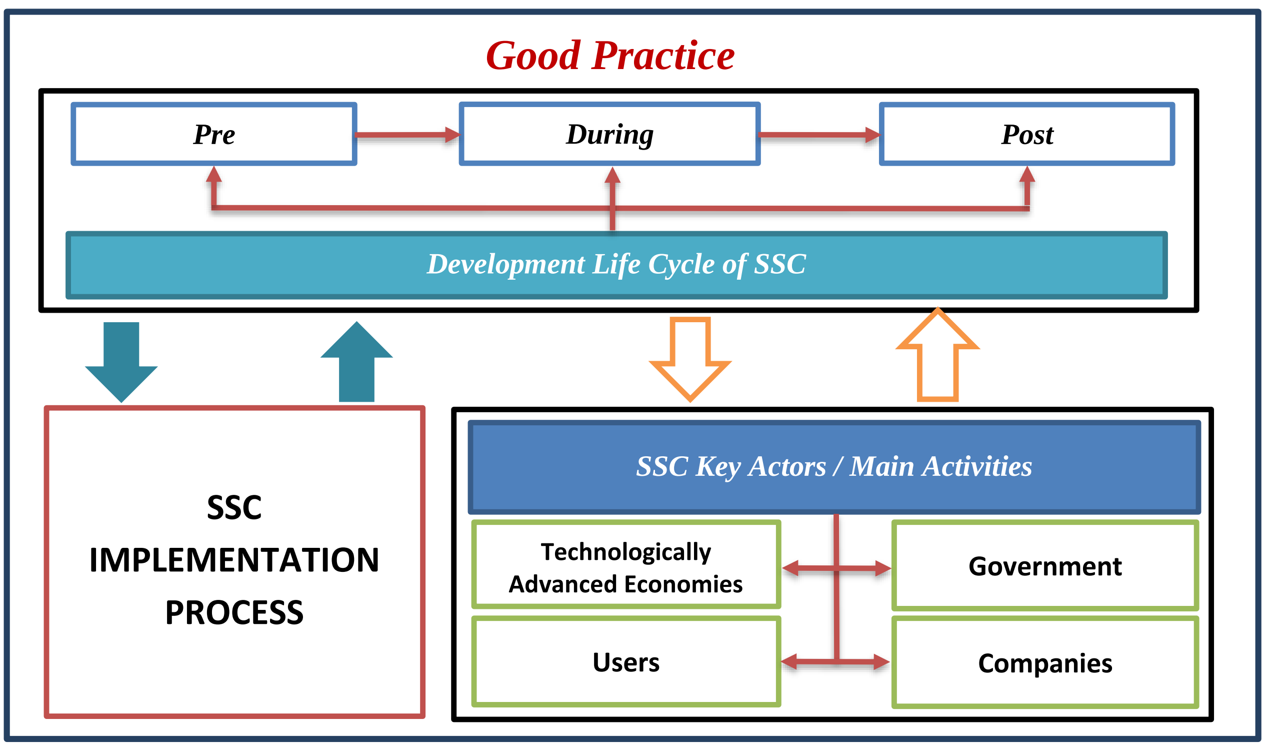

Figure 3-7: SSC Key Actors / Activities

A taxonomy of the good practices of SSC, its main activities along with key actors that form a part during the course of SSC lifecycle development which has the following chapters has been presented in Table 3-4.

- Lifecycle development key phases: pre, during and post
- Factors considered as guidelines for good practice in support to decision makers and implementers of change
- Important role played by the key actors in the implementation of SSC initiative

For change decision makers/implementers, the proposed framework will be a useful tool for defining the roles of key actors and to determine who would be the in charge and responsible for the different activities at different phases of the lifecycle (Consoli, 2015). This framework will also be useful for academicians for further studies in SSC concept. Figure 3-6 also maps the development cycle of SSC initiative pointing out the key actors and the good practice factors.

Smart City Development Life Cycle	*Good Practice Guideline*	*Key Actors*				*Main Activities (Mapping of the main activities performed by key actors at each phase of the developmental cycle required)*
		Gov	TAC	Comp.	User	
Pre-Implementation	1. Support from the political front 2. Executive support 3. Simple project objective 4. Technology selection 5. Private sector 6. Strong user					1. Telecoms 2. Legislations and regulations 3. Create SSC department 4. International trade 5. Training and awareness of labour 6. Lowered taxation
Implementation	1. Transparency 2. Sustainability 3. Cost minimizing and maintaining 4. All stakeholders get opportunities 5. Legal procedural requirements					1. Change in strategy 2. Change in business culture 3. Security 4. Transactions via credit card 5. Education and training 6. Culture and values
Post-implementation	1. Technology 2. Demand 3. Policy regulations 4. Budget 5. Training 6. Staffing 7. Assessment					1. Security 2. Promotions online 3. Updating and monitoring 4. Training and education 5. Customer satisfaction

Table 3-4: Taxonomy of SSC Good Practices, Key Actors and Main activities

Key: Gov: Government; Comp.: Company; TAC: Technologically Advanced Country; User: Employee

3.6 Mapping SSC Implementation Factors, Advantages, Risks and Barriers

An overview of the SSC factors mapped with the benefits, risks and barriers has been presented in Table 3-5. These research survey findings would aid the researcher is testing and validating the factors of the framework reflected in Figure 3-7.

<table>
<tr><th></th><th colspan="4">Taxonomy of SSC Implementation Benefits, Barriers and Risks</th></tr>
<tr><td rowspan="11">Mapping of SSC Implementation Benefits, Barriers and Risks</td><th>Factors</th><th>Benefits</th><th>Barriers</th><th>Risks</th></tr>
<tr><td rowspan="5">Internal Factors

Leadership
Funding
Network Collaboration
Attitude
Strategic Goals</td><td>Improved efficiency of the government</td><td>poor infrastructure</td><td>information accessibility by other organizations</td></tr>
<tr><td>Transparency</td><td>High investment</td><td>identity theft</td></tr>
<tr><td>improved productivity</td><td>lack of cultural awareness</td><td>reduction of control over shared information</td></tr>
<tr><td>improved service quality</td><td>unfavourable attitude of governmental authorities towards change bought about by smart city implementation</td><td>Financial and legal risks</td></tr>
<tr><td>better capacity of the government</td><td>lack of security and privacy</td><td>Misuse and misinterpretation of services</td></tr>
<tr><td rowspan="5">External Factors

Political
Organizational
Legal
Critical Mass
Technological
Economic</td><td>reduction in overall costs</td><td>low literacy of ICT compliancy</td><td>Inferior quality of service</td></tr>
<tr><td>better decision making capabilities</td><td>Leadership issues</td><td>-</td></tr>
<tr><td>transparency and accountability</td><td>-</td><td>-</td></tr>
<tr><td>enhanced use of ICT</td><td>-</td><td>-</td></tr>
<tr><td>reduced paperwork</td><td>-</td><td>-</td></tr>
</table>

Table 3-5: Overview of Mapping SSC Factors

3.7 Conceptual Framework

The purpose of developing a conceptual framework is to facilitate the determination and identification of the SSC implementation factors. This mainly due to gaps identified in the literature review in the previous discussions raised in the Chapter 2. The framework proposed comprises of a stage wherein the key actors in SSC initiative implementation and what their main activities within the lifecycle development phases which emerges from pre-implementation and goes to the post-implementation stage. After reviewing the available literature, the researcher has proposed a framework which integrates the environmental factors along with the benefits, risk and barriers for SSC implementation in the context of public sector institutions. The conceptual framework proposed in this section is shared in the Figure 3-7 and it constitutes of four important parts:

- ***Implementation factors:*** Identification of the internal and external factors along with the new possible factors which are within the institutional context. Use of Institutional theory.
- ***Implementation Characteristics:*** Identification of the benefits, barriers and risks of SSC implementation and also identifying any new possible factors. Use of the Drivers-barriers model which proposed by Hamed et al., (2008a) along with Lam (2005)'s Comprehensive barrier framework.
- Identification of the ***key actors in SSC*** initiative and implementation, important activities and the good practice guideline. Use of the Three-Quarter Moon model which posposed by author Hammed (2009)].
- Development life cycle: Includes the pre, during and post phases.

The conceptual framework proposed for the SSC implementation is primarily based on the institutional theory which allows the decision makers as well as change implementers for a more practical guideline (Komninos, Pallo and Schaffers; 2013). Since there isn't a single theory that needs to be followed with respect to SSC implementation, the researcher was at the liberty to combine the institutional theory with relevant research models and theories. The main reason for this was to enable key actors and decision makers to decide the organizational actions which can be executed as well as behaviours in the public sector organization.

The following research questions are to be addressed through the conceptual framework development, which were found to have not been addressed yet in previous studies.

RQ1: What is a Smart Safe City?

RQ2: Why does government around the world needs to adopt Smart Safe City?

RQ2.1: How Smart Safe City will assure the readiness to response for any national resilience?

RQ2.2: How Smart Safe City will enhance citizen's happiness?

RQ2.3: How Smart Safe City will support future foresight?

RQ2.4: How Smart Safe City will help in future accelerations?

As discussed earlier, there are external and internal factors which influence the SSC implementation narrowing down on the need for technology adoption and its success. The researcher aims to identify additional factors through the interviews.

RQ3: What is the type and nature of the technology to be adopted for smart safe city?

RQ3.1: What is the architecture of smart safe city in terms of technology?

RQ4: What strategic actions / steps to be adopted by governments participating in smart safe city to have maturity on the safety and security aspects?

RQ4.1: What are the roles played by the stakeholders in successful smart safe city?

It is imperative to follow certain guidelines for the implementation of the SSC concept so that it is successful. However, during the implementation process a number of barriers and challenges are met for which accurate plan needs to be followed. This is well documented in the literature review and thus reinforces the importance of an action plan.

RQ5: What are the emerging challenges for effective smart safe city implementation?

RQ6: What are the emerging barriers for effective smart safe city implementation?

The researcher aims to identify the key actors along with the main activities in every lifecycle development phase (pre-to post). Such a development will enable to develop practical guidelines which would in turn act as guidelines and reference for the implementation of SSC framework. Change management issues with respect to smart safe government implementation will be explored by the researcher in research survey.

Technology forms the core of a safe city and therefore there are a number of aspects within the adoption of technology which need to be addressed. The researcher aims to address them in research survey.

By conducting the interviews, the researcher aims to identify additional factors that could become a part of the framework wherever required. Thus, the proposed model has been formulated from the insights offered by the four main literature streams discussed in the research; internal/external factors, barriers and benefits that are perceived. Each of the mentioned factors is grounded within the literature that is reviewed or has empirical evidence that it influences SSC implementation and thus they have been classified as internal and external. Due to this, the researcher aims to adopt the relevant factors as per the area of study too in order to conceptualize a SSC framework that can be adopted. Furthermore, the literature review has depicted that there does not exist any framework which presents an all-inclusive view of the combination of the factors and characteristics that influence SSC implementation process. Thus, the researcher chosen to combine a few theories such as institutional theory, Three Quarter Moon, benefits-barrier model along with Lewin's theory for the development of a SSC framework.

In the opinion of the researcher, the application of the TQM model, (originally applied for e-commerce adoption), will also presents similar outcomes with respect to the SSC implementation process. This is mainly because both these concepts are similar apart from the fact that e-Commerce relates to marketing within the private sector while SSC relates to the application of ICT for the improvement of governmental infrastructure. The researcher strongly expects that there will not be a lot of difference in the determinants which influence the adoption of e-Commerce as well as SSC implementation within the IT environment. This would also allow managers as well as researchers to get an insight into the factors so that they can plan effective implementation process.

A number of researchers have successfully applied the Driver-Barrier model, for example the e-government implementation in Bahrain and the e-commerce implementation (Hamed et al, 2009). Thus, the model developed is reliable that can be adopted successfully in for safe city, smart city, smart government, e-government, e-commerce or intelligent city development since the basis of these developments are similar but the factors will differ from country to country.

Lam (2005) proposed the comprehensive barriers framework which is discussed in above sections at length and it was developed by him during his research examining the barriers for e-government implementation. It explains the e-government type of services which requires a good working relationship between the stakeholders and government. Lam (2005) however insisted that there is a need to further study the concept so that it can validate the identified barriers in the study on a larger scale, especially when there are participants from various organizations. Therefore, in this present study the researcher has combined these barriers with other frameworks and models to formulate the framework for SSC implementation. The perceived barriers, namely, strategic, policy, organizational and technological are applicable to the selected case studies and confirmed by experts. The generalized TQM (Hammed (2009)) was reviewed as it was not tested or validated for SSC. Also, the model was developed for the economy which was later generalized by Hammed (2009).

The proposed framework includes those factors (as identified in past literature) which influence the ICT project implementation. These studies have been used by the researcher and adapted into the SSC context by using the factors that have been reviewed in detail in literature, which resulted in the formulation of a new model which is integrated for implementation of SSC. Additionally, the factors and concepts identified were mapped in the new SSC framework so that it can be utilized as guidance for SSC implementation in the public sectors organizations. The researcher is of the opinion that the identifying the core responsibilities of each actor within the development phases is important. This will support and aid the decision makers, planners and developers in the identifying of the key actors, their respective activities, and relevance to the stages in the lifecycle development. It is the researcher's assumption that this could be a novel contribution in the field of study since there are no studies till date which identify the key actor main responsibilities/activities in the SSC implementation.

Given the imperative requirement to develop design guidelines for implementers of change and key decision makers, the researcher confirms the need for good practice development. This will allow them to be able to follow and plan effectively while implementing the SSC services, and form a part of organization change. The practical guide offered in this model would also be valuable during as well as after the execution of SSC projects. It is therefore recommended by the researcher to rank these factors according to priority determined via mapping, as a research survey part which has to be conducted. Therefore, the factors of SSC (internal and external), the benefits, risks and barriers, the key actors involved with the key activities should be prioritized along with the deliverables, because if the organization fails to do so it can cause severe impact and create barriers which could lead to loss in employees trust and confidence or delay in the SSC initiative implementation. These factors would thus become an integrated part of the new framework proposed in this chapter. A taxonomy of the good practices of SSC, key actors and activities has been presented which will become a part of the framework.

The below shown conceptual framework (figure 3-7) identifies the key factors which influence the SSC implementation all through the development cycle; right from pre, during and post implementation. This framework also leads to the identification of the key actors with the core activities, enabling researchers as well as academician to prioritize according to the relevance along with determining the good practice guidelines which will be required for the successful SSC implementation during every lifecycle development phase. Within the exploration of the institutional theory, the proposed framework helps in a wider application in context of IS/IT as it enables researchers to understand as well as explain the reason regarding why organizations create security structures which may or may not be fully implemented. Institutional theory allows grouping with other related models and theories as observed through the review of the past resources with respect to the management of an organization's security in term of IS/IT. With respect to institutional context, conceptual model's application is in relation to the external environmental factors influencing the SSC implementation.

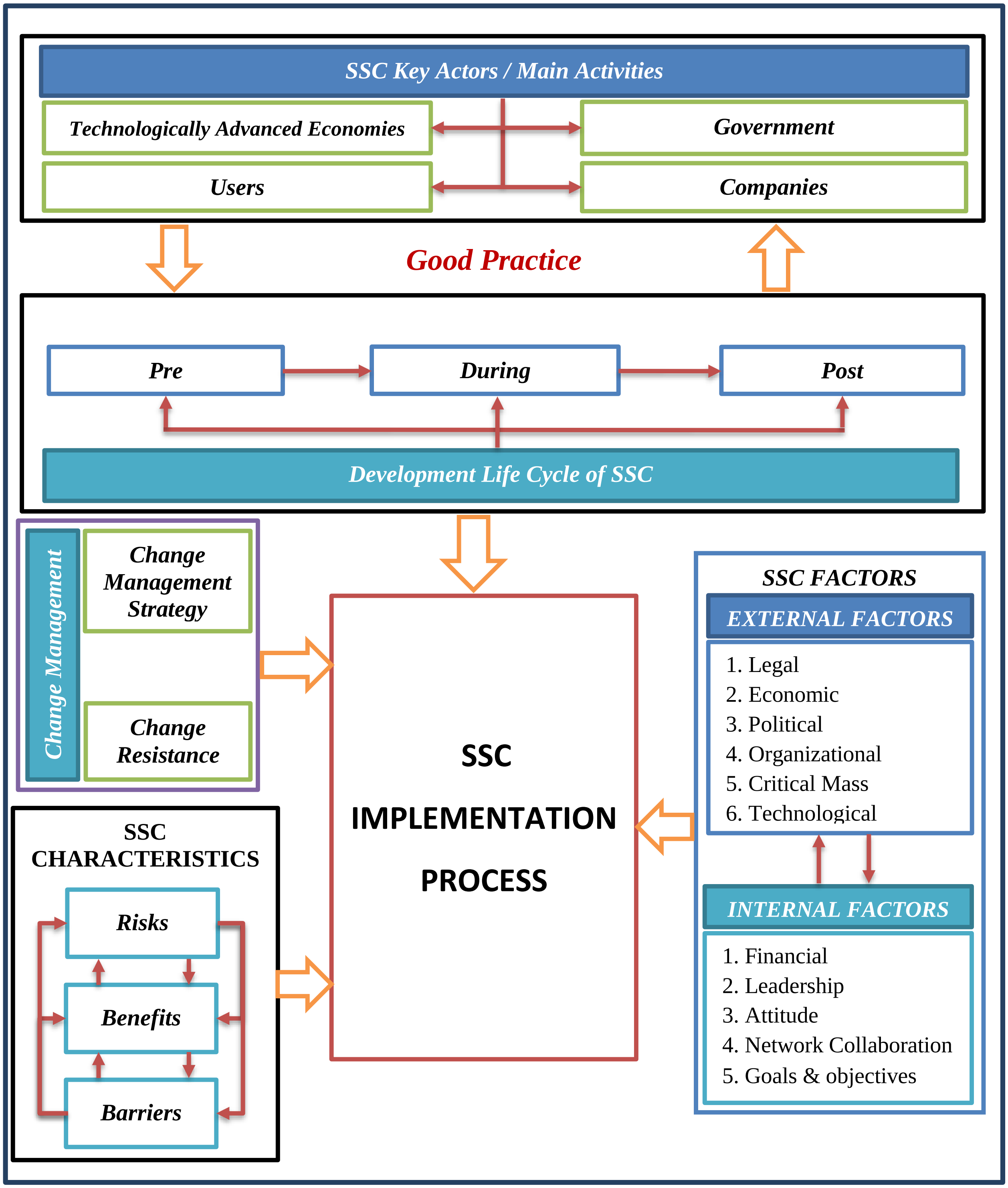

Figure 3-8: SSC Conceptual Framework

3.8 Framework Validation Strategy

The new framework proposed in the above section is a combination of three different models which were found suitable for SSC implementation. Government plays an important role in ensuring that there is successful implementation of the SSC initiative. Government is the major actor in the fields of people, process, technology and cost. Therefore, testing the feasibility with validity of the new framework is the next challenge. This is proposed through the inclusion of real case study analysis and experts field view which will be discussed further in the ensuing chapters. It is important that the four parts of the framework, that implementation factor (internal and external); characteristics; key actors and their core activities; and lifecycle development (i.e. pre, during and post). The current research aims to lead the available research on SSC implementation through reviewing the factors that influence the model and link it to the SSC implementation concepts with respect to benefits, barriers and risk. The 3-stage lifecycle development is associated with the implementation process, characteristics and concepts which are in turn linked with the key actors and their respective activities within the lifecycle development. The lifecycle development (classified as pre, during and post) stages were chosen given their relevant to development, design and evaluation stage. This is followed by the mapping of these factors lifecycle development stages leading to the identification of activities linked with actors, and how they contribute to the lifecycle. The researcher attempts the development of good practice guidelines which can be utilized by practitioners and academicians as a reference frame during the implementation of SSC systems. Validate the framework by case study experts field view and depending on the scope and limitations, this will help to determine whether all the proposed elements in the framework can be validated or not. Furthermore, there is also a requirement to state the model complexity as per the sources, data availability and feasibility with due consideration towards time and cost. From the lessons learnt, the limitations of the research will be presented in the latter chapters.

3.9 Conclusion

After conducting a thorough literature review in Chapter 2, the researcher presented the new framework as per the factors identified and their influence on the implementation of SSC. Also, the framework was strengthened through the inclusion of the key actors involved and the main activities they are concerned with during the lifecycle development. The research gaps within the available literature were also identified by the researcher, primarily concerning the good practice with the aim to identify the limitations within the SSC framework. Therefore, the researcher has integrated the institutional theory along with the drivers-barriers model that corresponds to the Hammed et al., (2008a) barrier-benefits model. The barrier framework as proposed by Lam (2005) was also integrated to the drivers-barrier model which was further connected by the researcher to the Three-Quarter Moon model (Hammed 2009). This was done to refine the model with context to the SSC concept and to conceptualize a strategic framework that helps in the identification of a SSC implementation framework based on the pioneer experience of UAE and to be the base for other cities around world to benefit from UAE experience.

The researcher mapped the factors of SSC implementation with the lifecycle development in addition to the characteristics. Furthermore, these were further enhanced through the mapping with the key actors and their activities being in line with the good practice. In combination, these elements formed the core the framework proposed to influence the SSC implementation.

Furthermore, the critical literature review also presents the perceived barriers, benefits and risks form essential factors which have a profound effect on the SSC implementation process. Therefore, it is the researcher's expectation that the perceived benefits, barriers and risks within the public sector organizations will serve as a guide for key government decision-makers and implementers of change at the time of SSC implementation. After the research analysis and findings in Chapter 5 and 6 along with the novel contributions made, validation of the proposed conceptual framework is anticipated.

4 RESEARCH METHODOLOGY

4.1 Introduction

The foundation underpinning knowledge and understanding is formed by the research methods adopted. Some scholars, such as Benbasat and Weber express how “research methods shape the language we use to describe the world and language shapes how we think about the world” (1996); whereas Leedy & Ormrod (2001) define research methodology as “***the general approach the researcher takes in carrying out the research project***”.

A diverse range of research methods were developed in response to different trends in research topics and problems. Robey (1996) states that the range of issues being researched as well as theoretical fields being utilised in research studies point towards the diversity in Information Systems (IS) research. Research can be defined as “***an activity that involves finding out, in a more or less systematic way, things you did not know”*** (Walliman and Walliman, 2011, p. 7). Furthermore, Brown (2006) explains that methodology “*is the philosophical framework within which the research is conducted or the foundation upon which the research is based*”.

The research methodology chapter of any study details the research methods, approaches and study structure in detail, drawing attention to the method and tools adopted. This chapter justifies the author’s methodology by assessing the advantages and disadvantages of the different frameworks available to this researcher. O’Leary (2004, p. 85) describes methodology as the framework which is associated with a particular set of paradigmatic assumptions that can be adopted in order to conduct research. Saunders *et al*. (2012, p. 5) perceive research and analysis as “***something that people undertake in order to find out things in a systematic way, thereby increasing their knowledge”.*** **The concept of being ‘Systematic**’ is important as it defines research as being based on rational relationships Justas opposed to beliefs alone (Ghauri and Grønhaug, 2010).

This present study considers research as a term of reference in a similar way to that of Merriam (2014, p. 4); in its broadest sense, ‘research’ is a systematic process that results in knowing more about something than was known previously. The term ‘evaluation’ also has many definitions, including Dahler-Larsen's (2013, p. 15) view that “***the systematic and methodological way of investigating and assessing an activity of public interest in order to affect decisions or actions concerning this activity or similar activities***.” The research methodology embodies this explanation, inasmuch as it combines all elements found in the research process, including the theoretical framework adopted through to data collection, analysis and interpretation (Hussey and Hussey, 1997). Consequently, answering the question of which methodology to adopt is critical to the success of every research project, and selecting the research framework, data sources, data types and methods of collection, hold far reaching implications on the researcher's ability to achieve the main research objectives (Blaikie, 2010; Creswell, 2014).

As summary Vaishnavi and Keuschler (2004); Vaishnavi and Keuschler (2010) and Hevner and Chatterjee (2010); Hevner and March (2004) had distinguished the research by "an ***activity*** that contributes to the ***understanding*** of a ***phenomenon***". Research methods or techniques assist in the reality of ***understanding*** obtained through the execution of a set of suitable ***research activities*** (Hevner & Chatterjee, 2010; Vaishnavi & Kuechler, 2004). The below figure 4-1 is abstracting the research in relations to phenomena understanding and activities

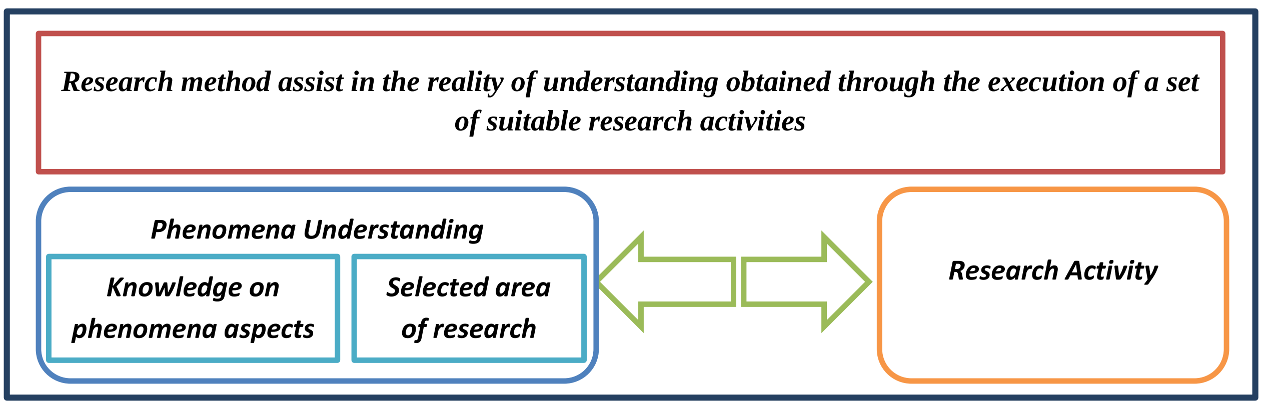

Figure 4-1: Research in relations to phenomena understanding and activities

4.2 Research Design

Research design can be described as: (1) causal research; (2) exploratory research; and (3) descriptive research (Hair *et al*., 2003). A number of scholars have used different hypotheses to investigate the level of acceptance of technologies by adopting one or more of the theoretical frameworks available. In order to understand the benefits, risks, barriers, control, technology adoption, SSC implementations stages and influence on future governments' intentions to utilise smart city systems, some researchers have attempted to combine different constructs and theories into a coherent framework. However, the literature is very poor and lacks sufficient attempts to address the issue under investigation; therefore, the subject remains underexplored and with few publications, especially in the field of exploratory research. Importantly, defining if a relationship or not can be very subjective, which necessitates the use of theoretical guidance. Therefore, even though causality research has its benefits, it is impractical when trying to analyse all variables of a phenomenon independently from one another and this approach is therefore not adopted in this current research. This is, in part, also because additional variables that might be relevant to the study may not be included in a causal framework method that may be of significant analytical relevance and should therefore not be excluded from this study.

Thus, this research adopts an exploratory research approach, in order to define the answers to ′what′ and ′how′ research questions (Hair *et al*., 2003; Zikmund, 2003). Descriptive and exploratory research are often confirmatory in the sense that they can be used to test existing hypotheses and their formulation (Hair *et al*., 2003). These approaches use a clear structure prior to data collection (Hair *et al.*, 2003; Malhotra and Varun, 1998). The table (4-1) below compares the research designs described above.

Research Designs	Justifications of Exploratory Research to be selected			Source
	Research Description	Methodology	Methods	
Exploratory Research	Focuses on the detection of ideas and understandings. Typically undertaken where the literature investigating a particular issue is limited.	Primarily qualitative with an inductive approach.	Literature reviews, interviewing focus groups and engaging with subject experts.	Saunders, Lewis and Thornhill, 2003.Sekaran and Bougie, 2010; Hair *et al*., 2003.
Descriptive Research	Seeks to explain in detail the current state of a phenomenon using existing understandings of the research problem as well as the dynamics between different variables. Typically used to define and collect data on the characteristics of the given phenomenon *"thereby ascertaining facts"*.	Adopts a series of scientific methods, including quantitative and statistical analysis techniques or data interpretation.	Often adopts a quantitative and deductive approach. This is typically used in cross-sectional studies, the analysis of raw data. Surveys are frequently used in this approach.	Collis and Hussey, 2013; Blaikie, 2007; Hair *et al*., 2003; Malhotra and Varun, 1998.
Causal Research	Identifies cause-and-effect relationships. This approach is *"solely concerned with learning why"*. It is used to determine causal relationships between events.	Usually quantitative and statistical data analysis techniques used to summarise data.	Typically includes scientific experimentation.	Hair *et al*., 2003; Wilson, 2010:104.

Table 4-1: Comparative analysis of the Three Research Designs and Justifications of Exploratory Research to be selected

4.3 Underlying Research Paradigms / Research Approach

A 'theory' is used to better understand events and to see them in a broader, new or different way. A theory may be a metaphor, a model or a framework for understanding or making sense of different social events. An idea or concept can only really be considered a 'theory' if it improves the explanatory and predictive power of society to understand and explain different phenomena. Treiman (2014, p. 4) argues that a theory need not be grandiose and/or abstract to be labelled as such: any idea about the cause/s of something and for instance why and how two variables are associated in the ways that they are, is a theory. Adopting a suitable research paradigm is a researcher's personalised decision and influences the course of the research study. Within IS studies, there are several research paradigms that are available.

Research was defined by Saunders *et al*., (2007) as a systematic process of discovery to acquire and advance knowledge. As such it is described as being grounded in relationships that are logical. Consequently, this scholar argues that data collection and analysis methods should be explained in order to address specific research questions and objectives (Saunders *et al*., 2007). Furthermore, according to Saunders *et al*. (2007), prior to selecting the research method, four considerations must be made; including research philosophy, research approach, research strategy, and timeframe. This process can then lead to three different research philosophies, which are positivism, critical analysis and interpretivism. Orlikowski and Baroudi (1991) propose three paradigms that they extract out of Chua's (1986) classification of "research epistemologies":

- ***Positive Research***, usually employs 'structured instrumentation' to explore set relationships in relation to a given phenomenon (Orlikowski and Baroudi, 1991). Such research activities seek to prove a theory and build knowledge of a research topic by means of prescribed propositions, quantifiable measures and the testing of hypotheses (ibid). Positive research makes the assumption that humans are rational beings and as such the investigation of the research topic can be undertaken with objectivity and rigour (Galliers, 1991).
- ***Interpretive Research***, accepts that shared meaning, records, mechanisms, various tools as well as other human constructions define and influence knowledge of a given phenomenon (Klein and Myers, 1999). Therefore, interpretivist scholars argue that the interpretation and understanding of reality is shaped by the researcher's beliefs and engagements with other researchers exploring the same topic. Orlikowski and Baroudi (1991) argue that

interpretive studies seek to build knowledge of a given phenomenon in a social and cultural context; that is to say that observations should be made exclusively from the perspective of study participants rather than the researcher applying context and parameters.

- ***Critical Research***, evaluates existing social processes and systems in order to identify all contradictions evident in the predefined constructions (Orlikowski and Baroudi, 1991). Critical research scholars adopt the principle that social reality is grounded in history, being produced and reproduced constantly by society. As such, this approach argues that all social systems exist in constant states of evolution. To illustrate this, Cecez-Kecmanovic and Klein (2008) argue that critical researchers comprehend "how IS serve particular interests, by developing a situated understanding of positions and experiences of people affected by the systems and by linking such understandings with broader conditions" (Cecez-Kecmanovic *et al.*, 2008).

The following table 4-2 presents the various types of research philosophies:

Philosophy	*Description Properties of the Philosophy*	*References*
Positivism	Explains the objective foundations of reality and autonomous of social actors, using measurable variables to explain a given phenomenon. The researcher adopts an observer state in this paradigm.	Orlikowski & Baroudi 1991; Yin *et al*. 2009; Straub *et al*. 2004; 2005; Bryman and Bell 2015; Walsham 1993; Saunder *et al*. 2007; Sekaran 2003; Galliers 1992; Wellington and Szczerbinski 2007
	There are five principles in positivism: phenomenalism, deductivism, inductivism, objective and scientific statement.	
	Formal proposition, hypothesis testing and quantifiable measures result in replication of events, in order to theoretically test the Deductive approach.	
	Can be applied to the field of IS using propositions, quantitative variables, hypotheses and the study of phenomena	
Interpretivism	Understanding of reality in the context of interpretivism can be gained through consciousness, shared meanings, records, documents, language, tools as well as other social constructions.	Galliers (1992); Kaplan and Maxwell (1994); Walsham (1995a); Walsham (1995b); Hussey & Hussey, (1997); Yin (2009); Klein *et al*., (1999); Hirschheim and Klein (1994); Myers & Avison (2002); Saunders *et al.*, (2007); Wellington and Szczerbinski (2007).
	Interpretivist research seeks to demonstrate the complexity and dynamism of human knowledge through empirical research.	
	Obtaining a truly in-depth understanding of a given phenomenon.	
	The inductive approach is used for theory building	
	Produces qualitative data and no preconceived theories. Usual for subjective review – debates – descriptive interpretations.	
	When IS and context interact in the context of social constructions an understanding of reality is gained.	
Critical	Critical philosophy argues that social reality is established in a historical nature.	Galliers (1992); Kaplan and Maxwell (1994); Littlejohn, 2000; Walsham (1995a); Myers & Avison (2002); Oates 2006; Gray (2009).
	Social reality is perceived as being constituted historically constituted, and furthermore, it is seen that people produce and then reproduce this reality continuously.	
	Different social, cultural and political forces shape the capacity of people to resist changes to their socio-economic context. Moreover, the primary focus is using a social critique to comprehend conditions that are either restrictive and/or disaffecting.	
	Critical research primarily adopts social assessments in its analysis.	
	Scholars state that the critical approach explores efforts to scrutinise, analyse, assess and transform the social reality.	
	Critical research primarily to build understanding of the contemporary conflicts and contradictions of modern society.	
	Furthermore, scholars claim that social reality is constituted in a historical context.	

Table 4-2: Types of research philosophies

The ontological and epistemological of the researcher shapes the research philosophy adopted for a given study. Ontology accounts for the nature of the phenomenon under investigation. Ontology can take two positions: objectivism and subjectivism. Objectivism indicates the existence of a phenomenon that is independent of the influence of social actors, whereas subjectivism sees the phenomenon as a consequence of the particular perceptions of social actors and their actions (Saunders *et al*., 2007). Thus, objectivism observes social phenomenon as unaffected by social interaction and can thus be investigated using quantifiable observations. In contrast, subjectivism integrates the understanding of actors within a social entity, the latter of which is then altered as a result (Creswell & Clark, 2011; Denzin & Lincoln, 2011; Merriam, 2014; Patton, 2014).

Ontology permits the researcher to obtain an understanding of the phenomenon being explored and provides guidance for further research. In order to define and understand which knowledge is most important in the research, Bryman and Bell (2015) suggest there are three primary lines of epistemology; positivism, realism and interpretivism (as presented in Table 4-1). Table 4-3 below provides an overview of the research paradigms in IS. Taking into consideration the distinction amongst the research approaches in IS and the research objectives of this study, the interpretivism approach has been adopted here. A detailed justification of this selection is provided in the next section.

Research Paradigms			
Basic Beliefs	***Positivist***	***Interpretivist***	***Critical***
Ontology	Single reality, where the researcher and reality are distinct from one another.	Includes multiple realities, wherein the researcher and reality are interdependent.	Reality is historically founded, and the researcher and reality are interdependent.
Epistemology	Objective, wherein reality exists outside the human boundaries of comprehension.	Subjective, wherein human experiences create the knowledge of reality.	The phenomenon is governed by social context, and meaning is revealed by iterative circumscription.
Methodology	Observation, primarily based on quantitative data, as well as experimental and statistical assessment.	Participation, which is mainly based on Qualitative data and hermeneutical analysis	Assumptions, including a process of production and reproduction of values and beliefs.
Interaction of Knowledge and Practice	The researcher cannot change the phenomena being explored and no subjective opinion can be considered.	Direct interference with the reality being studied by the researcher, wherein the subjective views of the researcher are taken into consideration.	The researcher interferes with the phenomon in order to change the status quo.

Table 4-3: Summary of research paradigms

Adapted from (Weber, 2004)

4.4 Justifications for Selecting Interpretive Research

Interpretive Research strives for the "***understanding of the context of the information system and the process whereby the information system influences and is influenced by the context***" (Walsham, 1993, p. 4). Selecting a research framework that best fits the study can be challenging, often because of the diversity and overlaying nature of the difference paradigms available to the researcher. Orlikowski and Baroudi (1991) note that, establishing knowledge of the available frameworks and defining research objectives are the initial steps of conducting IS research. A healthy and long-standing debate exists within the field of IS literature regarding which are the most appropriate and useful paradigms for research adoption.

The different philosophical positions explored above have often been referred to as stereotypes by their critics. The management of IS and the field's issues is complex and unique as it is shaped by both a diverse range of contexts and actors. As such, researchers encounter concerns and doubts about the ability of such paradigms to capture and comprehend in a generalised fashion the range of phenomena in IS. Phenomenologists, however, state that generalisation is not actually that important. Furthermore, they note that in order to discover the virtual context behind reality only methods based on the philosophy of phenomenology offer a solution (Easterby-Smith *et al.*, 2008; Saunders *et al.*, 2012). Furthermore, as discussed earlier, the philosophical position of positivism addresses social reality, in much the same way as natural science, and it employs quantifiable results in its analysis processes. Moreover, statistical analysis expands upon findings, allowing their generalisation in a way that allows them to be understood as laws of social nature (Remenyi *et al.*, 1998). In contrast, interpretivism adopts a different position, which is effectively the opposite of that adopted by positivism. Interpretivism sees entities as social constructions (Saunders *et al.*, 2007), and as such they are the result of constantly changing actions and perceptions of relevant social actors. This distinction between interpretivism and positivism can be described, for example, the quantifiable variables that explain how software can direct and influence social actors can be defined by studying efficiency and productivity gains achieved by employing specific software In contrast, interpretivism studies the perceptions and opinions that can potentially influence the development and nature of software.

Critical positivism establishes knowledge through scientific inquiry (Saunders *et al.*, 2007). In this paradigm, reality exists in the absence of any human awareness that it exists. The interpretive approach has been adopted as the most suitable framework for this research. In collecting and interpreting data for analysis, the researcher is somehow involved. For this study, the 'social constructionism paradigm' is deemed more appropriate as characterised in Table 4.1 as it will help to explain the scholars' reflection of the real world. Referring to the research philosophies matrix developed by Easterby-Smith *et al*. (2008) the following Figure 4-2 presents the author's philosophical assumptions.

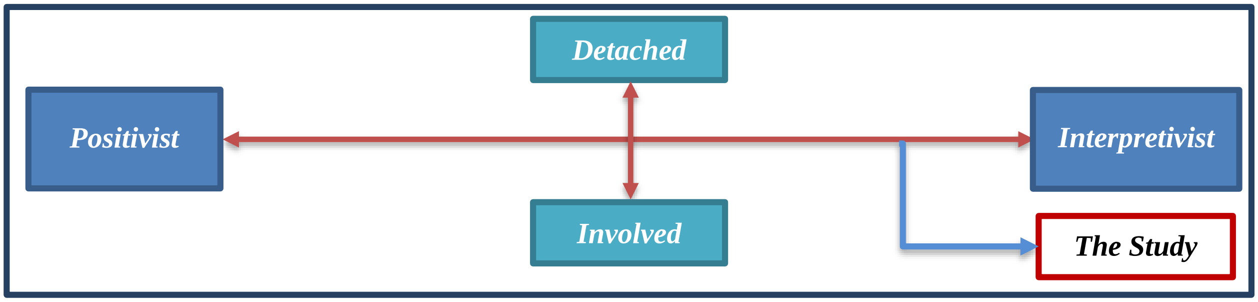

Figure 4-2: Positioning the author's philosophical assumption

Source: Easterby-Smith et al. (2008)

4.5 Research Approach

There are two important approaches to research which involve theory as a developmental process: inductive and deductive methods. The deductive approach utilises existing theories to develop and test hypotheses, while the inductive approach uses data collection and analysis to propose new theories. In other words, the deductive approach seeks to define relationships between variables, by collecting quantitative data, applying greater diligence to the validity of data and the understanding of different relevance concepts to guarantee clear definitions. In contrast, the deductive approach uses correlations between variables while utilising quantitative data collection and analysis methods to test and prove results statistically (Saunders *et al.*, 2003). Gill and Johnson (1997) argue that this method requires a structured methodological framework that can be replicated. In addition, this method seeks to ensure the researcher's independence and the ability to take an appropriate data sample size and produce accurate generalisations from it.

The inductive approach is very important in the process of establishing theory. The research design will determine whether the deductive or inductive approach is adopted. As a multidisciplinary science, the IS field incorporates complex contexts and advanced technology into relevant social relationships. The inductive method assists in building knowledge of a phenomenon that has a relationship to its context. Thus, in order to understand the context of the policy making process, this study adopts the inductive method to establish theory and a thorough knowledge of the reality being studied. Furthermore, it allows the analysis of the perspective on workflow adoption held by the policy maker as well as the collection of qualitative data. The two research approaches can be combined, taking into consideration the specifics of the research context (Saunders *et al*., 2007). As complex as this process is, it is clear that adopting the most appropriate research approach is critical to the design and success of the research (Walsham *et al*., 1994; Miles and Huberman, 2014). The multidisciplinary nature of IS increases the challenge of identifying and adopting the most appropriate research approach. As a strategic issue, the phenomenon of the SSC is relevant to both the strategic planning process and business strategy in the field of IS.

It is very difficult for any researcher to identify and utilise the most appropriate theoretical framework to any researcher in any field, and IS is no exception. Selecting an appropriate research approach for IS research is even more complex as it is a multi-disciplinary field. Thus, research objectives and questions must act as the foundation for selecting an appropriate theoretical framework (Malterud, 2001). Of course, there is no single approach that is superior to all others, however, it is entirely feasible, indeed necessary, to identify the most appropriate model for any given research study. Furthermore, a combination of complementary research models can be used by the researcher to enhance the study's robustness and conclusions where appropriate.

Patton (1990) states, the initial step is to identify which approach can provide the best suited solutions on which to base the most meaningful conclusions of a given data gathering and analysis process. However, Galliers (1994) noted that the adoption of a research framework that is most appropirate for IS related phenomenon presents many challenges, as suitable methods can be combined from different frameworks (see Morgan & Smircich, 1980; Evered & Louis, 1981; Luthans and Davis, 1982; Lee, 1989b; Orlikowski & Baroudi, 1991; Myers, 1997; Easterby-Smith *et al,* 2008; Myers & Avison, 2002; Saunders *et al,* 2007). Furthermore, Marshall (2014) identifies the adoption of both inductive and deductive approaches as follows:

> ***"When researchers first begin to open up any new line of enquiry there will be no useful theories available from which to deduce propositions for testing. Knowledge has to begin with collecting facts and then trying to find some order in them. This is known as induction. Deduction is the technique by which knowledge develops in more mature fields of enquiry. It involves a sort of logical leap. Going a stage further than the theory, data is then collected to test it" (Marshall, 2014:17).***

As Punch (2000, p. 54) notes, "the conceptual status of the things being studied and their relationship to each other". This places emphasis on how and where theoretical paradigms are used in defining research approach, as well as the importance of these process. Punch (Ibid.) continues to note the "advantage of planning research in terms of research questions is that it makes explicit the idea of levels of abstraction in research" (see Figure 4-3).

Figure 4-3: Punch's Hierarchy of Concepts

Source: (Punch, 2000)

4.6 Method of Analysis

In the field of IS management and social science research, as with most if not all research studies, there are two leading approaches that are adopted for data analysis: the quantitative and qualitative frameworks (Saunders *et al*., 2012). As the IS researcher has the ability to adopt the most suitable approach from different approaches, including a positivist model which quantitative, scientific, objective and traditionalist. The interpretivist approach is considered the most appropriate for this study by the researcher, as the study will analyse highly subjective opinions and perceptions. Researchers have proposed three key research approaches that can be adopted to assess a given phenomenon – qualitative, quantitative and the mixed-method, which combines both (see Orlikowski & Baroudi, 1991; Stake, 1995; Harling, 2002; Creswell, 2014).

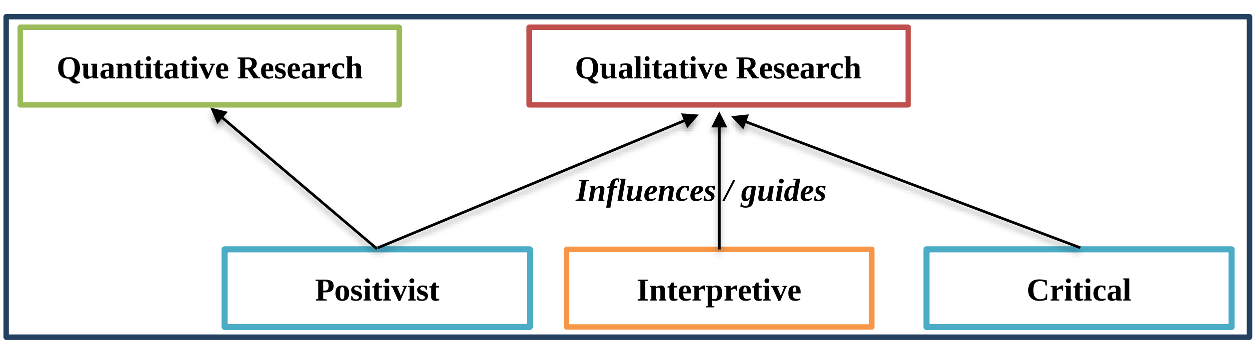

Figure 4-4: Quantitative and Qualitative research interpretations

Epistemological Assumption for Qualitative and Quantitative Research

In the field of scientific research there is much debate regarding which research approach is most effective; with some scholars advocating for quantitative and others qualitative approaches, while others advocate a mixed method approach. Those researchers who prefer quantitative research note its accuracy and ease of analysis and global credibility, as well as the commonly-held view that any researcher can adopt it. Conversely, some researchers adopt the qualitative research approach as it addresses the specifics of a research study from different perspectives accurately and provides confidence that the results of the study are closer to reality as opposed to empirical data. Moreover, a research study should not be conducted based on the methodology adopted, rather the methodology adopted should reflect the nature and objectives of the research (Holden and Lynch, 2004). A brief description of each of these is presented in the following sections (4.6.1 – 4.6.2).

4.6.1 Quantitative Research

It is widely considered that the quantitative method developed from analysing and assessing natural phenomena; and as such it is considered to be an objective and scientific approach. In contrast, quantitative analysis includes the analysis and interpretation of trends in empirical data, which might include ordinal, interval or ratio data. For instance, that might involve correlation measures, such as regression and comparison of means analysis, which may utilise various means of analysis and data representation, including graphs and diagrams. Furthermore, the results will have integrity and validity when the analysis is conducted appropriately. This can explain why the quantitative approach is considered to be an interdisciplinary field that understands phenomenon related to the human experience by using the mixed-method approach (Kaplan, 1964; Bryman, 1984; Creswell, 2014; Janesick, 1998; Lincoln & Guba, 2000; Corbetta, 2003; Oates, 2006).

The quantitative method advocates for a structured research process and focuses primarily on using large data samples and utilises various tests and other formal analytical tools (Creswell, 2014; Bouma & Atkinson, 1999; McClure, 2002; Oates 2006; Boeije, 2010).

Sarantakos (2005) argues that the quantitative approach primarily emphasises the use of measurement to analyse and narrate the objects and relationships being studied. Furthermore, Wellington and Szczerbinski (2007, p. 117) state that quantitative research relies on measuring variables or, at a minimum, the counting of objects or events: the data are converted into a numerical format prior to statistical analysis. In addition, quantitative researchers are frequently removed from the context of the research and they seek large amounts of data that is free from a given context constraint, in order to achieve statistical relevance and significance (David and Sutton, 2004; Neuman, 2003). Survey questionnaires, laboratory experiments, simulations, mathematical modelling, and econometrics all act as good examples of quantitative research tools (Myers, 2009; Neuman, 2003). The objective of survey research is to describe the characteristics (e.g., attitudes, behaviours, or values) of a group of people, the relationships among those characteristics, and the relationships of those characteristics with other variables.

4.6.2 Qualitative Research

Qualitative analysis, in contrast to the quantitative approach, can be used to explain multiple realities, acquiring understanding, building theory, and obtaining insights into regular daily realities. A review of the existing relevant body of literature indicates how this approach tends to define phenomena using insights that observers prescribe to them, which in the context of this study consequently produces a clear understanding of the IS perspective and its impact on the context within which it exists. The format of data that is collected can include text, pictures or sounds (Bogdan & Taylor, 1975; Nissen, 1985; Gaillers, 1992; Hussey & Hussey, 1997; Lee & Baskerville, 2003). Mukhopadhyay and Gupta, (2014) reported that "Generally, interpretive is associated closely with qualitative research while positivist is associated with quantitative research designs."

Qualitative evidence can be mutually complimentary with quantitative analysis in providing a complete picture of results; although it also sheds light on the experiences of the participants that quantitative data is unable to provide. Furthermore, surveys and questionnaires can be used to generate qualitative data and are commonly used in research. The qualitative data tend to be anecdotal, i.e., subjective rather than numerical. In the current research study, the researcher therefore uses an interview questionnaire with a semi-structured design to explore multiple case studies of participating on SSC implementation (Creswell, 2014; Naoum, 1999; Saunders *et al*., 2003).

In contrast to the quantitative method, the qualitative approach is grounded in words or pictures as opposed to empirical data (Johnson and Harris, 2002; Miles and Huberman, 2014). Berg (2012) also noted that qualitative studies typically work with smaller sample sizes of respondents who are studied in far greater detail and within their natural contexts. Silverman (2010) notes that the qualitative approach includes detailed observation and analysis of the natural context in which the research is undertaken. Qualitative approaches are adopted when little is understood about the research topic. The researcher often engages with participants face-to-face in order to observe their natural behaviour in their natural environment (Creswell, 2014). Qualitative research is relevant and valuable in exploring the organizational objectives, processes, and limitations in a given new phenomenon (Skinner *et al*., 2000; Broom *et al*., 2009). Thus, this research adopts the qualitative approach. Similarly, Bryman and Bell (2007, p. 418) state how qualitative approaches are the preferred method to study the context and process of the phenomenon in detail. They state that:

> ***"Many qualitative studies provide a detailed account of what goes on in the setting being investigated. Very often qualitative studies seem to be full of apparently trivial details. However, these details are frequently important for the qualitative researcher, because of their significance for their subjects and also because the details provide an account of the context within which people‟s behaviour take place.... (So) one of the main reasons why qualitative researchers are keen to provide considerable descriptive detail is that they typically emphasise the importance of the contextual understanding of social behaviour"***

Miles and Huberman (2014, p. 1) noted a similar conclusion in concluding that qualitative research is a "source of well grounded, rich descriptions and explanations of process in identifiable local contexts". The following table (4-4) shows some differences among qualitative and quantitative based on a number of key sources (Bryman and Bell, 2015; Maxwell, 2013; Corbetta, 2003; Hair *et al.*, 2011; Johnson and Onwuegbuzie, 2004).

Dimensions	*Qualitative Methods*	*Quantitative Methods*
Purpose	To analyse and understand social interactions.	To test hypotheses by exploring cause and effect and to ultimately make predictions.
when to be used	▪ When an in-depth understanding of a given phenomenon is required ▪ To understand behaviours, perceptions and priorities of the research sample ▪ To interpret and understand data obtained by quantitative data analysis ▪ To emphasize a holistic approach (processes and outcomes) ▪ When the reseracher only roughly knows what he/she is looking for in advance ▪ Preferential in the earlier phases of assessments	▪ To obtain a detailed understanding of the context ▪ To understand the socio-demographic characteristics of the research sample ▪ To compare relationships between different phenomenon ▪ When accurate and precise data is required ▪ To produce evidence about the nature of issues under study ▪ When the researcher knows clearly in advance what he/she is looking for ▪ Preferential during latter phases of assessment
Concepts	Research development	Operationalised
Objectives and main features	▪ To investigate and understand phenomena ▪ Provides in-depth understanding of specific phenomenon ▪ Detailed and comprehensive data, contextualization, interpretation and description ▪ Identifies the perspectives, opinions and explanations of affected individuals toward events, beliefs or practices	▪ To obtain precise measurement, quantify, and confirm hypotheses ▪ Provides a generic overview ▪ Provides demographic characteristics ▪ Objective, reliable and useful for generalization ▪ Objectively verifiable ▪ Prediction, causal explanation
Approach	Unstructured, driven and open	Structurally driven
Sample of Study	Limited and not randomly selected.	Large and randomly selected.
Focus	Connects events, activities, factors and people interpretation	Change in social world by static style
Relation between field and researcher	In-depth investigation	No detailed investigation of the phenomenon
Relation between respondent and researcher	Close and direct contact	Indirect contact
Forms of Data Collected	Qualitative data including open-ended questions, interviews, participant observations.	Quantitative data through precise measurements using structured data collection instruments.
Data format	▪ Data can be observed but not measured ▪ Mainly textual, such as words, pictures, audio, video, which can also be categorical	▪ Data which can be counted or measured. ▪ Typically, numerical and categorical values

Dimensions	*Qualitative Methods*	*Quantitative Methods*
Answers the questions	Answers How? Why? What do I need to look for in more detail questions, and questions that are generally open-ended	Answers a controlled sequence of questions with predetermined answers and closed questions
Perspective	▪ Observes the entire context from within and searches for patterns ▪ Lends itself to community participation. Seeks depth of perspective through ongoing analysis (e.g. Waves of data)	▪ Observes specific aspects from the outside
Methods	▪ Individual interviews ▪ Key informant interviews ▪ Semi-structured interviews ▪ Focus group discussions ▪ Observation	▪ Quick counting estimates ▪ Sampling surveys ▪ Population movement tracking ▪ Registration ▪ Structured interviews
Sampling	Non-random (purposive)	Random
Study design and instruments	Flexible, wherein the researcher is the primary instrument for data collection and analysis.	Fixed, standards control the assessor's bias.
Questionnaire tool types	Checklist with open questions and a flexible sequence	Predetermined questionnaire with a set sequence and structure
Analysis	▪ Use inductive reasoning ▪ Involves a systematic and iterative process of searching, categorizing and integrating data ▪ Describes the meaning of research findings from the perspective of the research participants ▪ Produces generalisations obtained from a limited range of specific observations or experiences ▪ Analysis is descriptive	▪ Uses deductive methods ▪ Descriptive statistics ▪ Inferential statistics
Expected Results	Specialised findings that is less generalisable.	Results that can be generalised and applied to other cases.
Findings	Deep and rich data	General and specific data with no attention to time or place, inflexible and reliable
Final Report	Narrative report with contextual description and direct quotations from the participants.	Statistical report with correlations and statistical significance of findings.

Table 4-4: Qualitative VS Quantitative Research Methods

Source / Adopter: Hair et al., 2011; Johnson and Onwuegbuzie, 2004; Bryman et al. (2007); WFP, 2009, p5

Qualitative Methods	*References*
Qualitative Methods Strengths	
The researcher gains an in-depth understanding of the phenomena	Benbasat and Zmud, (1999); Kaplan and Maxwell, (2005); Myers and Avison, (2002); Myers, (1997); Miles and Huberman, (2014); Johnson and Onwuegbuzie, (2004); Benbasat et al. (1987a); Benbasat et al. (1987b); Benbasat and Stake (1995); Myers (1997); Silverman (2010);
The researcher is able to study IS within in its natural context	
The researcher is able to produce theories out of practice	
The researcher is able to explore dynamic processes	
The researcher is able to analyse the meanings obtained by specific participants	
Reduces the barriers between the researcher and participant	
The researcher is able to obtain a deep understanding of a given phenomenon in its specific context	
The researcher gains a detailed understanding of the nature and complexities of specific processes	
Qualitative Methods Weaknesses	
Different methods of analysing and interpreting data	Silverman, (2010); Hair et al., (2011); Saunders et al., 2009; Silverman, 2010; Miles and Huberman, 2014; Lee (1991); Johnson and Onwuegbuzie, (2004); Lee (1991); Miles and Huberman, 2014;
The sample size is smaller than in other methods, which reduces its generalisability, controllability and deducibility	
The researcher must invest significant amounts of time engaged with the research in terms of data collection and analysis	
The result may be influenced by the researcher's personal biases	
The collected data is unstructured	
Can be very time-consuming and thus presents challenges to recruiting managers and other key participants into the study, due to their own time constraints.	
Contextual meaning can be lost when data is aggregated or summarised.	
Data can be open to individual interpretation, which can reduce the accuracy of interpretation results	

Qualitative Methods	*References*
Advantages of Qualitative Methods	
The researcher can understand the nature and complexity of the process of the study focus	Benbasat et al. (1987); Creswell (2014); Kuechler et al. (2009)
Can provide more real-life experiences and insights.	
Developing theories from practice by studying the IS in its natural context and using cutting edge learning methods	
Disadvantages Qualitative Methods	
More attention to the process of data collection is required because qualitative data is typically textual and rich, this may be lost during interpretation of the data. Therefore, it is imperative that attention is paid to the following points: • Ability to control the data collection process • Ability to deduct the required data • Ability to repeat required data collection for triangulation • Ability to generalise	Miles and Huberman (2014); Lee (1998); Cornford et al. (2005); Creswell (2014)
There is the potential for researcher bias due to the various ways to interpret the rich yet unbounded data.	
Changes to the context of the data during the collection process can occur and potentially lead to validation problems.	

Table 4-5: Strengths, Weaknesses, Advantages and Disadvantages of Qualitative Research

(Source: Ebrahim, 2005)

The qualitative research approach has been adopted for this research as it allows the researcher to interpret and explore the issue in its natural context wherein a number of social, organisational and technological factors have an influence. For example, this includes interdepartmental partnership, as well as data sharing in these collaborations, which are somewhat unique concepts in the government and public sector. Strauss and Corbin (1990) highlighted how qualitative research can be employed to more comprehensively analyse a phenomenon that has not been fully analysed to date, to obtain a new understanding of a phenomenon that is already known, and also to explore detailed information that is perhaps difficult to research quantitatively. Thus, the qualitative research approach appears to be the most suitable in this research. Furthermore, four primary reasons (Adopted from Kaplan and Maxwell, 2005) drive the adoption of qualitative methods in research relevant to this study, see figure 4-5:

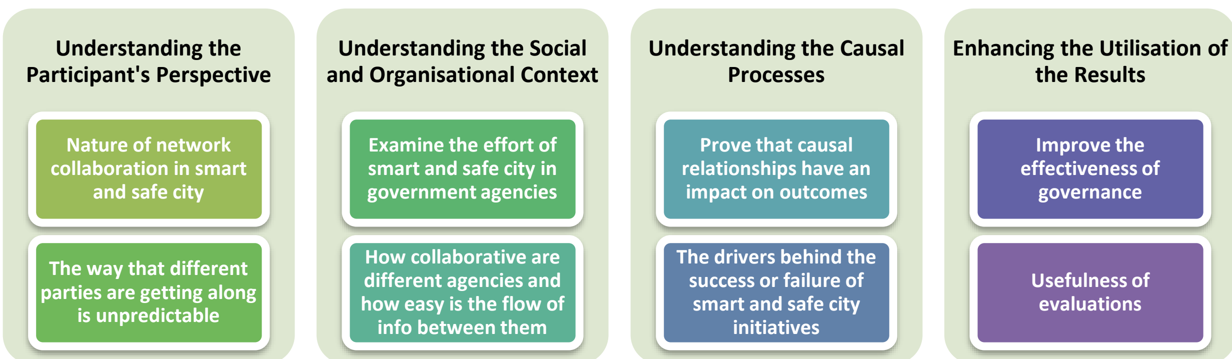

Figure 4-5: Main reasons for adopting qualitative research
Source: (Kaplan and Maxwell, 2005)

1. ***Interpreting the Participant's Perspective:*** The perspectives of the participants involved in SSC phenomena of implementations are unknown prior to the study. This is because network collaboration and the manner in which different actors interact is impulsive as a result of various variables, including trust and dependence (Mazen *et al.*, 2011). As it is very challenging to explore the participants' perspectives of technology architecture, impact on people's happiness and influence on shaping future government purely through quantitative approaches, qualitative methods are required.
2. ***Interpreting the Social and Organisational Context:*** The primary objective of this research is to explore the initiatives in governmental authorities to establish a SSC from a socio-technical perspective. As noted, the context of this research includes how successful SSC initiatives can improve people's happiness and shape future government and which technology architectures are required to achieve this. Analysing such initiatives successfully across public sector entities

cannot be undertaken without taking into consideration the organisation, political and technological setting. Therefore, due to their contexts, SSC initiatives are not necessarily the same in all jurisdictions. By selecting a qualitative approach, the researcher will establish a close relationship with the various organisations being studied and this will result in a better understanding of these unique contexts.

3. ***Interpreting the Causal Processes:*** A causal relationship exists between each group of actors influencing governments in the implementation of SSC initiatives. This relationship is observed as the multi-dimensional relationship between an organisation's actions and processes of change that are observed in the implementation of smart and safe city initiatives. Maxwell (2013) stated that a *"**quantitative method such as experimental intervention can prove that causal relationships exist, but they cannot effectively show how those causal processes work**"*. Furthermore, by using a qualitative method, the researcher can explain the relationship among the different factors impacting upon the level of improvement to people's happiness and future government structure through technology adoption (Miles and Huberman, 2014), and illustrate how and why such processes and results transpire (Markus and Robey, 1988).
4. ***Utilisation of the Results:*** In addition to assessing the impact on people's happiness, a key objective of this study is to improve the effectiveness of SSC by redesigning future government, which is achieved by analysing and prioritising strategic actions in establishing a successful smart and safe city. Patton (2015) noted how the results of qualitative analysis are able to improve the integrity and value of assessments in the decision-making process. This is because the qualitative approach produces insights that are directly linked to the understandings and perceptions of the respondants involved.

Characteristics of Qualitative Research	*Implications to Research*	*References*
Allows the in-depth analysis of complex issues and processes.	Identifies benefits, risks and controls relevant to shaping future governments.	Benbasat *et al.* (1987); Creswell (2014); Maykut and Morehouse (1994); Silverman (2010); Bryman and Bell (2015) and Kuechler *et al.* (2009)
Establishing new theories and exploring contemporary phenomenon.	Chapter 1 and 2 find a lack of research in SSC implementation and technology architecture.	Morse, (1999); Saunders *et al.*, (2000); Creswell (2014)
Enables a phenomenon to be interpreted in its natural setting.	Understanding how a smart and safe city initiative can be implemented, as well as what factors determine its success.	Benbasat *et al.* (1987); Maykut and Morehouse (1994); Silverman (2010); Kuechler *et al.* (2009)

Table 4-6: Characteristics and Implications of Qualitative Research

The table 4-7 below describe the Differences in Qualitative and Quantitative Approach

Research Approach	*References*	*Research Approach*	*References*
Research Approach			
Quantitative		***Qualitative***	
Employs mathematical and statistical techniques to define causal relationships and key facts. Large sample sizes. Results are generalisable, though with known margins of error.	Kaplan, (1964); Lincoln and Guba, (2000).	Determines what exists instead of how many things exist. Includes deep analysis. Often less structured. Attentive to the specific context of a research study.	Bogdan and Taylor, (1975); Nissen, (1985).
Research Philosophy			
Positivist		***Interpretivist***	
Fixed laws of causation. Uses reductionism to address complexity. Focus on objectivity, scientific measurement and ability to replicate.	Hirschheim, (1995); Klein and Myers, 1999;, (1999)	No universal truth. The researcher's perspective is the basis for interpretation and insight. Uncommitted neutrality. Realism of context important.	Bogdan and Taylor, (1975).
Research Process			
Confirmatory		***Exploratory***	
Testing and verification of hypotheses and theories. Positivist, quantitative modes of research.	Ives and Olson, (1984).	Seeks patterns in data and attempts to explain them. Provides a generic descriptive basis. Generation of hypotheses.	Trauth and O'Connor, (1991).
Role of Theory in Research			
Deduction		***Induction***	
General results used to value properties and particular phenomenon. Theory verification is central.	Popper, (1963); Mintzberg, (1996).	Case study focus to generate standardisations. Key role in the conception of theories and hypotheses, but widely criticised in scientific communities.	Popper, (1963); Hirschheim, (1995).
Analysis			
Laboratory		***Field***	
Precise measurement and control of variables, perceives that real-world intensity and variation may not be achievable.	McGrath, (1984).	Focus on realism and natural context. Precision control of variables and behaviour measurement is not realistic.	McGrath, (1984); Van Horn, (1973).

Table 4-7: Differences in Qualitative and Quantitative Approach

Source: (Missi, 2008)

4.7 Research Strategy

A research strategy is the plan established by the researcher to undertake a research project (Galliers, 1992). As Galliers (1992) noted, it is possible to see a research strategy as the mechanism by which research can be undertaken, by employing a range of research tools for data collection and analysis (Galliers, 1992). Research strategy is an incredibly important element of selection the most appropriate research model. There are a number of research strategies that can be used to collect data that are specifically relevant to IS, including, experimentation, surveys, field studies, grounded theory, action research, descriptive, exploratory, explanatory studies, longitudinal studies, and ethnography (Saunders *et al*., 2012; Cavaye, 1996). A number of scholars, including Silverman (2010), Yin (2009) and Benbasat *et al*. (1987), have noted the advantages and disadvantages of different research strategies, and how no single strategy is in effect superior or inferior. Consequently, it is critical that the researcher understands the specific relevance and benefits of each potential research strategy to the specific study being undertaken, in order to adopt the most suitable strategy.

There are a number of specific research strategies that can be selected for this study (Saunders *et al*., 2009). Table 4-8 below provides a brief overview of each strategy.

Research Type	*Purpose*	*Limitations*	*Justifications selections or excluding*
Experiment	Popular in psychology; focus on causal links; explores the linkage between two dependent variables; useful in both experiments can be controlled; prefers internal validity; researching a known population is preferred	External validity is difficult to establish; controlled environment; generalisation is possible, but less so than in field-based experiments; may not apply to a number of business management questions; requires a captive population	Excludes experiments on strategy options as proving or disproving hypotheses are not included (Oates, 2006).
Survey	Follows a deductive approach; popular in business and management strategy research; who, what, where and how questions; large data volumes; highly economical; uses sampling and questionnaires; useful for comparative analysis; can be used to explain relationships between and within entities (Saunders *et al*., 2009).	Representative sampling fundamental otherwise generalisations cannot be made; time consuming data analysis; lacks a good response rate; not as wide-ranging as other methods; data may not be available (Saunders *et al*., 2007; Bryman *et al*., 2015).	As surveys are seen as fixed choice questions, it is excluded here (Silverman, 2001); focus on patterns usually indicates directional conclusions (Oates, 2006). Not part of the current research focus
Case study	Focus on a particular contemporary phenomenon within its real life context; uses multiple sources of evidence; considers contextual factors; used in explanatory and exploratory research; combines different data collection techniques occasionally (Yin, 2014).	Unclear boundaries between the phenomenon and its context; produces an unscientific sense; requires multiple units of analysis; requires very strong justification of the type of case study being adopted (Saunders *et al*., 2009).	▪ Very practical for IS, business and management research (Saunders *et al*., 2009, Yin,2009); empirical investigation of a specific phenomenon in a real life environment; uses multiple source methods of data gathering. ▪ Achieves greater understanding of the research context and process. ▪ Saunders *et al*. (2007) argue that the case study could be a constructive strategy for examining theories; however, it is sometimes argued to be unscientific and anecdotal (Miles and Huberman, 2014; Walsham *et al*., 1994).

Research Type	*Purpose*	*Limitations*	*Justifications selections or excluding*
Action research	Emphasises the purpose of the research, the involvement of practitioners, iterative process of data analysis and implications for additional projects beyond the research scope; encourages organisational change; involves planning, diagnosis and action.	Useful for how questions; the researcher must be involved in the topic, potentially introducing researcher bias; may extend beyond the remit of the current research (Saunders *et al*., 2007). Three dimensions: change management, employee engagement, and results that can inform different contexts; distinct in that it strives to recommend change.	Excluded as the researcher does not intend to initiate, change, or play an active part in the resolution of problems in the context being researched (Cavaye, 1996; Oates, 2006).
Grounded theory	An inductive approach; uses both inductive and deductive approaches; used for theory building; useful to predict and explain behaviour; useful for business and management studies to explore a diverse range of issues; theory is developed using data generated from a range of observations. (Bryman *et al*., 2015)	Challenging to implement, requires extensive experience and knowledge; requires constant revision and iterations to avoid false conclusions	▪ Excluded because '*The discovery of theory from data systematically obtained from social research'* (Glaser and Strauss 1967). ▪ Extends beyond just a building theory; uses inductive and deductive approaches; data collected can be analysed to produce a new theory or framework (Bryman *et al*., 2015)
Ethnography	An inductive approach; explains the social world in a manner which stakeholders prefer; naturalistic; researcher needs to embed in the social world being investigated; new patterns of thought are likely to develop continuously as the phenomenon is observed; investigates the phenomenon in the context in which it exists; provides insight into particular contexts.	Time consuming; not a dominant research study in the business and management research; difficulties could be there in finding settings or groups matching the research requirements; possible introduction of researcher bias as the researcher is part of the phenomenon under study; needs extended particular observation.	Excluded as a research strategy because, even though the researcher spent some time attending company events in a detached non-participatory way, data were not gathered through a longitudinal approach (Oates, 2006).

Table 4-8: Types of Research

The following section (4.8) explains the case study and its characteristics, while section 4.8.1 justifies using a case study as an appropriate research strategy for this research and proves how this strategy enables the researcher to undertake this work through employing different data collection and analysis methods.

4.8 Case Studies

The case study is an idiographic approach (Cornford *et al*., 2005), which forms an appropriate research strategy to explore how IS within a given organisation can be analysed. Within IS phenomena, it has been proven that the case study approach is a valid strategy (see Klein and Myers, 1999). As Chan *et al*. (1992) noted, "***to obtain a rich and detailed understanding of strategy from multiple viewpoints, consider the case studies or historical approaches***" (Chan *et al*., 1992, p: 194). The literature does not contain a standard definition of what a case study actually is. Yet, Benbasat *et al*. (1987b) provide a sound definition derived from a range of sources (Stone, 1978; Benbasat, 1984; Yin, 2009; Bonoma, 1985; Kaplan, 1986) that is presented as:

> ***"A case study is a holistic inquiry that investigates a phenomenon in its natural setting, adopting multiple methods to collect information from single or few entities (people, groups or organizations). The phenomenon boundaries at the beginning of the research are not clearly evident and manipulation or experimental control is not employed.***

Furthermore, Yin (2009, p. 18) outlines the case study as "***an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident***". Case studies are widely used for research where *how* and *what* questions are integral elements to the study (Klein and Myers, 1999). Other scholars identify a case study as "***a detailed investigation, often with data collected over a period of time, of one or more organisations, or groups within an organisation, with a view to providing an analysis of the context and processes involved in the phenomenon under study***" (Hartley, 2004, p. 323). Thus, the case study approach provides the opportunity to understand the true nature of a given phenomenon. Moreover, it is also stated that:

> ***"A case study takes into account the context where social phenomena are constructed and embedded. Such an understanding helps researchers make sense of data without the risk of oversimplifying the social phenomena under investigation" Huang et al., (2003, p. 91).***

Case studies allow the detailed analysis of a phenomenon and within its natural context, taking into consideration the perceptions and insights of stakeholders. Yin (2009) notes that the case study approach enables a researcher to comprehensively investigate a phenomenon, and in particular in its real-life context, even when the context of the phenomenon and its boundaries are unknown. In this study, the reality of IS implementation is sought, in order to understand the context of managers, their decision-making and their perspectives. That is to say, analysis is required in as much detail as possible, regarding how managers perceive the value of the governance framework of technological adoptions intended to develop and maintain a smart and safe city environment. Many case study characteristics have been defined and are shown in the table 4-9 below.

SR#	*Case Study Characteristic*	*References*
1	Focus on newly emerging events	Benbasat *et al*. (1987); Yin (2009)
2	Flexible planning control is essential	Yin (2009), Cornford *et al*. (2005)
3	In-depth investigation of complex issues.	Yin (2009), Bryman *et al*. (2007)
4	Assessment of one or more entities.	Benbasat *et al*. (1987) ; Cornford *et al*. (2005)
5	Triangulation of data collection methods.	Yin (2009)
6	Flexibility to develop new themes by changing the data collection method.	Benbasat *et al*. (1987)
7	Supporting knowledge-building processes, by using various approaches, including taxonomies, examination and hypothesis building.	Saunders *et al*. (2007) ; Bryman *et al*. (2007)
8	For in-depth investigation, operational level of events can be focused on by different types of questions such as 'how', 'why' and 'what'. With this in mind a time horizon can be considered.	Benbasat *et al*. (1987); Yin (2009)
9	The investigation maturity impacts the results of the study.	Benbasat *et al*. (1987)
10	Rich, in depth, multi perspective exploration	Orum, *et al*. (1991); stake (1995); Green and Thorogood (2008)
11	Lack of control on behavioural events	Yin (2009)

Table 4-9: Case Study Characteristics

A significant number of IS studies have utilised case studies, including Yin (2009); Klein and Myers (1999); Galliers (1992); Orlikowski and Baroudi (1991).

4.9 Field Study

Before introducing the methodological approach utilised in this research in greater detail, it is useful to define the term 'field study'. As defined by Lillis and Mundy (2005, pp. 120, 121), a "field study" may refer to a specific methodology of studying the "***nature of the constructs on which the theory is built, the relations among these constructs, or their empirical interpretation***" **and the "*nature and impact of key social and contextual influences***". In contrast, the term "field study" may be used interchangeably with the term 'empirical study', which is defined as research involving obtaining data by means of empirical observation or experience. According to the definition put forward by Jabbour (2013), it is necessary to clarify that in this research the term 'field study' refers to the choice of methodology, while the expressions 'empirical study' or 'empirical research' describe an empirical study as a whole.

In this research, the field study method is adopted to explore the diversity of technology adoption and the associate architecture in establishing SSC. Furthermore, the field study contextualises the diverse literature on implantations practices using a systematic assessment of the level of assimilation of technology principles. It also notes the disadvantages and shortcomings of such risk management systems. Subsequently, the case study approach is adopted to examine organisational development of SSC, links with organisational logics, and the rationale for the alignment of different technology systems with the respective IT contexts. Furthermore, field studies can provide valuable interpretive knowledge, determining humans in their social context (Orlikowski and Baroudi, 1991). Intuitively, field studies are undertaken in the 'field', which the natural environment of the individuals being assessed thus is providing the opportunity to observe natural behaviour as it occurs in everyday life (Coolican, 2009; Orlikowski and Baroudi, 1991).

4.9.1 Justifying the Use of Case Study Research

Various scholars have described case study research as being perhaps the most generally qualitative approach used in IS research (Myers, 1997; Orlikowski and Baroudi, 1991). Moreover, it is described as being specifically useful in comprehending the relationships of ICT-related innovations and the business context (Darke *et al.*, 1998). Considering the theoretical assumptions and methodological reflections reviewed above, the case study method seems the most appropriate strategy for this research. There are however, additional reasons for adopting this approach, which are summarised below:

- ***The nature of the research questions and objectives:*** The key reason behind adopting a specific research strategy is to build an understanding of the research question (Yin, 2009). As is stated in Chapter 1, this research seeks to address questions that explore SSC implementations along with the technology architecture for citizen's happiness. Furthermore, seeks to understand how those components will assist in controlling the risks of SSC adoptions through governance frameworks. In addition, the research asks why the technology, processes and procedures involved in SSC context are typically similar, even when the governments and context behind such initiatives are often quite different.

- ***Examining the phenomenon in its natural context:*** The objective of this study is to analyse and understand the benefits, risks and controls of government-led technology adoption initiatives to establish a SSC. The study seeks to establish a narrative of the processes in which government authorities are following to establish a SSC and in shaping future governments accordingly.
- ***Previously under-studied area:*** As noted previously, there is almost no existing research on SSC implementations combined with the technology architecture and related to governance frameworks. Pardo and Tayi (2007) found that many of the existing research studies on IS have focused on a particular issue within the IS discipline (e.g., emergency response, traffic control and so on) and predominantly explore the phenomenon from a much focused point of view (e.g., political, business processes and technological). It can be presented that a study to define the risks, benefits and the implementation of SSC is to minimise the risks have not been widely explored in governmental authorities. Furthermore, there is almost no research exploring the SSC implementation framework along with technology architecture and shaping of future governments with regards to a collaborative environment. Benbasat (1987) argued how the case study approach is also particularly valuable in areas where the literature is limited.
- ***Comparing with other related strategies:*** In order to justify the case study approach as the most appropriate research strategy for this study, it is necessary to compare this approach with other strategies (Benbasat *et al.*, 1987). For instance, *Case Study Research* is perhaps most appropriate approach for a study that require expertise in a given and it is adopted as a strategy to solve such research problems (Silverman, 2010). This researcher was not involved in the process of adopting technologies and implementing SSC initiatives in government-led projects, and was not able to influence the relevant decision-making processes. Therefore, applying this method was not relevant or useful for this research. Table 4-10 below provides a summary of the advantages of the case study approach in contrast with other available strategies.

	Case Study	*Field Studies*	*Action Research*	*Application Description*	*Ethnography*
Aims for understanding of context	●		●	●	●
Does not pre-define a construct/problem	●		●	●	●
Topic defined by researcher	●	●		●	●
No intent of interference in phenomenon	●	●		●	●
Attempts to contribute to knowledge	●	●	●		●
Interpretation from researcher's viewpoint	●	●	●	●	
Relates findings to generalizable theory	●	●	●		

Table 4-10: Comparing characteristics of Case Study Strategy with the Related Strategies

(Adapted from Cavaye, 1996)

Yin (2009) proposed that case study analyses come in three distinct formats: descriptive, exploratory and explanatory. The following table 4-11 describes these types according to Yin.

Type of case study	*Description*
Descriptive cases	descriptive theory must be developed prior to data collection
Exploratory case	to develop pertinent hypotheses and propositions for future studies
Exploratory case	addresses a new set of public sector research questions
Explanatory case	attempts to initially describe the events and then use multiple theories to explain these events

Table 4-11: Types of Case Study Analysis

Source: Yin (2009)

In line with the classifications above, the case study adopted in this study is an *exploratory* approach. This is because the analysis answers a set of unique and specific questions in public sector studies. Furthermore, it answers questions with 'What?' and 'How?' forms. As the exploratory case study strategy has been justified for this research, it is necessary to decide on adopting either a single or multiple case to obtain sufficient understanding of the research topic. Using a single case study allows the phenomenon to be analysed in detail (Cavaye, 1996; Rowley, 2002). Yin (2009) notes that it is appropriate to adopt a single case study under the following circumstances:

1. "It represents a *critical case* for testing a well-formulated theory (i.e., it meets all the requirements for testing a theory).
2. It represents an *extreme* or a *unique case.*
3. It is representative (i.e., capturing the circumstances and conditions of everyday or commonplace situations).

4. It is *revelatory* (i.e., investigating a phenomenon that was previously inaccessible)
5. It is *longitudinal* (i.e., investigating the same single case at two or more different time references)." (Yin, 2009)

In contrast, when compared to the single case study approach, the multiple case study approach enables comparative analysis of different case studies and compares the range of data results, even though it does not allow for the same level of depth in the analysis that a single case study approach might (Darke *et al.*, 1998). Furthermore, the results obtained from multiple case study analysis can provide a more convincing and often complete argument regarding the causes and effects of the phenomena being studied (Herriott and Firestone, 1983). In order to both predict results that are similar as well as to hypothesise contrasting yet predictable results, multiple case studies can be adopted (Yin, 2014). Taking into consideration the nature and objectives of this research, a multiple case study method is used. The research intends to explore different circumstances and varied aspects of what a SSC is in government agencies as well as to understand what activities and collaborative efforts government agencies must take in order to successfully implement SSC. Furthermore, this approach allows the research to define common influential factors shared by authorities that are successful in implementing SSC. Therefore, this study adopts Yin's advice (2009, p. 27) that research study questions involving case studies of a "collaborative nature" must be addressed by all stakeholders. Yin stated that:

> ***"Such questions can be answered only if you collect information directly from the other organisations and not merely form the one you started with. If you complete your study by examining only one organisation, you cannot draw unbiased conclusions about interorganisational partnership."***

When considering how many case studies should be included in a research study, a number of scholars have argued for different parameters. For instance, Eisenhardt (1989), state that a comparative case study research should include at least four case studies but no more than ten. A further study by Gable (1994) argued that five case studies should be the limit. This research has adopted two case studies based on different governmental agencies that are involved in SSC initiatives. The research adopted two case studies based on limited access to data due to confidentiality, timescale constraints and the actual limited availability of appropriate case studies to adopt.

4.10 Investigational Research Methodology and Process

This section explains the different phases of empirical research adopted in this study, as seen in figure 4-6. These stages can be described as a 'research wheel', wherein the individual steps are considered part of a cyclical process rather than a linear enquiry (Rudestam and Newton, 2007). The related body of existing literature includes different accounts of how many stages are included in this research wheel, however, they can generally be categorised as the warming-up and preparation phase, stretching exercises and the cooling down phase (Janesick, 2003). This study adopts a research process bases on the three phases developed by Jankowicz (2005):

Figure 4-6: The Research Process

A number of scholars have stated clearly that the research phases should be fully defined before the study is undertaken (Yin, 2014; Saunders *et al*., 2007; Bryman *et al*., 2015).

4.11 Selecting a Research Design

The research design stage includes identifying how credible conclusions can be drawn from the data collected. (Yin, 2009; Rowley, 2002). This process ensures that the research questions are aligned with the objectives and acts as a constant reminder that maintains the focus of the research process. Yin (2009) notes that the research design is a logical sequence based on data collection and analysis followed by the interpretation of results in order to address research questions and ultimately draw conclusions.

As shown in Figure 4-7, this phase begins with exploring the background research on SSC initiatives, in addition to analysing previous and current studies (in Chapter 2) in the body of literature, which addresses the first objective in this study. Reviewing the existing literature allowed the researcher to identify important issues linked to SSC implementation along with technology architecture, in particular, with implications on the design of future government structures as defined in Chapter 1. Following this, the conceptual framework of the study must be defined, which forms the basis for empirical methodology and the theoretical framework of the study. Perhaps most importantly, the research methodology is defined. There are three key stages in the research methodology, including research strategy, research methods and the unit of analysis, all of which are detailed in this chapter.

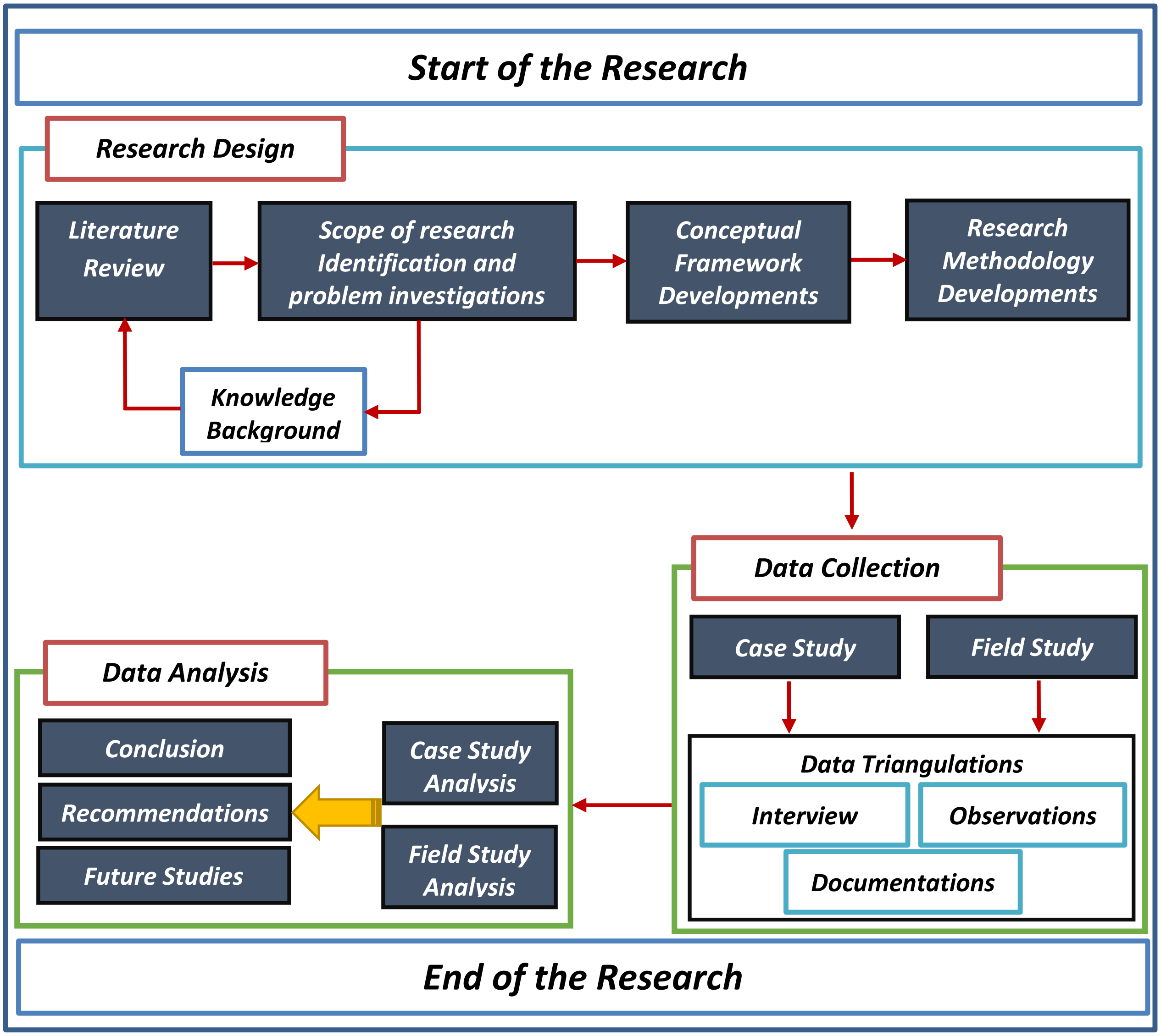

Figure 4-7: The Detailed Research Process

As noted above, this research study adopts a qualitative research strategy that uses multiple case studies in a comparative analysis format in order to investigate the different types of framework for establishing a SSC and to be validated from field expertise. The research is then converted into a case study protocol, which is the action plan of how data will be collected. The data is collected using interviews, observations and documentations in line with the case study protocol. The following sections detail the data collection process, which included the use of interviews and additional sources, such as archival material, published reports and documents from key service providers.

4.12 Data Collection

The data collection phase is the second stage of the research, as seen in figure 4-8. The method adopted to conduct this phase is the case study approach as justified above. According to Yin (2014), when conducting case study research, data can be collected using a total of six sources: documentation, archival records, interviews, direct observation, participant-observation and physical artefacts.

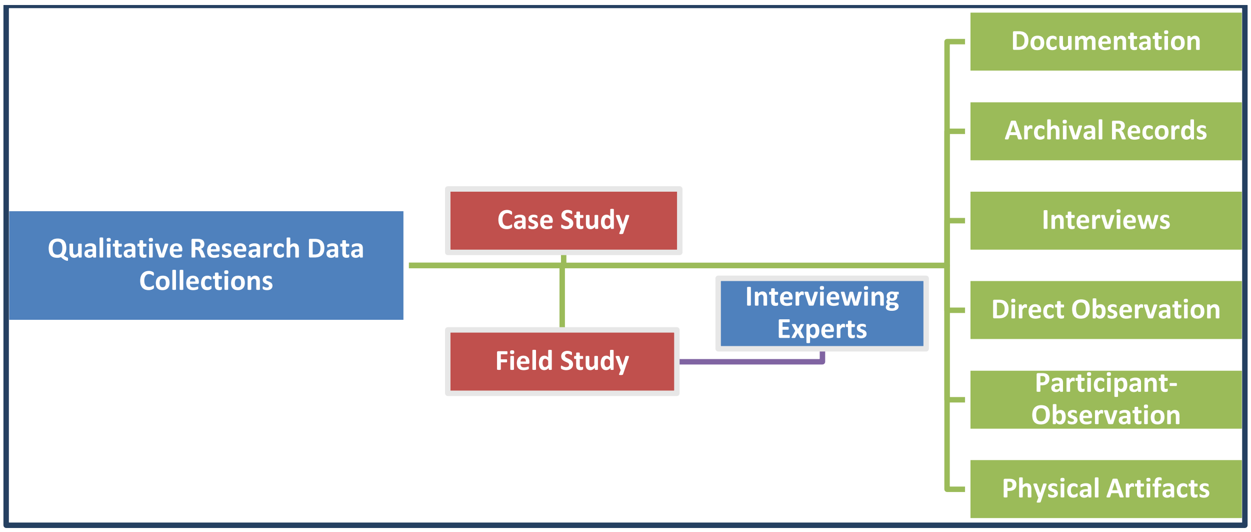

Figure 4-8: The process of data collection

Having defined the research strategy it is then necessary to specify which data collection techniques will be used in the research. Gillham (2000, p. 20) advises that when utilising a case study approach, the researcher ideally can seek to identify "what people say, what you see them doing, what they make or produce, what documents and records show". Yin (2009) also argues that data collection is the foundation to the research and that as many sources of data should be sought as possible (Yin, 2009).

According to Myers, (2009), seeking as many data collection techniques as possible is necessary "to gain a fuller picture of what is happening" and is referred to as "triangulation". By using the triangulation technique of the researcher can reduce the amount of "inappropriate uncertainty" in the study (Robson, 2002, p. 370). In other words, relying entirely on a single method of data collection and assuming that it has provided an accurate and complete answer is a research mistake. Therefore, triangulation provides a range of interpretations of the same phenomenon, allows for cross-checking of each source against all others, and provides more data or information to analyse. As Eriksson and Kovalainen (2008, p. 126) express,

> ***"Case studies are usually considered more accurate, convincing, diverse and rich if they are based on several sources of empirical data".***

Moreover, using triangulation, the researcher is able to "*obtain a rich set of data surrounding the specific research issue, as well as capturing the contextual complexity*" (Benbasat *et al.*, 1987, p. 374). Thus, complicated and sophisticated issues can be assessed using triangulation. Myers (2009) also states that the quality of data can be improved by triangulating data from different sources, which in turn improves the relevance and value of the findings.

Tables 4-9 summarises the main data collection techniques and their advantages and disadvantages. It can be observed that all techniques have pros and cons and that no single approach is superior to all others in every set of circumstances.

Source of Evidence	*Strengths (Yin, 2009)*	*Weakness (Yin, 2009)*	*Selected sources in this study*
Documentation	• Stable; reviewed repeatedly • Unobtrusive; not created as a result of the case study • Exact; contain exact details • Broad coverage; long span of time	• Low retrievability • Biased selectivity • Access; may deliberately blocked	• Business cases • Council constitution reports • Business strategy reports • Councillors guides • Annual plans • Manuals • ICT strategy report • Corporate procurement report • Websites
Archival Records	• [Same as above for documentation] • Precise and quantitative	• [Same as above for documentation] • Accessibility due to privacy reasons	• Deliverables on earlier interconnectivity projects within the case study organisations. • Case study organisations records.
Interviews	• Targeted; focuses directly on case study topic • Insightful; provide perceived causal inferences	• Bias due to poorly constructed questions • Response bias • Inaccuracies due to poor recall • Reflexivity; interviewee gives what • interviewer wants to hear	• Structured interview • Semi-structured interview • Unstructured interview
Direct Observations	• Reality; covers events in real time • Contextual; covers the context of event	• Time-consuming • Selectivity • Reflexivity; events may unfold differently as they are observed • Cost; man-hours required for observation	Through meetings with the interviewees of the case study organisations
Participant Observations	• [Same as above for direct observation] • Insightful into interpersonal behaviour and motives	• Same as above for direct observation • Bias due to investigator's manipulation of events	Straightforward participation with arranged meeting between different groups of participants. "through face to face interview meetings"
Physical Artefacts	• Insightful into cultural features • Insightful into technical operations	• Availability • Selectivity	Hardware and software.

Figure 4-9: Main data collection techniques and their advantages and disadvantages

Semi-structured interviews were adopted in this research as the main data collection technique, with non-participant observation and data obtained by reviewing the body of literature as key additional information sources, as recommended by various scholars (Miles and Huberman, 2014; Eisenhardt, 1989). The use of interviews was a clear fit for this research, considering the interpretive philosophical approach underlying this study. Typically, in case study research, interviews are seen as a key source of data (Yin, 2009; Voss *et al.*, 2002; Darke *et al.*, 1998). Yin (2009) pointed out that the "use of multiple sources of evidence" as the most appropriate form of case study data collection (p. 97). The use of interviews combined with document analysis has been widely used by previous scholars in interpretive case study research (e.g., Walsham, 1995; Lee, 1991; Maykut and Morehouse, 1994; Silverman, 2010; Voss *et al*., 2002).

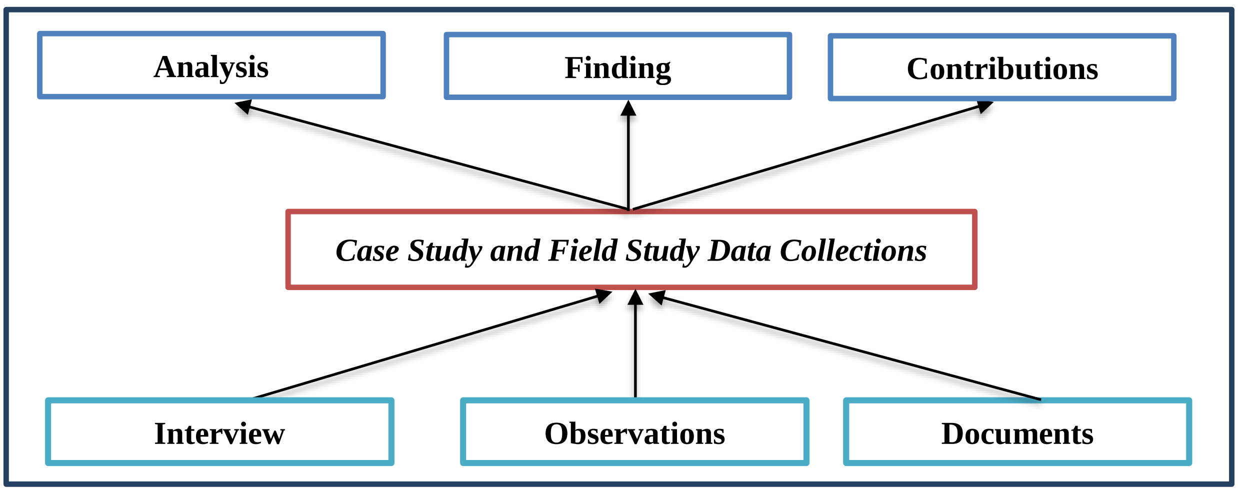

Figure 4-10: Case study and Field study data collection techniques

4.12.1 Interviews

In qualitative research, using interviews to gather data is certainly one of the most important tools available to the researcher (Myers and Newman, 2007; Gray, 2009; Yin, 2009). According to Saunders *et al.* (2009); Myers (2009) and Burns (2000) there are different ways in which qualitative interviews can be structured, as summarised in the figure 4.8:

4.12.2 Types of Interviews and Justifications of Selecting the Semi-Structured Interview

Research interviews can be categorised into three main types: unstructured, semi-structured, and structured (Myers, 2009; Burns, 2000). Unstructured and semi-structured interviews are qualitative interviews, while structured interviews include a quantitative approach. Kvale (2007,

p. 8) notes that a qualitative interview is a data collection technique "*with the purpose of obtaining descriptions of the real life-world of the interviewee with respect to interpretation of the meaning of the described phenomena*". In contrast, a quantitative interview includes pre-determined questions with wording that is fixed and arranged in a predefined order, and occasionally following a set time limit. In this manner, this technique is very similar to a questionnaire, however, the answers are delivered by the researcher directly, as opposed to the respondent self-administering the interview. As such, this approach is referred to as a structured interview (see Table 4.13).

SR#	*Interview Questions Types*	*Descriptions*
1	*Structured interviews*	Based strictly on a defined script with limited flexibility or improvisation permissible.
2	*Semi-structured interviews*	Based on pre-defined questions, that act as guides.
3	*Unstructured interviews*	Informal conversations.

Table 4-12: Types of Interview Questions

In contrast, the unstructured interview tends to be an informal conversation where the researcher explores broad issues and views in a fluid conversation that has no fixed questions and often no set time limit. Nachmias and Nachmias (1996) state that "*The interview is a face-to-face interpersonal role situation designed to elicit answers pertinent to the research hypotheses*" (Nachmias and Nachmias, 1996, p. 232). As mentioned by Frey and Fontana (1991), different specific methods can be used to conduct unstructured interviews, such as telephone or group interviews. Furthermore, Hannabuss (1996) states that unstructured interviews allow participants to explore their interpretations of in the reality that they live in. Furthermore, as there is a direct interaction between the interviewer and the interviewee, this data collection tool is ideal for complex issues, as they can be thoroughly explored. Interviews also facilitate the prioritising of critical issues and then allow the interviewer to focus more time on these critical areas (Cornford *et al*., 2005; Jarratt, 1996).

Semi-structured interviews reside somewhere between the structured and the unstructured interview approaches, though they are effectively qualitative tools. In semi-structured interviews the researcher predefines some questions, but the order in which they are delivered can be adopted as the interview unfolds and much of the remainder of the engagement is comprised of unstructured engagement. The semi-structured interview approach has been adopted for data collection in this research for five key reasons:

1. ***Firstly***; the primary driver for adopting a semi-structured interview approach has greater flexibility compared to other types of interviews, enabling the exploration of the SSC implementations and the technology structure. This can be done by looking at benefits, risks and barriers, adoption of IT for SSC. Furthermore, this approach allows for new factors, gaps and situations that influence governance to be explored, whereas structured interviews do not provide for this.
2. ***Secondly***; the semi-structured interview technique allows the interpretations and insights of the participants to be explored in detail, which is particularly relevant to this research as it is interpretive. As Myers (2009, p. 79) notes, semi-structured interviews can be very valuable in "finding out people's motivations, and their rationale as to why they did certain things". Furthermore, Gray (2009, p. 373) explains how semi-structured interviews are critical for the success of interpretivist research, noting, "where the objective is to explore subjective meanings that respondents ascribe to concepts or events".
3. ***Thirdly***, semi-structured interviews provide an equilibrium between the highly formalised structured approach and the loose conversational method, thus allowing the researcher to fully explore the respondent's answers (Easterby-Smith *et al.*, 2008) in order "to add important insights as they arise during the conversation" (Myers, 2009, p. 125). Moreover, the researcher is able to encourage the interviewees with potential answers that could be anticipated (Robson, 2002).
4. ***Fourth****:* Adopting the semi-structured interview technique allows the interviewees to express their perspectives and insights freely. Semi-structured interviews also enable the researcher to pursue a flexible format, providing greater space to engage with the interviewee, allowing for a better understanding of the more complex issues and dynamics of the phenomenon.
5. Semi-structured interviews are also considered appropriate when the research has an exploratory or explanatory approach (Willig, 2001). As this research aims to explore and explain the reasons of surprising results found through survey, semi-structured interviews are thus found to be well-suited for the aim of the research. Table 4.13 presents the usage of different types of interview in different categories (Saunders *et al*., 2012).

Research Type			
Interview Type	***Exploratory Research***	***Descriptive Research***	***Explanatory Research***
Structured		●●	●
Semi-structured	●		●●
Unstructured	●●		

Table 4-13: Usage of Different Types of Interview in Different Categories

Source: Saunders et al. (2012, p. 377)

Van Bruggen *et al.* (2002, p. 469) maintain that a "*multiple informant-based approach yields response data far superior quality*" in contrast to a single respondent context. Therefore, semi-structured interviews were undertaken with individuals that represented three hierarchical levels (stakeholders and senior executive directors, heads and managers, executers). This approach allowed the collection of "***rich data from people in various roles and situations***" (Myers, 2009, p. 121). This approach is in line with Eisenhardt and Graebner's (2007, p. 28) recommendation that in order to limit interviewee bias informed interviewees from different hierarchical levels of an organisation should be used, as they "***view the focal phenomenon from different perspectives***". Prior to running an interview, it is important for the researcher to prepare any relevant material as well as their own understanding of what the objectives are and how the researcher intends to conduct the interview. Following the completion of the interview the researcher must ensure that the participants have the following:

1. A sound understanding of what they have been asked and why
2. At least basic information regarding the objectives of the interview and an outline of the research project
3. A view of the likely or intended duration of the interview
4. An explanation of the need to record the interview
5. Instructions on where and when the interview will take place

To this effect, an interview guide was produced for this research as a critical element of preparing for and undertaking the interview process. This included a list of questions, topics and issues relating to the bureaucratic nature and performance of employees working for relevant government agencies.

4.12.3 Design and Validation of Interview Questions

A chronological structure was adopted for the interview guide provided to the participants that reflected their roles within the government agencies in which they worked. Mason (2002, p64) noted that the:

> ***"Interview is just as much a social situation as is any other interaction ... if your view is that knowledge and evidence are contextual, situational, and interactional, then you will wish to ensure that the interview itself is as contextual as possible, in the sense that it draws upon or conjures up, as fully as possible, the social experience or processes which you are interested in exploring" (Mason, 2002, p. 64).***

Thus, in order to obtain data relating to smart and safe city processes, the interview questions were formulated to achieve what has been referred to as "***a fairer and fuller representation of the interviewees' perspectives***" (Mason, 2002, p66). Drawing upon the theoretical framework and guidance obtained from the existing body of related literature, the primary themes and elements of the interview process were formulated into questions that clearly aligned with the research objective and overarching questions.

Open-ended questions have been used regarding to explore the contextual and functional perspectives of each smart and safe city initiative workflow. The interview questions were developed in line with the framework as adopted in this research and are detailed below:

SR#	***Interview Questions Components***	***Sub Components***
1	Contextual level factors for adoption and governance of Smart and Safe city for shaping future governments	Benefits
		Risks
		Barriers
		Governance
		Technology Factors Adoptions
		Strategic Actions
2	Functional level factors	Technology Functions
		Smart and Safe city function

Table 4-14: Interview Questions Components

Using the case study protocol as a design basis, the interviews were conducted with clear guidance (see Appendix A). The case study process (section 4.6) directs the interview sessions and maintains focus on the research objectives. Furthermore, it provides an overview of each case study and a data collection plan, as well as the reporting format used for each case study. Each interview covered three areas linked to each case study, which were used to build understanding and collect data in a more systematic manner. There are four areas covered in the case study protocol, which are described in table 4.15:

Interview Areas	*Descriptions*
General Background	Generic information, including organisational size, nature of business, management structure, as well as generic questions relating to the interviewee, such as name, contact details and position.
Technical Information	To collect data on IT infrastructure and related data, for SSC initiatives.
	To identify strategical actions and the adoption of solutions to support SSC.
	To identify the types of integrated systems,
	To identify technical factors that influence technology adoption.
Business Information	To identify processes; what are the stages involved and how technology workflow can benefit public safety formulation.
Strategic Planning Information	Data, such as, motivation for adoption of systems for smart and safe city initiatives, challenges prior to the adoption, system types, type of IS activity within an organisation, the planning team, benefits, drivers, requirements and, techniques for SSC implementation.

Table 4-15: Different interview areas

The interview agenda and structure will be reviewed by two scholars and senior officials from government in order to:

1. Suggestions of potential agencies to be approached,
2. Recommendations for specific individual candidates who could be approached for interview and who would be capable of effectively addressing the research questions,
3. Refine the wording of the questions to be presented in the time-constrained interview process in order to improve the interviewee's clarity and understanding of what is being asked,
4. Refine interview questions to improve alignment with the knowledge and experience of potential candidates for interview in the selected entities, and
5. Ensure clarity and understanding of the questions.

Based on the feedback obtained from the process outlined above, the following interview candidates were identified: 1. IT director; 2. Networking and Telecommunications head; 3. Information security Director / Head; 4. IT strategic Planner; 5. IT Technical Head; 6. System and Application development head; 7. Information security Specialist; 8. Physical security and monitoring head; and 9. IT Smart Safe City Program Head, also experts view from industry and working on SSC technology providing and consultancy.

Only positions and individuals who had direct involvement in SSC initiatives were identified as candidates. At the outset, the researcher acknowledged that access to these individuals and time constraints would be a potential challenge, so the interviews were designed to be as time-efficient as possible. It was determined that each interview should be undertaken independently during an in-person interview, each lasting about 120 – 160 minutes. In the interest of saving time, all interviews will be audio recorded, and transcripts prepared immediately following the interviews.

4.12.4 Selection of Organisations

To select the organisations most appropriate for this research, the author considered the organisation size, prior to implementing SSC initiatives. Approvals were to be sought from appropriate authorities within the identified institutions and organisations. As noted above, two governmental entities were chosen for this research and ten experts from the industry. Both cases being public safety. It was determined that the large size of the government agencies would allow the researcher to study the internal relationships and interactions between the employers and employees, in particular before, during, and after the implementation of SSC systems. The government also incorporates a number of departments that regularly use ICT systems; some of which have a level of knowledge and experience of implementing smart and safe city initiatives. The following table 4.16 describes the purpose of selecting the proposed government organisations:

<table>
<tr><th>SR#</th><th>Organisation</th><th>Justifications</th></tr>
<tr><td>Government 1</td><td rowspan="3">Public Safety Emirate A & B</td><td>Understand the executions of the initiatives</td></tr>
<tr><td rowspan="2">Government 2</td><td>Technology adoptions for safe city and public safety</td></tr>
<tr><td>Understand the risk behind the developments of smart and safe city and followed control to avoid the risks</td></tr>
</table>

Table 4-16: Organizations and Justifications

Consequently, the organisation regularly uses ICT infrastructure in collaboration with adjacent government agencies that partner in monitoring and tackling illegal goods and services imported into the country.

4.12.5 *Data Collection Process*

The process of data collection for the two case studies was segmented into four phases, see figure 4.11:

Figure 4-11: Stages of Data collection for the two case studies

Each phase of the data collection process is described as:

1. ***Preparation***: confirming interview questions, compiling documents, obtaining ethical approval, and so on
2. ***Data Collection***: interviews conducted in-person
3. ***Follow-up***: additional sessions used to present some of the data to the organisation to acquire feedback
4. ***Revision Phase***: review the final data results with all participants for final validation.

Following guidance provided by Mason (2010) regarding the sample size and saturation point of using qualitative interviews in PhD research, the interviews will be conducted with 40 members of staff, including managers and or higher, drawn from a range of departments, in particular, the IT department in each case study. All interviewees were stakeholders and decision makers in the IT department and broader organisation involved in the implementation of smart and safe city initiatives, either as currently or previous participants. Table 4.17 presents each interviewee, detailing their title and the governmental entity in which they work. Once identified, the candidates were contacted to check availability and schedule meeting times.

Case Study	*Category*	*Job Title*	*Purpose of Selections*	*Syncopate*	*Type of Interview*	*Total*
Organization 1	***IT Department***	IT director	To know the considerations for technology adoptions to meet the initiatives of smart and safe city.	ITD	**Face-to-face**	1
		Networking and Telecommunications head		NTH		1
		Information security Director / Head		ISD		1
		IT strategic Planner		ITSP		1
		IT Technical Head		IT - TH		1
		System and Application development head		SADH		1
		Information security Specialist		ISS		1
		Physical security and monitoring head		PSMH		1
		IT Smart Safe City Program Head		ITSSCPH		1
						Total = 9
Organization 2	***IT Department***	IT director	To know the considerations for technology adoptions to meet the initiatives of smart and safe city.	ITD	**Face-to-face**	1
		Networking and Telecommunications head		NTH		1
		Information security Director / Head		ISD		1
		IT strategic Planner		ITSP		1
		IT Technical Head		IT - TH		1
		System and Application development head		SADH		1
		Information security Specialist		ISS		1
		Physical security and monitoring head		PSMH		1
		IT Smart Safe City Program Head		ITSSCPH		1
						Total = 9
Experts	IT	IT Professionals in SSC Projects		NA		**Total = 10**

Table 4-17: Categorization of the Interviewees

4.12.5.1 Observation

Scholars, such as Marshall and Rossman (2011, p. 139) define observation the progression of "noting and recording of events, behaviours and artefacts (objects) in the social setting". Research observation allows the researcher to identify complex relationships in their social context and it explains "what happens, who or what are involved, when and where things happen, how they occur and why things happen" (Boeije, 2010, p. 59). Using observation, researchers can collect data on actions and the meanings associated with such behaviours (Eriksson and Kovalainen, 2008). According to Eriksson and Kovalainen (2008), observation can be conducted in two forms: '*participant observation*' and '*non-participant observation*'. The following table 4.18 describes the differences among participant and non-participant observation:

<table>
<tr><th>SR#</th><th>Type</th><th>Characteristics</th><th>References</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">participant observation</td><td>the researcher (i.e. the observer) is fully involved and becomes a participant in the culture or the context being observed</td><td rowspan="4">Collis and Hussey, (2013); Burns (2000).</td></tr>
<tr><td>This type of observation requires extensive effort over a long period of time as the researcher need to become accepted as part of the context being observed</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Non-participant observation</td><td>the researcher dose not becomes a participant; instead he/she attempts to observe specific issues (e.g. interactions, behaviours, actions)</td></tr>
<tr><td>often takes a shorter time in comparison to participant observation</td></tr>
</table>

Table 4-18: Differences in Participants and Non-Participant Observations

4.12.5.2 Documents

Identifying and reviewing documents is central to qualitative data collection (Creswell, 2014; Saunders *et al.*, 2012), and it is specifically relevant in case study research (Blumberg *et al.*, 2011). Researchers involved in case study analysis regularly supplement interviews and observations with an extensive literature review (Gibson and Brown, 2009). As Yin (2009, p. 103) notes that "*for case studies, the most important use of documents is to corroborate and augment evidence from other sources".* Marshall and Rossman (2011) state that meeting minutes, records, statements, formal policy announcements, and other data, are also very helpful in building insight into the research topic.

4.13 Data Analysis

Data analysis is the third element of empirical research. Collis and Hussey (2013) noted that the data analysis stage presents greater challenges than the data collection stage. This involves triangulating and analysing the data collected from the case study reports in a systematic process of identifying and organising the data to obtain valuable insight (Boeije, 2010; Burns, 2000).

Some scholars argue that the lack of statistical analysis is a disadvantage of interpretive case study research and experts view (Miles and Huberman, 2014; Cornford *et al*., 2005; Fisher, 2004), although this research adopts both cross case and analysis within each case to interpret the behaviours of participants, as supported by other scholars (Yin, 2014). However, there is no single method to qualitative data analysis, essentially as qualitative data by its nature cannot be collected in a general standardised way. Typically, qualitative data analysis encompasses data unit allocation and categorisation, identifying relationships between and within data categories, and drafting schemes to determine sound conclusions (Saunders *et al*., 2012).

As Figure 4.10 demonstrates, in line with work by Saunders *et al.* (2012), Strauss and Corbin (2008), and Miles and Huberman (2014), a unique analysis plan and set of data processing practices have been developed for this study by the author. Miles and Huberman (2014) state that the analysis of qualitative data involves three activity themes:

Figure 4-12: Three flows of Activity in Qualitative Data

In initially using Miles and Huberman (2014) as a strategic foundation, and then combining this with the approaches developed by Saunders *et al.* (2012) and Strauss and Corbin (2008) to define the data analysis strategy, these guidelines are applied effectively in this study. The data analysis strategy developed by Miles and Huberman (2014) is used to produce suitable results and, as recommended by Yin (2009), to conduct cross-case analysis as demonstrated in figure 4.13.

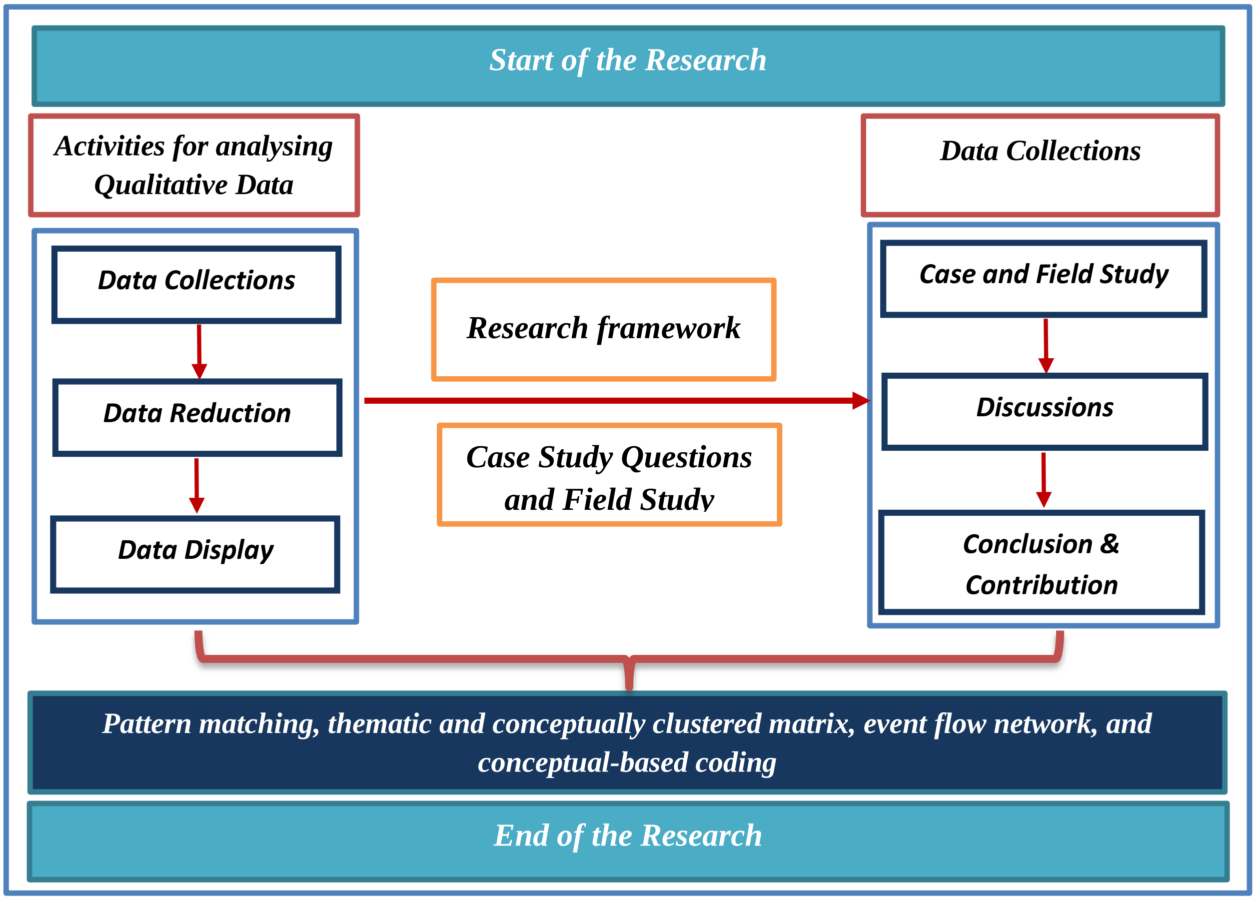

Figure 4-13: Data Analysis method developed by researcher

Source: Adapted by the researcher from descriptions given by Saunders et al. (2012), Strauss and Corbin (2008), and Miles and Huberman (1994)

4.13.1 Data Reductions

Qualitative data analysis can be used to display data into themes and patterns that can then be converted into theories, models and descriptions. The data reduction process is continuous, starting prior to data collection and continuing through to the concluding output of the research. Miles and Huberman (1994, p. 10) note that:

> ***"Data reduction is the process for selecting, focusing, simplifying, abstracting and transforming the data that appears in written up field notes or transcriptions."***

The reduction of data is typically completed by creating themes, coding, and aligning patterns (Miles and Huberman, 2014). The researcher has used components drawn from the conceptual framework in this study to develop a coding scheme. This helps in organising and extracting relevant information from the large amount of data into meaningful categories. Yin (2009) suggested using theory and research designed for the collection and analysis of data by applying a conceptual framework. Therefore, this study utilises a specific conceptual framework and defined research questions to establish the themes for the process of data reduction. A typical risk of mishandling large data sets is that some valuable data can either be lost or misinterpreted. As Miles and Huberman (1994, p. 55) note "***conceptual frameworks and research questions are the best defence against overload***" (Miles and Huberman, 1994, p. 55). Miles and Huberman (1994, p. 11) also note that "***qualitative data can be reduced and transformed in many ways: through selection, through summary or paraphrase, through being subsumed in a large pattern and so on*".**

4.13.2 Data Display and Drawing Conclusions / Verifications

The second element of the data analysis process includes displaying data. The data display refers to the transferring of reduced data into specific pre-determined categories. It is an organised and condenses assembly of data that allows conclusion and actions to be defined (Miles and Huberman, 1994, p11). Furthermore, it is an "***organised, compressed assembly of information that permits conclusion drawing and action***" (Miles & Huberman, 1994, p. 11). Meaningful conclusions can most often be derived from large data sets as opposed to smaller, limited assemblies of data. Displaying data in a coherent fashion enables the reader to grasp what the researcher has been able to observe and conclude and it also allows the researcher to maintain focus and define future direction. Yin (2009) states that using case study questions to define themes and categories can yield taxonomies. Furthermore, Yin notes that withholding themes is the preferred method; this approach has been adopted in this research. Matrices, diagrams, charts, graphs and various forms of networks can be used for data display (Miles and Huberman, 2014).

This research utilises matrices to display the results of the data collection and analysis process. This is followed by a process of iterative analysis to identify the relationships between data and determine any requirements for re-analysis (see Miles and Huberman, 2014). This is similar to the preceding phase of data reduction, although categorisation in data display conforms strictly to the research questions. Two main categories are revealed through this process: organisation structure, which resulted in respondents being categorised into one of seven different classifications based on department.

This classification process made is considerably easier to interpret and manage the raw data. Saunders *et al*. (2012) agree with this process, stating that a pre-determined theory is not always required for the development of analytical strategies, as some such strategies can be inductively applied. They also advise that qualitative data analysis can be undertaken deductively, wherein different data categories derive from theory. The researcher adopted the themes found in the literature and upon which the interview protocol was based. Different categories became evident on the basis of the derived themes, in accordance with the proposed interview (Appendix 1). The figure 4-14 is drawing the conclusion and verifications of the based on the data analysis process: (1) Data Collections, (2) Data Reduction and (3) data Display.

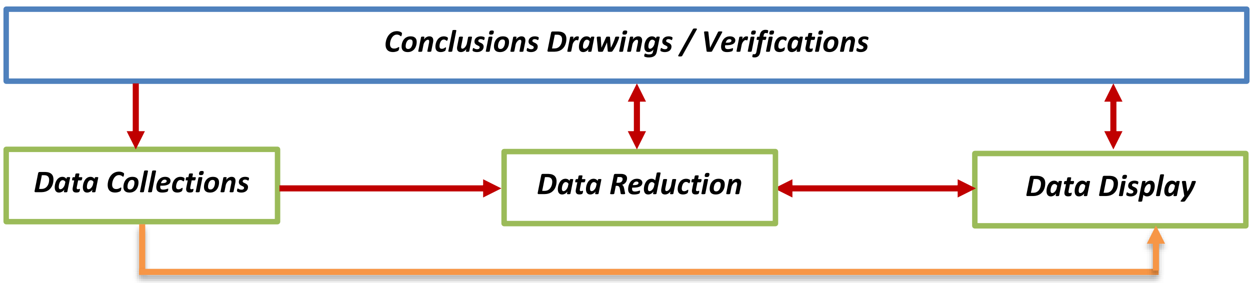

Figure 4-14: Process of Data Conclusions drawn

4.13.3 Within and Cross Case Analysis

As recommended by Eisenhardt (1989) this research recognises the value of both within-case and cross-case analysis as a strategy to deliver the most relevant and observable data patterns. The research conducts comparative analysis of theoretical predictions and frames of reference to address within-case analysis and it utilises the synthesis technique to deliver cross-case analysis (Yin, 2014; Miles and Huberman, 2014). Level two questions are utilised for within-case analysis, which maintains alignment with theoretical findings. Level three questions are used for cross-case analysis (case study protocol), wherein the findings derived from the results of level three question analysis allows comparative analysis against the theoretical foundations determined in this research.

4.13.4 Coding

Elements of information found in the data can be explored using coding, which allows similarities and differences to be identified and labelled (Patton, 2015). Coding is the *"fundamental analytic process used by the researcher"* (Strauss and Corbin, 2008, p. 12). Coding transforms data into theory via iterative and inductive data reduction to produce themes that the researcher can describe and derive conclusions from. Strauss and Corbin (2008) explain that coding contains three different stages.

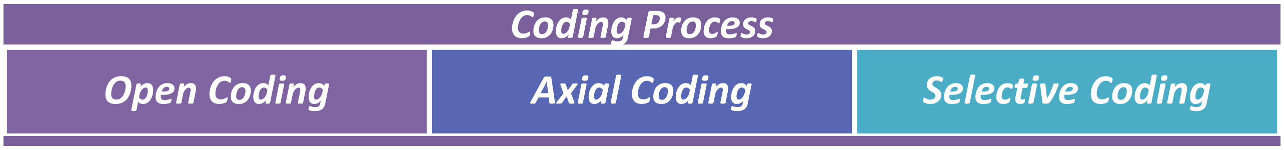

Figure 4-15: The Coding Process

Source: Strauss and Corbin (2008)

Open coding: is the opening phase of comparative analysis; it is *"an analytic process through which concepts are identified and their properties and dimensions are discovered in the data".*

- Axial Coding: is used to reconstruct data that has become fractured, in new ways *"by making connections between a category and its subcategory".*
- Selective Coding*:* is *"the process of integrating and refining the theory"*.

A core category is assigned by the researcher as the market against which all other categories can be related in order to accomplish this final data analysis task. Selective and axial coding are similar in that the categories developed in each process are based on properties, relationships and dimensions, although the integration of data occurs at different levels of analysis in each (Strauss and Corbin, 2008).

4.13.5 Quantifying Qualitative Data

Saunders *et al.* (2012) perceive that analysing the frequency of specific events allows the researcher to quantify qualitative data in significant volumes. Tables or diagrams can then be used to display these large data sets, which can be immensely valuable to the researcher. Therefore, this research attempts to quantify qualitative data to the highest extent possible in pursuit of the best mechanism to present the analysis.

4.13.6 Use of NVivo Software Package

A number of researchers have recommended the use of software packages to manage rigorous and clear data analysis (Creswell, 2014; Miles and Huberman, 2014; Myers, 2009; Robson, 2002; Weitzman, 2000). In this research, Nvivo software has been used to improve the quality and representation of data analysis at enhanced efficiencies this software package enabled the organisation of semi-structured interviews with deductive and inductive methods and the revision of data to achieve higher quality and reliable results. This software allows the researcher can identify and analyse themes, organise and categorise huge volumes of data, investigate complex relationships, and generate conclusions. Graphical representations can also be efficiently produced, as will be demonstrated in Chapter 5. However, data interpretations based on decision making, were primarily undertaken by the researcher directly.

The focus of this research is on the implementation of smart and safe city initiatives, as implemented by governments. The primary respondents were all individuals with key stakeholder positions within such organisations and related to the ICT department of their respective entities. The research design specifies the individual analysis of each group followed by an exploration of the relationships that exist within and between them.

NVivo was useful in organising and aiding the analysis of qualitative data drawn from the semi-structured interview transcripts and was therefore crucial in developing conclusions to the research. NVivo was, vital in identifying patterns and themes found within the views of the stakeholders, and allowing their examination It was instrumental in the iterative revision and inductive translation of such data and essentially invaluable to the quality and output of the research.

4.13.7 Triangulation of Data

Triangulation refers to the validation of data (Denzin, 1978), which is of central importance when conducting interpretive research. Yin (2009) identifies four types of data validation, as shown in figure 4.16:

Figure 4-16: Types of Data Triangulation

4.13.7.1 Types of Triangulations

Data triangulation refers to the use of a range of different data sources (Denzin, 1978). Investigator triangulation involves multiple investigators and evaluators. Theory triangulation is used to analyse and interpret data from the vantage point of different theoretical frameworks. Finally, methodological triangulation permits the researcher to employ multiple analysis methods to address a research question. Janesick (2000) took this model further and included a fifth element referred to as interdisciplinary triangulation, where multiple disciplines are used to explore a research topic. Table 4.19 below provides an overview of the methodological and interdisciplinary triangulation approaches, which have been used in this research, and shows where they are applied in the research strategy.

Entity / Case Study	*Applied Triangulation*	*Triangulation Sources*
Government 1 & 2	Data	Reports
		Interviews
		Deliverables
		Organisational records
		Observations
		Business cases
	Methodological	Documentation
		Archival records
		Interviews
		Observations
		Physical artefacts
	Interdisciplinary Data	Information Systems
		Strategy
		Management
		Reports

Table 4-19: Types of Applied Triangulation

4.14 Case Study Protocol

A case study protocol acts as the instrument by which case study analysis is carried out, and it also defines the procedures and regulations governing the research (Burns, 2000). Furthermore, it acts like an action plan keeping the researcher on target and in line with the desired research outcomes. Yin (2009) explained a case study protocol as a mechanism by which rules and regulations are defined for operationalising research and data collection. This can involve a repetitive cycle of updating and enhancing the protocol (Eisenhardt, 1989). The protocol should include a survey instrument, as well as the rules and procedures that the instrument should typically follow. Yin (2009) states that the protocol should be defined prior to any data collection. Yin (2014) also describes such a protocol as a key factor in improving the reliability of the research in case study research. A protocol helps in defining the study audience, necessary data, participants and timeframe (Yin, 2009). Some researchers also argue that a case study protocol enables greater focus and improved consistency throughout the data collection phase (Remenyi, 1991).

A case study protocol also provides a general overview of the project, which is a valuable guide to the researcher, including indispensable field procedures used throughout the data collection phase. Yin (2009, p81) states that a typical case study protocol must contain four sections: *(1) Study overview, (2) Field research procedures, (3) Case study questions, (4) A guide for the case study report*, as seen in table 4.20.

SR#	*Case Study Outline*	*Case Study Outline Descriptions*
1	***Study overview***	Including project objectives, case study issues, and relevant presentations
2	***Field research procedures***	Prompts relating to procedures, credentials required to access data and the location of key sources.
3	***Case study questions***	Questions to be considered by the researcher while collecting data
4	***A guide for the case study report***	The outline and format for the report.

Table 4-20: Case study outline and descriptions

4.14.1 Case Study Overview

The case study overview should cover the background information and the substantive issues being investigated in order to assist the researcher focusing on the research topic, objectives and questions, being studied. It describes the perspectives of a case study that can help anyone who may want to know about the research (Yin, 2014). This overview gives details of this research which leads the researcher to collect only the required data to study the smart and safe city initiative implementation in the public sector, and help concentrate on the main questions during the interviews.

4.14.2 Questioning the Case Study

Drawing upon case study protocol procedures, Yin (2014) and Maimbo *et al*., (2005) explore the value behind case study questions and provide explanations defining its parameters. The researcher's line of investigation is reflected by these questions. Furthermore, a series of questions that distinguish the individual case enquiry reside at the epicentre of the protocol. Yin (2009) identifies two question types:

1. Firstly, questions that provide an overall orientation to the research questions, and
2. Secondly, questions that case-specific and reflect the specific lines of investigation.

General orientation of questions: Provide guidance and direction to the researcher, helping prompt data collection in line with the research objectives while preparing for and conducting data gathering and analysis. Table 5.4 details the research questions as introduced in Chapter One, as well as accompanying general orientation questions.

Levels of questions*:* Define the lines of enquiry and direct the researcher to flow through a sequential data collection process. Table 4.21 provides an outline of such questions.

Level of Questions	*Questions Type*	*References in the thesis*
Level 1	Questions asked of specific interviewees.	The interview agenda (Appendix)
Level 2	Questions asked in an individual case study	
Level 3	Questions asked across multiple case studies.	
Level 4	Questions asked about the entire study.	
Level 5	Questions about the recommendations and conclusions beyond the scope of the study	

Table 4-21: Levels of Case Study Questions in Multiple Case Investigations

Source: Yin (2009)

A set of questions aligned across four levels was developed in order to maintain the focus of the research and orientate the data collection process in line with the research objectives. The interviewees are not intended to see these questions, which are intended for the sole purpose of guiding the researcher. Table 4.7 summarises these questions.

4.15 Research Ethics

Maintaining an ethical approach is very important in any research project. Researchers must protect the rights of participants and ensure that they fully understand the research procedure and any associated risks prior to gathering any data. The participants were informed that all data gathered in the study will be utilised exclusively for the benefit of the research study at hand and will remain entirely confidential. Each participant should also be ensured of the total anonymity of their identities throughout the research process. Permission to proceed must be obtained by all participants before any data is collected and no data should ever be recorded or used without the consent of the participant. Furthermore, the participants are to be informed that they are free to refrain from answering any questions or even to end the interview at any time. Approval to collect data relevant to the case studies was obtained from senior management in each organisation prior to any interviews being held or data collected.

4.16 Summary

Research is a process for improving and adding to the existing knowledge in any given research field. Although there is no universally accepted frame of reference for what exactly ‘research’ is, Collis and Hussey (2013) and Kothari (2004), note that it can be segmented into four categories. This study then considers research to be a combination of the following: to obtain familiarity and deeper insights into a phenomenon (or research problem); secondly to describe the key characteristics of a group or concept; and thirdly to ascertain the frequency or probability of occurrence of any phenomena and to find causation of the impact of one element over another.

5 DATA ANALYSIS

5.1 Introduction

This chapter compiles a detailed description of the research data collected for examination and validation of the conceptual framework developed for SSC implementation and technology architecture. Furthermore, the chapter also provides case study background and the outcomes of the study carried out in the UAE public safety sector organizations to determine the SSC implementation in the country along with interviews from experts to benefit other from UAE experience which considered pioneer experience on technology adoptions and public safety. Research interviews of the case study were used, and they contained ICT-related data and detailed gathered from the perspectives of the institutional theory, implementers of change management approaches, and decision makers.

Different case studies perspectives are put through a thorough analysis in this chapter, and it outlines the leading aspect of this entire research endeavour the SSC implementation. It also examines the components by way of benefits, risks and barriers; the participation of key actors and key activities in tackling issues such like change management; and good practice regulations at every stage of the development life-cycle to guarantee successful and efficient SSC implementation.

Following is the summary of the current chapter: The first section comprises of the introduction. The second section discusses the UAE's background, choice of case study, rise and growth of IT in the country, followed by a structural narrative of the case study. The next section describes the readiness and level of importance as a SSC. The section thereafter proposes the outcomes of the research data analysis and how it was executed using qualitative methods of analysis.

The data also comprises of internal and external factors of SSC implementation. The next section of the chapter meticulously studies characteristics benefits, barriers and risks. The analysis allowed the researcher to identify the factors and characteristics on basis of their level of importance. Moreover, in course of this chapter, the research also analyses the change management concerns found in SSC implementation in general and in the context of UAE, if any. The findings are founded on change management factors resilience to change, approaches and requisites. To conclude with, then the researcher presents the summary of all the findings in tabulated form.

5.2 Case Study

5.2.1 United Arab Emirates-Geography and Region

The UAE constitutes of the federation of seven emirates, established on 2nd December, 1971.These seven Emirates constitute of Abu Dhabi (capital), Dubai, Ajman, Sharjah, Fujairah, Ras-al-Khaimah and Umm al-Quwain (Zahlan, 2016). The sandy desert which surrounds the country consists of wild grasses along with palm trees. Being a desert land, the climate is hot; the summers are extremely hot and windy along with being humid. The highest temperature of the region is 50°C as of 2017. August is the hottest month of the region.

Along with Abu Dhabi, Dubai is the only emirate which has the veto power on important matters of legislature (Dubai.ae, 2017). UAE is considered a global country and became a business hub of the Middle East thanks to it being a major transportation hub for cargo and passengers. While the economy of the UAE was oil based primarily, it was able to diversify its economy towards tourism, trade, aviation, real estate, financial services and business apart from oil. It was the adoption of the western style business model which helped to drive the economy of the country (Why Dubai, 2017). Due to the innovative projects and large constructions, UAE has attracted a lot of attention world over. It has become iconic due to huge projects like the Burj Khalifa, the Grand Mosque-Abu Dhabi, Yas Island, Ferrari World etc. The global consulting firm, Mercer, rated UAE as one of the best places to live in the Middle East (Duncan, 2011; Dubai.ae, 2017). The economy of this region is considered as the most diversified economy amongst the Gulf Cooperation Council (GCC) countries.

Each emirate is ruled by a monarch and they together form the Federal Supreme Council and one of the monarchs amongst them is selected as the President of the UAE (Dubai.ae, 2017; Duncan, 2011). Due to recent advancements in technology, there have been major changes across the UAE with increased use of ICT in the governance and other major activities. This has given a rise to the use of smart services as increasing number of services are being provided online. The official religion of UAE is Islam while the language is Arabic, however there is extensive use of English Languages in the region (Dubai.ae, 2017).

5.2.2 Background of Case Study

The concept of SSC is rather new and there is no definite definition or methodology to it. Often it is defined based on the subject at hand and the manner in which the government intends to use its policies to make governing easy and to make all the services available to the country inhabitants in an easy format. UAE is amongst the leading countries in the world which has adopted and implemented SSC initiative. This is mainly because the UAE government has recognized the opportunities, in terms of efficiency and transparency of services and the ability to build better relations with citizens and businesses. Scholars are of the opinion that SSC initiative has already arrived in UAE and require research focus to show the experience of UAE on this domain since it's a pioneer on any implementation and also once it comes to technology adoptions and implementations.

The UAE government has been promoting the use of smart services in the region and in this regard have arranged a number of seminars, lectures and conferences in order to educate the masses and for networking. While the country is adapting to the new SSC initiatives, the point of focus has shifted on technology readiness especially with respect to collaborating with stakeholders, being vigilant about internet security and national strategy and being more transparent in its functioning. The government have identified the need for SSC initiatives in order to support the public safety reforms and to promote good governance via the introduction of sustainable and innovative ICT applications within the governmental administrations as well as while interactive with the public and businesses. Therefore, SSC initiatives can help smart cities in general in the transformation of the existing system of government and help in the establishment of a governance system that is inclusive via the use of digital mediums which is capable of performing its functions effectively and efficiently (Yusuf, 2006; Heeks, 2002).

5.2.3 SSC Readiness and Ranking

Zaied et al (2007) defines readiness as the degree of preparedness of a community to participate in the information age which is related to networked world in the present stance. In order to measure it, the community's advancement in the areas that are important for the adoption of ICT are assessed along with the assessment of the of the ICT applications that are being used. SSC readiness has been defined in various studies with respect to the preparedness of a country in terms of human resource development, telecommunication infrastructure and technological advancements. Technology readiness can be termed as the willingness to participate and benefit from the digital economy.

In order for the SSC initiative to be successful, it is important that there is support by the establishments of the country as allies in public safety. Support is also needed from technology providers in public safety and SSC implementation. The establishments need to participate in the legal framework of SSC that is made available to the end user in order to improve the quality of life. Therefore, the assessment of the SSC readiness enables governmental managers and authorities to measure as well as prepare for the integration of ICT (Bagchi et al., 2006).

World Bank has addressed technology-readiness of a country in terms of infrastructure, accessibility of ICT to a population and the effect of the regulatory and legal framework on the use of ICT. Over the years, UAE has shown tremendous improvement in terms of ICT implementation and SSC readiness. The country leads in terms of ICT within the GCC as well as worldwide (John, 2016). According to the World Economic Forum's Global Information Technology Report, UAE is ranked at 1st in terms of networked readiness. The UAE government has paved the way for a better and greater digital connectivity (John, 2016; UAE Rankings in International Studies and Reports, 2016).

5.2.4 Choice of Case Study

In order to obtain empirical data from case studies and field expert interviews, the researcher opted for UAE because it is one of the fastest growing countries in terms of IT and smart telecommunication. For the case study purposes, public safety government organizations were chosen in order to understand the various phases of development of SSC implementation, since it has been observed via research that SSC initiatives can help tackle various issues related to implementation and confirmed with expert’s view. Hence the researcher is of the opinion that the choice of these studies will help in the validation of the notions made and also help in making certain recommendations which will help in transparency and efficiency while also addressing the issue of SSC execution. Two public safety government organizations have been chosen for this case study; however, their details cannot be given by the researcher due to strict instructions to keep the name of the organizations confidential as part of the research ethicks. Hence for the purpose of this study, these organizations will be addressed as Organization 1 and Organization 2. Also, experts in the industry were consulted. In both the organizations, the researcher received inputs from professionals, outlined in table 4-17 in chapter 4. Both the organizations are large scale public organizations serving the public safety of UAE. There is use of ICT in these organizations, however the use is not extensive or integrated with the SSC initiative.

5.3 The Followed Steps of the Data Analysis

The carried methodological approach on this research comprises of four main stages to maximise research contributions by following the research methods approach to examine the developed framework of SSC implementation and technology architecture. These stages are illustrated on figure 5-1 and the following points:

1. ***Stage Number 1:*** This stage is elaborated of a project plan as well as the semi structured interviews designing grounded on the literature review of SSC implementation and technology architecture. This stage aided in attaining a wider view of SSC process of and implementation as well the technology architecture to address the needs of having SSC for Citizen's happiness, future accelerations and shaping future governments.
2. ***Stage Number 2:*** This stage consist of the first level of examination based on the case study investigations responsible for public safety "safe city". This stage objects:
    - SSC implementation was studied in order to diagnose the implementation lifecycle.
    - Technology architecture for SSC in terms of structure and components.
3. ***Stage Number 3:*** This stage consists of the second level of examination based on the field investigations by interviewing experts on technology and solutions for public safety "ten experts" to support the case study investigations. This stage objects:
    - SSC implementation was studied in order to diagnose the implementation lifecycle.
    - Technology architecture for SSC in terms of structure and components.
4. ***Stage Number 4:*** This is the last stage of revisiting the conceptual framework ***'SSC implementation and technology Architecture'*** based on Semi Structured Interview analysis from the previous steps (2 case studies and field study) followed by discussions of the findings which leads to research contributions, conclusions, limitations and future studies. The significance of this stage to contribute to body of knowledge and practice the considerations of SSC implementation and the technology architecture.

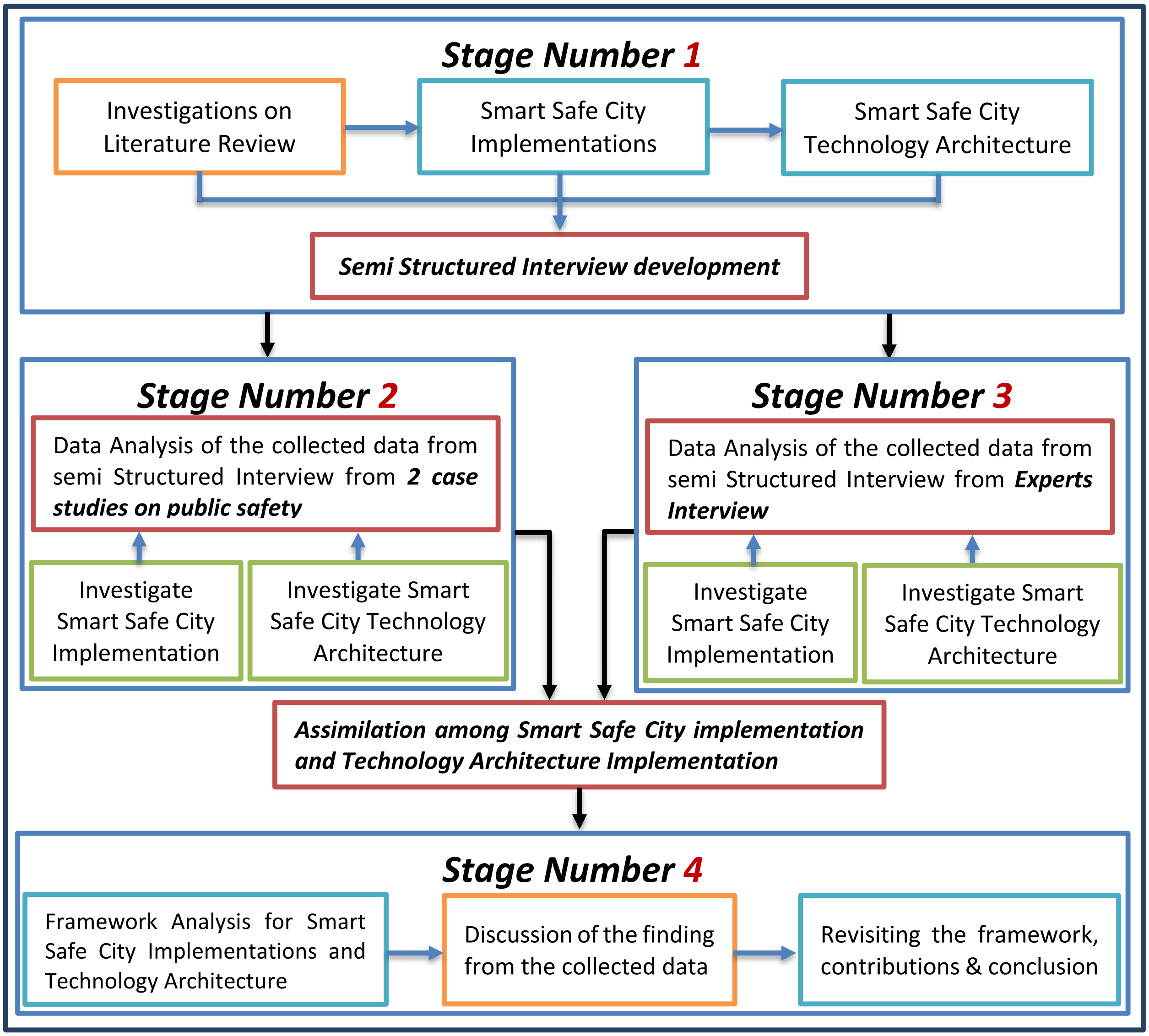

Figure 5-1: The Followed Steps of the Data Analysis

5.4 Data Analysis

For the purposes of this research, the researcher conducted surveys in 2 organizations within the UAE responsible on the public safety supported with expert's interview. Important personnel were presented with a semi-structured interview questions that were answered by them. An overview of the responses received is shared in the table 5-1.

Organisation 1	*Organisation 2*	*Experts*
9	9	10

Table 5-1: Total responses received

5.4.1 Demographics

Various questions were asked to the respondents to capture their demographics, which range from gender, age, experience and experience. The purpose of the demographics is to examine the current position of UAE in terms of IT manpower in leading its smart cities. An overview of the demographics of the respondents from the two case studies are shared in the tables 5-2 to 5-4.

Respondents	*Org 1*	*Org 2*	*Experts*	*Total*
Male	**8**	**7**	**6**	**21**
Female	1	2	4	**7**
Total Number	**9**	**9**	**10**	**28**

Table 5-2: Overview of the demographics – by gender

Respondents	*Org 1*	*Org 2*	*Experts*	*Total*
□ **18 to 24 years**	0	0	0	**0**
□ **25 to 34 years**	1	2	1	**4**
□ **35 to 44 years**	5	3	2	**10**
□ **45 to 54 years**	2	3	5	**10**
□ **55 to 64 years**	1	1	2	**4**
□ **Age 65 or older**	0	0	0	**0**
Total Number	9	9	10	**28**

Table 5-3: Overview of the demographics – by Age Group

Respondents	*Org 1*	*Org 2*	*Experts*	*Total*
□ **High School**	0	0	0	**0**
□ **Diploma**	0	0	0	**0**
□ **Bachelor**	3	1	0	**4**
□ **Master**	5	6	4	**15**
□ **PhD**	1	2	6	**9**
Total Number	9	9	10	**28**

Table 5-4: Overview of the demographics – by Education Level

5.4.2 General Information

In this section, the questions assessing the current state and practices followed in the organizations relating to SSC were shared with the respondents. It was observed that all respondents indicated the number of employees in their current company as 10,000 and above, while the number of employees in IT was found to be 200+ throughout. When asked the number of employees in SSC projects, all respondents indicated as 200+. Similarly, when asked the duration of participation in

SSC projects, a majority indicated as more than 5 years as seen in the table 5-5. This indicates that the concept of SSC in UAE is not new, and has high employee participation from many years.

Duration of participation in SSC	*Org 1*	*Org 2*	*Experts*	*Total*
□ **Less than 1 year**	1	2	0	**3**
□ **1 to 2 years**	0	0	0	**0**
□ **2 to 3 years**	1	0	1	**2**
□ **3 to 4 years**	1	0	3	**4**
□ **4 to 5 years**	2	3	2	**7**
□ **More than 5 years**	4	4	4	**12**
Total Number	9	9	10	**28**

Table 5-5: Duration of participation in SSC projects

When asked if the interviewees firms have a strategy for SSC, 100% majority was recorded in affirmative from the 2 organizations as well as the experts (table 5-6). On the same front, when asked if the interviewees firms have a SSC strategy and planning team, 100% positive response was reported (table 5-7). On the strategy of technology adoption and implementation for SSC, the interviewees responded in 100% affirmation (table 5-8). This indicates that the current system for SSC in UAE has a recognized strategy to drive SSC operations and initiatives, along with a team to manage the strategy and planning.

Do you have a strategy for a safe city?	*Org 1*	*Org 2*	*Experts*	*Total*
Yes	9	9	10	**10**
No	0	0	0	**0**
Total Number	9	9	10	**10**

Table 5-6: Do you have a strategy for a safe city?

Do you have SSC strategy and planning team?	*Org 2*	*Org 2*	*Experts*	*Total*
Yes	9	9	10	**10**
No	0	0	0	**0**
Total Number	9	9	10	**10**

Table 5-7: Do you have a smart SSC strategy and planning team

Do you have a strategy of technology adoptions and implementations for SSC?	*Org 2*	*Org 2*	*Experts*	*Total*
Yes	9	9	10	**10**
No	0	0	0	**0**
Total Number	9	9	10	**10**

Table 5-8: Do you have a strategy of technology adoptions and implementation for SSC

The interviewees were asked to identify the main drives for safe city adoption (as seen in table 5-9), to which the factors identified from the literature review were shared. As observed, all factors were identified as the main drivers.

What are the main drivers for safe city adoption?	*Org 2*	*Org 2*	*Experts*
□ **Terrorism**	●	●	●
□ **Public Disorder**	●	●	●
□ **Disaster / Crises**	●	●	●
□ **Road Accident**	●	●	●
□ **Extremism**	●	●	●
□ **Crime**	●	●	●
□ **Critical Incident**	●	●	●
□ **Urbanizations**	●	●	●
□ **Citizens Happiness**	●	●	●
□ **Economic Growth**	●	●	●
□ **Cyber Attack Threats**	●	●	●

Table 5-9: Main drivers for safe city adoption

Other factors were noted as mixed culture, supporting country strategy, and supporting tourism with the most important noted as future acceleration, future growth and future foresight. Experts stressed on factors such as the supporting country strategy to drive the mission and vision of the leaders, achieving future growth and development with future foresight as the main drivers. The interviewees from the two organizations stressed on the need for growth (i.e future acceleration) and supporting the vision and strategy of the country as the core drivers for SSC adoption.

Other drivers for safe city adoption identified from the interview		
Mixed culture	***Supporting tourism***	***Future growth***
Supporting country strategy	***Future acceleration***	***Future foresight***

Table 5-10: Other drivers for safe city adoption identified from the interview

5.4.3 SSC Characteristics

In this section, the questions linked with the characteristics of SSC were shared with the participants. The aim of inclusion of the characteristics with in questionnaire was to assess the current state of the UAE smart cities in meeting SSC characteristics. The characteristics were classified into benefits of having SSC implementation, risks of having a SSC initiative, strategic actions to control risks and barriers and challenges of having SSC. Each of the questions are examined in detail below.

A. Benefits of having SSC implementations for the city

Respondents were asked to identify the benefits of SSC with respect to the use of technology with the responses shared in the table 5-11. As observed, high vote was received by the two case study firms and by experts for factors concerning: improving the relationship with SSC participant/ government, supporting decision making process, increasing organization/ city effectiveness and organization/ city efficiency, supporting work coordination, increasing productivity of employees and improving business value.

Benefits	*Org 1*	*Org 2*	*Experts*
Reduce overall cost of the corporate	●	●	●
Reduce and improve the response time	●	●	●
Improve collaborations between relevant and concerns departments	●	●	●
Helping on future accelerations and shaping future governments	●	●	●
Response to any resilience	●	●	●
Citizens happiness	●	●	●
Quick information availability for proper decision	●	●	●
Improving the relationship with smart safe city participant/ government	●	●	●
Support decision making process	●	●	●
Increase organization/ city effectiveness	●	●	●
Increase organization/ city efficiency	●	●	●
Support of work coordination	●	●	●
Increasing productivity of employees	●	●	●
Increasing city quality	●	●	●
Global alliance	●	●	●
Improve the business process	●	●	●
Others, please specify:	●	●	●

Table 5-11: Benefits of having SSC implementation for the City

Various other factors were noted during the interviews conducted. Experts in the field shared resonance in opinion on the benefit of SSC implementation to support the economic growth of the country, being in line with the vision and strategy of the country's' leaders. Interviewees from the two organizations highlighted the importance of SSC implementation to benefit the innovation based projects in the country. They raised the scope of SSC implementation with the need for developing UAE as a smart economy and to be ahead of 10 to 20 years to be leader on a global scale.

Other Benefits of having SSC implementation for the City from the interview	
Economic Growth	***Innovation***
Support to vision and country strategy	***Smart economoy development***

Table 5-12: Other Benefits of having SSC implementation for the City from the interview

B. Risks of having smart safe city

Respondents were asked to share what the risks of having a SSC initiative were in UAE, with the responses shared in table 5.13.

Risks of having SSC	*Org 1*	*Org 2*	*Experts*
Reduce full control of information	●	●	●
Information security concerns	●	●	●
Limit of the accessibility of information from other entities,	●	●	●
Delayed of accessing required information	●	●	●
Lack among system integrations within the entity	●	●	●
Lack among system integrations within the other entity	●	●	●
Others, please specify:	●	●	●

Table 5-13: Risks of having SSC

Respondents had a similar outlook towards the risk of having SSC, with few highlighting information security concerns' and 'delayed of accessing required information' as risk factors in general. Experts raised concern on the need to control on risks for successful implementation, with expert 4 noting:

> ***'Success of SSC depends on how well the structure of SSC is defined allows a strong control on information, enhancing security and lowering redundancies.'***

According to the SADH of organization 2 that considers the UAE SSC as one that is well-developed:

> ***'In general concept, the major slowing factors for the adoption and the implementation of SSC remains the lack of an overall strategy and roadmap supported by the governments, regulators, and with a dedicated budget. Most often, such projects fail on other countries to even start due to the inability to properly position them in the budget lifecycle of the concerned entities. Given that most of the smart city infrastructure projects require a long period of time to show a RoI, it becomes difficult to make them fit into the traditional annual budget lifecycles of most entities, unless they get broken into smaller pieces that are put together into a roadmap. UAE is a good example for SSC wherein an effective balance begin adoption and implementation is found, with clear roadmap from the government, regulations and dedicated budget.'***

Similarly, the IT SSC Program Head of organization 1 said:

> ***'There is a clear direction in the implementation of SSC within the UAE. There is well-defined structure and therefore the implementation process is systematic'***

When asked to specify if there are any other risk factors for SSC, factors such as experience in technology selection, technology providers presence in the country and lack of experience to support technology from providers were noted. As said by an expert:

> ***'Technology is usually imported, thereby increasing the dependency on foreign technology firms that lack presence in the country of technology deployment leading to issues of poor support.'***

Other Risks of having SSC from the interview
Experience in technology selection
Technology providers presence in the country
Lack of experience to support technology from providers

Table 5-14: Other Risks of having SSC from the interview

C. Considerations / strategic actions taken to avoid the mentioned risks

Participants were asked to specify what in their opinion were the considerations / strategic actions to be taken to avoid the mentioned risks. In response, a majority of the respondents from the 2 organizations and the experts highlighted the need for development of a roadmap and segmentation of projects with clear deliverables for a successful SSC for smart cities.

The IT SSC Program Head of organization 1 stated the following actions based on his positive experience from UAE SSC projects:

> ***'Have a roadmap!***
>
> ***"Break the projects into smaller pieces with each piece delivering an immediate benefit that can justify the investment. Be super clear on what is the expected benefit. If the benefit is not financial, have a clear mandate for that benefit from the government, regulator, etc. or don't start the project".***

Similarly, the ITSP of organization 2 stated that

> ***"It is vital that the projects have a proper schedule and what are the expected outcomes from the project".***

Expert 3 on the consideration for strategic action quoted:

> ***"A clear roadmap is the strategy for a secure and successful SSC. The program heads should have a clear idea on the roadmap to be followed and adhered to on the requirements, requisites and vulnerabilities that may be a part of the implementation".***

On the other hand, the SADH of organization 1 quoted

> ***"ICT integration should be the priority of every SSC project, since without it, it is not a smart city at all".***

These responses by experts clearly indicate that for UAE to be a truly SSC while reflecting on other smart cities to address the risks in a systematic manner.

B. Barriers and challenges of having SSC

Respondents were asked to identify the barriers and challenges of having a SSC with the responses shared in table 5.15.

Barriers / Challenges of SSC	*Org 1*	*Org 2*	*Experts*
High skills and experience of employee	●	●	●
High skills and experience from technology providers	●	●	●
High skills and experience from system integrators	●	●	●
The complexity on technology integrations	●	●	●
The readiness of IT infrastructure	●	●	●
Information security concerns	●	●	●
Current systems capabilities to integrate with the new systems and other entity systems	●	●	●
Difficulties on understanding the currents processes and IT systems	●	●	●
Collaborations and partnership with Public Private Partnership (PPP)	●	●	●
Lack of ownership of smart city and safe city	●	●	●
Lack of updating the strategy and services	●	●	●
Require investment	●	●	●
Resistance from authorities participating on smart safe city	●	●	●
Commitment, motivations and support from leadership	●	●	●
Others	●	●	●

Table 5-15: Barriers and challenges of SSC

As observed in the table, almost all challenges were noted as important by the interviewees, with few expressing stress on reliance on employee skills and experience, complex technology integration and integration with current systems.

The IT SSC Program Head from organization 1 highlighted for a successful SSC in general,

> ***"Lack of updating the strategy and services' along with 'Resistance from authorities participating on SSC are major barriers".***

On the other hand, IT - TH from organization 2 highlighted

> ***"Information* security *concerns', 'The complexity on technology integrations' and 'High skills and experience from technology providers* as the major challenges a country *can face for SSC".***

It is important to note that all the experts in the field of IT and communication indicated similar challenges and barriers. This reflects that in the implementation of SSC initiative and IT are important components and their accurate integration or lack thereof can be a major barrier to the implementation process. Other factors noted by the interviewees include data classification (type of data / information), data sharing and integration, and collaborating data and monitoring mechanism to be defined.

Other Barriers and challenges of SSC from the interview
Data classification (type of data / information)
Data sharing and integration
Collaborating data and monitoring mechanism

Table 5-16: Other Risks of having SSC from the interview

5.4.4 SSC implementation factors

In this section, an examination of the external and internal factors affecting SSC implementation was made. The purpose of examining the SSC implementation factors is to understand how different factors (as identified in the literature review in Section 2.5) influence the government in efficient implementation of SSC.

5.4.4.1 *External Factors*

Experts were asked which External Factors of SSC initiatives will affect the implementations with the responses shared in table 5-17. The responses of the participants helped to gauge what the implementation factors were; NTH from Organization 2 pointed that that Critical Mass was an important factor elaborating that:

> ***'Whether other entities are doing something should not be a decision factor on what needs to be done to meet the requirement/benefit'***

External Factors	***Org 1***		***Org 2***		***Experts***	
	Yes	***No***	***Yes***	***No***	***Yes***	***No***
Organizational	●		●		●	
Politics	●		●		●	
Economic	●		●		●	
Critical mass	●		●		●	

Table 5-17: External Factors of SSC affecting implementation

The IT SSC Program Head from organization 1 selected economic factor as a challenge to get the required budget for implementing SSC, quoting that he and his team acquired the budget from governmental sources in batches, which was approved according to the completed work. Similarly, the ITSP of organization 1 and 2 experts highlighted the organizational factors as a prime factor in SSC implementation. When inquired whether the Top management and the stakeholders, decision making process will support safe city initiatives and the required technology adoptions, an industry expert replied that the top management fully supported initiatives and technology adoption remained top priority. The other external factor identified from the interviews to affect SSC implementation is technology factor and legal factor. As said by the ITD of organization 1:

> ***"Implementation of SSC in any country is based on its technology architecture and infrastructure. With the technology as an external factor, its integration in the existing systems is a challenge which restricts the transformation of a city into a smart city".***

In the ensuing question when the experts were share the level of importance of the factors affecting SSC implementation, as seen in the table 5-18. As observed, high level of importance was given to all factors corresponding to the external factors noted to effect SSC implementation. The ITD from Organization 1 quoted:

> ***'While economic factor affects in terms of external funding sources and political factor affects in terms of regulations in SSC implementation, technology factor affects in terms of technology adoption, deployment and integration.'***

External Factors	*Org 1*			*Org 2*			*Experts*		
	H	**M**	**L**	**H**	**M**	**L**	**H**	**M**	**L**
Organizational	9	0	0	9	0	0	9	0	0
Politics	9	0	0	9	0	0	9	0	0
Economic	9	0	0	9	0	0	9	0	0
Critical mass	9	0	0	9	0	0	9	0	0
Other External Factors identified by theinterview									
Technology	9	0	0	9	0	0	9	0	0
Legal	9	0	0	9	0	0	9	0	0

Table 5-18: Rankings of External Factors According to the Importance Level
H – High Importance, M – Medium Importance, L – Low Importance

5.4.4.2 *Internal Factors*

In this section, the internal factors affecting the implementation of SSC were shared with the interviewees, with the responses presented in the table 5-18. As observed, 100% positive responses were received, indicating that that the 6 internal factors play a critical role in SSC implementation.

Internal Factors	*Org 1*		*Org 2*		*Experts*	
	Yes	*No*	*Yes*	*No*	*Yes*	*No*
Strategic objectives an deplaning	●		●		●	
Leadership	●		●		●	
Technology adoptions and collaborations	●		●		●	
Financial issues	●		●		●	
Business process	●		●		●	

Table 5-19: Internal Factors of SSC affecting implementation

ISS of organization 1 shared that Strategic objectives and planning was a vital internal factor and responded that:

> ***"An SSC project requires strategic planning since at every step there is integration of various factors which dictate the manner in which the project will shape. It forms the part of strategic goals of the government as well as the entities which are working towards the realization of the SSC initiative".***

On the other hand, NTH from Organization 2 quoted that leadership was an important factor and that:

> ***"Key management support along with a robust governance help in the implementation of SSC. Leadership helps in the accurate direction of the project completion and thus forms an important factor".***

ITSP and IT - TH consider technology adoptions and collaborations as critical noting:

> ***"Although technology choices impact the implementation of smart/safe city projects, they do not constitute the major success factor compared to having a clear strategy and roadmap supported by the leadership and the investing parties. Policies and regulations can solve this issue and reduce it to minimal impact."***

Financial issue was noted as a prominent internal factor by a majority of experts, with one expert quoting: ***'lack of resources makes it difficult to adopt technology and integrate it with the objectives of the SSC initiative"***. Other factor noted by the experts was business processes with one expert stating that:

'Business processes of the organization usually change according to the requirements of the SSC implementation process. It is not feasible to have set business processes since the requirements are dynamic and are always changing.'

Other internal factors affecting SSC implementation were noted as data classification, data sharing and integrity and collaborative data monitoring. To examine the level of importance for the internal factors affecting SSC implementation, the interviewees were asked to rate the importance based on high, medium and low scale. The responses are shared in table 5-20.

Internal Factors	*Org 1*			*Org 2*			*Experts*		
	H	*M*	*L*	*H*	*M*	*L*	*H*	*M*	*L*
Strategic objectives and planning	9	0	0	9	0	0	9	0	0
Leadership	9	0	0	9	0	0	9	0	0
Technology adoptions and collaborations	9	0	0	9	0	0	9	0	0
Financial issues	9	0	0	9	0	0	9	0	0
Business process	9	0	0	9	0	0	9	0	0
Other Internal Factors									
Data Classification	9	0	0	9	0	0	9	0	0
Data Sharing and Integrity	9	0	0	9	0	0	9	0	0
Collaborative data monitoring	9	0	0	9	0	0	9	0	0

Table 5-20: Rating of Importance of Internal Factors affecting SSC Implementation

As observed, high level of importance was attributed to all internal factors by the interviewees from the two organizations and experts. The ITSSCPH of organization 1 quoted:

'Organizational change is linked to leadership in SSC projects. Every project comes with a set of challenges, however, with the right leadership and support from a robust governance system, they can be overcome leading to project success and consistency in implementation.'

Similarly, the ISD of organization 2, confirming the high level of importance to financial issues states:

'Smart cities, in general, are subject to financial restrictions given the economic situation of the country. Unlike UAE, other countries may not be able to secure excellent services and financial funding to support SSC initiatives, thereby affecting the project implementation, maintenance and leading to failure.'

The three new internal factors identified from the interviews were rated high in importance. The ITSSCPH confirmed on the importance of data security and safety in SSC projects, highlighting the role of data classification and sharing regulations to ensure efficient operations with data safety.

5.4.5 Change Management

In this section, the interviewees were asked a series of questions to examine the role of Change Management (CM) on the initiatives of SSC implementation in UAE. The purpose of this section was to examine the current level of importance given to CM in SSC projects in UAE, identify any reasons for change resistance and identify the best approach to CM.

A. Rating CM Importance in SSC Implementation

Change management has been identified by researchers as one of the challenges of SSC implementation. Out of 28 respondents, 25 responded to 'level of importance' as high while 3 as 'medium'. Similarly, for 'level of effect', 24 responded high while 4 responded to it as medium, see table 5-21. The NTH of organization 2 quoted:

> ***"Like any big project, smart/safe city implementation requires a strong change management program to support organizations in adapting the change successfully and reducing the risk of failure".***

CM	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Level of importance	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Level of effect	***High***	8	7	9	**24**
	Medium	1	2	1	**4**
	Low	0	0	0	**0**

Table 5-21: Level of Importance of CM

B. Main reasons for Change Resistance

To examine the most important change resistance factors, interviewees were asked to a series of factors as shared in table 5-19. The interviewees reflected on the change process within the UAE SSC, and confirmed the support and clear direction of the government in SSC implementation to achieve lower change resistance. However, in general context, a total of 22 respondents chose 'majority of employees don't like the implications of changes' indicating that changes may not have been communication clearly leading to resistance. Similarly, 19 chose 'majority of employees do not consider the changes as part of the organization development' with the ITSP from organization 1 quoting:

> ***"Employee awareness and inclusion in the change process is crucial for successful CM. In UAE, the teams involved in the SSC projects are provided clear directives on actions needed along with clear communication on the future update, be it in the process or the program itself to achieve hassle free change. Any updates received during the communication are taken positively."***

Factors such as 'Inadequate information and lack of the communications' as well as 'Low tolerance to change' are also highlighted by the interviewees as resistance to change that may affect SSC in general.

Change Resistance		*Org 1*	*Org 2*	*Experts*	*Total*
Majority of the employees don't like the implications of changes	**Yes**	9	7	6	**22**
	NO	0	2	4	**6**
Majority of the employees do not consider the changes as part of the organization development	**Yes**	6	6	7	**18**
	NO	3	3	3	**9**
Inadequate information and lack of the communications	**Yes**	4	8	9	**21**
	NO	5	1	1	**7**
Low tolerance to change	**Yes**	6	8	7	
	NO	3	1	3	**7**
Others Change Resistance					
Lack of clarity in vision setting					

Table 5-22: Main reasons for Change Resistance

When asked to list other factors that may cause resistance to change to SSC projects in general, the Head of physical security and monitoring for organization 1 stated that '*Lack of clarity from the leadership on the strategy and the benefits leads to resistance'* while ISS from organization 2 said:

> ***"Corruption and non-transparent decision making processes/accountability rules in other countries can cause for resistance to change".***

C. Approaches to Change

The next part was aimed at identifying the approaches of Change with the responses shared in table 5.23. As observed, 100% positive response was received from the 28 participants indicating that open communication, education and awareness, participation and involvement, manipulation and co-operation, and leadership are crucial for change achievement.

Change Approach		Org 1	Org 2	Experts	Total
Open communications	**Yes**	9	9	10	**28**
	NO	0	0	0	**0**
Educations and Awareness	**Yes**	9	9	10	**28**
	NO	0	0	0	**0**
Involvements, Participations and Involvements	**Yes**	9	9	10	**28**
	NO	0	0	0	**0**
Manipulations and cooperation	**Yes**	9	9	10	**28**
	NO	0	0	0	**0**
Leadership	**Yes**	9	9	10	**28**
	NO	0	0	0	**0**
Others Change Approach					
Organziational Restructuring					

Table 5-23: Approaches to Change

Other approaches shared by the interviewees to achieve change include organizational restructuring with the IT - TH of organization 2 quoting:

> ***"Sometimes, creating a separate environment for very innovative and ahead of the curve initiatives can greatly reduce the risk of failure due to change resistance. This is similar to how incubators work or how big corporations create start up-like environments to foster innovative ideas."***

5.4.6 Development Life Cycle of SSC

In this section, an examination of the development life cycle of SSC constitutes of three phases- pre, during and post implementation was made. Different factors at each stage affect the life cycle which were discussed in the literature review and were then identified by experts during the interviews.

5.4.6.1 *Development Life Cycle of SSC: Pre-implementation stage*

The researcher asked the participants to identify the factors to be considered during the stage of pre-implementation on the Development Life Cycle of SSC as good practices to be followed (see table 5-24). As observed in the table, while all factors were considered as a crucial part of the SSC life cycle during pre-implementation, the top factors were noted as setting clear objectives, designing project requirements with road map, stakeholder support, and need establishment with technology providers.

Pre Implementations factor	Org 1	Org 2	Experts
Setting a clear objectives	●	●	●
Design the projects requirements and needs with clear road map	●	●	●
Stakeholders support	●	●	●
Collaborations with the participants (government entities, department, technology providers, etc)	●	●	●
Understanding the needs from the technology providers	●	●	●
Establishing division responsible for smart safe city implementation	●	●	●
Others identified Pre-Implementations factor			
Defined collaborated data	●	●	●
Defined access rights	●	●	●
Monitoring procedures	●	●	●
Defined skills and resources	●	●	●
Defined roles and responsibility	●	●	●

Table 5-24: Development Life Cycle for Pre-implementation Factors

Other factors affecting SSC life cycle during pre-implementation were identified as define collaborated data, defined access rights, monitor procedures, define skills and resources required and define roles and responsibility. To further drive this point, experts were requested to share the level of importance of the factors of SSC life cycle during pre-implementation with responses shared in the table 5-25.

Pre Implementations factor	Importance	Org 1	Org 2	Experts	Total
Setting a clear objective	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Design the projects requirements and needs with clear road map	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Stakeholders support	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Collaborations with the participants (government entities, department, technology providers, etc)	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Understanding the needs from the technology providers	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Establishing division responsible for smart safe city implementation	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Pre Implementations factor	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Others Pre-Implementations factor					
Define collaborated data	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Define access rights	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Monitor procedures	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Define skills and resources required	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Define roles and responsibility	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Table 5-25: Pre-Implementation Factor Ranking

As observed, all factors of SSC life cycle during pre-implementation were given high level of importance. As noted by the ITSSCPH of organization 2:

> ***'SSC projects during pre-implementation initiate from setting of clear goals and defining project requirements with a well-development roadmap. In UAE, the SSC projects are noted in terms of establishing clear roadmap and vision, and strong stakeholder support to develop technologically sound projects.'***

The other factors identified during the interviews were rated high priority, with the IT - TH stating:

> ***'Technology plays a crucial role in SSC implementation, and to support efficient technology application, there is a requirement for skills, processes and resources in terms of manpower and operational requirements.'***

The high level of importance recived by the two organizations and experts for pre-implementation factors point the important of the factors selected for pre-implementation stage of SSC. The interviewees indicate the pre-implementation stage to include clear objectives, designing of the project with clear roadmap, stakeholder collaboration, and technology provider integration in the goals and establishing responsibilities as the factors that contribute towards the success of pre-implementation of SSC. Also, the identification of new factors in the form of data collaboration, access design and monitoring, and responsibility identification are also noted to contribute to the pre-implementation success.

5.4.6.2 *Development Life Cycle of SSC: During Implementation*

In this section, the researcher asked the participants to identify the factors to be considered during implementation stage on the Development Life Cycle of SSC as good practices to be followed (see table 5-26). The interviewees from the two organizations as well as experts stressed on the importance of achieving operational efficiency and developing sustainable solutions with desired technology.

During Implementations factor	*Org 1*	*Org 2*	*Experts*
Maintenance and operation cost of the technology	●	●	●
Technology fit to the desired objective	●	●	●
Solutions sustainability	●	●	●
Achieving operational efficiency	●	●	●
Liaising with other governmental entities participating on smart safe city to simplify integrations and procedures	●	●	●
Others During Implementations factor			
Good practices during implementation	●	●	●
User acceptance testing	●	●	●
Real time data synchronization	●	●	●
Technology integration	●	●	●

Table 5-26: Development Life Cycle of SSC: During Implementation

For other factors noted as good practices during implementation are acceptable of desired objectives, acceptance of defined scenario for user acceptance testing (UAT), real time data synchronization and technology integration. In support, one expert quoted:

> ***'Benefits realization and measurement of the impact is a factor. If something is not delivering on the objective, better stop it early or steer towards a different direction to avoid massive losses and bad reputation for the smart city initiative.'***

In continuation of this analysis, the researcher also sought to identify the factors according to their importance in high, medium and low (see table 5-27). As observed, high importance was reported for all factors, with few interviewees stressing on the prominence of: Maintenance and operation cost of the technology; Solutions sustainability; and Achieving operational efficiency. The justification for the high importance of the during-implementation factors can be attributed to the actual need of those factors in SSC. A successful project is dependent on technology maintenance and cost, and the role of technology in achieving the set objectives. Also, the need for achieving operational efficiency through solutions that are sustainable with effective collaboration with various internal and external partners is vital. Experts in the industry voiced opinion on the high importance on Elaborating the medium importance for Technology fit to the desired objective, with an expert quoting: '***Technology can change and sometimes there is no perfect solution'. Similarly, liaising with other government entities was noted to be achievable through progressive planning, while not being considered as a blocking factor*.**

During Implementations factor	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Maintenance and operation cost of the technology	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Technology fit to the desired objective	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Solutions sustainability	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Achieving operational efficiency	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Liaising with other governmental entities participating on smart safe city to simplify integrations and procedures	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Others: ***During Implementations factor***					
Good practices during implementation	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
User acceptance testing	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Real time data synchronization	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Technology integration	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Table 5-27: Level of Importance of during Implementation Factors

5.4.6.3 *Development Life Cycle of SSC: Post Implementation*

Examining the factors that need to be considered at the stage of Post Implementation in the Development Life Cycle of SSC as good practices, the interviewees were asked to share their opinion (as seen in table 5-27). As observed in the table, an absolute majority of the interviewees from case study 1 and 2, and experts chose all factors of post implementation in SSC as of high importance. The ITD of Organization 1 stated that:

> ***'SSC post-implementation success is determined by factors such as skills and resources of the staff, financial and budget support. He indicated that SSC thrive in PPPs, leading to efficient technology adoption and integration.'***

Adopting advanced technology was quoted by an expert as:

> ***'Technology is a means to a goal not necessarily a goal in itself. As an example, Google created one of the most advanced data center technology not for the sake of data centers but simply to maintain its search response time below a second even with several billion users.'***

Post Implementations factor	*Good practice*	*Org 1*	*Org 2*	*Experts*	*Total*
Staffing skills resources	***Yes***	9	9	10	**28**
	No	0	0	0	**0**
Adopting advanced technology	***Yes***	9	9	10	**28**
	No	0	0	0	**0**
Technology integrations among other entities	***Yes***	9	9	10	**28**
	No	0	0	0	**0**
Financial and budget support	***Yes***	9	9	10	**28**
	No	0	0	0	**0**
Public Private Partnership (PPP)	***Yes***	9	9	10	**28**
	No	0	0	0	**0**

Table 5-28: Post Implementation factors affecting SSC Development Life Cycle

The other post implementation factors in SSC were noted as corrective action and problem solving, enhanced integration between SSC system and entities for consolidated data, and enhanced collaborative monitoring for crucial segments. In order to identify the importance of these factors, the researcher asked the interviewees to share the post implementation factors according to their level of importance which affects SSC implementations (Table 5-26). The importance was made in terms of high, medium and low. As observed, high importance was associated with all factors, including the new factors identified above.

Post Implementations factor	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Staffing skills resources	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Adopting advanced technology	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Technology integrations among other entities	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Financial and budget support	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Public Private Partnership (PPP)	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Others Post Implementations factor					
Corrective Action / Problem Solving	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Enhanced integration between SSC system and entities	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Enhanced collaborative monitoring for crucial segments	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Table 5-29: Post Implementations factor Ranking

The level of high importance identified in the post implementation stage can be attributed to the importance of the factors included. For example, the SSC post implementation stage is dependent on the manpower to run the operations through the application of the required technolkogy support and its integration with other entitites in the SSC. Also, it is dependent on the monetary constraints and the parterships with third parties, which is again essential in the development of SSC. Interviewees confirmed the high importance of PPPs and technology integration and adoption for SSC implementation success, with the ISS from organization 2 stating:

> ***"Building partnerships through PPPs brings in enhanced technology adoption and integration, allowing the government to increase the efficiency of the overall project. With the involvement of third party entities in the projects, it is crucial that a sound system is in place for monitoring and corrective action to achieve improved performance and lower discrepancies."***

Other factors affecting the development life cycle in SSC were confirmed to be of high importance, especially in terms of collaborative monitoring and enhanced integration between the system and entities involved.

5.4.7 SSC Development Life Cycle Actors

As part of the research, it was imperative to identify the key actors and their role in key activities throughout the development life cycle of the SSC. The researcher thus identified the key actors for the research via the three-quarter moon theory proposed by Hammed (2009) which was later amended for general application. These key actors include, Government, technology providers, regulators and policy makers and SSC users with the responses shared in table 5-29. Respondents from both the case studies as well as the expert gave high importance to all factors. The ITD from organization 1 highlighted the importance of Government and Advanced technology as key actors in SSC success while sharing a new actor in the form of process and procedures, and technology readiness with staff support. Similarly, one expert attributed high importance to Companies/ Partnership with Private Sector (PPP) and SSC Users indicating a new actor as classification of information and access rights for the information.

Actors	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Government	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Companies/ Partnership with Private Sector (PPP)	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Users	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Advanced Technology	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Others: SSC Development Life Cycle Actors					
Process & procedures	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Classification of information and	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Access rights for the information	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Table 5-30: SSC Development Life Cycle Key Actors Level of Importance

5.4.7.1 *SSC Development Life Cycle Actors: Pre-implementation stage*

To measure the relationship between the key actors and SSC pre-implementation factors, the interviewees were asked to map the factors. As seen in the table 5-30, high mapping is observed between actor-government and all factors of pre-implementation stage, while the lowest mapping is reviewed with SCC users. Also, technology providers are found to relate closely with the pre-implementation factors, except for SSC strategy indicating that external vendors do not have much influence in strategy related activities.

The pre-implementation stage is a stage in SSC implementation that has lower influence of users in selection of technology related aspects such as IT infrastructure and telecommunication infrastructure. This is found to be true primarily due to the point that users are not a part of the SSC in the pre-implementation stage, however, consideration of the users as stakeholders is essential to be made in order to enable improvement in the overall system. Also, the mapping between technology providers and technology readiness of the staff is high given the dependence of the staff on technology during-implementation and post-implementation.

Influences	*View*	*Government*	*Technology Providers*	*Users*	*PPPs*	*Process & procedures*	*Information Classification*	*Access Rights*
IT infrastructure	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●		●	●	●	●
	Experts	●	●	●	●	●	●	●
Telecommunications Infrastructure	***Org 1***	●	●		●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●		●	●	●	●
Training and awareness	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Technology readiness	***Org 1***	●	●	●		●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Hardware and software cost	***Org 1***	●	●	●	●	●	●	
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Overcome of the barriers and challenges of partnership with private sectors and technology providers	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
SSC strategy	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Staff Readiness	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Technology Adoption	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●

Table 5-31: Key Actors and Influences on Main Activities: Pre-Implementation Stage

The four new factors identified in section 5.3.7 (key actors) were also included in the mapping with the pre-implementation stage factors in SSC. As observed, mapping was observed between process and procedures, staff readiness, technology adoption and responsible readiness with all factors of pre-implementation stage factors. The IT - TH from organization 2 quoted:

> ***'Pre-implementation stage success in SSC is closely related to not just technology adoption and integration, but also the readiness of the staff and the overall system.'***

5.4.7.2 *SSC Development Life Cycle Actors: During implementation stage*

In this section, the mapping between the SSC development life cycle actors and during-implementation factors is development (see table 5-31). As seen in the table, high mapping is observed between government actor and all factors of during-implementation stage, except for IS practice and procedure for secure system integration. Similarly, mapping of technology providers with education and training; and IS practice and procedure for secure system integration was found. Users were mapped with change to the business concept and culture and new strategy for SSC. However, PPPs were restricted with mapping only to encourage expertise and participation in SSC initiatives and implementation.

Four new factors were noted as influences in during-implementation stage. As seen in the table, technology changes and advancements were mapped to government and technology primarily, followed by users and PPPs. Also, it was also mapped to Process & procedures; Information Classification; and Access Rights. Similar observation was made for new factors: Updating IS to meet Technology Changes; Participation of business dependents for technology and Business Acceptance of technology function.

Technology adoption for SSC is an integrated factor connecting to different stakeholders with the aim to meet their expectations and this includes users as well as technology providers. The influence of users in activities such as education and training allows SSC authorities to develop a user-centric SSC that engages users in effective communication and utilization of the SSC services. On the other hand, the SSC infrastructure and technology implementation to meet user requirements is dependent on technology specifications, which is fulfilled by the technology provider. This reflects the influence of technology providers on the new strategy of SSC. Also, changes in IS are required to the communicated with the users in order to ensure security and privacy of the user data within SSC.

Influences	*View*	*Government*	*Technology Providers*	*Users*	*PPPs*	*Process & procedures*	*Information Classification*	*Access Rights*
Change the business concept and culture	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
The new strategy for the SSC	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Encouraging expertise to come over and participate on the SSC initiatives and implementations	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Information security practice and procedure for secure system integrations	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Education and training	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Others Key Actors and Influences on Main Activities: During Implementation Stage								
Technology Changes and advancements	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Updating IS to meet Technology Changes	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Participation of business dependents for technology	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Business Acceptance of technology function	*Org 1*	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●

Table 5-32: Key Actors and Influences on Main Activities: During Implementation Stage

The ISS from organization 1 quoted:

> ***"Technology adoption and integration in the SSC brings along the need for efficient management while covering key aspects such as preparation for change in technology with time, and enhancing security standards on various technology functions."***

Similarly, the ISS from organization 2 quoted:

> ***"There should be a sync between the technology front and its adoption. The success of SSC projects in UAE can be associated with the high correlation found between technology adoption and future preparation, as well as technology integration and policy support to monitor and control security of the information."***

5.4.7.3 *SSC Development Life Cycle Actors: Post-implementation stage*

In this section, the mapping between the key actors of SSC development life cycle and the activities of post implementation stage is executed (see table 5-32). As seen in the table, high mapping is observed between technology providers (actor) and Security / Information Security; Educations and training; Update and Patching and System integrations. Whereas, process improvement were mapped actors: government and PPPs. The new factors identified in section 5.3.7 as actors were added to the table, with the inclusion of new influences that effect SSC development life cycle in post-implementation stage. As observed, clear mapping was found between actors - process and procedures; information classification and access rights with all influences, including business department enrolment on evaluation and monitoring for Technology. The SADH of organization 1 quoted:

> ***'Strengthening the system for SSC implementation is dependent on building an effective coordination between the main actors and the activities. For Example, government should be involved in the security of the systems, monitoring and review and rendering training. Similarly, technology providers should coordinate with systems integration, technology deployment, and systems improvements.'***

On the data integrity, an expert from the field commented:

> ***'UAE SSC projects stand strong in terms of technology integration to efficient adoption, classification and monitoring. All activities in each stage of the SSC system is managed with attention to detail, with due consideration towards process and procedures, information classification and access to information.'***

Influences	*View*	*Government*	*Technology Providers*	*Users*	*PPPs*	*Process & procedures*	*Information Classification*	*Access Rights*
Security / Information Security	***Org 1***	●	●	●	●	●	●	●
	Org 2	●	●	●	●	●	●	●
	Experts	●	●	●	●	●	●	●
Educations and training	***Org 1***	●	●	●		●		●
	Org 2	●	●	●		●		●
	Experts	●	●	●		●		●
Monitoring	***Org 1***	●			●	●	●	●
	Org 2	●			●	●	●	●
	Experts	●		●	●	●	●	●
Update and Patching	***Org 1***	●	●			●	●	●
	Org 2	●	●			●	●	●
	Experts	●	●			●	●	●
System integrations	***Org 1***		●			●	●	●
	Org 2		●			●	●	●
	Experts		●			●	●	●
Process improvements	***Org 1***	●		●	●	●	●	●
	Org 2	●		●	●	●	●	●
	Experts	●			●	●	●	●
Others: *Key Actors and Influences on Main Activities: Post-Implementation Stage*								
Business department enrolment on evaluation and monitoring for Technology	***Org 1***	●	●		●	●	●	●
	Org 2	●	●		●	●	●	●
	Experts	●	●		●	●	●	●

Table 5-33: Key Actors and Influences on Main Activities: Post-Implementation Stage

The point to note in the above Table 5.30 is the low mapping of technology providers with SSC post implementation activities – monitoring and process improvement. The role of technology providers as seen in the pre and during implementation stage (section 5.4.7.1 and 5.4.7.2) is towards technology infrastructure identification and adoption which should meet the requirements of different stakeholder i.e. key actors in the process. However, they have lower influence in managing monitoring activities as the activity is an integrated element of the government function and management internally and not through external actors. Similarly, the lower mapping between PPPs and education and training reflects the role of PPPs as actors in the development stage i.e. pre and during and not in post. Education and training in post implementation stage relates closely to internal actors such as the government, compliance and security activities. Other activities that were found to hold lower mapping with education and training were update and patching and systems integration which are a key element in technology provider role in managing post implementation activities.

5.4.8 *Challenges and Best Practices for SSC*

In this section, the challenges and best practices for establishing Smart Safe City along with technology adoptions are reviewed. The aim of this section is to offer visibility on the challenges, barriers and best practices to implement proper smart safe city along with technology adoptions.

5.4.8.1 Main challenges facing government participating on smart safe city implementations

The interviewees were asked to share the main challenges that are faced by the governments participating in SSC implementation as per their experience and suggestions on how to overcome them. In response, the following set of challenges and recommendations were outlined (see table 5-30):

Challenges	*Recommendations*
Bureaucracy	Rendering decision-making power to heads of departments, to a certain level, to improve decision making.
Resistance to change from involved entities	Increasing awareness amongst the team to understand the requirements of growth and acknowledge them.
Special interests driving decisions rather than benefits and objectives realization	Focussing on decision making to be based on achieving both special interests as well as objectives will be helpful.
Vendors bias and too much focus on the technology rather than the objective/benefit	Controlling the focus on technology and how it affects achievement of objectives.
Inexperienced and unskilled staff	Focussing on recruitment of skilled manpower

Table 5-34: Challenges to Government in SSC Implementation

In case of experts who were interviewed by the researcher, various replies pointed towards what the IT SSC Program Head had to say:

> ***'SSC initiative in the UAE is well developed and streamlines. In general, for other smart cities, one of the challenges that may surface include lack of training and resources for implementation.'***

5.4.8.2 Main Barriers and Difficulties in SSC Implementation

When asked to share the main Barriers and difficulties that a government may face participating on SSC implementations, three main barriers were identified (see table 5.31). Interviewees from both the organizations including experts highlighted on the lack of funds to support SSC implementation in general. While it may be noted that the government has a key role in the process and may even has allocated good financial resources, lack of funding from third parties can affect the overall SSC implementation. The SADH and ISS of organization 2 quotes:

> ***"The partnering companies through PPPs should be equally interested in the implementation process to avoid delays."***

It is noted that delays in implementation of SSC activities through PPPs is linked with delays. This can be attributed to the role of outsourcing of technology projects to third parties through PPPs leading to delay in quick decision-making. IT consultants working on SSC activities need to follow a streamlined flow of communication externally to internally within the SSC system. Such as low of information is associated with high time consumption leading to missed opportunities. Also, the heavy reliance of external manpower through PPPs to handle SSC implementation activities can lead to barriers as the internal manpower may not be sufficiently skilled to understand the implementation and relevant decision-making requirements. Similarly, experts too pointed out the barriers being budget and lack of realization of objectives.

Barriers and Risks	*Recommendations*
Lack of funds	Engaging in PPPs to boost funding externally
Poor interest from participating PPPs	Increasing participating in PPPs through subsidies and special benefits
Unrealistic objectives that cannot be met by available solutions and technologies	Setting up of a clear roadmap with SMART objectives that can be met through either available technology or by upgrading the technology
Information security	Developing processes for information security, focussing on how information is stored /shared / accessed

Table 5-35: Barriers and Risks of SSC Implementation for Government

5.4.8.3 Critical Factors influencing Success/Failure of SSC Implementation

To further understand what factors influenced the success or failure of SSC implementation by UAE government, the interviewees were asked to list the critical factors as their experience. An overview of the factors is shared in the Table 5-33.

Critical Factors influencing Success/Failure
An overall strategy with a roadmap
Clear objectives and measurement of the benefits since early stages of the project
Proper policies, regulations in place
Monitoring and adjustment of the projects implementation through a solid governance structure

Table 5-36: Critical Factors influencing Success/Failure of SSC Implementation

5.4.8.4 Importance of SSC for citizen happiness, future accelerations and shaping future governments

The next question asked the respondents in their opinion, how important is SSC for citizen happiness, future accelerations and for shaping future governments and furthermore, how will technology help in achieving the same. Overall, it was found that urbanization has increased the challenges to SSC implementation, thereby affecting citizen happiness and future development. However, it is also a driver. It was observed that citizen happiness and future accelerations were greatly influenced by the SSC initiative. As said by the IT - TH in organization 1:

> ***'Urbanization is inevitable and with it come a number of complex issues to solve in the new mega-cities, such as safety, logistics, transportation, access to healthcare, clean environment, etc. Happy citizens create productive societies and efficient economies. Therefore, developing smart cities with citizen happiness as the top objective is extremely important.'***

Similarly, with respect to technology, some interesting responses received include the following:

From the Networking and Telecommunications in case study 2:

> ***'For the achievement of all the objectives of SSC, the adoption of technology is a pre-requisite, without which the city cannot be termed as a smart city.'***

From the ISD in case study 1:

> ***'One of the main challenges in achieving happiness through smart city development is how to scientifically link happiness to smart city development. It becomes necessary to do a thorough planning exercise to identify the key factors contributing to happiness in the city, how to measure them, what influences them etc. Then to move on to assessing the existing city capabilities and identifying the gaps that affect the citizen happiness. Only when those gaps have been clearly identified that we can start building a sound roadmap for the smart city development.'***

Experts, on the other hand, support the importance of technology in the success of SSC with one interviewee stating that '*without the adoption of technology, the SSC infrastructure would be rendered useless.'* Any aspect of city planning and execution is termed 'smart' when it is integrated with ICT, and lack of that aspect would make the city a normal one and not 'smart'. Therefore, the integration of ICT and technology is vital for a SSC project. Similarly, such an adoption will strengthen future government and acceleration.

5.4.8.5 Strategic Actions to be adopted by the Government for SSC success

When asked what strategic actions should be adopted by the government for success of SSC initiative, the following responses were received (see table 5.33). Actions such as setting of clear objectives with measurable benefits and development of a roadmap have been identified from interviewees of the 2 case studies as well as from experts.

Strategic Actions
Developing clear objectives with measurable benefits
Create a roadmap to address the existing gaps
Put in place a governance structure for the smart city initiatives to monitor the benefits realization and adjust the strategy/roadmap accordingly
Be realistic with availability of funds to support the objectives
Accountability and transparency
Create a committee on the organizational level and on participatory level
Increase participation at business department level on Technology adoption on specific technology function

Table 5-37: Strategic Actions adopted for SSC Success

5.4.8.6 Technology Components and architecture for SSC

When asked what are the key technology components and architecture for SSC, the following components were identified (see table 5-35).

Technology Components and architecture	
Big Data	LTE / Networking (Connectivity)
Surveillance	Facial Recognition
Collaborative Monitoring	Data Centres (for servers, information storage and applications)

Table 5-38: Technology Components and architecture for SSC

The IT - TH of organization 1 stated that:

> ***"Although technology is not the most important part of achieving happiness in a smart city, there are a number of technologies such as digitization of process and IoT that have demonstrated positive impact on smart city projects."***

Similarly, the ITSP from case study 2 stated:

> ***'Technology forms the basis of a smart city and in order to keep the city safe, technology components play a crucial role. These technologies include software systems, Internet of Things, Broadband amongst others.'***

Experts participating in the interview stressed that technology components formed the backbone of a SSC infrastructure. Furthermore, there is a need to apply IT frameworks which do not allow outside threats to enter into the smart city framework.

5.4.8.7 Critical Success Factors for Technology Adoption of SSC

The interviewees were asked to share their view on the critical success factors of technology adoption in SSC as per high, medium and low importance scales to examine the impact of adoption. As seen in the table 5.35, the level importance for the success factors is provided. High importance is observed for all components of technology adoption for SSC.

Critical Success Factors for Technology Adoption of SSC	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
IT skills required for using new technology	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Compatibility and integrations with existing systems	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Integrations with other entities	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Stakeholders support	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Mandates from the government	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Technology providers and supplier	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Readiness of the employee to use new technology	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	
Reliance on IT for processing large information data	***High***	9	9	10	28
	Medium	0	0	0	
	Low	0	0	0	

Table 5-39: Critical Success Factors for Technology Adoption of SSC and rating

In the organization 1, a majority of the interviewees highlighted technology integration acts as a success factor when it is employed property. It should be supported by transparent selection and evaluation of vendor technology solutions with no bias or special interests. Also, focus should be on understanding that '***technology life cycle nowadays is super short (2-3 years) and minimize huge investment in technology that will have to be replaced in 3 years'***, as quoted by IT - TH.

In the case of organization 2, respondents indicated the need for creation of new and advanced services and processes, new competitive products and services and building a connection between the IS of different organizations as the key for success.

Expert interviews also led to similar findings, indicating the need for effective governance which integrates technology, cloud computing, analytics for success of IS framework and handling of large structured and unstructured data by entities.

5.4.8.8 Challenges of Technology Adoption for SSC

Although the success factors were identified in the section 5.3.8.7, there was still a need to know what the challenges for technology adoptions for SSC are. The following factors were identified as challenges (see table 5.36). As observed, technology adoption is restricted by unskilled employees reducing the overall success of adoption. Similarly, employees building special interest with vendors for additional (monetary) benefits and the heavy reliance on foreign technology leading to increase in costs also pose a challenge. The other factors, as noted by the ISD of organization 2 include: unavailability of resources, lack of technology to implement safe city infrastructure and differences in vendor expectations.

Challenges of Technology Adoption for SSC	***Recommendation***
Unskilled people	Developing strict protocol in selection and recruitment of manpower to participation in SSC projects.
Special interest with vendors	Building a clear protocol on dealing with vendors and the benefits they receive, while controlling any unauthorized benefits in any form.
Heavy reliance on foreign technology	Supporting technology from local providers to ease adoption and integration, leading to reduced costs.
Complex technology	Developing an assessment of technologies available and how to fit in the SSC system, with lower complexities.
Low technology support from vendors	Preparing clear requirements on vendors support the SSC project teams locally.

Table 5-40: Challenges of Technology Adoption

5.4.8.9 Barriers of Technology Adoption for SSC

The barriers for technology adoption for SSC were identified as follows (see table 5.37). As observed, technology adoption is found to be linked with financial (budgeting) elements, while expertise of the employees also affects technology deployment in the SSC process. From the interviewees of organization 1 and 2, two factors which were commonly identified were poor financial planning and forecasting without any concrete actions. The below barriers are also supported by experts.

Barriers of Technology Adoption for SSC
Lack of budgeting
Lack of planning
Lack of expertise
Complex technology
Lack of adequate support from technology vendors locally
Lack of adequately skilled staff from vendors to support locally
Capability of full integration with other systems
Lack of incentives for Technological advancement
No ICT integration due to lack of understanding of the processes

Table 5-41: Barriers of Technology Adoption for SSC

5.4.8.10 Strategic Actions for Successful Technology Adoption

In this section, the researcher attempted to identify the factors that improve the strategic actions taken by the government for successful technology adoption of SSC. In response, participants from organization 1 and 2 highlighted the need to develop local skills, encourage production of local technology and create strong PPP models that involve localization of the technology production (see table 5.38). These factors were also identified in the development life cycle review conducted in section 5.3.7. Unlike the two case studies, the expert interviews reflected on local production and technology development as the main factor highlighting the requirement to enhance partnerships with those nations who have already implemented the processes. Furthermore, experts also suggested that it is vital for the government to bring about major changes in ICT Integration. This is needed so that the integration does not leave out on any aspects of security which could provide outside threats a gateway to indulge in malpractices. Technology being the core of SSC needs to be integrated completely within the structure.

Strategic actions of Technology Adoption for SSC
Developing local skills
Encouraging of local technology
Creating strong PPP models that involve localization of the technology production

Table 5-42: Strategic actions for successful technology adoption

5.4.8.11 Best road map for having / establishing smart safe city

The researcher asked the interviewees to present their views on the best roadmap for establishing a SSC. In other words, what was an ideal holistic approach to the development of SSC. One expert pointed out that:

> ***'There is no such magical ready to follow roadmap. The best roadmap is one that is built for the local needs, to address the local gaps and taking into account the capabilities and maturity of the local entities.'***

On an overall view, the need for a comprehensive roadmap was pointed out by all 28 interviewees, indicating that the government should build a definite roadmap that clearly identifies the shortcomings in the present framework and establishes a new outlook. Experts on the other hand highlighted the following (Table 5-40).

Best road map for having / establishing smart safe city
Identify the vision to be achieved
Conduct assessment by consideration of various factors such as safety parameters, geographic areas based needs
Involve stakeholders in development requirements and set up effective coordination across departments
Identify and address challenges in the path which may involve problems related to funding, policy, technology needs, adoption and awareness
Engage in project planning for technology, while reviewing global standards for SSC implementation
Implementing the project based on best practices while overcoming the issues identified
Planning of continuity of operations

Table 5-43: Best road map for having / establishing smart safe city

5.4.8.12 Matching between Adopted Technologies' Functions and SSC task requirement

The interviewees were asked to express on the need to match between adopted technologies functions and the task requirements of SSC, to which the ISD of organization 2 stated:

> ***'Coordination and response is as necessary as technology adoption for Smart Cities, and a mismatch in the requirement of the smart city and technology functions can lead to failure in achieving the set gaols.'***

SSC planning and implementation was observed to be dependent on technology adoption and technology architecture. For effective implementation of SSC, it was found that the gap between the technology and objectives should be fulfilled, thereby leading to achievement of the vision.

5.4.8.13 Benefits of having technology adoptions for SSC along with the level of importance

The interviewees were asked to share the level of importance for a list of benefits achieving through technology adoption for SSC. As seen in the table 5.39, a high importance was shared for all benefits of having technology adoption for SSC.

Benefits	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Reducing operational cost of smart safe city	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Increasing city productivity	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Increase citizens happiness	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Support future governments	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Support future accelerations	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Improving the relationship with smart safe city initiatives	***High***	8	9	8	**28**
	Medium	1	0	2	**0**
	Low	0	0	0	**0**
Support work coordination	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Enhancing competitive advantage	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Improve knowledge	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Increasing response quality	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Table 5-44: Benefits of having technology adoptions for SSC

The ITD from Organization 2 pointed out that the success of SSC is crucial to support the vision of the government, i.e. to achieve citizen happiness, future accelerations and future government as well. SSC projects need an effective coordination with the vendors as well as the employees involved, while ensuring to meet the required productivity and operational efficiency. Also, its success was noted, from the interviews, to be linked with reducing operational costs and increasing response time. The other benefits identified from the interviews include: data collaboration, and improving decision making.

5.4.8.14 People involved in IT adoption decision making process for SSC

Smart cities are developed through effective collaboration between the technology, people and process components; however, decision making for IT adoption relies with the technologies head. Prior to decision making, as stated by expert, extensive review of the available options is executed with the results supplied to the key decision making involving the stakeholders, and IT department heads. Overall, the key personnel involved in the IT adoption decision making process are:

- IT director
- Networking and Telecommunications head
- Information security Director / Head
- IT Smart Safe City Program Head
- IT Technical Head
- System and Application development head
- Physical security and monitoring head

5.4.8.15 Recommended Evaluation Criteria for Technology Adoption in SSC

The evaluation criteria for technology adoption, as confirmed by a majority of the interviewees relates to the technology architecture, covering the desired functionality evaluation, challenges in adoption, functionality, benefits and drawback analysis of the technology.

5.4.8.16 Main technology integrations functional benefits

The interviewees were asked to share their knowledge and understanding on the main technology integrations leading to functional benefits in SSC. As seen in the table 5.40, high importance was associated with all factors of technology integration. No other factors were shared during the interviews. The ITSSCPH of organization 1 in response quoted:

> ***'Integration of technology in SSC programs should be based on the principles of collaboration, coordination and control. It should be supported with a well-defined policy on how information is processed, sharing of information and most importantly, setting of clear roles and responsibilities to avoid overlap.'***

Technological Integration Benefits	*Importance*	*Org 1*	*Org 2*	*Experts*	*Total*
Collaboration	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Coordination	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Control	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Information Processing	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**
Role Resolution	***High***	9	9	10	**28**
	Medium	0	0	0	**0**
	Low	0	0	0	**0**

Table 5-45: Ranking of Technological Integration Functional Benefits in SSC

5.4.8.17 How can SSC enhance governments process and efficiency

Lastly, the researcher asked the interviewees whether a SSC can help enhance government processes as well as efficiency. In response, the IT SSC Program Head from organization 1 quoted:

> ***"Linking government investments in the city to specific measurable objectives of increasing happiness, solving safety issues, etc… has the benefit of driving governments to operate in a transparent model with strong governance based on KPIs. This has shown that it can improve the efficiency of governments and enhance the benefits to the citizens."***

Other interviewees within the organization 1 and 2 had similar viewpoints, indicating that SSC initiatives help enhance transparency and accountability within the government leading to future development. Furthermore, it was also stressed that SSC will enhance the quality of life of people, thus ensuring citizen happiness. The experts too expressed a similar opinion stating that implementation of SSC initiative will prove to be beneficial for everyone, the citizens, the entities and the government. It will bring forth future acceleration and growth that supports future government. In the next section 5.4, the researcher has presented an analysis of the results and discussed the outcomes.

5.5 Discussions

As mentioned earlier, this section aims to discuss at length the findings of the interviews and surveys conducted by the researcher in order to verify that the literature review and the proposed framework are accurate for the SSC initiative and thus can be adopted by the cities to improve SSC implementation.

5.5.1 External Factors

Face-to-face interview interaction responses show that maximum numbers of respondents believe that the most influential factors in the SSC implementation are organizational, political, economic, and critical mass with the inclusion of a new factors - technology. Both of these factors are external elements and most likely to sway the decision makers and implementers of the SSC project.

(1) Organizational: The findings submitted in this study further back the assertion given by DiMaggio & Powell (1983). They believe that it is highly probable for public sector organizations to enact the SSC implementation due to the consistent pushes from regulation and competition. While examining the institutional theory, the case studies made it obvious that public sector entities are regularly influenced by several different forces from external as well as internal environment factors and organizations have come to become more or less alike due to the similarity of pressures they encounter, which are in turn affected by valid actions of regulatory/coercive, cognitive/mimetic, and standard forces (Shichiyakh et al., 2016). There is a need for government outlets to be unified and organized, as emphasized by Agunloye (2007), in order for the SSC rollout to occur properly. Government agencies need to cohesively function as they design and execute policies (Shichiyakh et al., 2016). Also there are needs to be a solid political will so that SSC implementation is successful. The organizational advantages include: increased competency and enhanced transparency and access to information.

(2) Political: Cities which are planning to be safe and smart as well, should have political stability environment leading positively towards the planning and implementation of SSC in the country. Due to the stability in the country's governance – across all tiers – strong political will is consistently available. Also backing the implementation goal is the fact that most respondents believe that because of clear governance, SSC implementation will be greatly supported and successful (Weerakkody *et al,* 2013).

(3) Economic: As far as economic findings are concerned, they reveal that economic factors (along with organizational and political) are indeed critical to the successful implementation of the SSC in the UAE; and governmental and related bodies have an important role in its success (Shelton et al., 2015). Sponsorship and funding from external parties is expected to back up the project and any delay in the same would cause the project to lag behind in completion and implementation (Komninos et al. 2013). Top-tier officials from two public sector companies shared that the SSC projects in UAE are well-backed with clear finance structures to support timely development and completion of the projects. An expert quoted:

> ***'Given the strong economic condition of UAE, SSC projects have been consistently successful right from the stage 1 – planning to the deployment and execution. The development of clear roadmap for SSC has led to overcome any hidden costs in the process and lead to efficient fund management for overall success.'***

(4) Legal/Legislation: Even though not as necessary as documenting the political and legal factors, yet it was necessary that a strong legal framework be outlined for the successful implementation of the SSC in general. Moreover, design of a legal framework was described as necessary by the interviewees. Senior officials in the public sector organizations of UAE expressed their positive outlook towards the existing legislation and regulatory framework that supports the development and implementation of SSC in the country successfully. Having such as framework in would assist the other countries too in enacting the SSC rollout as well as other smart projects in future with high efficiency, information sharing and data flow.

(5) Critical Mass: In this research study, critical mass pertains to the skill of the organization to possess knowledge about other outlets taking part in the same project or initiative. There is a unanimous agreement in the respondents that critical mass is helpful as it allows companies to examine each other and the possibility of idea-sharing. The subjects interviewed at other public sector organizations expressed that critical mass had a good influence on the decision-making of organizations to contemplate the implementation of SSC initiatives. According to the respondents, while organizational, political, economic and technologies factors to be the most imperative, critical mass is also found to be taken into consideration. The research findings illustrate the analysis of the aforesaid external factors in reference to the SSC implementation. The results are generated from interview. These were taken from managerial staff senior and junior in the case studies organizations.

(6) Technological: The integration of technology in the SSC has been found to play a crucial role in SSC implementation. Technology adoption, which was found to be dependent on third party vendors availed through PPPs, is successful by building engagement and willingness to collaborate (Washburn et al, 2010). While technology is vulnerable to threats, effective integration of technology with IS components can lead to smart control and interfacing while maintaining the integrity of the overall system. Decision-makers within the SSC should focus on the technology components in SSC implementation and take effective action to increase technology adoption, integration, maintenance and continuity.

5.5.2 Internal Factors

Next, in the process of validating the conceptual model, internal influences were examined wherein the researcher asked respondents to express their views. They were asked to base their views in light of the SSC initiative. Internal factors can be controlled by the organization and these include: Leadership / management ability, financial matters, strategic objectives and planning, technology adoption, collaboration, and business processes.

(1) Leadership: Top management support is most vital for any project on specific mega projects such as smart initiative to be successfully planned and implemented. All of the respondents that participated in the surveys and interviews concur that leadership is easily amongst the most important of factors that is influential and needs to be considered. The research determinations have confirmed the imperativeness of this factor in the successful rollout of the SSC project. It must be also mentioned that leadership and political issues of a country are compactly linked with each other (Shelton et al., 2015). This is so because a country's political system and stability have a key role in ensuring the SSC rollout takes place comprehensively and successfully (Khanh, 2014). Respondents from case studies organizations quoted that good leadership requires a good vision and creativity. Literature shows that both these attributes are linked (Jaeger & Thompson, 2003; Hunter & Jupp, 2001) with innovative leaders as then only they will be able to deliver innovative solutions for businesses and citizens in a country.

(2) Financial Issues: Research results have financial matters and funding numbered identified as the most important factors critical to the implementation of SSC. Majority of smart projects run for a long period of time, hence, need strong and sufficient financial backing to cover the increasing costs (Abdallah & Fan, 2012). As a result, respondents voiced their views that financial aid ought to be consistent for projects of such scale. The research findings in this regard coincide with the literature reviewed (Heeks, 2003). One of the top-tier officials in the cited that past projects in UAE were successful given the strong planning and budgeting actions, and strategic partnership with PPPs for external funding. Also, interviewees expressed that recruiting skilful and experienced strategic managers will have a good influence on the SSC implementation.

(3) Strategic Objectives and Planning: The respondents' views on strategic objectives and planning illustrate that they value setting up of appropriate goals and objectives as the next most important factor second to leadership and funding which must be thoroughly contemplated upon by implementers and decision-makers of the SSC implementation. Furthermore, the widespread opinion is that strategic objectives and planning will assist the decision makers to develop a strong roadmap with sound strategies for execution and have a project blueprint and priority list for the services (Abdallah & Fan, 2012). Respondents recommended SSC objectives and goals such as citizen happiness, future acceleration and future government support along with data security and integrity. Where also readiness to any national resilience can be from SSC. This trend of establishing specific strategies and objectives echoes the UNESCO recommendation for SSC is emerging countries (Song, 2006).

(4) Technology adoption and collaboration: Technology collaboration is explained as the dynamics that exist between agencies and departments, and how trust-levels between managers and staff ought to have a notable impact on their associations in light of the SSC implementation. Empirical data, on the contrary, suggests that neither trust nor collaboration is as pivotal as leadership or behavior of staff and managers, in the rollout of the SSC project. Still, popular literature (Nodu, 2004) indicates that collaboration is an essential element for the successful execution of the SSC. Top-tier officials in public sector organizations hold the opinion that PPPs have the strength to supporting the SSC financially, with the government focusing on improving relationships with PPP vendors. Research findings in this regard seem to validate Agunloye's (2010) remark that UAE's government and other relevant state bodies are adept in adoption of PPP, thereby strengthening SSC implementation projects in the country (Alizadeh, 2017). A maximum number of respondents highlighted that, in the context of smart city in general, there may exist distrust between managers and subordinates in an environment where transparency is absent, and it may trigger adverse concerns with reference to knowledge sharing, and information and data flow. Hence, clear guidelines on technology adoption and integration with the system should be developed, with transparency in roles and responsibility of every party involved to increase overall accountability. This also an innovation approach to think loudly and brain storming with the relevant experience across the world which helped on future accelerations and shaping the future government as future foresight.

(5) **Business Process Factors:** A section of the interviewees affirms the need to continually monitor, review and update the business plan in SSC to be success in implementation. Results indicate that maximum number of respondents reacted in positively to the developments in UAE in SSC area, reflecting on the sound roadmap developed to achieve the SSC objectives. SSC projects were supported with direction on governance of each entity with the system while examining the best strategies to integrate technology adoption to meet the SSC implementation (pre-during-post) (Alizadeh, 2017; Nam and Pardo, 2011b).

5.5.3 Challenges and Best Practices for SSC

Globally, smart cities are facing a number of challenges in the successful implementation of the SSC initiative. Research has corroborated to the theory postulated by Lee et al., (2014) stating that lack of coordination within the governmental agencies and between different ministries with similar responsibilities. It is vital that leaders understand between effective governance and SSC. According to Ibrahim et al. (2015) the rate of diffusion of ICT within the country has been slow which has led to an extended due to the lack of communications among the parties and missing assigned roles and responsibilities. Additionally, the rate of ICT literate citizen is quite high in the country and therefore the implementation of SSC is at a high pace in the majority of the projects. Some challenges identified through research in smart cities context in general include: lack of training, lack of funds, unrealistic objectives, privacy and security, partnering companies not being interested in the implementation process and lack of financial resources (Ndou, 2004; Komninos, 2013; Agha, 2016; Efthymiopoulos, 2016). While the respondents agreed to the above factors, they also pointed out that it was necessary for a government to be involved actively for setting up the necessary infrastructure required for the implementation of the SSC initiative, such as in the UAE. Apart from the above mentioned obstacles, some of the other general challenges include high investment for set up and training and knowledge level of employees (Komninos, 2013; Rahman et al., 2016). Since technology forms the basis of a SSC, research revealed that participants too considered technology an integral part of the initiative and that it was vital for citizen happiness. Researchers such as Cocchia (2014) have argued that in the absence of technology, the initiative would not succeed nor would it be able to achieve its objectives.

The researcher attempted to identify the strategies that were being utilized by case study organizations to verify if good practice was applied to achieve citizen happiness and future acceleration. The researcher was able to conclude that these case study organizations had their important strategies in place. As mentioned by researcher Ferrara (2015), certain good practices help the organization achieve their objectives and ensure that the implementation process as well as post implementation the services provided are functioning appropriately. Upon inquiring with the participants, the organizations took heed of such practices which included clear objectives, identification of gaps, important technological infrastructure. Vanolo (2014) suggests that by following such strategic practices, organizations and governments are able to fulfil their obligations towards the SSC implementation procedure. Lastly, the participants identified that the implementation of a SSC can help government and organizations enhance their efficiency. Researcher Abid (2014), states that having the government link its investments to the SSC initiative ensures that the government is on par with the developments of the initiative, meets citizen's happiness, and supports future government.

5.5.4 Change Management

Change management is not similar to project management; project management relates to the application of knowledge, skills, tools and techniques to the project in order to meet the requirements of the project (Van der Voet, 2014). On the other hand, change management has been described as the process, techniques and tools used for the management people side of change so that it helps in the achievement of business goals. Therefore, organization tools are utilized for individuals to help them make smooth transitions while adopting change. Azenabor et al. (2012) has identified change management as one of the challenges of SSC government integration. According to previous researches, effective leadership and management are the main components which provide the vision for change (Hayes, 2014; Van der Voet, 2014)). Therefore, in order to implement the SSC initiatives successfully, management actions will have to undertake by organizations enhance the acceptance levels of change amongst employees. Furthermore, in the opinion of Cameron and Green (2015), it could be beneficial for the management if they are able to gain the confidence of their employees, when a more participative approach is adopted. This can be achieved by enrolling the participation of all stakeholders' right from the decision-making phase to the implementation phase, including the change management. In this manner, the organization will be able to gain support of all those employees who will be affected by the ensuing change (Thom-Otuya and Thom-Otuya, 2013).

The researcher, upon interviewing the experts regarding their views on resistance to change especially in the implementation of SSC initiative was able to find out that the major reason for this resistance in smart cities in general. It is because employees are concerned about the implication of change on self. Some of the reasons are consistent with the past literature wherein the employees were of the opinion that implementation of SSC would result in the reduction of their jobs. As pointed out by researcher Van der Voet (2014) it could also be due to lack of clarity regarding what the change would bring in. This factor was further corroborated by the results of the interview conducted by the researcher. The respondents also identified additional reasons for the resistance to change apart from those which were already identified in the interview. Thus, all the identified reasons, along with the additional ones affirm to the observations made by scholars further validating the view by Lam (2005) that states that control of resistance to change will lead to project success.

5.5.5 Development Life Cycles of Smart Cities

The researcher attempted to learn about the practices that were in place in each of the case study organizations and from the expert interviews. The researcher observed from the responses as well as the expert interviews that the organizations had the necessary practices in place that would ensure implementation of SSC initiative and also indicated the seriousness of the entities.

5.5.5.1 Development Life Cycle of SSC: Pre-implementation stage

During the evaluation of the good practices guidelines for SSC systems at each phase, from pre-implementation to post-implementation, it was identified that stakeholders support was the most significant factor. This was in-line with the suggestions made by past researchers which stated that stakeholder support was an important factor of good practices (Paskaleva et al., 2015; Mattoni et al., 2015). The second most important factor identified by the respondents was setting up of clear objectives as it helps in understanding the expectations out of the implementation process. In the opinion of Paskaleva et al. (2015) relaying the objective clearly to the employees and all stakeholders is important in order to fulfil the required stages of the implementation process. Other factors affecting the pre-implementation stage in SSC development include collaborative monitoring, defining access rights and monitoring procedures, skill and resources identification along with project design and technology deployment.

5.5.5.2 Development Life Cycle of SSC: During implementation stage

Under this section, all respondents from both the case studies as well as expert interviews identified achieving operational efficiency as an important factor that must be taken into consideration by decision makers and change implementers as good practice. Solutions sustainability was the second most important factor identified by the respondents. Thus as pointed out by Mattoni et al., (2015), application of these factors can prove to be beneficial for organizations who form the part of the SSC initiative. Findings also indicate the need to include acceptance of desired objectives and scenarios into the during-implementation phase along with real time data synchronization for project success in SSC.

5.5.5.3 Development Life Cycle of SSC: Post implementation stage

The findings from the interviews indicate that adopting advanced technology is a vital factor in good practices guideline. Past researchers have pointed out that after implementation of the SSC initiative, it is vital that the initiative is supported with advanced technology (Shelton et al., 2015). In the absence of good technological support, the implementation can be rendered useless (Albino et al., 2015). Respondents also indicated Public Private Partnership (PPP) as the second most important factor. According to Agunloye (2007), PPP helps not only in the easy management of the projects but also ensures its stability and sustainability. The private funds, innovations, financial disciple are driving factors of a smart government project. Some of crucial elements of the post-implementation stage for a SSC were pointed out as corrective action and problem solving, system integration to include participating entities and collaborative monitoring to meet SSC objectives.

5.5.6 SSC Development Life Cycle Actors

5.5.6.1 SSC Development Life Cycle Actors: Pre-Implementation

The results pointed out that during the pre-implementation stage; actors, government, PPPs and technology providers play a major role. Furthermore, policy-makers and regulators were also key actors in the pre-implementation stage. This supported Agunloye's (2007) hypothesis that the government played a crucial role in the formulation and application off policies which ensured sustainability. Responses also supported the theory postulated by Meijer and Bolivar (2016) that suggested that the formulation and implementation of governmental policies would help to resolve the barriers faced during the pre-implementation phase. It was found that, for SSC success in pre-implementation stage, an effective coordination is required between the government, PPPs, and technology providers, and IT infrastructure, technology readiness, staff readiness and strategy deployed.

5.5.6.2 SSC Development Life Cycle Actors: During Implementation

During this phase, Actors, government and technology providers were found to play a vital role in the implementation of SSC initiative as they are responsible for the identification of new strategies and policies for the government and businesses while determining the security for stakeholder (Mishra, 2013). On the other hand, in case of adapting to changes, it is the responsibility of the companies and organizations to ensure that the staff is able to adapt to change smoothly (Rodríguez-Bolívar, 2015). Participants also pointed out that it is vital that all the actors must undergo training and participate in education programs during the implementation phase. New influences in the form of technology advancements, updating IS to meet new technology and participation of business departments were noted for SSC success.

5.5.6.3 SSC Development Life Cycle Actors: Post Implementation

The interviewees shared their positive outlook towards the mapping of actors, government, technology providers and PPPs in monitoring, process improvement and system integration during post implementation of SSC. However, it is important to note that in terms of monitoring and updates, apart from users all the other actors have an important role to play. In the opinion of Mishra (2013), monitoring along with evaluation ensures that there is continuous service delivery after the implementation of SSC framework. The research findings help to reiterate the proposition made by past researchers stating education training along with process improvement are vital activities which all actors must participate throughout the development cycle (Paul et al., 2011; Giannakoulias, 2016). New activities identified to include in the post implementation stage were noted as business department enrolment on evaluation and monitoring, and technology function evaluation.

5.6 Conclusions

The aim of this chapter was to collect data and analyse the findings to reach to a suitable conclusion that validates the literature review and the proposed conceptual framework. In order to conduct the same, the researcher focused on two core case studies responsible for public safety in the UAE along with expert interviews.

The data was collected via semi-structured interviews and expert interviews which helped to validate the proposed conceptual framework. Additionally, new components were identified which will be further added to the proposed conceptual framework to develop a new one, which includes the identified factors. While achieving the aims of the study, the researcher was able to certify the propositions made with regards to SSC initiative which included mapping of SSC factors (internal and external), barriers and risks along with the key actors and main activities at each phase of SSC development cycle. It was proven that the government plays a crucial role in the implementation of SSC initiative. The findings also aided the researcher in validating the change management approaches. This was based on the theory by Lam (2005) which stated that resistance to change, that forms a part of change management, may in many cases lead to the failure of the initiative. Additionally, the researcher also attempted to identify the good practice guidelines to which respondents were able to suggest important inputs throughout the pre, during and post implementation stages.

In the next chapter, the researcher will identify the lessons learned and also revisit the conceptual framework, making new additions and proposing a new one.

6 Revisiting the Conceptual Model and Data Analysis

6.1 Introduction

This chapter of the research study is designed to define and present a brief discussion of the research facts and findings. This chapter also manifests the data gathered out of the case study and expert interviews and the conceptual framework that has been amended on the basis of the validity of the data researched. The research also mirrors the fulfilment of the research aim and objectives and if or not, the research questions were addressed. In accordance with research findings and data analysis conducted, this chapter mediates on the supplementary factors detected, which were not included in the literature review or the interview designed for the research. By means of the findings and analysis of the research, this chapter contains explanations of some of the concerns and limitations, therewith also presenting recommendations for the proper and successful completion of SSC.

In Chapters 2 and 3, the literature review and proposal of the conceptual framework, and Chapters 5 and 6 exhibits the data to examine the conceptual framework. On that premise, this chapter makes the attempt to integrate the observational data along with the literature and accordingly modify the conceptual framework presented in Chapter 3 on grounds of the internal and external factors, barriers and risks that impact the SSC implementation in emerging countries – using the UAE public sector outlets as the case study sample. It also develops discussion on change management approaches and its applications in SSC context, elaborating on the roles of the key actors and their activities in the SSC implementation. The above have been validated at every stage of the development life cycle i.e. before, during and post implementation respectively.

This chapter, for the purpose of accomplishing the research aim, aims to corroborate and review the conceptual framework developed for the SSC implementation using the empirical findings gathered and analysed in Chapter 5. This step was executed in order to draft an all-new conceptual framework model for SSC for UAE, and also trying that the framework is generalized for SSCs globally.

6.2 Findings and Discussions

6.2.1 Lessons Learnt from the Analysis of the Case Studies

This segment of the research presents a summary and clear understanding of the main findings gathered in chapter 5. As the literature analysis reflects, the factors, benefits, barriers and challenges of SSC implementation in emerging countries have been limitedly researched and studied. This research study nonetheless conducted a detailed case study research on the UAE public safety for the following objectives:

1. Examine and affirm the internal and external factors affecting the SSC implementation.
2. Examine and affirm the benefits, barriers and risks affecting the SSC implementation.
3. To follow points **(1)** and **(2)** mentioned above, and identify key SSC implementation factors, benefits, barriers and risks.
4. Investigate, verify and then follow the involvement of the key actors and their respective primary activities in SSC implementation across different stages pre, during and post implementation and development life-cycle.
5. Examining change management approaches and needs in SSC implementation.

Contingent on the two case studies findings along with experts view on the SSC domain and ICT laid out in Chapter 5 and the analysis of the same thereafter in Chapter 6 (supported with the findings from the expert interviews), more factors surfaced and were underlined in Table 6-1. Consequently, the study presents a few key changes which were executed by accruing or eliminating a handful of issues, factors, and theories affecting the SSC implementation essential of the information and facts provided in the Chapter.

A synopsis of the lessons learnt as an outcome of the data analysis and discussion is given as under:

1. The conceptual framework of SSC implementation was thoroughly examined and validated with the identification of new factors, highlighting that factors are not universal for every country. As a result, for SSC plans to be fruitfully implemented, the identification and rate the values of factors are a must, as compiled in Chapter 5. To cite an example, whereas maximum respondents quoted the Organizational factor as the most influential external factor which should be deliberated upon by the decision-making parties and implementers of SSC, a few of the respondents opined that economic factors should be taken into

consideration. When performing the data analysis, the view of the majority was taken into account at the time the factors were arranged on basis of importance.

2. The responses gathered from the interviews of the two case studies and experts revealed that there was a consensus amongst respondents that there ought to be increased limpidity of purpose and transparency for the sake of the SSC implementation to go through successfully since the study will be reference for any cities planning for smart and safe city where they will be getting the UAE experience on this domain due to the maturity of the UAE on public safety and technology innovation.
3. While the revised Three-Quarter moon model suggested by Hamed et al (2008) was being validated for SSC implementation, analysis of responses shows that both the aforesaid processes are, in essence, the same. Additional actors identified include: government firms (including third party entities and PPPs), and other private sector entities. These all have a stake in the SSC implementation, as found in the current study.
4. Research revealed that the relationship between the government and employees in UAE is highly cohesive supporting the position of the country as no. 1 globally in networking adoption. Managers and department heads are perceived as decision-maker. Leadership roles need to further transformation, as well as employees need to be trained and retooled, to make sure to achieve citizen happiness, future acceleration and growth qualitative.
5. The research visitations led to a few observations such as: the availability of IT-qualified personnel in the two case study organisations were qualified to meet the SSC requirements. Heads of IT departments were interviewed for this research, to gather better understanding of the prevailing scenario. The main reason cited for the small percentage of shortage of IT staff in public sector because of the lack of IT staff in decision making positions which requires being adequately skilled with acumen and knowledge needed for executing SSC initiatives internally. The existing IT talents work with expert technicians and consultants belonging to other companies in executing changes in their ICT. Also observed was deficiency in opportunities being meted out to IT staff as part of training and career development. Instead, organizations directly hire experts or consultants, in a bid to minimize costs.

6. The factor mapping influencing SSC implementation would greatly benefit relevant practitioners and experts in future researches or studies on the topic, and they would also have awareness about which issues need to be looked into. These are as follows:
   - ***External Factors*** (i.e. Organizational, Economic, Political, Critical Mass, Legal and Technology).
   - ***Internal Factors*** (i.e. Leadership/Management Capability, Goals/objectives, Finance, Collaboration, data storage and protection, data privacy and access rights).
7. Based on the key actors identified in the research findings, it is found that each one to play a significant part in their specific activities at every stage of the development life cycle to ensure that SSC implementation meets completion. In general, government needs to increase focus on policy-making and its execution and sustainability. Also, it needs to ensure and enact proper security measures, regulation and update of the same.
8. Based on the semi-structured interviews, data analysis confirms that respondents of the two case studies had experts view on all areas of the questionnaire, which also synchronizes with experts in the field. All the same, analysis of the findings on in opinion (about factors and aspects - benefits, barriers and risks) with regards to SSC implementation facilitates the validation of the conceptual model given in Chapter 3.
9. Maximum priority needs to be given to maintenance of privacy and confidentiality. This is an important requirement that needs to be met to the fullest as it is going to be an influential factor in the success of SSC implementation in any country.

6.3 Achievement Measurement of the Research Aims

In this research study, the aim was to propose a conceptual framework for the adoption of certain technologies required to establish a smart and safe city for resilience readiness, which is capable of delivering happiness to its residents, achieve future accelerations and shape future governments. To achieve the above aim, the researcher conducted an extensive data analysis on the data collected from two public sector firms (responsible for public safety in UAE) along with experts in the field (See Appendix 1). Each of the main objectives within the research study is evaluated in detail as following:

6.3.1 Research objective 1

Objective 1: Critically review the SSC and the approach of technology architecture for the success of the SSC, achieving citizen's happiness, future accelerations and the shaping of future government.

Finding: Post review of the data and the detailed discussions conducted in chapter 5, it is found that the most crucial factors for the success of SSC implementation are those identified in the literature review. Having reviewed the concepts of SSC in chapter 2 and 3, the conceptual framework was developed that was based on the factors that influence the conceptualization and implementation of SSC for readiness to response to national resilience, achieve citizen happiness, future accelerations and development of future government. The framework proposed with the factors of the literature was validated, with a detailed review of the internal and external factors, along with the benefits, risks and barriers to efficient implementation of SSC. Furthermore, mapping of the factors was achieved along with identification of priorities enabling the validation of the overall framework.

6.3.2 Research Objective 2

Objective 2: Explore the driving factors behind technology adoption by governmental agencies in the context of the SSC, by defining and categorising their advantages, underlying requirements and the key drivers behind them.

Finding: The aim within this objective was to examine how different factors influence the adoption of information security within government entities in the context of SSC. Post review of the literature on the various theories that exist within the SSC domain, the researcher was able to reflect upon the implementation requirements and success factors. This contributed as a crucial part of the conceptualization of the framework in chapter 3. The framework utilized three primary theories: i.e. the institutional theory (for implementation based factors), drivers/barriers theory (for benefits and barriers) and the 3-quarer moon theory (for key activities and actors involved in SSC). These formed the basis of the questionnaire development for the interviews in a semi-structured format. While the basis of the SSC model was derived from the e-government and smart city model, the elements were critically reviewed to match the SSC requirements and hence, it can be said that not all factors from the three theories utilized as the base were considered. It is important to note that the three-quarter model was chosen as it closely resembled the SSC framework for key actor identification and implementation. The adopted model of Hamad (2009) was successfully validated for SSC implementation, thereby leading to identification and validation of the influencing factors on SSC IT adoption in the form of drivers, benefits and risks.

6.3.3 Research Objective 3

Objective 3: Critically assess and analyse the stages at which governmental agencies choose IT through participating in SSC initiatives.

Finding: As per the findings outlined in the above section (i.e. objective 1 and 2), the factors constituting the SSC framework was validated through the inclusion of two case studies and expats. The three stages of implementation of the SSC concept for successful IT adoption by government entities was validated, thereby validating the life cycle. It was found that the three stages of implementation (pre, during and post) have a critical impact on the overall implementation of the SSC, through the application of the three-quarter moon theory.

6.3.4 Research Objective 4

Objective 4: Reveal the methods, stages and influential aspects of technology adoption and architecture, such as the impacts of and alignment with SSC in governmental agencies.

***Finding*:** The research literature review indicates the key phases and factors influencing the adoption of IT for SSC in government entities. For example, the alignment of the pre-implementation factors such as setting of goals, road map development and support of stakeholders affects the during-implementation factors i.e. technology fit and operational efficiency. Also, the mapping of the factors based on importance led to the identification of the most crucial actors and influences pre, during and post implementation phases for SSC.

6.3.5 Research Objective 5

Objective 5: Develop a conceptual framework for SSC implementations along with technology architecture to be adopted by governmental agencies participating on SSC.

Finding: From the extensive literature review, various factors were identified to effect SSC implementation. The factors were examined individually supportively with the review of the theories applicable for smart city implementation. The theories were selected based on their relevancy to the e-government model which is the initial concept before the transformation to smart city concept. The theories led to the development of the initial ground for the SSC conceptual framework, consisting of identification of the development life cycles, characteristics of implementation, good practice and mapping. While the past research studies focussed on the examination of the e-government models, the researcher attempted to develop a new one-of-its-kind model for SSC in general. The model will enable governments to enhance the efficiency of their SSC systems and implementation thereby achieving citizen happiness, growth and future acceleration.

6.3.6 Research Objective 6

Objective 6: Analyse the data collected from different case studies and field studies in order to test the developed conceptual framework.

Finding: To validate the conceptual framework developed for SSC in government entities in general and those in UAE to explore the pioneer experience of the UAE and be references for cities planed for SSC, data collection was conducted from two case studies (in public safety) supported with expert interviews. The data was gathered through the aid of a semi-structured interview questionnaire that covered the key factors, phases and actors in SSC. In the chapter 5, an extensive data analysis was conducted to review and validate each of the factors contributing to the conceptual framework.

6.3.7 Research Objective 7

Objective 7: Provide a unique contribution to the domain of the smart safe city in governmental authorities, as well as implications of developments for the theory and practice and future research directions.

Finding: The validation of the conceptual framework developed for the SSC for government entities led to a significant unique contribution by the researcher (elaborated in the next sections). While the concept of SSC is considerably new, it was found to be limited in terms of research especially with the focus on security and safety. In this research, the researcher attempted to develop a unique framework (not yet attempted) supported through a detailed review of the past literature covering the concepts of smart cities. The factors were examined in detail to match the new concept i.e. smart safe cities in theory and the application of those factors as an overall model validated in the chapter 5.

6.4 Achievement Measurement of the Research Questions

6.4.1 SSC and Factors affects its Implementation

RQ1: What is a Smart Safe City?

An extensive literature review was conducted by the researcher to examine SSC in detail while reviewing the elements that form the key components of SSC. The review comprises of examining of the definitional issues relevant to SSC, the factors driving SSC and the factors affecting SSC development. Also, focus was made on the implementation, examining the benefits, challenges and risks along with the life cycle development phases.

RQ2: Why does government around the world needs to adopt Smart Safe City?

> ***RQ2.1: How Smart Safe City will assure the readiness to response for any national resilience?***
>
> ***RQ2.2: How Smart Safe City will enhance citizen's happiness?***
>
> ***RQ2.3: How Smart Safe City will support future foresight?***
>
> ***RQ2.4: How Smart Safe City will help in future accelerations?***

RQ5: What are the emerging challenges for effective smart safe city implementation?

RQ6: What are the emerging barriers for effective smart safe city implementation?

The government of UAE is bright in its vision to transform the nation into a city of the future, targeting three main elements: readiness for any resilience, citizen happiness, future foresight and future accelerations. In this research study, these three elements were the foundation based on which the characteristics of SSC in terms of benefits, barriers and risks were evaluated. The researcher examined how the internal and external factors influence the implementation of SSC. The proposed conceptual model for the SSC implementation was validated with certain updates as per the findings. Also, the researcher reviewed the factors (i.e. benefits, risks and barriers) in light of the two case studies in public safety, supported with the interviews of experts in SSC. Based on the findings, mapping of the factors as per the importance was made, with the details shared in the following table 6-1.

SSC Implementation Factors	*Factors from Literature*	*New Factors Identified*
External	▪ Organizational. ▪ Political. ▪ Economic. ▪ Legal/Legislation. ▪ Critical Mass.	▪ Technology.
Internal	▪ Leadership. ▪ Finance. ▪ Objective Setting. ▪ Network Collaboration.	▪ Data classification and security ▪ Collaborative monitoring ▪ Collaborative data sharing
Benefits	▪ Boosting Productivity. ▪ Boosting service level. ▪ Cost Reduction. ▪ Accountability and Transparency. ▪ Increased ICT Usage. ▪ Decision making. ▪ Collaboration. ▪ Enhancing Processes. ▪ Networking Cohesion.	▪ Readiness for any national resilience. ▪ Well-developed office infrastructure to support operations. ▪ On-to-go information sharing. ▪ Efficient decision making. ▪ Increased governance. ▪ Economic growth of country. ▪ Supporting country vision as a leading country. ▪ Innovation.
Barriers	▪ IT Infrastructure. ▪ Investment. ▪ Knowledge and skills costs. ▪ High knowledge level. ▪ Resistance to change. ▪ Complex systems. ▪ Partnerships. ▪ Leadership.	▪ Policy Implementation. ▪ Data classification. ▪ Collaborative monitoring. ▪ Collaborative data sharing.
Risks	▪ Information access by third parties (consultants). ▪ Information security threat. ▪ Control on information. ▪ Service quality degradation. ▪ Misuse of services.	▪ Manpower dependency. ▪ Unemployment. ▪ Experience in technology selection ▪ Technology provider presence in local country. ▪ Lack of experienced staff to support technology from providers.

Table 6-1: SSC Implementation Factors with new factors

As seen in the table above, the factors of SSC implementation are arranged as per the level of importance identified in chapter 5 (section 5.3.3) with additional factors identified during the discussion from expert interviews. As per the findings, it is seen that the policy implementation was identified as a new barrier restricting the effectiveness of SSC development and implementation. Similarly, new benefits were identified in the form of advanced infrastructure for operational support, effective sharing of information, decision making and increased governance to boost SSC implementation. These factors were tested as well as validated by the researcher leading to revising of the framework. The mapping of the factors as per the level of importance will enable future researchers and practitioners to consider the factors for further study and examination.

6.4.2 SSC Technology and Strategic Actions

RQ3: What is the type and nature of the technology to be adopted for smart safe city?

RQ3.1: What is the architecture of smart safe city in terms of technology?

As part of the life cycle development and implementation, the factors and actors influencing the technology of SSC were reviewed by the researcher. With reference to the institutional and the three quarter moon theories discussed in the chapter 2 (section 2.7), the key actors involved in the technology development and adoption in SSC (pre-implementation stage) are the government, policy markets and regulators, PPP vendors and technology providers. While the government was found to focus on training and awareness, strategy development and execution, PPP vendors were mapped to IT infrastructure, telecommunications infrastructure, technology readiness, and hardware/software costs. Whereas in the post implementation stage, vendors were mapped to information security, education and training system integration and update and patching as the key priorities (See Table 6.2). Also, a number of technologies essential for the SSC technology development and infrastructure were identified with a review of the critical success factors and challenges for successful technology adoption

RQ4: what strategic actions / steps to be adopted by governments participating in smart safe city to have maturity on the safety and security aspects?

RQ4.1: What are the roles played by the stakeholders in successful smart safe city?

The strategic actions for the successful adoption and implementation of SSC for UAE were discussed and reviewed in detail by the researcher based on the interviews from the two case studies and experts. The review led to the identification of various strategic actions needed for successful adoption, ranging from developing a roadmap to identification of realistic funds to support the SSC objectives. Also, the strategic actions needed to be taken by the government were reviewed with the identification of the key stakeholders and their role (key actors).

As seen in table 6.2, the activities within the pre, during and post implementation life cycle are mapped with the good practices and key actors (with new actors). It can be said that the successful implementation of each of the three stages in the life cycle, the connected good practices and activities should be utilized with the inclusion of the key actors within its development. For example, for pre-implementation life cycle development, focus should be made on the inclusion of good practices that govern clear vision and objective setting, building roadmap, involving stakeholder support, assessing technology needs and establishing responsibilities. To cover these good practices, focus should be on IT infrastructure, telecommunications development along with training and awareness development, identifying of hardware/software costs and overcoming the barriers and challenges in partnerships. The following table shows the "***Key Actors***" and their symbols used on 6-3.

Key Actors and their symbols				
Actor	Government	PPP Vendors	Policies / Procedures / Data Classification	Regulators
Symbol	Gov	PPPV	PPDC	Reg

Table 6-2: Key Actors and their symbols

SSC Development	*Identified Good Practices*	*Key Actors*				*Main Activities*
		Gov	PPPV	PPDC	Reg	
Pre Implementation	Setting a clear objectives	●	●	●	●	IT infrastructure
	Design the projects requirements and needs with clear road map	●	●	●	●	Telecommunications Infrastructure
	Stakeholders support	●	●	●	●	Training and awareness
	Collaborations with the participants	●	●	●	●	Technology readiness
	Technology Readiness	●	●	●	●	
	Understanding the needs from the technology providers	●	●	●	●	Hardware and software cost
	Establishing division responsible for smart safe city implementation	●	●	●	●	Overcome of the barriers and challenges of partnership with private sectors and technology providers
	Process and Procedures	●	●	●	●	
	Staff Readiness	●	●	●	●	SSC strategy
During Implementation	Maintenance and operation cost of the technology	●	●	●	●	Change the business concept and culture
	Technology fit to the desired objective	●	●	●	●	The new strategy for the SSC
	Updating IS to meet changing technology	●	●	●	●	
	Technology advancements	●	●	●	●	
	Solutions sustainability	●	●	●	●	Encouraging expertise to come over and participate on the SSC initiatives and implementations
	Achieving operational efficiency	●	●	●	●	Information security practice and procedure for secure system integrations
	Liaising with government entities	●	●	●	●	Education and training
		●	●	●	●	Additional activities, Information Sharing

SSC Development	Identified Good Practices	Key Actors				Main Activities
		Gov	PPPV	PPDC	Reg	
Post Implementation	Staffing skills resources	●	●	●	●	Security / Information Security
	Financial and budget support	●	●	●	●	Educations and training
	Public Private Partnership	●	●	●	●	Monitoring
	Adopting advanced technology	●	●	●	●	Update and Patching
	Technology integrations among other entities	●	●	●	●	System integrations
	Business department enrolment for evaluation and monitoring	●	●	●	●	Process improvements
	Technology function evaluation	●	●	●	●	

Table 6-3: SSC Mapping based on Phases in Implementation

6.5 Changes Suggested to Framework Post Validation

In this section, a review of the factors and the validations is conducted with the ranking as per the data collected and analysed through the semi-structured interviews. Table 6.3 provides the factors and the changes suggested per internal and external prior to the revised framework development.

Factors	*SSC Implementation Factors validation*		*Importance Identified*	*Importance Validated*	*Change*
Internal	**Tested Factors**	Strategic objectives a deplaning	1	3	Ranked 3rd
		Leadership	2	1	Ranked 1st
		Technology adoptions and collaborations	3	4	Ranked 4th
		Financial issues	4	2	Ranked 2nd
		Business process	5	5	None
	Others New Factors	***Data classification and security***	**6**	**6**	
		Collaborative monitoring			
		Collaborative data sharing			
External	**Tested Factors**	Organizational	1	1	None
		Politics / Legal	2	2	None
		Economic	3	3	None
		Critical mass	4	4	None
	Others New Factors	*Technology*	1	1	None

Table 6-4: Level of Importance and Validation of the Internal and External Factors for SSC

Apart from the validation of the internal and external factors level of importance and validation, the benefits, barriers and risks of SSC implementation along with the key actors and main activities (see table 6.4). As observed in the table, the benefits identified in the literature review are listed with their validation (upon review in chapter 5 section 5.3.3) with the new benefits listed under 'identified'. Similarly, the barriers and risks are also listed with the pre-identified and new factors. In the SSC implementation life cycle key actors, the validation of the actors is presented and whether or not the validation was accompanied by a change. Same applied to SSC main activities and the conceptual model theory. In the latter, the framework based on the three-quarter moon theory was updated to include an additional element i.e. the Plan-do-act-check to increase the model efficiency.

<table>
<tr><th colspan="2">SSC Implementation</th><th>Factors</th><th>Validation</th><th>Identified</th></tr>
<tr><td rowspan="21">SSC Implementation: Benefits / Barriers / Risks</td><td rowspan="9">Implementation: Benefits</td><td>Boosting Productivity</td><td>Yes</td><td rowspan="9">Well-developed office infrastructure to support operations
On-to-go information sharing
Efficient decision making
Increased governance
Economic growth of country
Supporting country vision as a leading country
Innovation</td></tr>
<tr><td>Boosting service level</td><td>Yes</td></tr>
<tr><td>Cost Reduction</td><td>Yes</td></tr>
<tr><td>Accountability and Transparency</td><td>Yes</td></tr>
<tr><td>Increased ICT Usage</td><td>Yes</td></tr>
<tr><td>Decision making</td><td>Yes</td></tr>
<tr><td>Collaboration</td><td>Yes</td></tr>
<tr><td>Enhancing Processes</td><td>Yes</td></tr>
<tr><td>Networking Cohesion</td><td>Yes</td></tr>
<tr><td rowspan="8">Implementation: Barriers</td><td>IT Infrastructure</td><td>Yes</td><td rowspan="8">Policy Implementation
Data classification
Collaborative monitoring
Collaborative data sharing</td></tr>
<tr><td>Investment</td><td>Yes</td></tr>
<tr><td>Knowledge and skills costs</td><td>Yes</td></tr>
<tr><td>High knowledge level</td><td>Yes</td></tr>
<tr><td>Resistance to change</td><td>Yes</td></tr>
<tr><td>Complex systems</td><td>Yes</td></tr>
<tr><td>Partnerships</td><td>Yes</td></tr>
<tr><td>Leadership</td><td>Yes</td></tr>
<tr><td rowspan="5">Implementation: Risks</td><td>Information access by third parties (consultants)</td><td>Yes</td><td rowspan="5">Experience in technology selection
Technology providers presence in local country
Lack of experienced staff to support technology from providers
Manpower dependency
Unemployment</td></tr>
<tr><td>Information security threat</td><td>Yes</td></tr>
<tr><td>Control on information</td><td>Yes</td></tr>
<tr><td>Service quality degradation</td><td></td></tr>
<tr><td>Misuse of services</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">SSC Implementation</th><th>Factors</th><th>Validation</th><th>Identified</th></tr>
<tr><td colspan="2" rowspan="4">SSC Implementation Key Actors</td><td>Government</td><td>Yes</td><td>No Change</td></tr>
<tr><td>PPP vendors</td><td>Yes</td><td>No Change</td></tr>
<tr><td>Users</td><td>Yes</td><td>No Change</td></tr>
<tr><td>Regulators</td><td>Yes</td><td>No Change</td></tr>
<tr><td rowspan="4">SSC Main Activities</td><td>Development Life Cycle</td><td></td><td>Yes</td><td>No Change</td></tr>
<tr><td rowspan="3">Implementation Life Cycle</td><td>Pre-Implementation</td><td>Yes</td><td>No Change</td></tr>
<tr><td>During Implementation</td><td>Yes</td><td>No Change</td></tr>
<tr><td>Post Implementation</td><td>Yes</td><td>No Change</td></tr>
<tr><td>Conceptual Model</td><td>Three Quarter Moon Model adoption</td><td></td><td>Yes, with variation</td><td>Addition of PDCA as contribution to enhance the model efficiency for SSC</td></tr>
</table>

Table 6-5: Validation of SSC Implementation Factors

6.6 Revised Conceptual Framework for SSC Implementation

The revised conceptual framework in Figure 6.1 illustrates the main factors driving the SSC implementation throughout different phase's pre, during, and post. The main actors and their respective roles and activities have also been recognized and validated so as to allow researchers to assemble the research in order of pertinence, along with ascertaining qualitative guidelines needed for successful overall implementation. The institutional theory is examined as it permits its usage in the IT context and assists researchers to acquire an understanding and explain the reason why organizations opt to create and maintain security. Furthermore, institutional theory combines itself to other models and theories as seen in previous literature developed appertaining to management of IT security. On the basis of this theory, this conceptual framework is associated to the environmental aspects of the organization including external and internal factors impacting SSC implementation during three phases.

The conceptual framework lists external factors not controllable by organizations – including organizational, political and legal. These have an influence on internal factors which are leadership, financial, strategic objectives and technology adoption. These factors are not particularly specific to a country or locality; and there's always a chance to come across new factors contingent to the scope of the SSC implementation. For this reason, this conceptual framework was examined and validated from the semi-structured interviews conducted in the UAE. For the benefit of researchers and practitioners, this conceptual model is built with flexibility. It will allow them to establish the main tasks and the major roles the actors will perform throughout the different stages of the implementation process on priority basis.

The key actors identified in the conceptual model, deemed to play an influential role, include: governmental bodies, technology providers, PPPs firms, public sector organizations, and users (employees, citizens). The SSC actors have been identified using the three-quarter moon model. For its validation in this context, interviews were conducted on the basis of the research methods and strategies adopted. This allowed for the analysis of the model and research findings to be revised appropriately so as to develop an improved framework which would be useful and relevant for use in SSC implementation in emerging countries such as the UAE with strong IT environments. Upon revisiting the framework and identifying the gaps, the new model has been presented in figure 6.1 and an explanation of the new components has been presented below. In the SSC initiative, cycles are a common approach wherein the government undergoes learning cycles, and builds iterative cyclic approaches with respect to policies, laws and standards. The Plan-Do-Check-Act cycle (PDCA) also known as Deming Cycle has been identified the researcher as a vital addition to the conceptual framework as it will help to make the framework a complete one that does not have any gaps.

Plan: in this stage, the government needs to make certain important political commitments while also analysing the current status with respect to smart and safe city components. As mentioned earlier, ICT has been integrated within the government services in the UAE, however their integration is not extensive and the people are not yet adept to making use of these technology based service. Therefore, the government needs to assess the current situation. After assessment, it is vital to build on the strategies for policy, planning and goals; these will ensure that the government is ready to implement the SSC initiative (Taniguchi, 2014).

Do: once the policies, the goals and the strategies have been identified at the planning stage, it is now imperative for the government to take action (Lekamge and Marasinghe, 2015). Thus, at this stage, implementation of measures and operations is crucial. Furthermore, in order to ensure that the implementation process is smooth, awareness and training are imperative (Teufel and Teufel, 2015). Only when the employees along with the public have received accurate training and guidance can the SSC implementation be done without any glitches.

Check: after the implementation is under way, it is vital that there is continuous evaluation of implementation process is carried out (Lekamge and Marasinghe, 2015). This ensures that if there are any discrepancies they can be ironed out. Managers also need to report procedures and make sure that there is a smooth functioning of the implementation process. Continuous evaluation is important as it helps to check those procedures which work against the implementation procedure (Taniguchi, 2014).

Act: after the evaluation process, it is now imperative that the government takes appropriate corrective actions which ensure that those procedures which do not help in the SSC implementation process are removed and replaced with those processes that can aid the implementation process (Lekamge and Marasinghe, 2015). This will help in continuous improvement of the processes. Thus, for the continuous improvement and for the relevancy of the framework at every stage, the identified gaps and the revised framework need to be applied for the SSC initiative.

In support to the PDCA, the Problem Based Analysis (PBA) was added to the framework in the development life cycle stage of SSC (see figure 6.1) which consist of five main stages. The stages of the PBA and their contribution to the framework are explained below table 6-6.

Problem Based Analysis	*Description*
Stage # 1 ***Problem Identification***	This concern to the pre-implementation stage within the SSC framework, driving forth the need to set up clear objectives with requirements per projects in SSC. It supports the inclusion of stakeholders within the project design stage through identification of barriers and risks.
Stage # 2 ***Problem Analysis***	Supportively to the step 1 in PBA, the step 2 revolves around building collaboration with the participants and understanding the needs of the technology providers for successful deployment of SSC technology. It is conducted in the pre-implementation stage, coinciding with the Plan phase of PDCA cycle
Stage # 3 ***Plan Development***	The step 3 of PBA covers the plan development focussing on strengthening the during-implementation activities as part of the DO phase of PDCA. It aims to establish SSC implementation success through breaking down roles and responsibilities, maintaining of technology and associated cost, bridging the gap between technology fit and objectives, and achieving sustainability of the solutions.
Stage # 4 ***Plan Implementation***	In the PBA step 4, as part of the Do phase, focus is rendered on achieving of operational efficiency and building coordination between various government departments for efficient operations.
Stage # 5 ***Plan Evaluation***	In the last step of PBA, the plan for SSC implementation (post phase) is evaluated to review the availability of skilled staff and resources, with focus on technology adoption, PPPs, budgeting and technology integration. The Plan evaluation is part of the Act phase of PDCA which considers the lessons learnt from implementation and feeds the information with remedial action to the step 1.

Table 6-6: Problem Based Analysis Stages and Descriptions

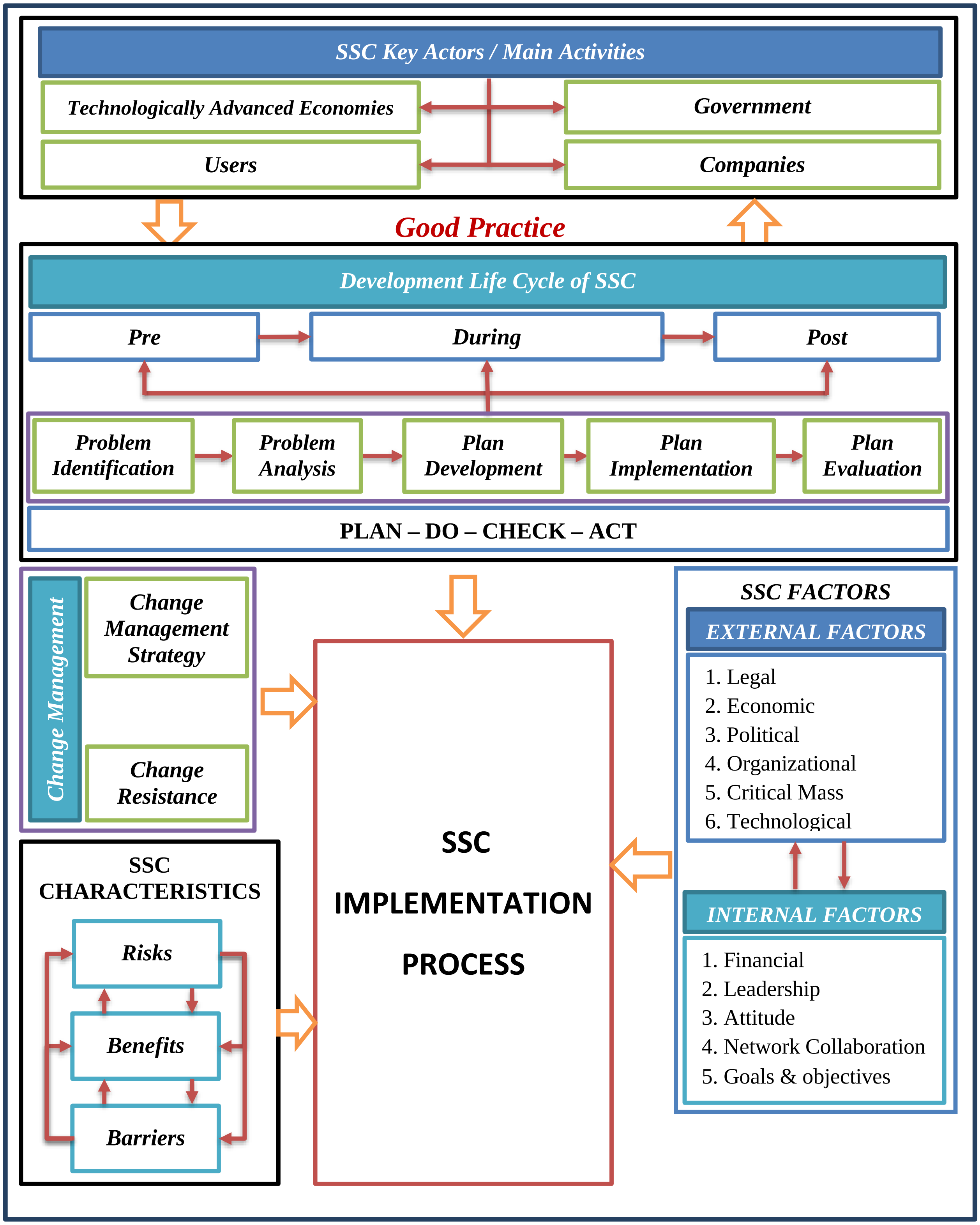

Figure 6-1: Revised Conceptual Framework

The integration of the PDCA into the SSC conceptual framework, within the development lifecycle is aimed to increase the overall execution efficiency. The table below elaborates on the new elements within the development lifecycle of SSC and the mapping of the activities from the pre, during and post implementation stages.

PDCA	*SSC Implementation*	*Activities*	*Problem Analysis Stages*
P Plan	**Pre Implementation**	Setting clear objectives	Problem Identification
		Design the projects requirements and needs with clear road map	
		Stakeholders support	
		Collaborations with the participants	Problem Analysis
		Understanding the needs from the technology providers	
		Establishing division responsible for smart safe city implementation	Plan development
D Do	**During Implementation**	Maintenance and operation cost of the technology	
		Technology fit to the desired objective	
		Solutions sustainability	
		Achieving operational efficiency	Plan Implementation
		Liaising with government entities	
C Check	**Post Implementation**	Staffing skills resources	Plan Evaluation
		Financial and budget support	
		Public Private Partnership	
A Act		Adopting advanced technology	
		Technology integrations among other entities	

Table 6-7: Classification of SSC Implementation Activities with PDCA

6.7 Frame Reference: Smart Safe-City Good Practice Guidelines

It is vital to develop a frame of reference for SSC implementation which would act as good practice guidelines for implementers of change as well as decision makers for the determination of key actors along with main activities at each stage of the project life-cycle. Such a frame is very useful in the navigation through the number of ways that will be adopted by decision-makers during appraising of the SSC evaluation and implementation factors (Irani and Love, 2008). Fig 6-2 along with Table 6-6 helps in understanding of this frame of reference which can be utilized by academicians along with decision makers for the implementation of the SSC initiative.

While the conceptual framework has been revisited and modified in Fig 6-1 after due validation, the key actors along with the main activities might need to be applied to other developing as well as developed nation. The extension of the three-quarter moon model may need further validation so that its relevancy based on the country can be established. This is mainly due to the fact that the ICT integration along with SSC growth is varied in each country, based on technology-readiness as well as ICT infrastructure. Table 666 shows the stages which need to be followed along with taxonomies of frame of reference for SSC implementation while highlighting the action plan and activities for the application of the revised conceptual framework for the implementation of SSC services.

The framework for SSC implementation should initiate with a detailed appraisal of the SSC project requirements, while considering the internal and external factors affecting implementation along with the benefits, barriers and risks. Based on the above, the level of importance of the factors should be identified so as to focus on the most important factors. Following to the above step, the development life cycle elements should be reviewed. This should be conducted in view of the PDCA and the PA stages, within the pre-during-post implementation. This step within the framework aims to reduce the discrepancies in the development of SSC projects, while achieving the objectives set, deploying the needed technology and integrating it in the current systems. Also, it will allow to build collaborations with PPPs and third-party entities to boost technology utilization and maintenance. Following the PDCA, the key actors involved in the SSC projects are identified and associated (delegated) with the SSC implementation responsibilities (as per the validation of the implementation factors). Any new factors identified during this stage are taken into consideration for revising the framework for any discrepancies and boosting the efficiency of the overall model. The new framework is aimed to support readiness for any resilience, innovation, future foresight and accelerations, thereby supporting future government and achieving citizen happiness.

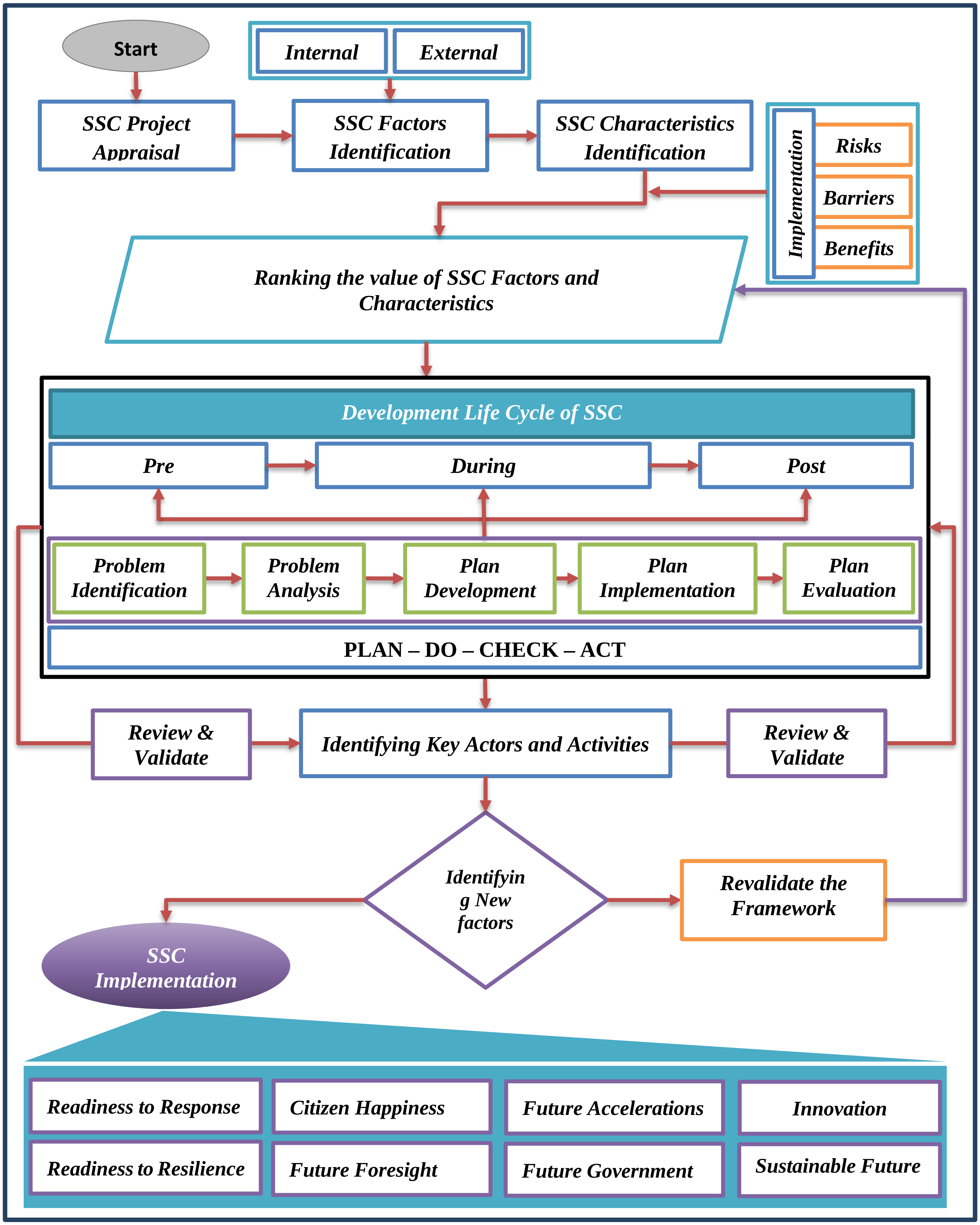

Figure 6-2: Frame of Reference for SSC Implementation

The researcher is hopeful that the devised framework will act as practical guide for managers as well as decision makers within the public sector organizations who are undertaking the SSC implementation as well as for those researchers who are further researching SSC concept. In the table 6.6, each of the stages presented in the figure 6.2 are outlined with the related factors and associated theories, along with the activities.

Stages	***Factors***	***Activities / Description***	***Theory***
Stage # 1 **SSC Appraisal**	Planning of project brief and techniques	Identifying the projects sponsors and stakeholders, with the receipt of approvals being in line with regulations	NA
Stage # 2 **SSC: Factors Identification**	Internal	Leadership	Institutional Theory
		Finance	
		Technology adoption and collaboration	
		strategic objective setting	
		business processes	
	External	Organizational	Institutional Theory
		Political	
		Economic	
		critical mass	
	Change Management	Change resistance	Institutional Theory
			Change Management theory
Stage # 3 **SSC Implementation Characteristics Identification**	Benefits	Technology	Drivers - Barriers Theory
		Strategy	
		Operations	
		Finance	
		Manpower and resources	
		Security and privacy	
	Barriers	Technology	Drivers - Barriers Theory
		Strategy	
		Operations	
		Finance	
		Manpower and resources	
		Security and privacy	
	Risks	Technology	Drivers - Barriers Theory
		Strategy	
		Operations	
		Finance	
		Manpower and resources	
		Security and privacy	

Stages	*Factors*	*Activities / Description*	*Theory*
Stage # 4 **Ranking of Factors**	SSC Factors	Internal Factors	NA
		External Factors	
	SSC Characteristics	Benefits Characteristics	NA
		Barriers Characteristics	
		Risks Characteristics	
Stage # 5 **SSC Development**	**Pre -** Implementation	Key Actors,	NA
		Good Practice and Activities,	
		Reviewed under PDCA requirements	
		Reviewed under problem analysis requirements	
	During Implementation	Key Actors,	NA
		Good Practice and Activities,	
		Reviewed under PDCA requirements	
		Reviewed under problem analysis requirements	
	Post - Implementation	Key Actors,	NA
		Good Practice and Activities,	
		Reviewed under PDCA requirements	
		Reviewed under problem analysis requirements	
Stage # 6 **Identification of Acts and Activities**	Key Actors	Government	Three quarter moon model
		PPP vendors	
		Users and Regulators	
	Good Practice	Government	
		PPP vendors	
		Users and Regulators	
	Key Activities	Government	
		PPP vendors	
		Users and Regulators	
Stage # 7 **Identification of New Factors**	Revisiting / Revalidating the framework	Testing and validation of new factors to identify relevancy	NA
Stage # 8 **Application**	Execution of the SSC framework	SSC factors,	SSC Model
		Characteristics,	
		Key actors,	
		Good practices	
		Main activities	

Table 6-8: SSC Implementation Frame of Reference – Checklist for Implementation of the Model

6.8 SSC Technology Architecture

For the successful implementation of any ICT architecture for a modern city, the following set of objectives needs to be targeted and achieved: law enforcement outlets and citizens must be allowed to take advantage of the state-of-the-art connectivity features, while also being guaranteed public safety. Synthesis of presently-operational public security systems is required alongside the chosen features and infrastructures, and extends this execution to public for disseminating significant awareness. Encouraging participation of integral users and public forces at all levels (local, regional, and national) from the onset of the SSC project is essential. Most importantly, it is important not to surrender to and overcome regulation and policy concerns such as, data security and privacy, interoperability, standards, and openness.

Developing a well-defined public safety service infrastructure must be the primary aim of SSC architecture. The infrastructure should be unified and networked appropriately, and supports consistent information and data sharing. Such an infrastructure design will enable public safety bodies (law enforcement outlets, municipal agencies etc.) in collecting, distributing and examining the data competently to aid decision-making whilst devising responses to events and emergencies. Several virtual layers play a significant role separately and cohesively when the model architecture for any city comes into design and implementation. Furthermore, to enable citizens to receive and share information, the delivery service channels will become touch points through which citizens can communicate. A centrally-integrated command centre will be the support-system of this layer, and it will conduct control and command tasks for the city machinery. The smart safe city platform will be the main ground where applications, data, IT infrastructure will be integrated to support the overall system. This layer will boast of a broad network and a setup of sensors which will be strategically placed throughout the city. They will supply input data to units responsible for data processing in higher levels and operators. The commands from processing units will be relayed to sensors installed in devices such as phones, CCTV cameras, and traffic panels amongst others.

6.8.1 Sensing Layer

The role of sensing layer comes to regulation and monitoring of environment is facilitated by the deployment of several class of sensors. Assimilation and uploading of data becomes possible as a result where the common sensing layer could combine and give access to other types of sensors.

The sensing layer benefits and value proposition as technologies collaborations for SSC as the following points:

- The sensor network which are on filed are built based on the similar to the sensory system found in a human body.
- It assists operators to visualize, perceive and evaluate situations, transmit situational awareness to the command control centre, conduct automated or informed actionable events.
- The different sensors work collectively and produce enormous amount of data which is then transferred to the command and centres and the operators then execute required actions on basis of stipulated procedures and standard commands.

The sensing layer is further segmented categorically based on its functionalities as represented in the diagram below and explained in detail.

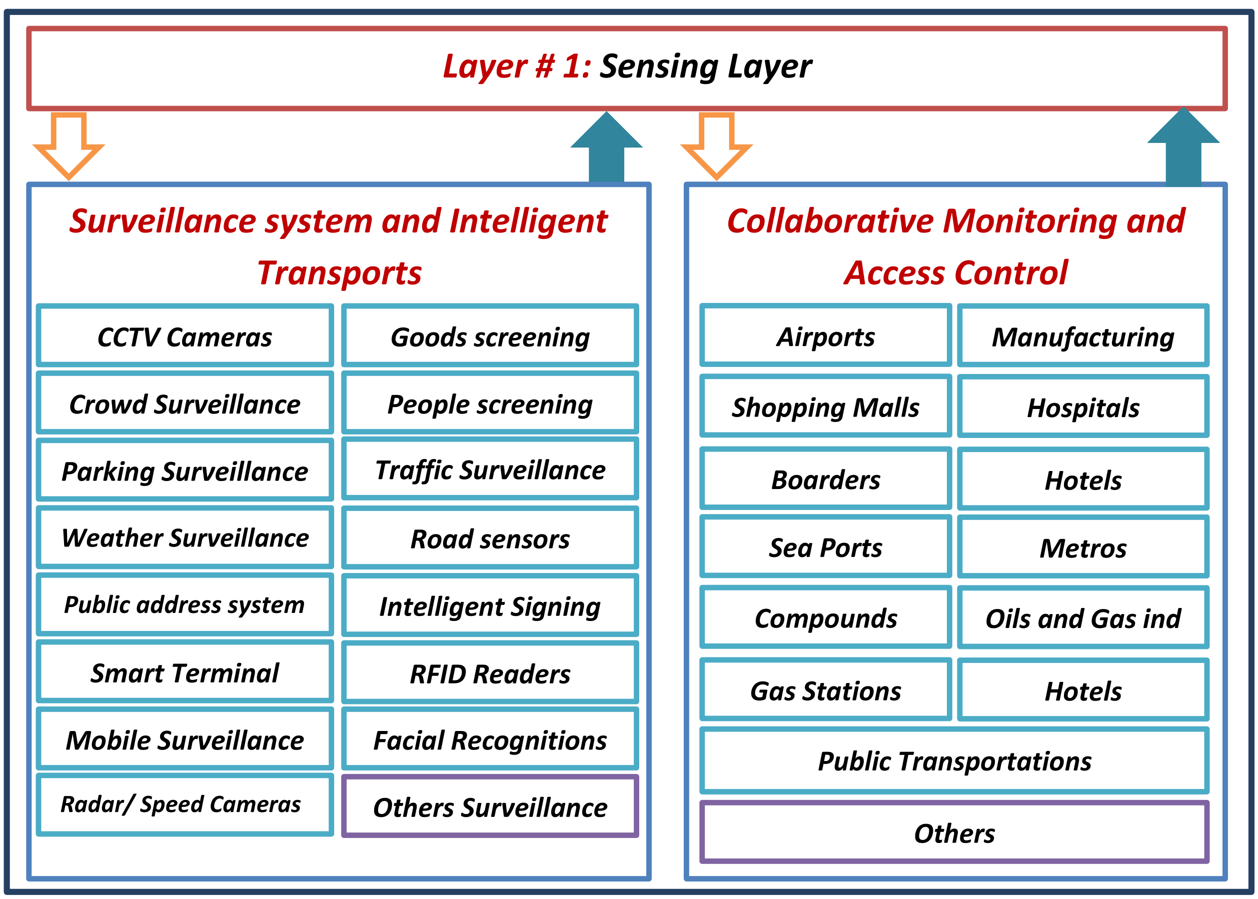

Figure 6-3: Layer # 1 Sensing Layer

In a SSC implementation, the surveillance sensors are an important element embedded in the sensing layer. It helps real-time surveillance to occur as the sensors collect data about government properties, public assets, traffic, and facilitates in detecting criminal activity. Public and private video surveillance resources are duly integrated to transmit live video surveillance, historical query monitoring, and precise intelligent data evaluation services. When the surveillance system is wired to the command and dispatch framework, it activates quick incident response thus enhancing protection levels of public security. Criminal and terrorism threats are also meticulously monitored by the system, which further aids in upkeep and maintenance of public safety and traffic activities respectively.

Given the SSC urban settings are constantly evolving and changing, the video surveillance system deployment must be equipped with features of flexibility, scalability, and future-readiness, adaptability to easily adjust to the growing needs and demands. The system is aligned with citizen assistance platform, crime investigation services, emergency helpline and response coordination, pre-warning, and disaster response stimulation framework. So as to support accuracy in video association, video location, case analysis, information dissemination and coordinated response, the surveillance system has centralised video management and prompt video indexing. The centralized video management setup is endowed with features such as video stream forwarding, video storage, video diagnosis, feature extraction, image recognition, and facial detection and recognition.

The access control and intelligent transport management system is an elaborate setup designed for assimilation and analysis of real-time transportation information so that system competencies can be enhanced. It can supply knowledge useful for creating services that meet the needs and demands of citizens, and also be resourceful in advancing the transportation model to become sustainable enough merge facets such as land use, economic growth and transportation strategizing. The system comprises of the elements such as automatic signalling system, enforcement camera applications, a specialized signalling system catering to the pedestrian and non-vehicular transport, citywide integrated traffic signal framework, consolidation IT systems for Bus Rapid Transit/ Transport System (BRTS), and smart travel cards.

For the purpose of precise supervision and monitoring by means of traffic size detection and automated coordination of traffic signals, the aforementioned devices and applications contribute significantly in transport management. Furthermore, they will also assist in overseeing traffic flow and traffic congestion. It will help enhance peak capacity and improve traffic flow on busy roadways. It will also render assistance in identification of traffic-law violations and execution of traffic laws (speeds included) and guidelines. In order to decipher images of vehicle registration plates, the ANPR system deploys optical character recognition, CCTV, specialized ANPR cameras or custom-made road-rule enforcement cameras. This system can be used by different sections of the police and it also applicable on pay-as-you-use roads which have electronic toll gates installed. It is a good instrument to monitor traffic or commuter movements. The standard functions of an intelligent integrated management system are shown in the figure 6.4 below:

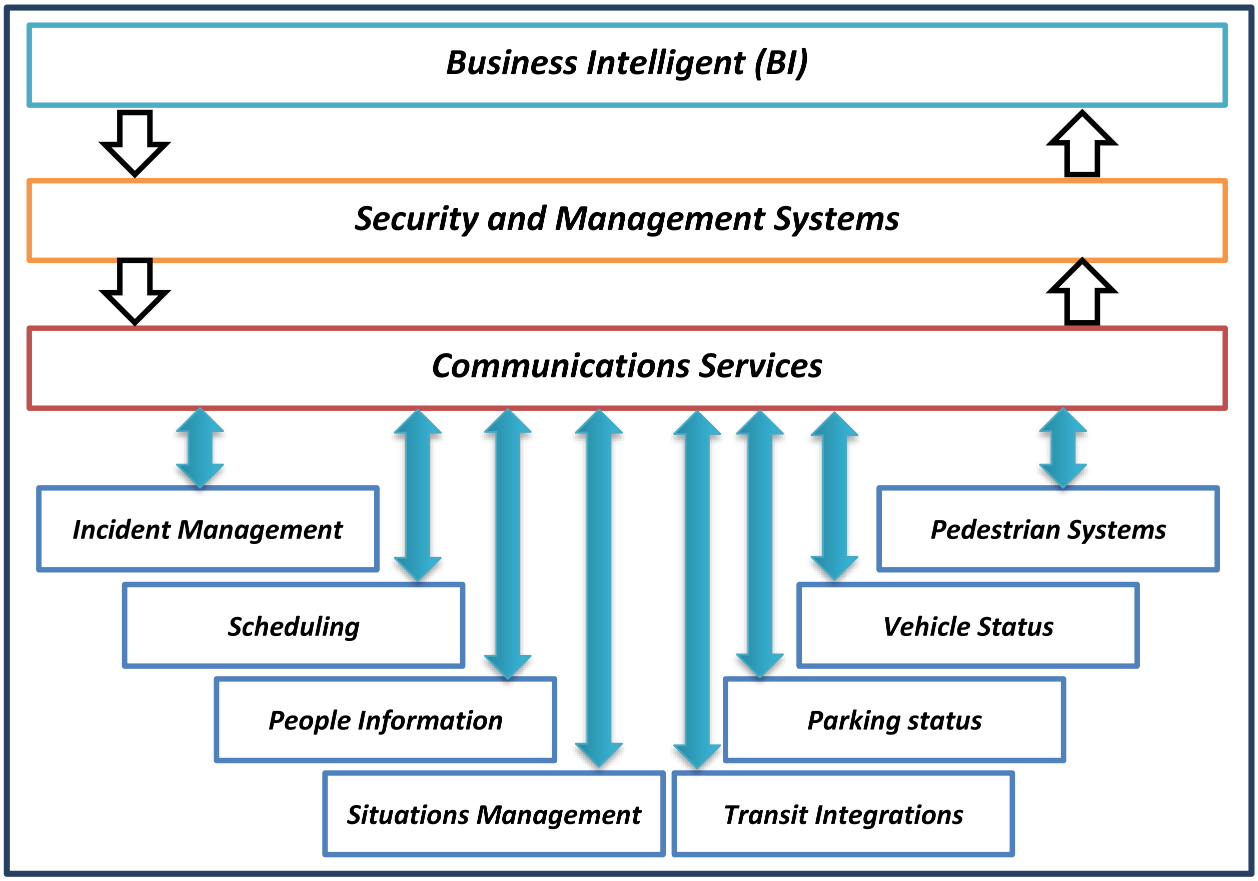

Figure 6-4: Intelligent Integrated Management

An intelligent transport management system comprises of the following superior elements:

- Surveillance cameras are useful for identifying incidents and monitoring directions of junctions.
- Enforcement cameras are available for catering to two distinct requirements namely speed detection (equipped with by magnetic or virtual loops to detect over-speeding vehicles and automatically record the vehicles' information in image format with the help of Automatic Number Plate Recognitions (ANPR) application or device.

- Single detection cameras are built to catch and record signal-jumping behaviour of vehicles.
- Automated signaling system helps to oversee and supervise signals from a central location (watching camera feeds or sensor-generated data) or deploying a localised area traffic controller device.
- Variable messaging system is serviceable for dissemination of real-time data. It is a critical tool as it helps in relaying important messages to commuters.

6.8.2 Communication Layer

Given how disastrous circumstances (overuse, congestion or natural/man-made calamity) can critically damage civilian wireless communications infrastructure, therefore an autonomous and highly secure communications system infrastructure. It is vital and needs to be place so that first-responder efforts can be successful. So, the role is similar to the nervous system of the human body, which is responsible for carrying and transmitting messages. In context of SSC, the communication layer will facilitate as an interactive channel amongst sensor layers, data and command centres. The most pertinent and modern communication technologies ought to be adopted for perfect execution of services in a smart safe city. Availability of various network devices to facilitate uninterrupted transmission of services which are safe, convenient and environment-friendly. Existence of ad-hoc networking as it permits communication data to pass to and fro the sensors in the absence of communication infrastructure. Having LTE or higher network guarantees high-speed delivery of data and video surveillance amongst on-field responder groups and also with central command centre, enabling video and data information sharing between active personnel so they can monitor the situation in air and on ground. Detection of Wi-Fi service areas (clusters) to connect to a Wi-Fi access point. Public venues (airports, railway stations, buses, malls, markets etc.), government offices, and miscellaneous places.

The figure 6-5 below shows the different types of communication network for SSC implementation.

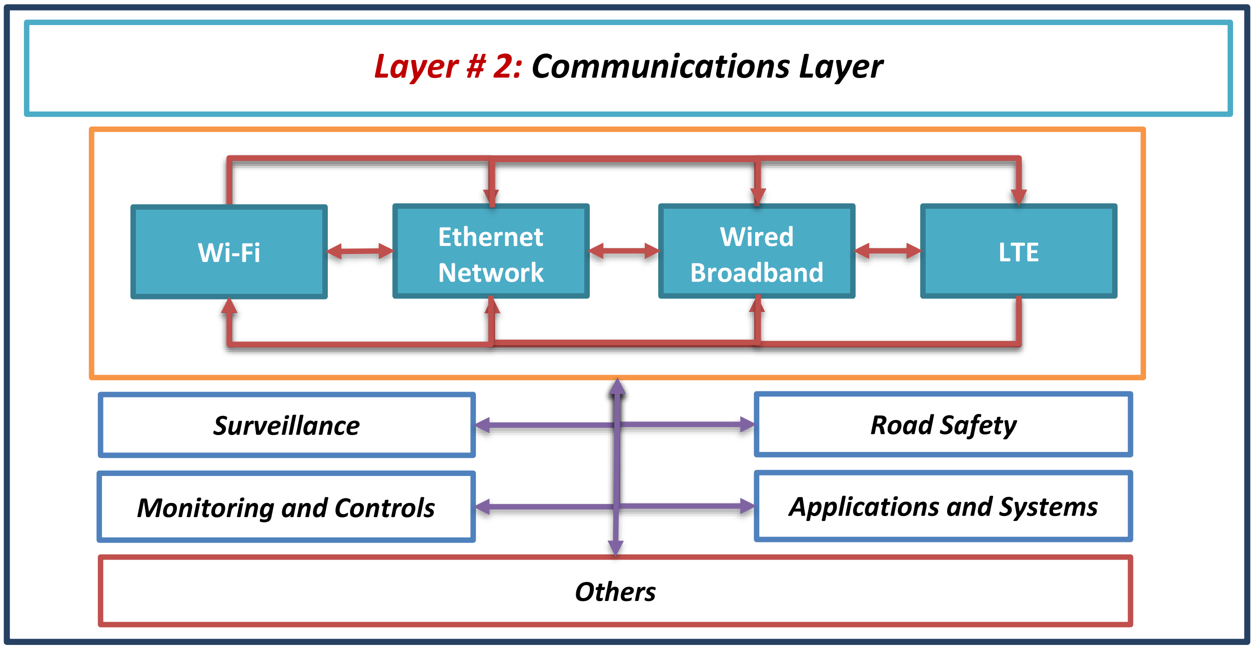

Figure 6-5: Layer # 2 Communications Layer

The main anticipated functions of the communications layers can be put forth as:

- Use of Overlay Area Network (OAN) with optical fiber connectivity combined with a LTE network to facilitate different connectivity preferences thus allowing ad-hoc interaction between mobile recipients and central command center.
- Avail highly consistent network connection and large bandwidth for prompt and proficient transfer of live video surveillance data.
- Centralized control and supervision of Wi-Fi connectivity and access points by Wi-Fi controller device is achieved.
- Broadband access (high speed) to make sure long-term smooth backhaul for high-definition video with the help of LTE and microwave networking LTE and hybrid energy materials that adjust to harmful settings and remove surveillance blind spots.
- Support enabled for non-line of sight (NLOS) and point-to-multipoint (P2PM). Microwave for multiple frequency spectra, high bandwidth, and long-distance backhaul is activated.
- User **A**uthentication, **A**uthorisation and **A**ccounting (**AAA**).
- Detect usage frameworks (charged, partially charged, partially vacant, etc.)
- Develop and establish an automated sensor network that regulates and identifies modifications in the public infrastructure conditions to make sure that adequate services are quickly and appropriately provided.

6.8.3 SSC Platform/ Podium

The SSC is equipped with all the facilities required to implement a city network that helps makes cities for habitable for their dwellers. In order to enhance the conventional city operations and service, the citizen empowerment and sustainable city competencies of the platform are subject to more innovation and focus is on improving the creative proficiencies of the cities and the dwellers.

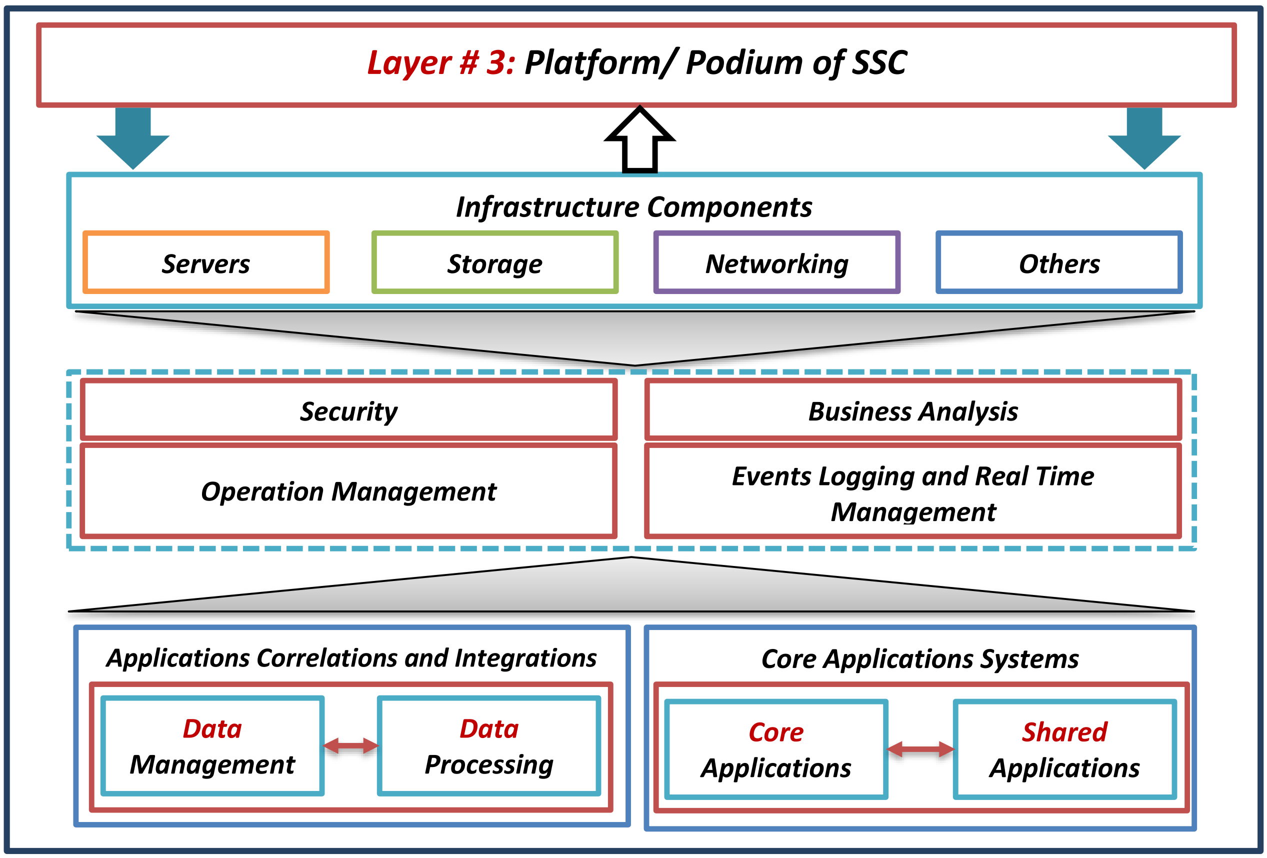

Figure 6-6: Layer # 3 Platform/ Podium of SSC

It believes that the government and citizens are collectively responsible in building a futuristic city; where SSC can:

- Boost and take advantage of modernistic advancements, citizens, SME's and other agents from all over the country as opposed to just a city.
- Participate and assist the multinational service-based environment by imparting and sharing schemes of open business with other cities.
- Establish a service framework that practices and delivers 'one-stop governance' from services integration, systems interoperation and service delivery by usage of intelligent actionable data.

The construct of this platform is based on three primary tenets of architecture: **(1)** ***extension of multipurpose components as required***, **(2)** ***system data regulation whereby data is standardized*** **and (3)** ***normalized through services involved and subsystems***, and also conventional format and user interface is supplied these enabling operators to characterize their ends respectively. Lastly, the execution of tasks in an integrated manner is needed. In the figure 6-7 below, a representation is given of SSC platform along with its many layers and blocks that allow the system to address to diverse smart safe city activities. A SSC framework can be further transformed into a SSC system by incorporating city sensors into the SSC platform.

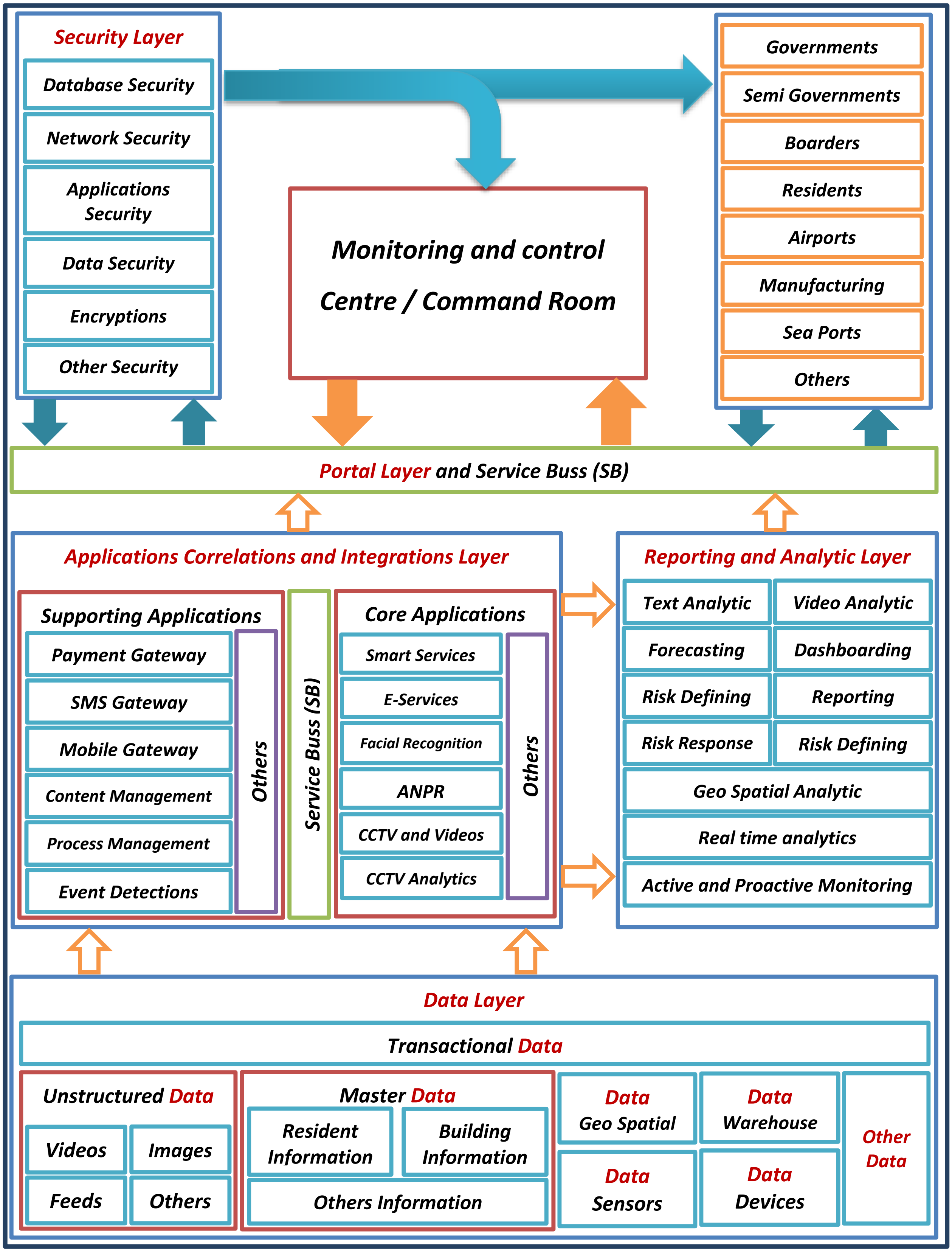

Figure 6-7: SSC platform and layers

6.8.4 Command Centre

Decision-making activities are executed from the command centre. It utilizes various concurrent and/or correlated information modes (ANPR cameras, surveillance cameras, road sensors) which allow the system to conduct intelligent enrichment of information. The aforesaid devices also enable operators to understand situations in real-time. CCTV operators also have other advanced visualisation capabilities at their disposal. These allow CCTV operators to view the city crime and traffic incidents maps (updated regularly), automatic 3D video tracking of criminals, and ability to produce relevant associated metadata video devices in real-time, and also log in to the memory repositories of events in the past (if required). The command centre is equipped with facilities which allow operators to perform functions such as pre-event prediction and warning, intra-event surveillance and command, in addition to post-event retrospective analysis and review. Capacities such as HD video recording, dynamic alarming, voice control, collaboration with other systems are available for performing the functions mentioned above.

The information from across the field is gathered by the command centre and converted into actionable data. The conversion takes place by transmitting the data to the best-suited resource to tackle that incident size and type. In many respects, the integrated command control centre is similar to the human brain. It process information coming from several sensor systems. It directs a sensor to perform a certain function in a particular way so that incidents are addressed in the most optimal manner. It collects, verifies and examines data in order to upgrade quality of incidental response for future. It utilizes technologies such as Digital Information Display (DID) and Digital Light Processing (DLP) screen splicing, which provide speedy image processing thus allowing multiple signals to be managed in a centralized manner. Real-time onsite information control and visual dispatching is activated so that the incident response time becomes improved. To attend to various events, an open platform is deployed for integration of CAD, ECC, customer care centres and alarm systems. For the implementation of SSC, the command and control centre will assist in overall city management therefore advancing the quality of decision-making, resource deployment and response time. The figure 6-8 below shows the different facets of a command centre.

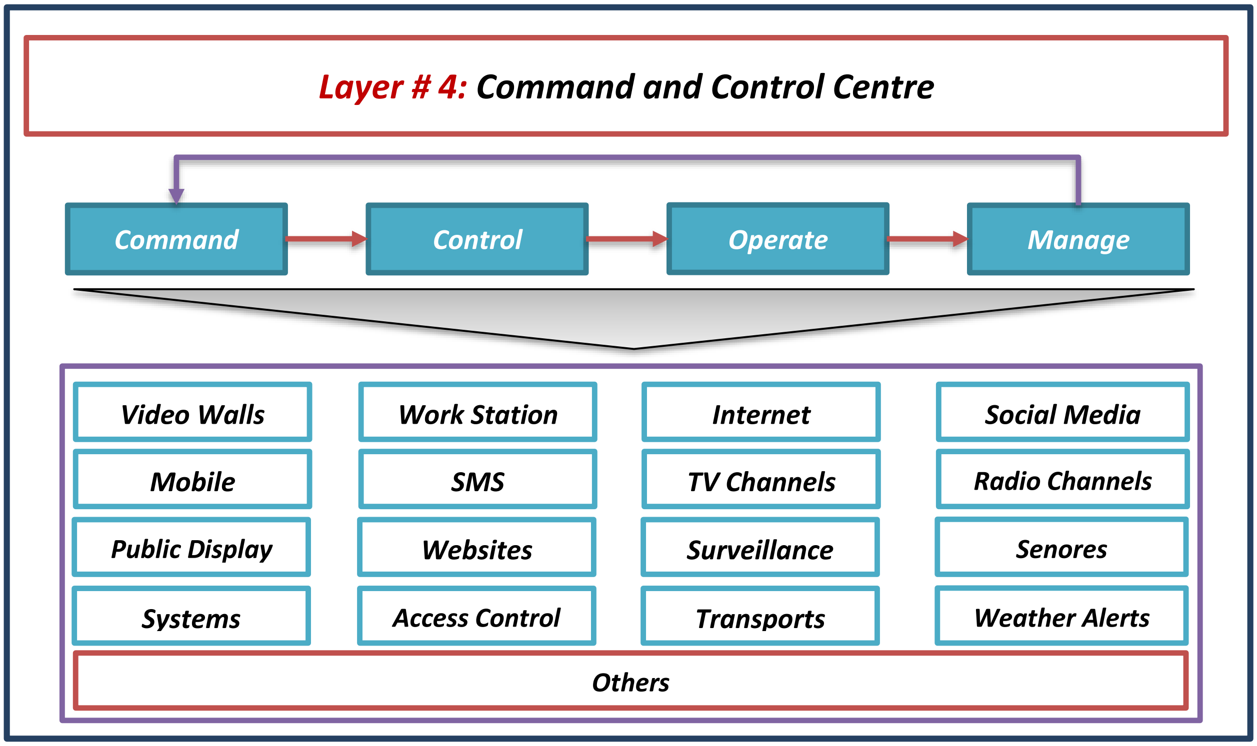

Figure 6-8: Layer # 4 Command and Control Centre

As desired functionalities of command and control centre is to be well-integrated centre and the following table 6-9 is summarizing the main responsibilities as follows:

Functions/ Responsibilities	*Descriptions of the Functions/ Responsibilities*
Command and control	Operations such as HD video recording, voice control, dynamic alarming and synergy with various other system frameworks from sensors, surveillance systems, and different public utilities are supported for achievement of strategic and response-based goals and targets.
Communication	It handles interaction with the on-field devices and different stakeholders involved, to tackle decision-making activities and incidents in general.
Computation	Real-time data is computed so that correlativity between events can be established, on the basis of SoPs.
Intelligence	Using past events, the quality of integrated operations and regulation is further improved upon. It also assists in pre-event forecast and warning, post-event retrospective analysis and review, alongside intra-event monitoring and command.

Figure 6-9: Command and Control Centre summary of the functions

The figure 6-9 given below illustrates different functionalities supervised and maintained by the command and control center.

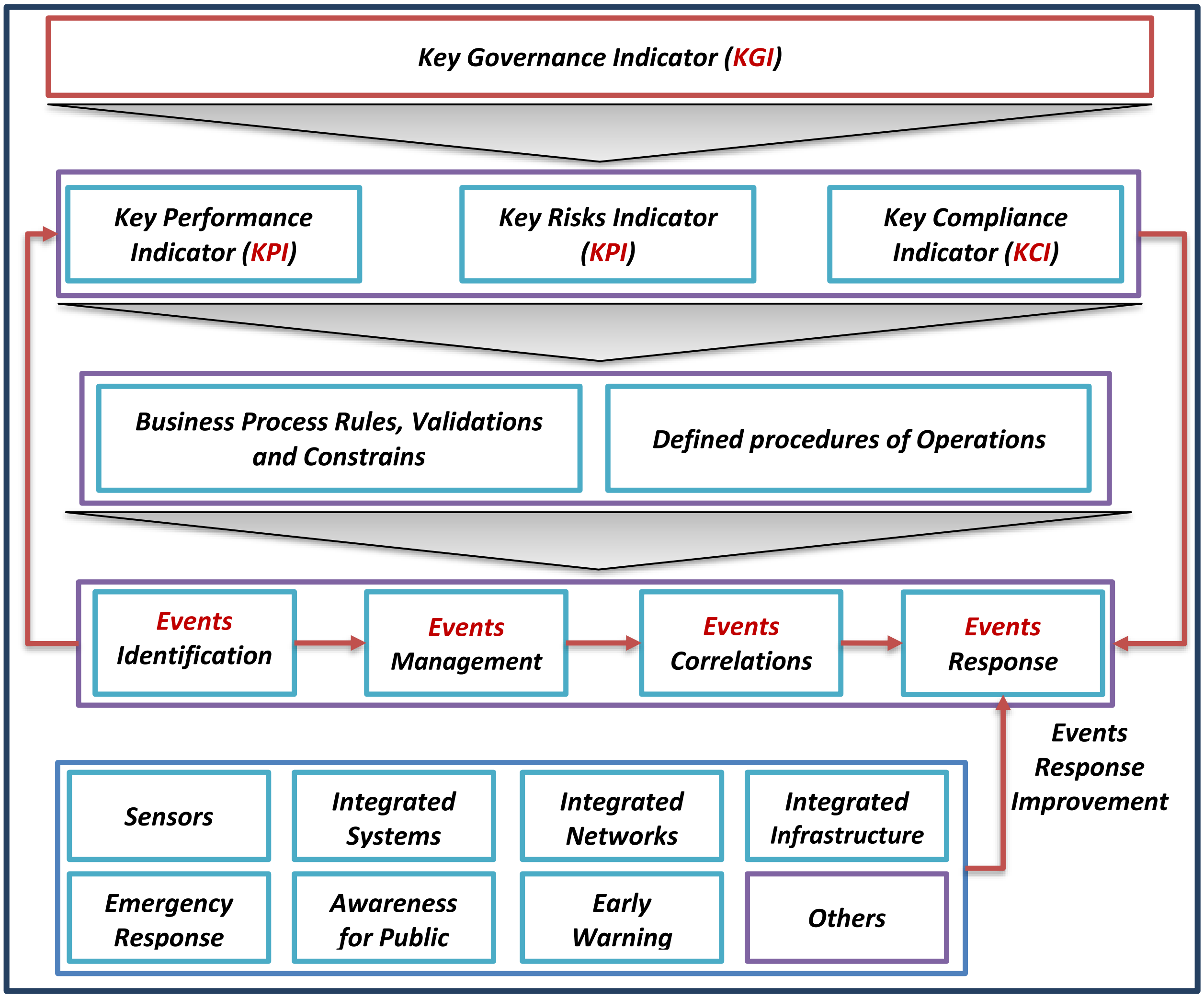

Figure 6-10: Functions maintained by Command and Control Center

6.8.5 Service Delivery Layer

The service delivery layer is described as a system that is knowledge-based and useful in the decision-making function, and it also supplies interaction tools and many other safe smart city applications to the authorities responsible for public safety. The user interfaces are equipped with secure web services which can be accessed by operators to record data for real-time sensing information. Recordings are accessible and the relevant assistance tools enable the operator to predict future situations and events as a result. The service delivery layer is lined by numerous interactive settings using which information can be accessed through smart safe city system and relaying alerts or notifications. A representational diagram outlining the main components used for service delivery is shown in table 6-9 below:

Delivery Service	*Descriptions*
Mobile devices	The live feeds and data produced by the sensors (from the command and control centres) could be viewed on mobile devices such as smartphones, tablets, iPads etc. The smart safe city network could be accessible on these devices, so long as the users have permission from authorities to do the same.
SMS	Similarly, SMS alerts can be sent on registered mobile numbers of registered users in the system
Email	Email alerts can be sent to email addresses of registered users in the system
Social Media	The new trend of service delivery and communications to public mass, since it's hugely used by public and easily reach to every one with a very cheap cost.
Kiosks	Information kiosks serve an ideal platform to show and spread information in the public. The kiosks can be placed strategically placed at venues frequented by commuters such as main roads, main markets, and popular public places. The kiosks can showcase awareness information related to road traffic and safety.
Service help-desks	Customer-care services can be made available by setting up dedicated call centres. The customer care representatives will notify registered users information regarding current traffic statuses and other relevant events. Public can call on any of the customer care numbers (Toll-free) to acquire information

Table 6-9: Service Delivery Descriptions

6.8.6 Data Flow

The key directive for the platform is to facilitate smart management of SSC activities. The communication layer is the main component as all kinds of data (images, audio, video feeds, alerts, etc.) first travels from the sensing layer and is then dispatched to the smart safe city platform from the communication layer (where data processing and management occurs.). The data is subjected to further processing and analysis by the several applications which exist at the smart safe city platform layer. The output particulars are then sent to the command and control centre. The final reports or outcomes are received by the service delivery layer where they undergo further processing for incident management actions (a requisite.)

A holistic framework is used for a comprehensive list of emergency data exchange standards built to assist in logistics, operations, planning and finance. With the help of this framework, all of the alerts and notifications get regulated throughout hazards of all kinds, including natural hazards (bad weather, natural fires, earthquakes etc.), and also hazards related to law enforcement and public safety. The framework can be utilized an prototype for the alert concept, inclusive of factors such as category, scope, status, severity, certainty, urgency, start time, time of expiry, type of response, instructions etc. The flow of data pattern in the SSC platform can be extensively described as follows:

Data Flow	*Descriptions*
Flow of Event Data	An event message is transmitted to the system, at which point several, rules undergo processing. Afterwards the message is included in the internal data store. When the reader collects the event message, the set policies become system-activated and the message is refined as necessitated. Soon after it is positioned in the database and the presentation layer gets notified to make an update. At the same time, the data provider also receives a notification regarding the data being made available for end users.
Flow of Notification Data	A message alert is dispatched to the system after which it gets queued in the notification queue. Before the message is put in the data store, several rules are processed and incorporated in the message. The message then gets transmitted to the presentation layer by the impact notification policy.
Flow of KPI Data	Prior to getting placed in the internal data store, the KPI data is forwarded to the system wherein several rules are refined. When the reader collects the event message, the prescribed policies get system-activated and the message undergo processing as required. Afterwards, it is incorporated in the database and consequently the portal server receives an update. Hence the KPI provider detects the change and the GUI is updated accordingly.

Table 6-10: Data Flow on SSC Platform

6.8.7 Role of the portal and GIS

6.8.7.1 *Portal*

Service status and important information of application need to be duly conceived and ascertained respectively to facilitate timely predictions and responses to situations and changes. The platform is compatible with the user interface design. The information structure is flexible and overall appearance is conventional. A portal is described as effective when it is operated by the following components: Delivering critical information in a simplified manner to decision makers, combining different and reliable sources to supply extensive data about infrastructure, operations, service status, and domain business, providing summarized information which is easily expandable for further details, giving notifications based on real-time data, facilitating prompt analysis and response, displaying pertinent information throughout views (powerfully-linked). For instance, on selecting a detail on a geospatial map, all other relevant information appears on the associated views, and lastly, having a permanent appearance so that the user-interface is easy-to-use, and learning time and confusion is minimal. Every type of user is likely to need different informative details. To cite a few examples: Executive users demand most important facts (in form of charts and scorecards) so as to view the overall scenario, detail-oriented users require information which is comprehensive and utilize raw data in case of programs that are purpose-driven, and analytic users access data to examine it more analytically.

6.8.7.2 *Geographic information system (GIS)*

GIS has been regarded as a major area of crime analysis and policing strategy and in the context of crime mapping facilitates it helps in mapping, analysing as well as visualizing the crime hotspots followed by other trends and patterns. GIS is based on the usage of geographical and computer-generated maps that act as the interface for getting access to huge amount of location based data. It further allows the police personnel to plan for an emergency response in an effective manner followed by determination of mitigation priorities as well as analysis of historical event and prediction of upcoming events. It can further be utilized for transferring crucial data to emergency responders upon dispatch to assist in support of tactical plan/response to an incident. A role is further played by GIS in the identification of possible crime sites which is done via examining the difficult and unrelated criteria followed by displaying them in a graphical and layered format or a map. Integrating the GIS and video surveillance systems has led to proper security as well as city management. It further aids in the provision of spatial temporal information on a real time basis which is then displayed on the electric map. The technology is inclusive of mapping between videos and maps followed by keeping a track of dynamic objects. The command centre in the context of incident processing can get access to onsite HD snapshots that generate comprehensive information which then aids in simplifying the decision making. When there is an activation of emergency contingency plans then command centre makes use of dispatching system for deploying police as well as medical resources. Seamless communication is then ensured by the trunking communication system which then sends onsite data to application systems so as to improve collaboration between cross departmental service. GIS has been considered as a highly valuable tool for carrying out safe city initiatives and it assists the police and law enforcement agencies in many ways which are described as the following:

- ***Identification and visualization of crime*** hotspots so as to understand crime patterns and trends.
- ***Prevention of crime*** by the provision of valuable information in an effective and holistic manner.
- ***Strategizing of police beats and patrolling***.

- ***Zeroing down the crime*** hotspots and finds out the measures that can be taken for making the city safe.
- ***Periodic indication of interactive*** aoristic output through graphs.
- ***Assessment of the timeline*** so as to indicate the crime patterns (monthly/yearly basis).

When the above-mentioned factors are placed on spatial map then it helps in decreasing rates of street crime as well as the ones done against females. This is followed by improving the overall effectiveness of investigation through provision of precise location about the victim and the offender.

6.8.8 User management

In a sophisticated system such as SSC that boasts of various types of sensors and numerous layers of equipment and network, having a fool-proof user management system is imperative. There can be tremendous traffic of users who would want to access the system to execute different actions. This platform is equipped with monitored user-management guidelines so that only authorised and prioritized access is allowed and stability of system processes, maintenance of information confidentiality and system-upkeep is well-placed. There is the facility for a role-based sign-in system that allows individuals on the basis of their role in the SSC implementation hierarchy. Individuals that hold positions administrators, supervisors, officers, and operators, amongst others will be allowed single and multiple logins into the system. Other than role-based login, the system is also equipped to allow location-based access to users. The core facets of the user management system are as follows:

- The management unit is equipped to record basic information (email ID and mobile number) of personnel (police and others) that need administrative or viewing rights.
- The interface is enabled to make and set changes in basic information after proper verification.
- Administrators are endowed rights to create new groups and assign them to one and another.
- An intuitive interface is also been incorporated and it permits delegation of administrative roles, and authenticate and monitor group members, thus giving group managers powers to supervise their respective groups and permissions.
- Role-based rights will be delegated to different faculties, sub-faculties and functionalities, and appropriate log reports are preserved by the system recording such access behaviours.

- In order to ensure that only authorised personnel login is permissible, biometric standardisation measures along with usernames and passwords are provided.
- The surveillance system is lined with camera mapping facility which is relayed to police personnel at different police stations. In case of PTZ camera, specification of role within the hierarchy is necessary for authorization to operate the cameras from various venues.

6.8.9 SSC platform extensions

Collaborative regulation is a significant facilitator. In UAE, every public and private sector outlet has become aware of the need to protect their infrastructure and set up surveillance along with supervision and incident response systems, data collection and sharing amidst each other is also deemed as an important tactic. On-board surveillance systems are already being installed by government departments- mainly aviation and transport. The surveillance systems provide CCTV cameras surveillance to be installed in airports, public buses, bus depots, metros and railway stations. Under collaborative monitoring, these systems can efficiently circulate information in real-time with security outlets. Likewise, CCTV-systems implemented in private bodies such as malls, entertainment houses, business parks, and others can generate live feeds which can be relayed to the command and centres set up across the city. These real-time data can serve as a valuable resource for security agencies. Surveillance installations have been implemented by various public and private institutions and businesses across many cities worldwide. These cities benefit from collaborative regulation to get video-based data which is sourced from various systems so that prompt real-time responses can be guaranteed. Apart from elements of CCTV surveillance, many other services can be incorporated and integrated into the smart safe city infrastructure. Some of them are outlined as under:

SSC Services	*Descriptions*
Land and estate management	A system of such kind can help in real-time regulation and supervision of real estate projects by the owner, Construction Company, Government or local municipal body, and even customers/investors.
Parking lot availability automation	A parking lot management system could be an appropriate application at venues such as airports, railways stations, bus deports, tourist locations, and marketing. By deploying a safe smart city infrastructure of such type, it will convenient to acquire information (via SMS, VMS, kiosks, etc.) pertaining to parking space availability.

SSC Services	*Descriptions*
Emergency call box system	Such a system would facilitate citizens to contact the police department promptly in case of emergency. This application can be implemented by installing high-quality digital transceivers across strategic public venues. In some places, the information could be relayed publicly
Public address system	A public address system at particular public locations and venues can be incorporated with the smart safe city platform and it can be duly used in times of emergency or crisis. The use of this sensor could be regulated
Variable messaging signs	This can be a useful for giving pertinent and important information to commuters on the move; these can be placed at strategic road location
Other sensors	Air quality sensors, temperature sensors, flood water sensors, fire and smoke sensors. Green city initiatives along with GPS-enabled devices installed in public and private modes of transport are some other examples that could be incorporated with the smart city platform.

Table 6-11: Services integrated with SSC systems / platform

6.9 Over all SSC architecture

Smart and Safe City is using each and single data by integrated all relevant resources across city using a unified management and analysis platform. As discussed earlier, SSC gives a details visibility to various systems across the city which provides actionable information on real time for the current situations. SSC comprises of integrated command and control centre, integrated network, video searching, chains of various integrated application systems, monitoring and alarm subsystems, CCTV and Collaborative Monitoring, information security management others.

This increases the interoperability, Colorations and collaborations of various systems for the purpose of urban public safety, discussed on the SSC layers the following is constructed layer based on the structure / architecture of each layer for the smart safe city as the following:

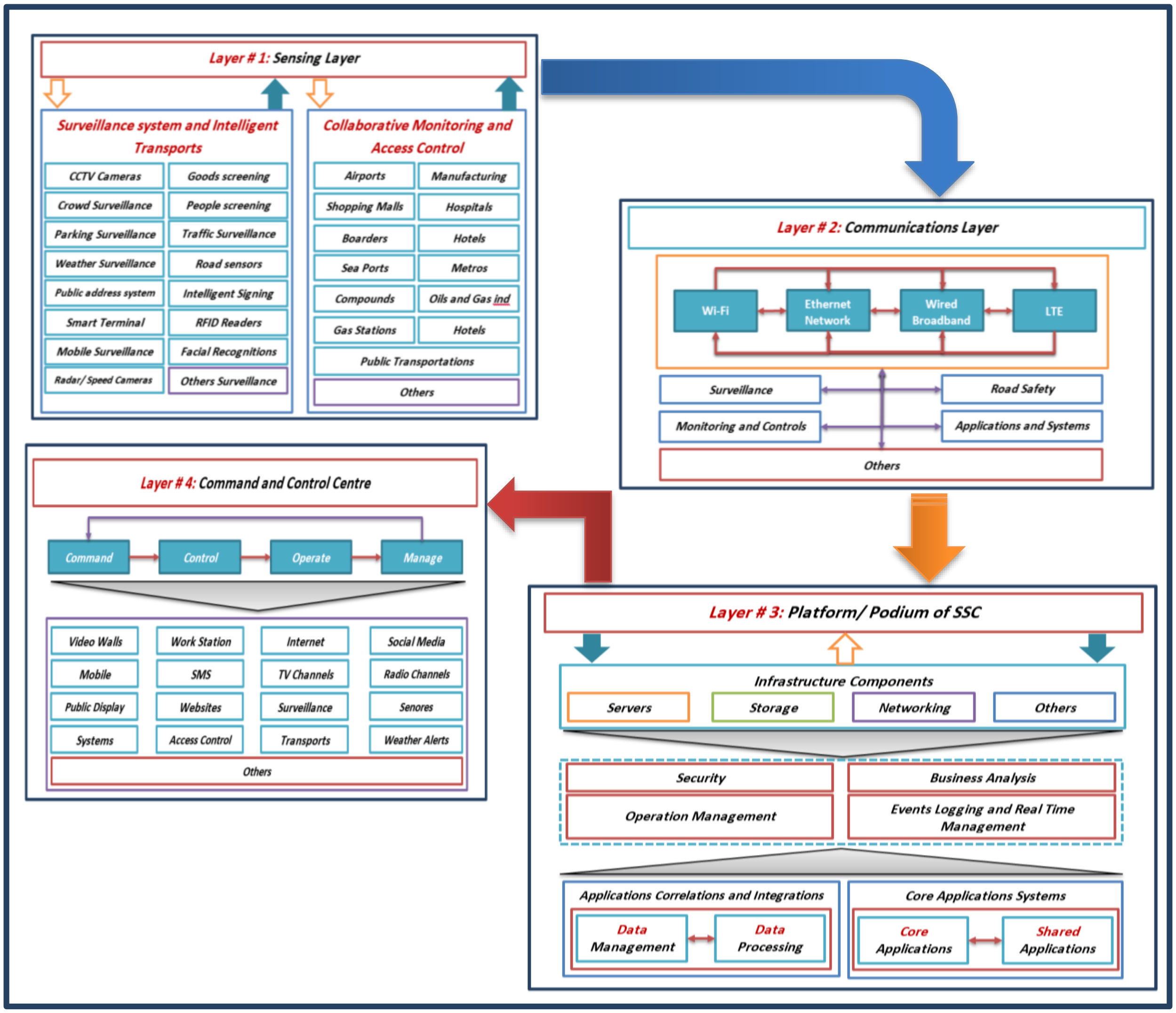

Figure 6-11: Safe City Layers Architicture

As discussed on Smart City definitions table (2-1); safe city is part of the smart city where there are lack of studies to study Smart Safe City to describe the ubiquitous connectivity features, information sharing, correlations and integration through the collaboration among the participant parties. The safe city in smart city share information via platform conveys numerous smart applications, such as Smart Government, Safe City, Smart Transport, Smart Enterprise, Smart Education, and Smart health. The following figure is showing the safe city position within the smart city, in addition to that it shows that in order to have smart city, safe city should be positioned utilizing the same architecture of the safe city.

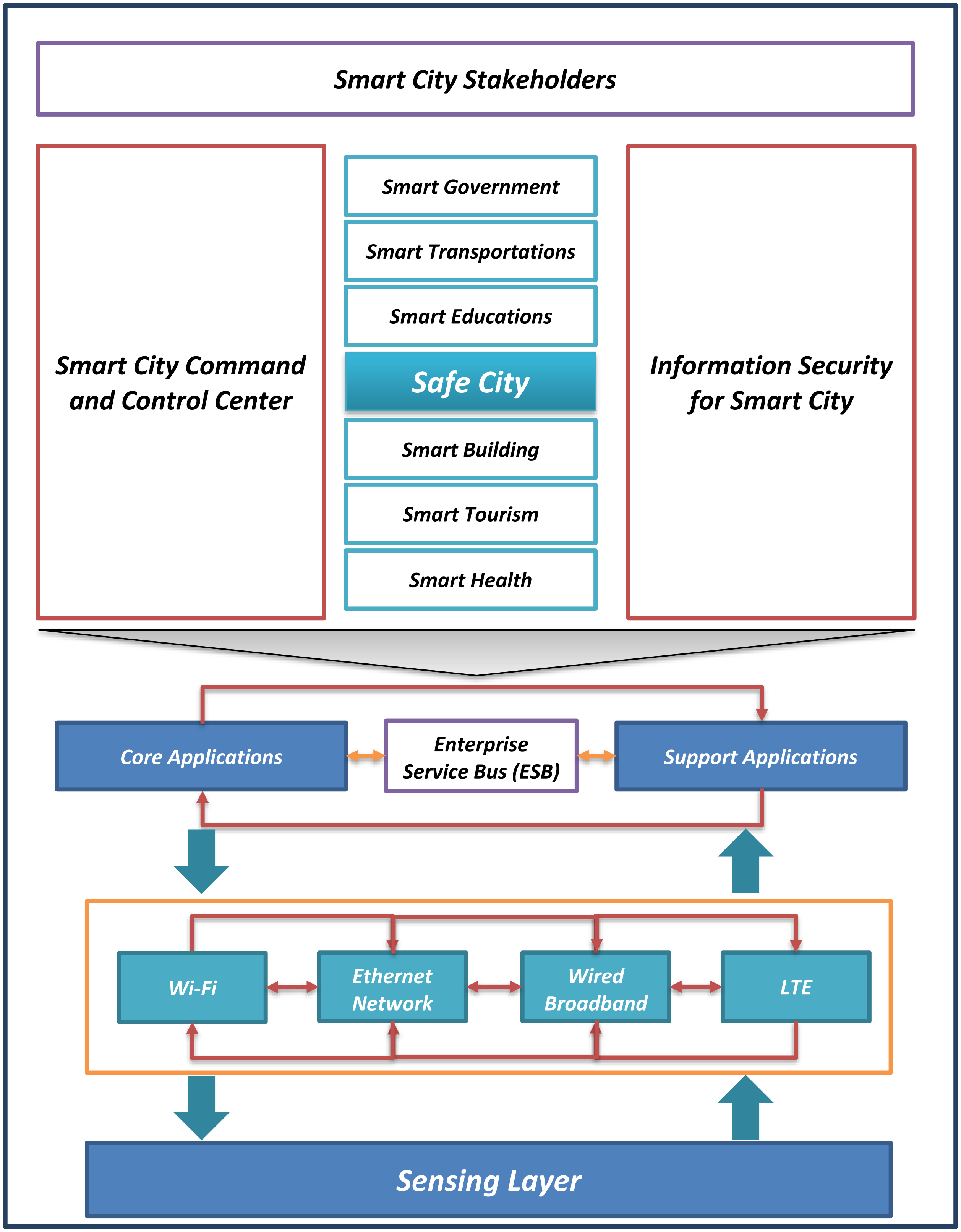

Figure 6-12: Safe City position within the smart city

6.10 Effective collaborations for SSC after build

For effective collaborations SSC should build integrations among others and not limited to agencies, government authorities, borders, etc, where figure (6-13) shows the defragmented approach SSC integrated componenets. Another important of SSC efficient management to have collective and collaborative infromations in order to manage the situations, the following table describe on summary the value propositions for SSC efficient management:

Requirements	*Descriptions*
Visual Command	let you feel that you are part of the event and visability on the situations "***Situation Awareness***"
Mobile Office	Keep connected at anytime anywhere
Integrated and Incontrol	Integrated data and collaborative will support proper decision
Collaborations	Enable details and accurate decision making details "***Situation Awareness***"
Dots crossing collectively	Provides various sources of information and early detections

Table 6-12 : SSC Efficient Management Requirements

The Smart Safw City command centre should be fully equipped with the technology and solutions supporting SSC operation and collbarations with varioud agencies to response effecintly by compining Data, Voice and Video to manage the incidents, also this will assess to response to any incidents before it occure, during and post the incidents for efficient incident solving which will make the city not only safe but also happy safe city.

The SSCcommand and control centre as discussed on figure Figure)6-8) layer of the Command and Control Centre, where the following figure will show the main integrations and setup of the SSC command to manage the incidents before, during and post figure (6-14). Where also as discussed on literature and on discussions about technology components of SSC where the figure (6-14) shows all the SSC connected with others and various devices and technology types to enhance collaboration of service.

To provide comprehensive security protection across the country; an integrated monitoring and surveillance across the entities to be established. This must be integrated on a way to be scalable, secure with high availability and reliable acorss the city to assure the response on real time with visability on the case. In addition should be integrated with the public and private surveillance, all the records with real time intilligen analitic. Once this setup is done; the command and control centre will assure the immediate response to any incident occure to protect the nation and public safety, this has to be supported with the proper technologies as discussed on the literature and the analysis.

Incidents should be managed: (1) before it occurs, (2) during the incident and (3) post the incidents, where the SSC should work on (1) preventing the incidents to occure, (2) Reciving the alerts, (3) incidents response and handling, (4) lesson learned. The following figure shows how the allignments and and activities on each step along with activities.

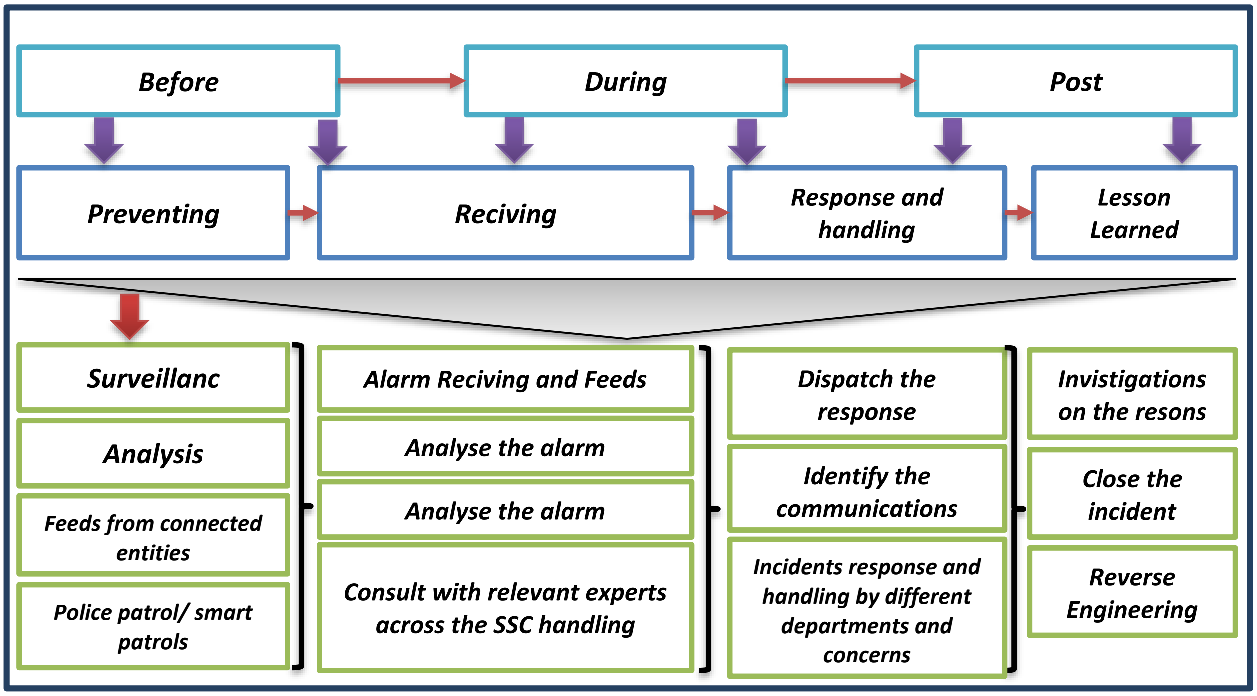

Figure 6-13: Incidents handling and stages

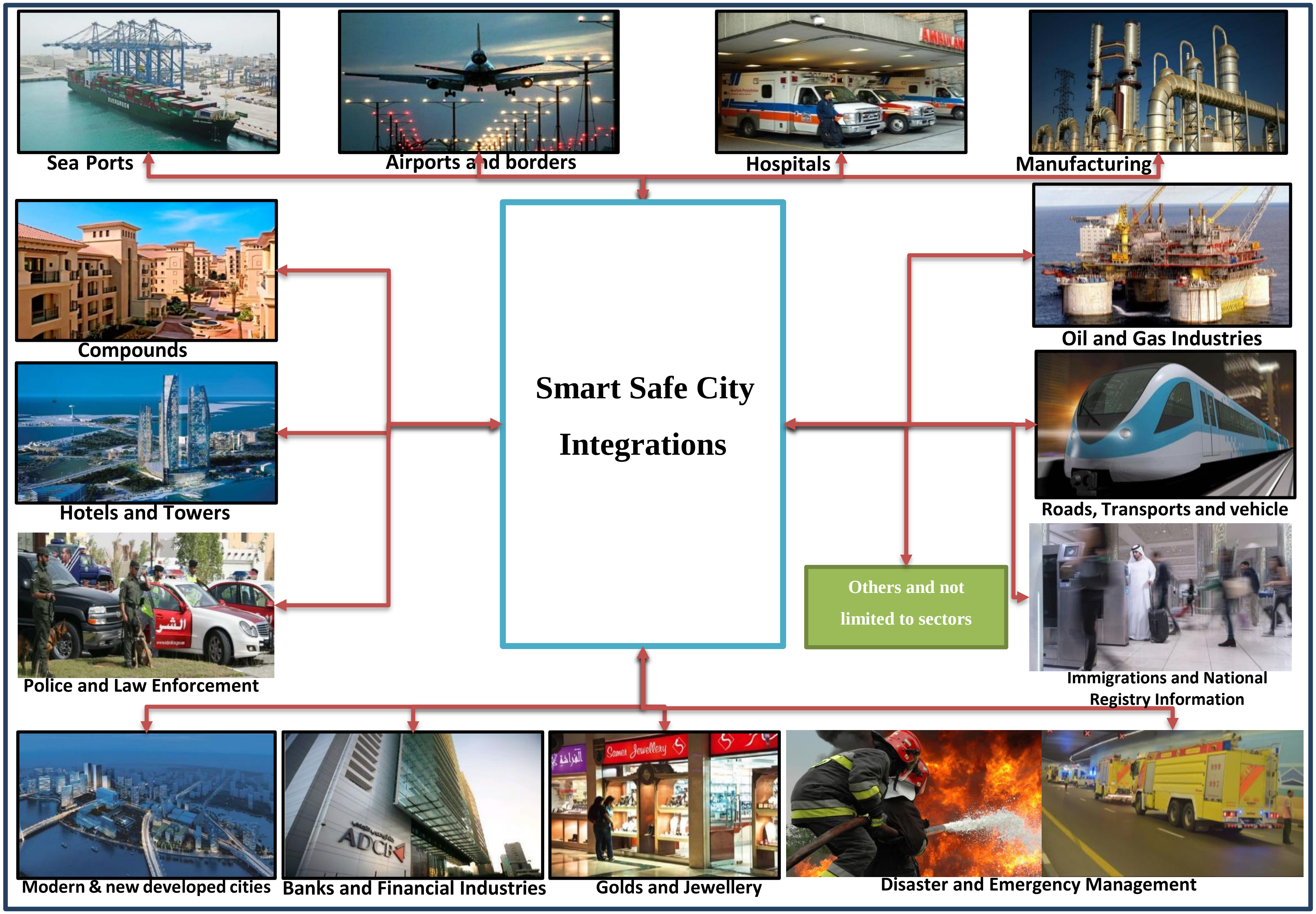

Figure 6-14: Defragmented Smart Safe City as Integrated Components

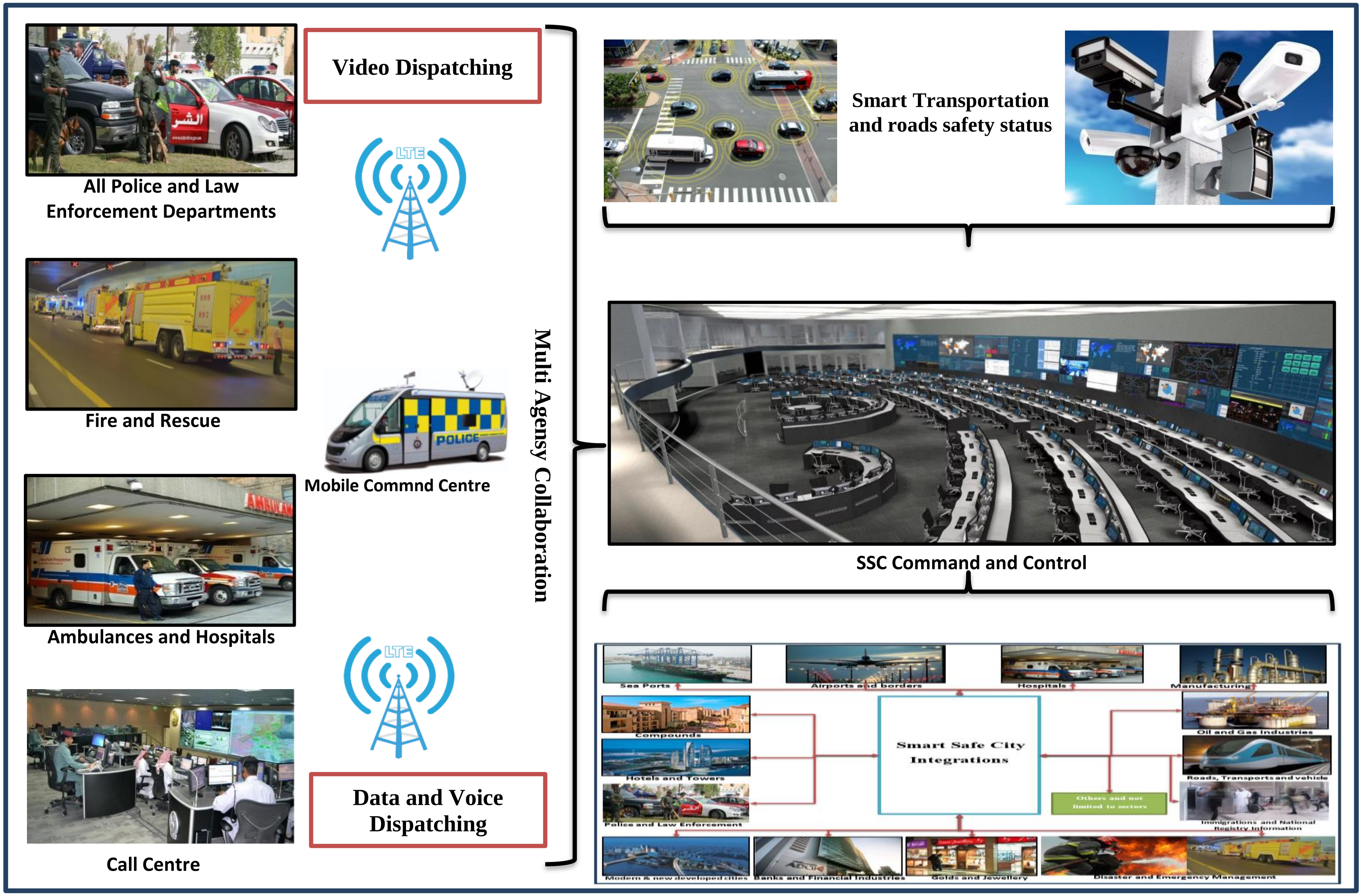

Figure 6-15: SSC Architicture conneted dots

6.11 Conclusions

The modified conceptual framework was developed as a result of the analysis of every factor contributing the framework as highlighted in Chapter 3 while tracing the factors of high importance powering the SSC implementation. The revised conceptual framework (Figure 6.1) comprises of the following:

1. The framework development for SSC implementation in the context of UAE is a one-of-its-kind framework which examines the factors influencing SSC. The research is centred on government to citizens context, and the institutional theory was used as the foundation for the first conceptual model in order to provide an appropriate theoretical construct for examining the SSC initiatives.
2. The framework comprises of SSC concepts and issues that are considered to be benefits, barriers and risks. The drivers-barriers model (Hamed et al, 2008a) has been intentionally picked, but its aspects were afterwards generalized for clarity and also for detection of more factors that are seen as either driving elements or obstacles to the SSC initiatives.
3. For the purpose of identifying the key actors in the SSC implementation process, this research study utilized the Three-Quarter Moon Model (Hamed, 2009). The model is useful for developed and emerging countries – such as the UAE – and suggested with the government-to-citizens perspective. However, the model was further simplified so that it could be utilized with the citizens' perspectives too.
4. The revised conceptual model includes approaches to change management and requisites in SSC, and they could be utilized as a key guideline while supervising change at the time of SSC implementation. Furthermore, the Deming Cycle has been incorporated to complete the conceptual framework. The Plan-Act-Check-Do (PADC) cycle and the Problem Analysis stages are an important component of the framework as it helps the government to decide its course of action.
5. It is a useful instrument for governmental bodies, stakeholders and decision-makers in specific to apply changes in the SSC implementation, and it will also lead to increased understanding of the decision making process.
6. The framework contains a list of constituents and factors which could be tracked and lead to identifying more factors and possibilities to revise the model further to match with the research objective.

7. Assessing the conceptual model from an academic standpoint, it is weighted by constituents which deliver understanding of the issues, concepts, barriers and risks that impact SSC initiatives and the manner in which decision makers are supposed to execute their services, taking into account all of the issues and concerns (priority-basis) along every phase of the development life cycle.
8. As the main contribution, the researcher developed the technology architecture to strengthen the 'safety' aspect with the SSC framework. The architecture presents the framework for successful adoption along with the challenges to technology layers for SSC.

In the chapter 7, the research findings are presented in light of the results and discussion raised in the chapter 5 and the revisiting of the framework in chapter 6. Also, the chapter presents the recommendations for future research and for planned cities to take into consideration.

7 Research Conclusions and Recommendations

7.1 Introduction

This chapter puts forward the thesis by analysing the crucial components encompassed in the research study and extracting conclusions from chapters 1, 2 and 3. This chapter also provides summary of the findings, discussions pertaining to the theoretical and practical inputs to the construct of information and knowledge focusing on the smart city initiatives and implementation in the UAE public sector companies. After the research limitations are established, the next section to follow is the Recommendations wherein more research inputs on smart city implementation are made for the UAE governance. This, to make sure that successful execution goes through planned cities.

7.2 Research Overview and Findings

7.2.1 Research Overview: Chapters 1 – 7

The concept of smart cities is pillared to making government data accessible for the general public, businesses, and workforce. It takes cue from the private sector by providing citizens and businesses with public services which are well-organized, transparent and easy-to-access. The competence of SSC, as a result, is certainly associated with the availability or lack of public accountability (Caird et al., 2016; Lom et al., 2016).

Chapter 1 of this thesis elaborates the concise background to the context of research and confers the meaning and impetus for taking up this research and analysis on SSC implementation in fast growing countries such as the UAE. The chapter also put forth the aim of the research, which is to examine and analyse the kinds of principles that should lead positive implementation of SSC structures in developing geographies. For the purpose of accomplish the aim of research, this research endeavour focused on the 3 key research questions:

(1) What are the external and internal aspects weighing in on the SSC implementation in public sector in regard of fast growing countries so as to initiate a system that is transparent and up to standard?

(2) How do this aspects and traits benefits, barriers and risks, impact smart city implementation process and what are the repercussions which may surface from this implementation? How are we able to number and map these aspects and traits on basis of priority, and if or not we are able to recognize new aspects and traits that have not been mentioned in the literature review?

(3) Identify who are the main actors participating in the smart city implementation process, and what are their primary tasks and activities throughout its start-to-finish cycle? What is it that makes decision-makers able to recognize and deal with any obstacles that emerge in the implementation process of smart city systems (including issues of change management)?

Chapter 2 is the Literature Review. It comprises a review of all the pertinent literature sources on the subject of smart city concept and characteristics respectively. The review elaborately illustrates about the theoretical factors comprehensive and motivational and framework that have an impact on smart city implementation. Furthermore, a detailed summary of the SSC aspects and traits including benefits, barriers and risks were also presented at length, using taxonomy for classifying the same. The brief description of project life cycle, stages, were also discussed in the contents of the literature review, which guided to giving an input to the subject of smart city implementation albeit from the government-to- citizens perspective.

Further down in the contents of Chapter 2, certain key SSC theories were introduced in detail, ones that are relevant to the smart city implementation. The theories include Government Key Business Process (G-KBP) model, Adaptive Structuration Theory (AST), Stage Growth model, Theory of Reasoned Action and Planned Behaviour (TRA/TPB), Triangulation model, Institutional theory, Three-Quarter Moon model and the Drivers and Barriers model.

The research endeavour made an attempt to give rationale to the espousal of the institution theory above the various others, few of which was due to that fact that the theory was applicable when combined with other theories, and also because of its flexibility. The chapter also elaborately contemplates on additional models like the Comprehensive Barrier Framework (Lam, 2005), he Driver-Barrier model (Hamed et al, 2008a), and Three-Quarter Moon model (Hamed, 2010). The explanation for the usage of the aforesaid models in concurrence with institutional theory was discussed in length in chapter 3

In chapter 3, focal theory, wherein the attention was paid on the research issues identified in chapter 2. This allowed for the identification of the loophole in the literature in relation of absence of combined theoretical outline for gathering a comprehension of smart city implementation, particularly in emerging countries. On the basis of this identified research gap, this chapter aspired to design a framework that would be appropriately suitable for this analytical study.

As a result of the aforesaid analysis, a conceptual framework was drafted to motivate enhanced sense of the implementation procedure and the many aspects and traits the influence on smart city. Other than comprising of the internal and external features, the suggested framework, allowed for the use of the institutional theory coinciding with other theories such as Comprehensive Barrier Framework, Drivers-Barrier model, and Three-Quarter Moon model. Consequently, institutional theory approves for further useful and practical directives for decision making parties and enforcers of change (Hamed et al, 2008a; Hamed, 2010; Lam, 2005), and also it allowed for the use of theory and others to be validated for putting forth a conceptual framework that facilitate the comprehension of the features and matters which impact the utilization and implementation of smart city systems.

Chapter 4 covers the research methodology segment of the research thesis wherein the data theory was introduced. The chapter encapsulates the epistemic attitudes, elaborating as to why interpretivist paradigm was chosen to the others. The logic for the aforesaid choice is because, interpretivism, when used to Information Systems, results in gathering an understanding of the information system context, and the procedure through which the information system impacts or is impacted contextually. Moreover, it conceives qualitative data that is abundant and subjective (Collis & Hussey, 2009; Walsham, 1995; Yin, 2003).

Above and beyond the research paper vindicates, the range of qualitative analytical method as it appropriately suits within the prefatory research analysis, and is deemed the most apt for a case study endeavour. Cordial qualitative methodologies were also chosen mainly for data collection needs. Moreover, research strategy, dimensions, and research design were also enlisted for discussion. A multi-method approach was undertaken for data collection. Internet websites were accounted for as the secondary source, and separate interviews with government employees (senior and junior) that are part of the smart city implementation (in direct or indirect capacity) were utilized as primary materials to carry out the research. Expert interviews was incorporated to gain a broader viewpoint and to validate the research. Use of primary as well as secondary sources was essential and necessary so as to assess and justify the suggested framework and examine the research determinations.

Chapter 5 contains continuation of the data theory. The research puts forward the background for the case study, and the findings from it which was carried out in the public sector responsible for public safety in the UAE along with experts view. This chapter imparts a review of perspectives of varied case studies that outline the larger part of this research endeavour. Other than explaining the chosen case study and the growth of ICT, this chapter also studies the many different facets if the suggested framework covered in Chapter 3: Implementation process; aspects and traits with regard to benefits, risks and barriers; the role of key actors and crucial activities and tasks in tackling issues such as change management; and appropriate practical directives at every stage of the development life-cycle to make sure of successful and competent occurrence of the smart city implementation.

As a whole, the research data was certainly able to determine the conceptual factors which were observed from the literature review, covered in Chapter 3. The same also facilitated the detection of surplus issues which were available in the suggested conceptual framework model discussed in Chapter 3. The analysis and investigations were necessitated by the need to simplify the discussions about the research findings in the following chapters, and also revise them, if required. Chapter 6 onwards, the research puts its focus on the data theory. The chapter illustrates the research findings, which were put through an analysis exercise after data was gathered via a survey which was conducted at case studies outlets. This was a necessary measure so as to thoroughly authenticate the suggested conceptual model, specifically, and assess the application and implementation of smart safe city in the UAE.

The findings approved the conceptual model as majority of the respondents agreed to most of the perceptions put forth, and they were also able come up with good amount of theoretical and practical inputs and suggestions during the survey. Taking into account the discussions and discoveries (from the survey), the research ably illustrated the factors gathered for the case study endeavour and concisely present, if or not, the research aim was fulfilled, and answers to the research questions were up to the mark. Next, the research thesis shed light on the issues from the research study. The conceptual framework underwent thorough revision and validation, based on the findings and data analysis.

Chapter 7 is the concluding segment of the research wherein a conscious attempt has been made to submit an authenticated conceptual structure which reflects the discoveries of the theoretical outlooks, which was recommended for SSC implementation in the emerging economies, and UAE being utilized as a case study. Despite the fact that the framework was fundamentally based on the UAE public sector responsible for public safety, the research still presents handful of action plans for the generic smart city implementation which can also be applied to other emerging nations.

Lastly, the research sums up the research aims theoretical and practical respectively and on the basis of the research limitations, the suitable recommendations were drawn out for future analysis and investigative studies on smart city implementation, along with for the government of the UAE.

7.3 Findings: Meeting Aim, Objectives and Research Questions

7.3.1 Research Findings

The main result in terms of research findings and innovative inputs gathered from this research are listed as under.

Findings 1: The literature review in connection to the factors impacting smart city and its implementation points out that they are generic, without any combined theoretical models linked with SSC implementation. This research study chooses the institutional theory by assessing the internal and external environmental attributes respectively that are affecting the smart city implementation. The factors also needed to be identified and classified on basis of priority. In a move that is a premeditated, the conceptual framework would assist decision makers as well as enforcers of changes like the UAE government to possess enhanced understanding of the factors of smart city implementation.

Findings 2: Further to discerning the factors of smart city implementation, well inside the parameters of the institutional theory context, this research study is aimed at understanding and assorting the smart city implementation aspects and traits – benefits, barriers and risks influencing implementation in the UAE, from the perspective of features such as technology, people, process, resources (monetary and organizational), and safety and privacy.

Finding 3: There appears to be a complete lack of or restricted availability of literature on the subject of good practice directives that shapes a segment of the framework for SSC implementation. To a greater degree, there is also a need to verify and plan these factors so as to appear as practical benchmarks for decision makers to take into account when implementing smart city throughout each stage of the development phase. Furthermore, it could also be utilized as a reference example at the time of making decisions.

Findings 4: On the basis of the suggested conceptual framework and reviewed literature, a need a emerged to detect the key actors in the SSC implementation process. This need has presented itself as a result of the previous literature which is more or less mainly highlights the stakeholders' role. Therefore, on the basis of the authentication of the conceptual framework model, the framework needs to be revised and rectified in order to fulfil the loopholes and recommendations respectively. For example, though the main actors and their roles were detected, more actors such as enforcement outlets and governmental bodies were proposed to be imperative to the application and validation of the smart city implementation.

Findings 5: The research gaps detected in the literature review caused for a conceptual framework model to be designed and suggested for successfully implementing smart city so that the issues elaborated and put forth in Chapter 3 could be duly dealt with. One of the gaps is the inadequate framework and absence of a cohesive theoretical model for comprehending on SSC implementation and key actors' contributions.

7.3.2 Meeting Research Aim, Objectives and Questions

Investigations carried out of the research data and findings throughout chapters 5 and 6 allow the research to tackle the research questions listed in Chapter 1. An overview of meeting the aims and objectives is shared in the table 7-1 below

Research question (RQ) 1, RQ 2, and RQ 3 was dealt with by detecting the SSC implementation factors – comprehensive and motivational – via means of a literature review in Chapter 2. In the following chapter, the factors were further looked into and assorted prior to getting validated on the basis of research analysis of collected data (from public sector outlets in the UAE) in Chapter 5. The research tried to get answers to RQ 4, RQ 5 and RQ 6 by analysing and assessing smart city implementation aspects and traits - benefits, barriers and risks – found in the literature review in Chapter 2 and 3. The factors and concepts were further charted and tallied in order of priority and significance. The same were then put through a validation process – from analysis of the data gathered in chapters 5 and 6.

SSC Research Areas	*RQ #*	*Research Questions*	*Chapter*	*Findings*
Literature	**1**	***RQ1: What is a Smart Safe City?***	Chapter 2	The aim of the research was to develop a framework for effective implementation of SSC for UAE, with focus on achieving citizen happiness, future foresight and future accelerations.
				As per the findings identified in the chapter 5, it was found that the components of SSC played an influential role in the overall effectiveness of the SSC model.
Implementation Framework	**2**	***RQ2: Why does government around the world needs to adopt Smart Safe City?*** ***RQ2.1: How Smart Safe City will assure the readiness to response for any national resilience?*** ***RQ2.2: How Smart Safe City will enhance citizen's happiness?*** ***RQ2.3: How Smart Safe City will support future foresight?*** ***RQ2.4: How Smart Safe City will help in future accelerations?***	Chapter 1, 3 and 5	While the chapter 1 presented a detailed review of the factors influencing the adoption of SSC in UAE, the chapter 3 presented the framework for its implementation. The framework was developed taking into consideration the effectiveness of the overall model during the pre-during-post stages of implementation.
				It was found that the citizen happiness, future foresight and future accelerations are interlinked with the technology architecture of the model, with the governing factors identified as the IT (technology) component.
Components in Implementation	**3**	***RQ3: What is the type and nature of the technology to be adopted for smart safe city?*** ***RQ3.1: What is the architecture of smart safe city in terms of technology?***	Chapter 2 and 5	As per the data analysis conducted, it was found that technology architecture is the core element that drives the success of SSC implementation.
				For UAE, while the government was found to focus on training and awareness, strategy development and execution, PPP vendors were mapped to IT infrastructure, telecommunications infrastructure, technology readiness, and hardware/software costs.
				A number of technologies essential for the SSC technology development and infrastructure were identified.

SSC Research Areas	*RQ #*	*Research Questions*	*Chapter*	*Findings*
Strategic actions and key actors	**4**	***RQ4: What are the strategic actions to be adopted by governments participating in Smart Safe City to have maturity on the safety and security aspects?*** ***RQ4.1: What are the roles played by the stakeholders in successful smart safe city?***	**Chapter 5 and 6**	The strategic actions for the successful adoption and implementation of SSC for UAE were discussed and reviewed in detail in chapter 5. Various strategic actions needed for successful adoption, ranging from developing a roadmap to identification of realistic funds to support the SSC objectives were identified. It was found that for successful implementation of each of the three stages in the SSC life cycle, the connected good practices and activities should be utilized with the inclusion of the key actors within its development.
Challenges	**5**	***RQ5: What are the emerging challenges for effective smart safe city implementation?***	**Chapter 5**	▪ In support to the RQ 4, the challenges and barriers were examined. ▪ It was found that focus should be on IT infrastructure, telecommunications development along with training and awareness development, identifying of hardware/software costs. ▪ Building effective collaboration with PPPs was found to aid in overcoming the challenges and barriers in SSC implementation.
Barriers	**6**	***RQ6: What are the emerging barriers for effective smart safe city implementation?***	**Chapter 5**	

Table 7-1 : Meeting the Research Questions

The following diagram is showing how the objectives of the study were addressed through the research chapter

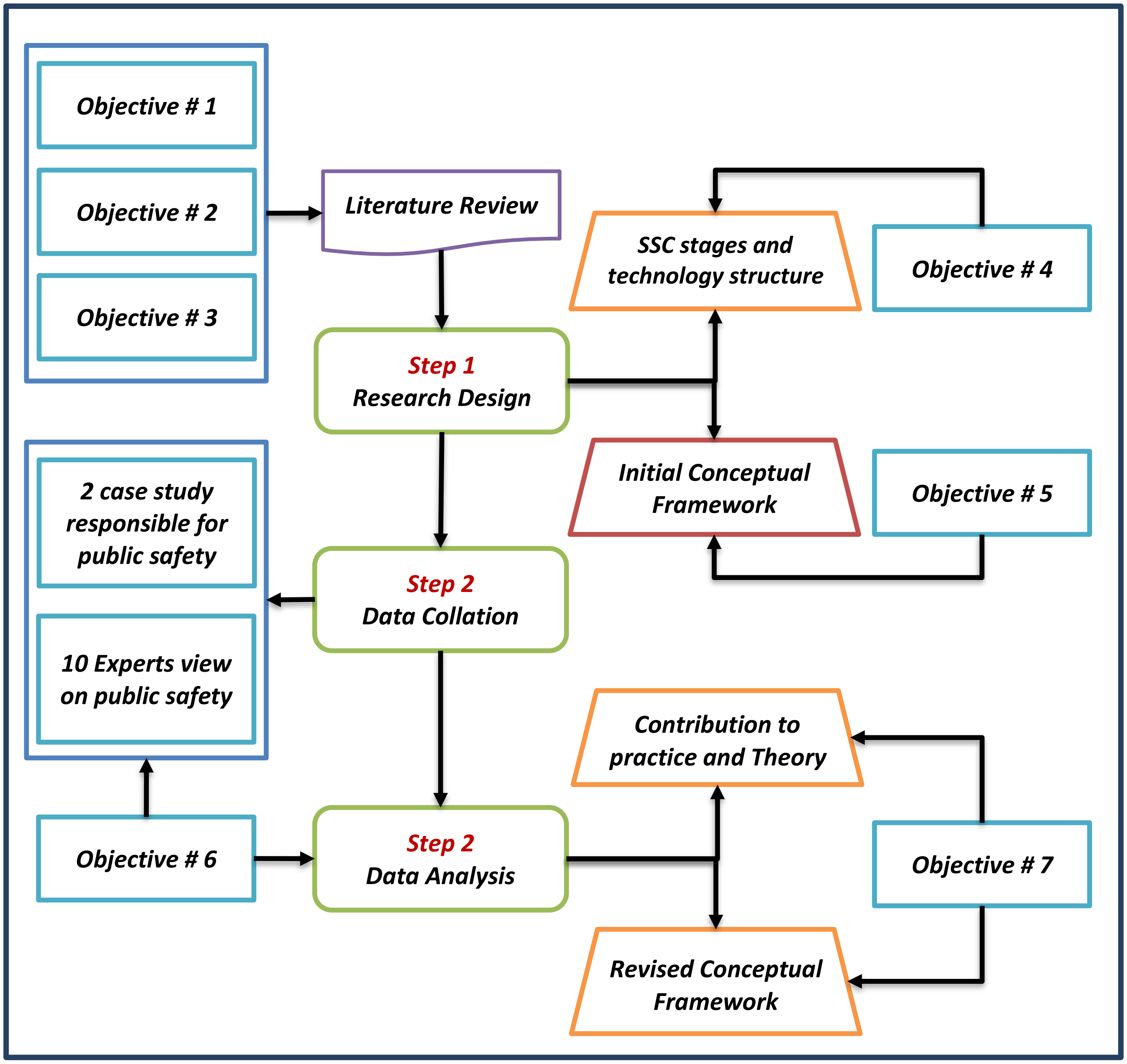

Figure 7-1: flow of meeting the objectives

7.3.3 Outcomes of the Research

The researcher, as observed in the chapter (5 & 6) was able to identify and examine the findings of this study as per the conceptual model (proposed in the chapter 3) and revisit it. As a result, it was observed that the domain of SSC is an extension of the smart city model (which in turn is of e government model) and thus is relatively a new concept which is not yet examined in detail in the context of UAE. Also, the new conceptual framework clears the unmapped field of identifying the key actors in SSC for UAE and thus, linked it with the characteristics and implementation factors thereby strengthening it in both theory and practice.

7.3.4 Contribution to Knowledge (Theoretical)

The basis of the SSC model was derived from the literature review, predominantly smart city and e-government. It was from the literature review that the key factors and characteristics of SSC for fast growing country and pioneer on any implementations such as the UAE can be outlined and utilized for the analysis. As per the analysis conducted and the findings identified, the conceptual model and the relationships were validated along with the identification of new factors that can strengthen the overall effectiveness of the model. To note, while the literature review was able to identify the various factors of SSC, new benefits were further noted from the analysis. This included the following:

▪ Readiness for any national resilience.	▪ On-to-go information sharing.
▪ Efficient decision making.	▪ Economic growth of country.
▪ Increased governance.	▪ Innovation
▪ Supporting country vision as a leading country.	▪ Well-developed office infrastructure to support operations.

The research study also led to the identification of additional barriers such as policy implementation, data classification, collaborative monitoring and collaborative data sharing. Similarly, on the risks for implementing SSC, the following additional risks were identified:

- Manpower dependency.
- Unemployment.
- Experience in technology selection
- Technology provider presence in local country.
- Lack of experienced staff to support technology from providers.

Based on the findings, the researcher was led to the identification of new knowledge contributed towards the existing literature on SSC implementation, focusing on the public sector organizations in the UAE. As per the new knowledge identified that also fills the missing gap between the factors and characteristics of SSC for effective implementation, being in line with the institutional theory.

7.3.4.1 Expanding the Implementation of SSC (Three Quarter Moon Expansion)

The three-quarter moon theory which was utilized as the base for identifying the key actors in SSC were confirmed for the adoption of SSC. The model is also the empirical version of the rectangular model with four actor activity which was utilized in the past for the development of adoption models for e-government. As per the model, there are four key actors ie.e. SSC users (government firms), companies, users (citizens) and countries of high technology advancement. While the model was not found to have been utilized for the context of SSC in the past for e-government of smart and safe city in particular, it was found to be a model significantly matching the SSC adoption and hence, can be utilized as a guideline for good practice for countries / cities planning for SSC. The theory was also utilized as part of the new revised conceptual framework for SSC. The rectangular model can be expanded to enable enhanced decision-making for public sector firms. Primarily, with the expansion comes the possibility of identifying further new actors that can form a crucial component of the SSC framework. This new concept for SSC implementation is identified in the form of the following contributions:

7.3.4.2 Contributions:

(1) The framework developed for SSC implementation was revised as per the findings identified in chapter 5 from the interviews of experts and 2 case study organizations. The aim of the testing and validating the framework was to evaluate the factors concerning the SSC and the relationships that exist between the factors for effective implementation. As per the ranking in terms of the level of importance, the internal and external factors were linked with the characteristics for the public sector of UAE responsible for public safety. The aim behind this mapping was to enable improved decision making for SSC and related firms for the implementation of SSC, with enhanced planning, improved future foresight and future accelerations. In addition, the readiness for any national resilience by having actionable information in real time.

(2) The characteristics of the SSC framework were based on the components identified from the literature review, and later mapped leading to the revised framework. The internal and external factors tested were validated, with the identification of technology factor as the key factor in the external environment. Similarly, in the internal environment, new factors in the form of data classification and security, collaborative monitoring and collaborative data sharing were identified. The new SSC implementation framework led to the identification of new benefits, apart from those identified from the theory of drivers and barriers (as seen in chapter 2 and 3). The new benefits include readiness for any national resilience, well-developed office infrastructure to support operations, on-to-go information sharing, and efficient decision making, and increased governance, economic growth of country, supporting country vision and driving innovation. Apart from the barriers noted in the literature review from the drivers & barriers theory, new barriers were noted in the form of policy implementation, date classification, collaborative monitoring and collaborative data sharing. Further, additional risks were identified by the researcher in the form of manpower dependency, unemployment, experience in technology selection, technology provider presence in local country and lack of experienced staff to support technology from providers. These factors were justified with the revised conceptual framework aiding decision-makers in the public sector organizations responsible for public safety enhanced decision making and SSC implementation. However, the ranking of the characteristics of SSC with the implementation factors is important as it can vary from one country to another.

(3) The expansion of the smart city and e-government model into smart safe city model is a novel contribution which includes a good practice guideline to aid decision makers in taking the right step in the SSC development. The new framework will entail adoption of the model for SSC from the pre-implementation stage to post implementation rendering decision makers the needed guidance to understand between concept (i.e. theory) and practice with the SSC implementation.

(4) With the domain of SSC, a very limited literature was found which was primarily concerning either smart city or e-government model. However, this current study is a step forward linking the characteristics of smart city with the core actors and activities within the development stages (being in line with the institutional theory). The new conceptual framework is a guidance for future scholars/researchers in taking the study forward, thereby strengthening the area of SSC development and implementation with the mapping of the stages with actors and activities validated in this study.

(5) The development of the new model for SSC implementation (based on the institutional and the rectangular model with four actor/activities) is a novel contribution by the researcher. This is primarily due to its application to be applied by the decision-makings in implementation of SSC. Also, it will support future researchers and scholars in further expanding the framework for successful SSC implementation and development, focusing on readiness response to national resilience, citizen happiness, future foresight and future accelerations. The new conceptual framework for SSC is developed for cities planning to do SSC to benefit from UAE experience determining the role of actors and activities in SSC development life-cycle. However, the technology architecture proposed in chapter 6 needs to be further validated in order to extend the application of the framework for development and developing countries as well. This is due to the point that there may be a difference within the domains of theory and practice in the application of SSC.

7.3.5 Contribution to Practice

As per the findings identified in the chapter 5, recommendations are presented in the section 7.4 for an effective implementation of SSC. Researchers in context to SSC may have valued the services of a smart city over an e-government model. In UAE, a fast growing country, is equipped with the right resources and support from the government to transform its economy into a smart economy and has made consistent progress and developed ahead of plan. With this research, it is found that the decision-makers from public sector firms in UAE understand the importance of citizen happiness and the need to continuously strive forward to achieve future acceleration and foresight. The drivers for SSC identified in this study require the support of well-built strategies to overcome the risks and barriers encircling SSC development and implementation. On the practical front, the new framework developed for SSC (which has tested) will aid decision-makers in taking better decisions thereby supporting their respective communities, and the nation itself on the whole. The three-quarter model and the rectangular model is rather a guideline for the decision makers, however, the new SSC framework allow the decision makers to understand the development life cycle. As seen in the figure 6.1 (in chapter 6) reflects the mapping of the factors and components of SSC along with the key actors, activities and relationships. The addition of the PDCA to the development life cycle of SSC adds the needed stages to refine and boost the development of the SSC, eliminating problems through careful problem analysis, plan development and evaluation. While the internal and external factors were validated, the characteristics were mapped with the actors and activities. The new framework developed is as per the best knowledge of the researcher and the research put in together tested and validated.

7.3.6 *Research Limitations*

The study was conducted in the UAE which is fast growing economy which is regarded as the leading country for ICT globally. With the country being acknowledged as the leading economy in technology readiness, the growing need for expand the horizons for smart city to transform into smart safe city has laid the foundation for this research.

The primary limitation encountered in this research study was time. Given the requirement to complete the thesis in 3 years, the actual process to put together the plan of action, gain approvals and invite key people to participate in the interviews was time consuming.

The second limitation encountered during this research was the access to information. Given the sensitivity of the topic selected and the research participants, it was rather difficult for the researcher to put in place the needed documentation for data collection from the two public sector organizations responsible for public safety. Given the lack of time, the case study participants chosen to go ahead with the interview being semi-structured wherein they have the leisure to answer the questions at per their own convenience. While this required the researcher to chase after the interviewees to answer all possible questions and to verify the questions left blank intentionally for clarity.

The third limitation in this research study was arrangement of the interviewees. The topic of smart city (or to say smart safe city) is not an open topic and individuals employed with the public sector organizations are bound with data integrity and security. Hence, care had to be taken to not to misuse the information shared nor to obtain sensitive data that may jeopardize the interviewees. Also, the researcher ensured that all interviewees were pre-informed about the research topic and its scope so that the interviewees are well-prepared to take up the interview.

The research study applied a qualitative approach and analysis which was highly time consuming. Apart from the above mentioned prerequisites, the researcher has to spend a large amount of time to collect the interviews which was followed by categorization of the data into identifiable themes and recoding to meet the research objectives. While the researcher was able to utilize qualitative research in effectively meeting the aim and objectives of this research, however, causality of the key factors couldn’t be established due to the qualitative nature. Another point to note is that qualitative researches are unique in nature, and re-conducting the study may not lead to the same results. Given the quantity of data collected, one challenge was the data analysis and the restrictions that encompass it. SSC being a wide concept, there interviewees that agreed to participate were from different departments and had different roles. Hence, the researcher had to take steps to ensure that all interviewees understood the questions and were able to provide the right inputs. Care was given to data screening wherein every response received was thoroughly screened for redundancy and any doubts on the responses received was immediately clarified with the interviewees.

7.4 Recommendations for SSC Implementation

7.4.1 Recommendations for Further Research

Smart city is essentially a broad theory which pertains to information systems and management, still there is scope and need for elaborative research work from varied management approaches on the subject. Academic scholars and research analysts are required to conduct even more detailed analyses and studies so as to gather enhanced understanding of corporate actions and attitudes, with regards to smart city implementation. The following are the recommendations for the future studies based on the outcome of this research:

(1) The research study was undertaken in context of the UAE government, targeting to develop a conceptual framework for effective development and implementation of the SSC. With reference to the drivers and characteristics, the framework was validated from the data collected from case studies and experts view. Hence, the findings are applied to any city not only UAE, because UAE is a pioneer country on technology adoptions and implementations and this can generalize to other countries/ cities, the model should be further tested specially validating the basic concept of the three-quarter moon and the rectangular model (highlighting the actors and activities). Further mapping based on the level of importance should be undertaken between the actors and activities in the SSC framework for successful adoption in other countries.

(2) While there is a possibility that the SSC framework for implementation can be generalized to developed countries, however, the same cannot be said for developing countries. This is because developed and developing countries vastly differ in the technology aspect which directly affects the life cycle development and also, the implementation. Hence, future researchers are required to expand this study by taking up the research in context of ***Smart Safe Country*** and examining the implication of technology readiness in SSC development and implementation across different cities.

(3) Information sharing is another important issue to be studies, such as Information Sharing for public safety and safe city, the purpose of that to examine how the data flow, kind of data, who should provide in order to response to any national resilience or things affecting the public safety. The diagram on figure (7-2) summarize the recommended layout for future research based on recommendations (2&3).

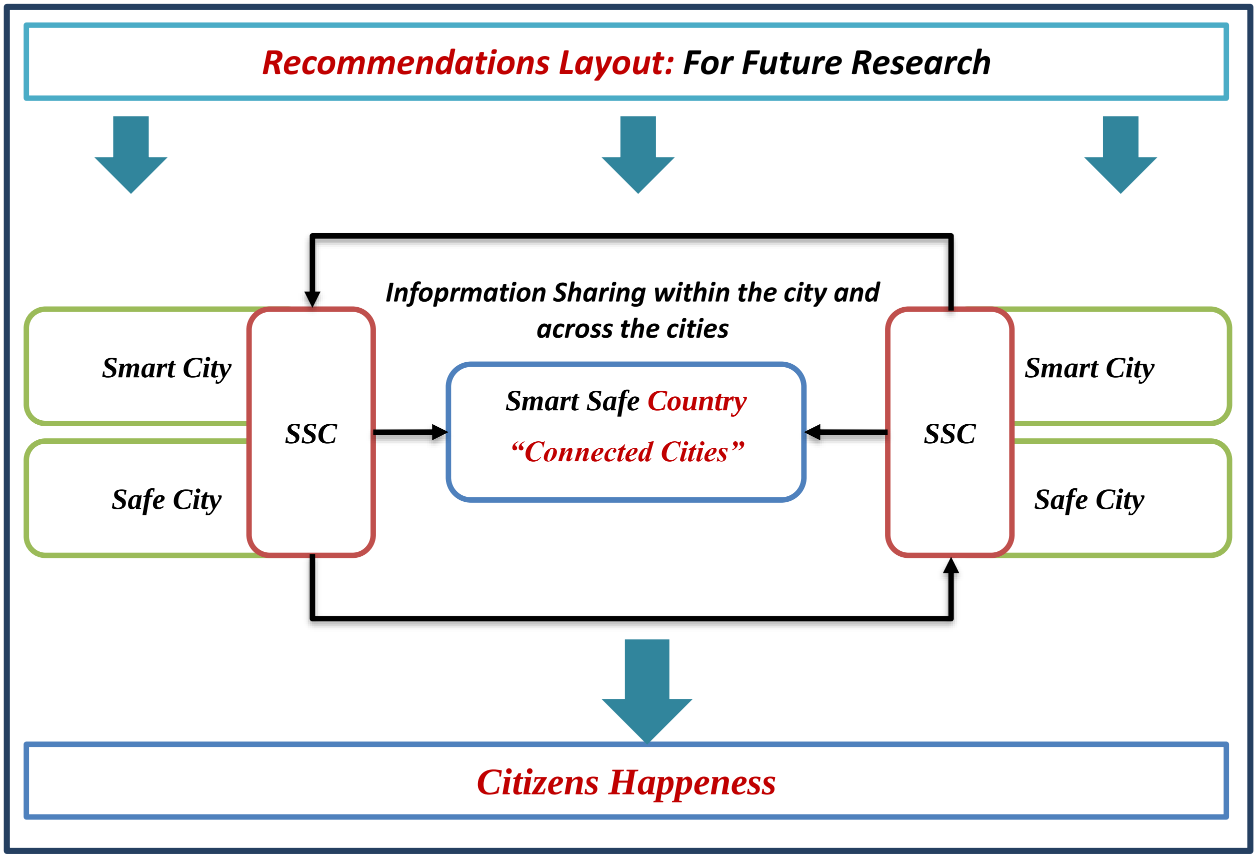

Figure 7-2: Recommendations Layout: For Future Research

(4) To study the risks management concept in the context of SSC along with the practices and methods of risk management this should cover the security versus safety and privacy. Also future research should study the threats of the used technologies on SSC how to be exploite to Vulnerability. In addition to that; technology risks should be studed to manage the risks based on likelihood of occurrence and the impact of the risks.

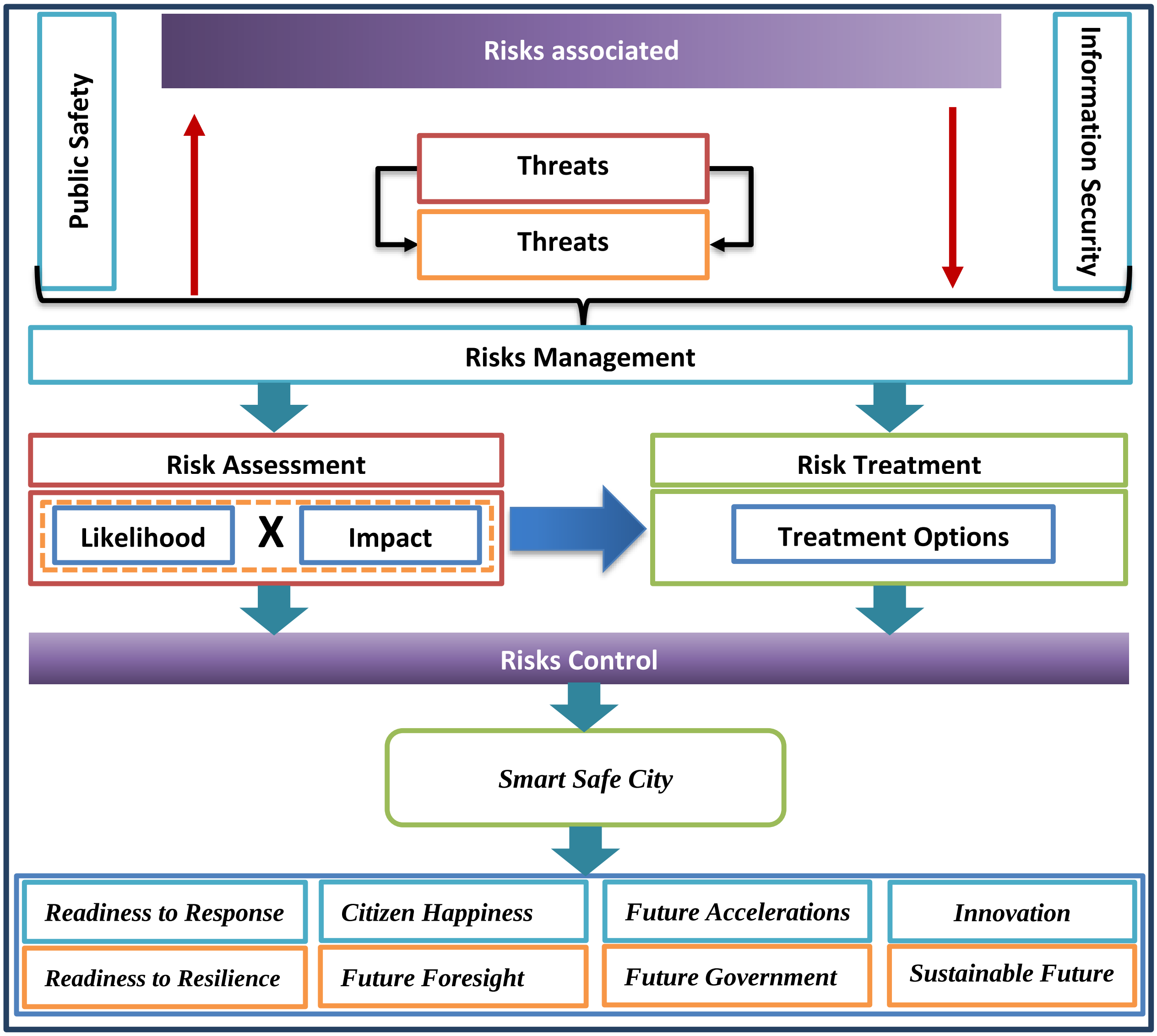

Figure 7-3: SSC risk management and Impact

(5) The role of change management needs to be explored further in SSC initiatives given the barriers in terms of technology adoption and execution. A kind of resistance from managers and staff can hinder the development and implementation of SSC and hence, needs further investigation. As identified from the findings, process success is linked with the process of bringing change in occurrence i.e. change attitude and change management. Resistance to change (be in technology adoption or manpower management) should be specifically dealt with higher prejudice with support from the leaders in setting a clear vision and sharing the same with the team. This leads to successful implementation of SSC. The SSC conceptual model success or the validation of the model for other countries is still not proven and needs the support of future researchers. It is recommended that researchers employ the use of quantitative method or mixed (qualitative and quantitative) to enhance the efficiency of the results through the inclusion of a larger sample. This will allow generalizing the findings to countries of similar context. Also, the evaluation phase added to the revised framework in the form of PDCA should be further researched and validated in order to further strengthen the framework for development and implementation.

(6) Another recommendation to study blockchain and Artificial Intiligent / Robotics value for SSC since SSC depends on connecting things, in another word depends on Internet of Things (IOT). According to IBDM; blockchain defined as

> **"*A distributed database that maintains a continuously growing list of data records that* are *hardened against tampering and revision, even by operators of the data* store's *nodes. The most widely known application of a blockchain is the public ledger of transactions* for cryptocurrencies *used in Bitcoin. This record is enforced cryptographically and hosted on machines running software*."**

Blockchain will play major role in the Internet of Things as well as Smart Safe City to connecting the dotes and reach to all historical information by one click. In addition, Artificial Intelligence is progressing rapidly because it helps on reashing on areas where human or sensor can not reach and can be controlled centrally.

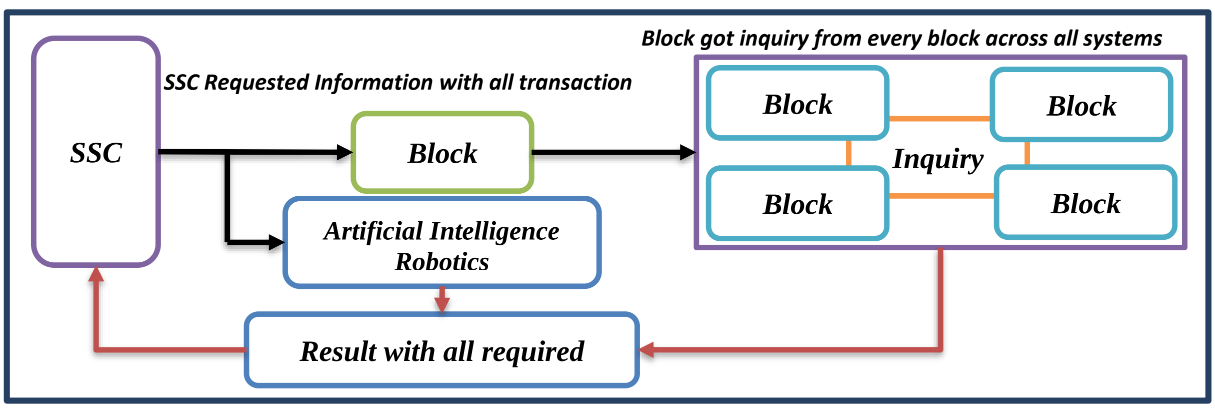

Figure 7-4: Blockchain and Artificial Intelligence / Robotics value for SSC

(7) For future researchers, it is recommended to apply either a mixed research i.e. qualitative interviews or quantitative survey for collection of information validating the framework proposed for SSC implementation in this study. The application of a mixed research is a strong alternative to qualitative research as it allows overcoming the research limitation of causality. Also, to future improve the reliability of the data, increasing the sample size of the participating companies is advised. The following diagram summarize the remnded layout for future research.

7.4.2 Issues and Recommendations for cities planning for SSC

Strategy and planning are key facets of the SSC implementation process, and they have a part to play in establishing vision, targets and goals. Furthermore, the smart city implementation is supported by technology, people and processes. Based on the research outcomes, the following recommendations are posed for cities to deliberate upon:

1. ***SSC planning and strategy*** outlets need to work in tandem with organizations and involve them more in the aforesaid process. The purpose of this stage overcome of any challenges facing the implementation and executions by setting up a dedicated and specialized team to handle the projects requirements through the stages of the project.
2. ***To identify an entity responsible for the SSC*** and it will be leader on setting the requirements and the needs for the public safety in terms of technology, process, resources, rules, regulations, etc.
3. ***Technology awareness and understanding*** for the underlying SSC needs and requirements. This will assure the adopted technologies for SSC are the proper and minimizing the risk of adopting technologies not meeting the objectives.
4. ***ICT infrastructure combined*** with consistent and regular availability of internet services and electricity are key components which need to be assessed before enacting any smart city services.
5. Cities needs to proper other technologically superior economies and corporate entities to participate in the smart city implementation process by means of developing smart city implementation strategies.
6. Cities needs for ***setting up of an autonomous monitoring and regulating outlet*** that has the government's backing, however it operates and functions independently.
7. ***Availability of resources in abundance and government support*** are the two pillars on which an endeavor such as smart city implementation rests. The city governments are a critical player especially in areas such of legislative control, smart city regulation activities. Regular financial support needs to be provided to enhance ICT infrastructure, education, government staff training and sustenance of citizens' rights.
8. ***CCTV Collaboration of multiple departments*** (private – governments – semi – other) their owned CCTV infrastructure to be integrated and collaborated with SSC command and control center which considered as critical task.

9. ***Information Sharing and data exchange*** is also another important to be in place within SSC, as information sharing among several entities for the purpose of public safety. Another such challenge is the ***non-existence of a security system*** at certain locations to support the public safety, where also the ***information security control*** should be considered to protect the information sharing among the entities participating on the public safety.
10. ***Network bandwidth with redundancy and high availability infrastructure*** is an important requirement to be considered for real time information for the concerns parties. In addition to that CCTV using IP cameras require bandwidth to record the activities and monitoring. Furthermore, it is imperative to make available the requisite network infrastructure in order to ensure connectivity of the field at all times. During the design phase, the required bandwidth should be studied properly for the purpose of the video quality and having information on real time.
11. ***Government policy*** this will be facing any city since there are local and federal law which consider as once of the major challenges of SSC deployments. Some of the policy challenges that come up during the implementation phase of the project, and which need immediate attention are as follows:
    - The lack and shortage of the skills resources to handle SSC operations
    - Awareness for the stakeholders and policy makers to raise the level of their awareness and importance on participations on the project.
12. ***Policymakers*** as well as other ***stakeholders*** must work towards raising the level of awareness amongst citizens towards such safe city projects.
13. ***The Fund of SSC*** which considered project with high value of investments which required high initial budget as capital investment where the other investments is for the SSC operational expenses. To assure the project sustainability; funding is important to cover each stage of SSC. The following should be taken into considerations:
    - SSC project fund should be jointly among the participant parties on public safety.
    - Funding should be identified (local or federal level).

Actually there are two type of the projects funding as per the following table:

Self Funded by the government	***Public private partnership (PPP)***
This model the government are funding them self to implement the SSC, where the SSC	PPP is a government service funded and operated through a partnership between the government and one or more private sector companies.

Table 7-2: SSC self funded versus public private partnership

8 References

1. *2013 - United Nations international year of water cooperation: Facts and figures* (no date) Available at: http://www.unwater.org/water-cooperation-2013/water-cooperation/facts-and-figures/en/ (Accessed: 21 February 2017).
2. Abid, M.T., (2014). *Assessment of Smart City Approach: Its Tools and Components* (Doctoral dissertation, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ)).
3. Agha, A., (2016). A Stakeholder Based Assessment of Developing Country Challenges and Solutions in Smart Mobility within the Smart City Framework.
4. Alawadhi, (2013), Building understanding of smart city initiatives, In International Conference on Electronic Govern.
5. Alawadhi, S, et al. (2012). *Building understanding of smart city initiatives*. Electronic Government. Springer Berlin Heidelberg, Pp. 40-53.
6. Albino, V., Berardi, U., & Dangelico, M, R. (2015) Smart Cities: Definitions, Dimensions, Performance, and Initiatives, *Journal of Urban Technology*, 22. pp.1, 3-21
7. Al-Busaidy, M.M., (2011). *Evaluating the institutional factors affecting e-government implementation* (Doctoral dissertation, Brunel University, School of Information Systems, Computing and Mathematics).
8. Al-Hader, M., and Rodzi, A. (2009) The smart city infrastructure development & monitoring, *Theoretical and Empirical Researches in Urban Management*, 4(2(11)), pp:87-94
9. Alizadeh, T. (2017) An investigation of IBM's Smarter Cites Challenge: What do participating cities want? *Cities*, 63(March 2017), pp 70-80.
10. Allan, AJ, Randy, LJ, (2005), *Writing the Winning Thesis or Dissertation. A Step-by-Step Guide*, Corwin Press, California
11. Al-Nuaimi, E., Al-Neyadi, H., Mohamed, N., and Al-Jaroodi, J. (2015) Applications of big data to smart cities. *Journal of Internet Services and Applications*. 6(25), pp: na, doi: 10.1186/s13174-015-0041-5
12. Al-Rashidi, H. (2009). Examining internal challenges to e-government implementation from system user perspective. Paper presented at *the European and Mediterranean Conference on Information Systems (EMCIS 2010)*, Abu Dhabi, UAE, April 12-13, 2009

13. Al-Shafi, S., Weerakkody, V. and Janssen, M., (2009). Investigating the adoption of eGovernment services in Qatar using the UTAUT model. *AMCIS 2009 Proceedings*, p.260.
14. Anand, A, and Sami, N. (2015) Urban corridors: Strategies for economic and urban development. *International Growth Centre working Paper*. Indian Institute of Human Settlements: Bangalore.
15. André, A.M. and Crutzen, N., (2015). *The role of companies in «smart and sustainable city» initiatives in Belgium*. The Shift.
16. Angelidou, M., (2014). Smart city policies: A spatial approach. *Cities*, *41*, pp.S3-S11.
17. Anthopoulos, L, & FP (2010), 'From online to ubiquitous cities: The technical transformation of virtual communities.', *Next Generation Society: Technological and Legal Issues*, vol 26, pp. 360-372.
18. Anthopoulos, L, & TIA (2005), 'The implementation model of a digital city', *Journal of E-Government*, vol 2, no. 2, pp. 91-110.
19. Anthopoulos, L., & Fitsilis, P. (2010). From digital to ubiquitous cities: Defining a common architecture for urban development. In *Proceedings of the 6th International Conference on Intelligent Environments.* Kuala Lumpur, Malaysia.
20. Anthopoulos, L., & Fitsilis, P. (2010b). From online to ubiquitous cities: The technical transformation of virtual communities. In A. B. Sideridis & C. Z. Patrikakis (Eds.), *Next Generation Society: Technological and Legal Issues (Proceedings of the Third International Conference,* e-Democracy 2009, Athens, Greece, Sep 23-25, 2009) (Vol. 26, pp. 360-372). Berlin, Germany: Springer. Available at http://www.springerlink.com/content/g644776482968k36/fulltext.pdf.
21. Aoun, C., (2013). The smart city cornerstone: Urban efficiency. *Published by Schneider electric*.
22. Ashaye, O., and Irani, Z. (2014) E-government Implementation Factors: A Conceptual Framewor, *Journal of Modern Accounting and Auditing*, 10(2), pp: 241-247.
23. Asimakopoulou, E. and Bessis, N., (2011), June. Buildings and crowds: Forming smart cities for more effective disaster management. In *Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS), 2011 Fifth International Conference on* (pp. 229-234). IEEE.
24. ASSOCHAM, (2016), *Safe Cities Architecture for India*, Price Waterhouse Cooper commissioned paper

25. Aurigi, A., (2006). New technologies, same dilemmas: policy and design issues for the augmented city. *Journal of urban technology*, *13*(3), pp.5-28.

26. Bailey, C. (2007) *A Guide to Qualitative Field Research*, Pine Forge Press, Thousand Oaks.

27. Bakıcı, T., Almirall, E. and Wareham, J., (2013). A smart city initiative: the case of Barcelona. *Journal of the Knowledge Economy*, *4*(2), pp.135-148.

28. Barba, C.T., Mateos, M.A., Soto, P.R., Mezher, A.M. and Igartua, M.A., (2012), June. Smart city for VANETs using warning messages, traffic statistics and intelligent traffic lights. In *Intelligent Vehicles Symposium (IV), 2012 IEEE* (pp. 902-907). IEEE.

29. Bartlett, L. (2005). Smart city: Social entrepreneurship and community engagement in a rural regional city. In Proceedings of the International Conference on Engaging Communities, (Brisbane, Australia, Aug 14-17). Available at http://www.engagingcommunities2005.org/abstracts/Bartlet-Leo-final.pdf.

30. Baskerville, R.L. & Myers, M.D., (2002). Information systems as a reference discipline. *MIS Quarterly*, 26(1), pp. 1–14.

31. Batty, M., Axhausen, K., Fosca, G., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G., and Portugali, Y. (2012) *CASA Working Paper 188 – Smart Cities of the Future*, The Bartlett Centre for Advanced Spatial Analysis – UCL. Web. Last accessed 16 Feb. 2017.

32. Batty, M., Axhausen, K.W., Giannotti, F., Pozdnoukhov, A., Bazzani, A., Wachowicz, M., Ouzounis, G. and Portugali, Y., (2012). Smart cities of the future. *The European Physical Journal Special Topics*, *214*(1), pp.481-518.

33. Belanche, D., Casaló, L.V. and Orús, C., (2016). City attachment and use of urban services: Benefits for smart cities. *Cities*, *50*, pp.75-81.

34. Bélissent, J., (2010). Getting clever about smart cities: New opportunities require new business models.

35. Benbasat, I. (1984). An analysis of research methodologies. *The Information Systems Research Challenge*, 47-85.

36. Benbasat, I. and Weber, R. (1996) Research commentary: rethinking diversity in information systems research, *Information Systems Research*, vol. 7, no. 4, pp. 389-399.

37. Benbasat, I. and Zmud, R.W. (1999) Empirical research in information systems: the practice of relevance, *MIS Quarterly*, , pp. 3-16.

38. Benbasat, I., Goldstein, D. & Mead, M. (1987a). The case research strategy in studies of information systems. *MIS quarterly*, 11, 369-386.
39. Benson, R.J., Bugnitz, T.L. & Walton, W., (2004). *From business strategy to IT action: right decisions for a better bottom line*, John Wiley & Sons.
40. Berg, B. L., & Lune, H. (2012). *Qualitative Research Methods for the Social Sciences* (8th ed., p. 408). Harlow, Essex, England: Pearson.
41. Bhatnagar, S., (2004). E-government: from vision to implementation-a practical guide with case studies (Vol. 21, No. 1). Sage.
42. Bifulco, F., Tregua, M., Amitrano, C. and D'Auria, A. (2016). ICT and sustainability in smart cities management. *International Journal of Public Sector Management*, 29(2), pp.132-147.
43. Blaikie, N. (2010). *Designing Social Research 2nd Edition*. Polity Press.
44. Blumberg, B., Cooper, D.R. and Schindler, p. S. (2011) *Business research methods*, 3rd edn, McGraw-Hill Higher Education, London.
45. Boeije, H. (2010). *Analysis in Qualitative Research*. California: Sage Publications Inc.
46. Bogdan, R. & Taylor, S. J. (1975) *Introduction to qualitative research methods*. New York: Wiley.
47. Bonoma, T. V. (1985). Case research in marketing: opportunities, problems, and a process. *Journal of marketing research*, 199-208.
48. Borja, J. (2007). *Counterpoint: Intelligent cities and innovative cities*. Knowledge Society, [online] 5. Available at: http://www.uoc.edu/uocpapers/5/dt/eng/mitchell.pdf. [Accessed 7 Feb. 2017].
49. Boulton, A., Brunn, S. D., & Devriendt, L. (Forthcoming). Cyberinfrastructures and “smart” world cities: Physical, human, and soft infrastructures. In P. Taylor, B. Derudder, M. Hoyler & F. Witlox (Eds.), *International Handbook of Globalization and World Cities. Cheltenham*, U.K.: Edward Elgar. Available at http://www.neogeographies.com/documents/cyberinfrastructure_smart_world_cities.pdf.
50. Bouma, G. A. & Atkinson, G. B .J, (1999). *A Handbook of Social Science Research: A Comprehensive and Practical Guide for Students*. New Revised and Expanded Edition. Oxford: Oxford University Press.

51. Bowerman, B., et al. (2000). *The vision of a smart city*. 2nd International Life Extension Technology Workshop, Paris.
52. Branchi, P.E., Fernández-Valdivielso, C. and Matias, I.R., (2014). Analysis matrix for smart cities. *Future Internet*, *6*(1), pp.61-75.
53. Brenna, M., Falvo, M.C., Foiadelli, F., Martirano, L., Massaro, F., Poli, D. and Vaccaro, A., (2012), September. Challenges in energy systems for the smart-cities of the future. In *Energy Conference and Exhibition (ENERGYCON), 2012 IEEE International* (pp. 755-762). IEEE.
54. Brown RB, (2006), Doing Your Dissertation in Business and Management: The Reality of Research and Writing, Sage Publications
55. Brown, L.R. (2011) *World on the edge: How to prevent environmental and economic collapse*. London: Earthscan.
56. Bryman, A. (1984). The Debate about Quantitative and Qualitative Research: A Question of Method or Epistemology? *The British Journal of Sociology,* 35(1): 75-92.
57. Bryman, A. and Bell, E. (2007) Business research methods, USA: Oxford University Press.
58. Bryman, A., & Bell, E. (2015). *Business Research Methods* (4 ed.). Oxford: Oxford University Press.
59. Budd, L. and Harris, L. eds., (2004). e-Economy: rhetoric or business reality? (Vol. 4). Psychology Press.
60. Burns, R.B. (2000) *Introduction to research methods,* Sage, London.
61. Caird, S., Hudson, L. and Kortuem, G., (2016). A Tale of Evaluation and Reporting in UK Smart Cities.
62. California Institute for Smart Communities. (2001). *Smart Communities Guide Book*. Available at http://www.smartcommunities.org/guidebook.html.
63. Cameron, E. and Green, M., (2015). *Making sense of change management: A complete guide to the models, tools and techniques of organizational change*. Kogan Page Publishers.
64. Campbell, T (2009), Learning cities: Knowledge, capacity and competitiveness, *Habitat International*, vol 33, no. 2, pp. 195-201.
65. Capdevila, I. and Zarlenga, M.I., (2015). Smart city or smart citizens? The Barcelona case. *Journal of Strategy and Management*, *8*(3), pp.266-282.
66. Caragliu, A., Del Bo, C. and Nijkamp, P., (2011). Smart cities in Europe. *Journal of urban technology*, *18*(2), pp.65-82.

67. Cardone, G., Bellavista, P., Corradi, A. and Foschini, L., (2011), December. Effective collaborative monitoring in smart cities: Converging MANET and WSN for fast data collection. In *Kaleidoscope 2011: The Fully Networked Human?-Innovations for Future Networks and Services (K-2011), Proceedings of ITU* (pp. 1-8). IEEE.

68. Carr, T., & Hayes, A. (2015). Social media: Defining, developing, and divining. *Atlantic Journal of Communication*, 23(1). doi: 10.1080/15456870.2015.972282

69. Cavaye, A. (1996) Case study research: A multifaceted research approach for IS. *Information Systems Journal*, 6 (3), pp. 227-242.

70. Cecez-Kecmanovic, D., Klein, H.K. and Brooke, C. (2008) Exploring the critical agenda in information systems research, *Information Systems Journal*, vol. 18, no. 2, pp. 123-135.

71. Chan, Y.E. & Huff, S.L., 1992. Strategy: an information systems research perspective. *Journal of Strategic Information Systems*, 1(4), pp. 191–204.

72. Chourabi, H, Nam, T, Walker, S, Gil-Garcia, JR, Mellouli, S, Nahon, K, Pardo, TA & Scholl, HJ (2012), *Understanding smart cities: An integrative framework*, 5th Hawaii International Conference, IEEE.

73. Chourabi, H., Nan, T. and Walker,. Gil-Garcia, S.J.R, Mellouli, S., Nahon, K., Pardo, T. A., and Scholl, H. J., (2012). Understanding Smart Cities: An Integrative Framework. In: *45th Hawaii International Conference on System Sciences*. IEEE Computer Society. Pp 2289-2297.

74. Chua, W.F. (1986) Radical developments in accounting thought, *Accounting Review*, , pp. 601-632.

75. Clarke, R.Y., (2013). Smart cities and the internet of everything: The foundation for delivering next-generation citizen services. *Alexandria, VA, Tech. Rep*.

76. Clohessy, T., Acton, T. and Morgan, L., (2014), December. Smart City as a Service (SCaaS): a future roadmap for e-government smart city cloud computing initiatives. In *Proceedings of the 2014 IEEE/ACM 7th International Conference on Utility and Cloud Computing* (pp. 836-841). IEEE Computer Society.

77. Cocchia, A., (2014). Smart and digital city: A systematic literature review. In *Smart city* (pp. 13-43). Springer International Publishing.

78. Collins English Dictionary (2005) 5th edn, Collins, Glasgow.

79. Collis, J. and Hussey, R., (2009). *Business Research* (3: e supple.). Hampshire: Palgrave Macmillian.
80. Collis, J., & Hussey, R. (2013). *Business Research: A Practical Guide for Undergraduate and Postgraduate Students* (4 ed.). Basingstoke, UK: Palgrave Macmillan.
81. Consoli, S., Mongiovic, M., Nuzzolese, A.G., Peroni, S., Presutti, V., Reforgiato Recupero, D. and Spampinato, D., (2015), May. A smart city data model based on semantics best practice and principles. In *Proceedings of the 24th International Conference on World Wide Web* (pp. 1395-1400). ACM.
82. Coolican, H. (2009) *Research methods and statistics in psychology*, Routledge.
83. Corbetta, p. (2003) *Social research: Theory, methods and techniques*, Sage Publications Limited, London.
84. Corbin, J. and Strauss, A. (2008) *Basics of qualitative research: Techniques and procedures for developing grounded theory,* 3rd edn, Sage Publications, London.
85. Cornford, T. & Smithson, S., (2005). *Project research in information systems: a student"s guide*, 2nd ed., Palgrave Macmillan.
86. Cornford, T. and Smithson, S. (2006) *Project research in information systems: A student's guide*. Palgrave.
87. Cosgrave, E., Arbuthnot, K. and Tryfonas, T., (2013). Living labs, innovation districts and information marketplaces: A systems approach for smart cities. *Procedia Computer Science*, *16*, pp.668-677.
88. Creswell, J. W. (2013). *Qualitative Inquiry and Research Design Choosing Among Five Approaches* (3rd ed., p. 472). Los Angeles, CA: SAGE Publications.
89. Creswell, J. W. (2014). *Research Design Qualitative, Quantitative, and Mixed Methods Approaches* (4th ed., p. 304). Thousand Oaks, CA: SAGE Publications.
90. Creswell, J., & Clark, V. (2011). *Designing and Conducting Mixed Methods Research* (2 ed.). London: SAGE Publications.
91. Curry, D. (2016). *How leveraging data can create a safer smart cities*. [online] ReadWrite. Available at: http://readwrite.com/2016/12/28/how-leveraging-data-can-create-a-safer-smarter-city/ [Accessed 7 Feb. 2017].

92. Da Cunha, M., and Costa, P.M. (2004) Towards Key Business Process for E-Government. In: Lamersdorf W., Tschammer V., Amarger S. (eds) *Building the E-Service Society. IFIP International Federation for Information Processing*, vol 146. Springer, Boston, MA
93. Dahler-Larsen, p. (2013). *The Evaluation Society*. Stanford: Stanford University Press.
94. Dam, R.V.D (2013) Personal Communications, IBM Institute for Business Value, ITU Telecom World.
95. Dameri, R.P. (2013), Searching for smart city definition: a comprehensive proposal, *International Journal of Computers & Technology*, 11(5), pp. 2544-2551.
96. Dameri, R.P., and Cocchia, A. (2013), Smart city and digital city: twenty years of terminology evolution, ItAIS 2013, *Conference of the Italian Chapter of AIS*, Milano, 14 December.
97. Darke, p. , Shanks, G. and Broadbent, M. (1998) Successfully completing case study research: combining rigour, relevance and pragmatism, *Information systems journal,* vol. 8, no. 4, pp. 273-289.
98. David, M. and Sutton, C.D. (2004) *Social research: The basics,* Sage Publications, London.
99. Deakin M, Leydesdorff L (2013) *The triple helix of smart cities: a neo-evolutionist perspective*. In: Deakin M (ed) Smart cities: governing, modelling and analysing the transition. Routledge, Oxon
100. Denzin, N. Y. K. (1978) The Research Act: A Theoretical Introduction to Sociological Methods, McGraw Hill, New York, USA.
101. Denzin, N., & Lincoln, Y. (Eds.). (2011). *The SAGE Handbook of Qualitative Research* (4 ed.). London: SAGE Publications.
102. Dirks, S., Gurdgiev, C., & Keeling, M. (2010). *Smarter Cities for Smarter Growth: How Cities Can Optimize Their Systems for the Talent-Based Economy*. Somers, NY: IBM Global Business Services.
103. Dixon, M. J. (2012). How Smart Cities Save Money (and the Planet), Harvard Business Review, HBR Blog Network. Web. Last accessed 16 Feb. 2017. http://blogs.hbr.org/cs/2012/10/tech-savvy_cities_are_saving_m.html.
104. Dsc.gov.ae. (2017). *Population and Vital Statistics*. [online] Available at: https://www.dsc.gov.ae/en-us/Themes/Pages/Population-and-Vital-Statistics.aspx?Theme=42&year=2000#DSC_Tab1 [Accessed 26 Apr. 2017].

105. Dubai.ae. (2017). *About Dubai*. [online] Available at: http://www.dubai.ae/en/AboutDubai/Pages/default.aspx [Accessed 24 Jul. 2017].

106. Duncan, G 2011, Abu Dhabi and Dubai are best places to live in the Middle East, survey says, *The National.*

107. Dvir, R., & Pasher, E. (2004). Innovation engines for knowledge cities: An innovation ecology perspective. *Journal of Knowledge Management*, 8(5), Pp. 16-27. Available at http://www.emeraldinsight.com/journals.htm?issn=13673270&volume=8&issue=5&articleid=106527&show=pdf&PHPSESSID=nhgj3cfuo0c783rinvovb73am1.

108. Easterby-Smith, M., Thorpe, R., Jackson, p. and Lowe, A. (2008) *Management research,* 3rd edn, SAGE Publications Limited, London.

109. Ebrahim, Z. & Irani, Z. (2005). E-government adoption: architecture and barriers. *Business Process Management Journal*, 11, 589-611.

110. Edvinsson, L. (2006). Aspects on the city as a knowledge tool. *Journal of Knowledge Management,* 10(5), Pp. 6-13.Available at http://www.corporatelongitude.com/download/Aspects_on_city.pdf.

111. Efthymiopoulos, M.P., 2016. Cyber-security in smart cities: the case of Dubai. *Journal of Innovation and Entrepreneurship*, *5*(1), p.11.

112. Eger, J. M. (2000). *Cities: Smart growth and the urban future*. The San Diego Union Tribune.

113. Eger, J. M. (2009). *Smart growth, smart cities, and the crisis at the pump a worldwide phenomenon.* I-Ways, *32*(1), Pp. 47-53.

114. Eger, JM, & MA (2010), Technology as a tool of transformation: e-Cities and the rule of law, *Information Systems: People, Organizations, Institutions, and Technologies*, pp. 23-30.

115. Eisenhardt, K.M. and Graebner, M.E. (2007) Theory building from cases: Opportunities and challenges., *Academy of management journal*, vol. 50, no. 1, pp. 25-32.

116. Eisenhardt, K.M., (1989). Building theories from case study research. *Academy of Management Review*, 14(4), pp. 532–550.

117. Elmaghraby, A., and Losavio, M. (2014) Cyber security challenges in Smart Cities: Safety, security and privacy. *Journal of Advanced Research*, 5(4), pp: 491–497.

118. Energia, I. (2010) *SlideShare*. Available at: https://www.slideshare.net/IMDEAENERGIA/smart-energy-management-algorithms (Accessed: 20 February 2017).

119. Ercoskun, OY (2015), *Green and Ecological Technologies for Urban Planning: Creating Smart Cities: Creating Smart Cities*, IGI Global.
120. Ergazakis, M., Metaxiotis, M. and Psarras, J. (2004), Towards knowledge cities: conceptual analysis and success stories, *Journal of Knowledge Management*, 8(5), pp. 5-15.
121. Eriksson, p. and Kovalainen, A. (2008) *Qualitative methods in business research*, Sage Publications Limited, London.
122. Evered, R. & Louis, M. R. (1981). Alternative Perspectives in the Organizational Sciences. *Academy of Management Review*, 6(3): 385-395.
123. Ferrara, R., (2015). The smart city and the green economy in Europe: A critical approach. *Energies*, *8*(6), pp.4724-4734.
124. Ferrari, G., Busanelli, S., Lotti, N., and Kaplan, Y., (2011) Cross-Network Information Dissemination in VANETs, *11th International Conference on ITS Telecommunications*, pp. 351-356.
125. Flick, U. (2007) *An Introduction to Qualitative Research,* 3rd edn, Sage, London.
126. Flick, U., (2008). Managing Quality in Qualitative Research, Sage Publications Ltd.
127. Florida, R. (2002). *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday life.* New York: Basic Books. Available at http://www.washingtonmonthly.com/features/2001/0205.florida.html.
128. Forest, F, &WD (2009), Roadmap for real world Internet applications: Socioeconomic scenarios and design recommendations, *Towards the Future Internet: A European Research Perspective*, pp. 325-344.
129. Frey, J.H. & Fontana, A., (1991). The group interview in social research. *Social Science Journal*, 28(2), pp. 175–87.
130. Gable, G.G., (1994). Integrating case study and survey research methods: an example in information systems. *European Journal of Information Systems*, 3(2), pp. 112–126.
131. Gaffney, C. and Robertson, C. (2016). Smarter than Smart: Rio de Janeiro's Flawed Emergence as a Smart City. *Journal of Urban Technology*, pp.1-18.
132. Galdon-Clavell, G., (2013). (Not so) smart cities?: The drivers, impact and risks of surveillance-enabled smart environments. *Science & Public Policy (SPP)*, *40*(6).
133. Galliers, R. (1992) *Information systems research: issues, methods and practical guidelines*, Blackwell Scientific.

134. Galliers, R. (1994). *Information systems research,* Waller.

135. Galliers, R.D. (1991) Choosing appropriate information systems research approaches: a revised taxonomy, *The Information Research Arena of the 90s,* , pp. 155-173.

136. Gartner (2012) *Big data Analytics - predictive Analytics - Gartner glossary*. Available at: http://www.gartner.com/it-glossary/predictive-analytics/ (Accessed: 20 February 2017).

137. Ghauri, p. and Grønhaug, K. (2010) *Research Methods in Business Studies*, 4th edn, Financial Times Prentice Hall, Harlow.

138. Giannakoulias, A. (2016). Cloud Computing Security: Protecting Cloud-Based Smart City Applications. *Journal of Smart Cities*, 2(1).

139. Gibson, W. and Brown, A. (2009) *Working with qualitative data*, Sage Publications Limited, London.

140. Giddens, A. (1984) *The constitution of society: outline of the theory of structuration*. University of California Press, Berkeley, CA.

141. Giffinger, R. and Gudrun, H., (2010). Smart cities ranking: an effective instrument for the positioning of the cities?. *ACE: Architecture, City and Environment*, *4*(12), pp.7-26.

142. Giffinger, R. and Pichler-Milanović, N. (2007). *Smart cities: Ranking of European medium-sized cities*.

143. Giffinger, R., Fertner, R., Kramar, C., Kalasek, H., Pichler-Milanović, N., and Meijers. (2007) *Smart cities Ranking of European medium-sized cities*, Vienna, Austria Cent. Reg. Sci. (SRF), Vienna Univ. Technol.

144. Gil-García, J.R. and Pardo, T.A., 2005. E-government success factors: Mapping practical tools to theoretical foundations. *Government information quarterly*, *22*(2), pp.187-216.

145. Gill, J. and Johnson, p. (1997) Research Methods for Managers, 2nd edition, London, Chapman.

146. Gillham, B. (2000) *Case study research methods,* Continuum International Publishing Group., London.

147. Girtelschmid, S., Steinbauer, M., Kumar, V., Fensel, A. and Kotsis, G. (2014). On the application of Big Data in future large-scale intelligent Smart City installations. *International Journal of Pervasive Computing and Communications*, 10(2), pp.168-182.

148. Glaeser, E. L., & Berry, C. R. (2006). Why are smart places getting smarter? Taubman Center Policy Briefs, PB-2006-2. Available at http://www.hks.harvard.edu/rappaport/downloads/policybriefs/brief_divergence.pdf.
149. Glaser BG Strauss AL (1967*) The discovery of grounded theory: Strategies for qualitative research* New York: Aldine de Gruyter
150. Goodyear, L., Barela, E., & Jewiss, J. (2014). *Research Methods for the Social Sciences: Qualitative Inquiry in Evaluation, From Theory to Practice*. Somerset, NJ, USA: Wiley.
151. Gottschalk, p. (1999). Strategic information systems planning: the IT strategy implementation matrix. *European Journal of Information Systems*, 8(2), pp. 107–118.
152. Gray, D. E. (2009) *Doing Research in the Real World,* California: SAGE Publications/Thousand Oaks
153. Green, J. and Thorogood, N. (2009) *Qualitative methods for health research*, 2nd edn, Sage Publications Limited, London.
154. Guba, E. and Lincoln, Y. (1994) Competing paradigms in qualitative research. In: Denzin, N. and Lincoln, Y. (ed*.). Handbook of Qualitative Research, London*, Sage Publications, pp. 105-117.
155. Guleria, P., (2012). *International Journal of Engineering & Science Research*.
156. Hair Jr, J.F., Celsi, M.W., Money, A.H., Samouel, p. and Page, M.J. (2011) *Essentials of business research methods,* ME Sharpe Inc.
157. Hair, J.F., Babin, B., Money, A.H. and Samouel, p. (2003) *Essentials of Business Research Methods*, John Wiley & Sons Inc, New Jersey, USA.
158. Hajduk, S. (2016). The Concept of a Smart City in Urban Management. *Business, Management and Education*, 14(1), pp.34-49.
159. Hajer, M (2014), *Smart About Cities. Smart urbanism: an agenda for planning and design*, pp. 29-42.
160. Hall, P, (2014), *Cities of tomorrow*, Blackwell Publishers.
161. Hamed, A., (2009). *E-commerce and Economic Development in Libya* (Doctoral dissertation, University of Wales).
162. Hamed, A., (2010). E-commerce and Economic Development in Libya (Doctoral dissertation, University of Wales).

163. Hamed, A., Berger, H., Cleary, P. and Ball, D., (2008). E-Commerce drivers and barriers: A new classification method in digital revolution. In *Proceedings of The UK Academy of Information Systems (UKAIS) Conference, Bournemouth*.
164. Hancke, G.P. and Hancke Jr, G.P., (2012). The role of advanced sensing in smart cities. *Sensors*, *13*(1), pp.393-425.
165. Hannabuss, S. (1996) Research interviews, New Library World, 97(1129), pp. 22–30.
166. Harfouche, A. and Robbin, A., (2012). *E-government implementation in developing countries: a neoinstituional approach to explain failure. An example from Lebanon* (No. 123456789/13601). Paris Dauphine University.
167. Harling, K. (2002). An overview of case study. *Retrieved August*, 4, 2007.
168. Harrison, C., Eckman, B., Hamilton, R., Hartswick, P., Kalagnanam, J., Paraszczak, J., & Williams, P. (2010). *Foundations for Smarter Cities*. IBM Journal of Research and Development, 54(4).
169. Hartley, J. (2004) Case study research in *Essential Guide to Qualitative Methods in Organisational Research*, eds. C. Cassell and G. Symon, Sage London, London, pp. 323-333.
170. Haughton, G., and Hunter, C. (1994). *Sustainable Cities*, London: Jessica Kingsley and Regional Studies Association. http://www.civ.utoronto.ca/sir/.
171. Hayes, J., (2014). *The theory and practice of change management*. Palgrave Macmillan.
172. Hayes, N. (2000) *Doing Psychological Research: Gathering and Analysing Data*, Open University Press, Buckingham, Philadelphia.
173. Hernández-Muñoz, J.M., Vercher, J.B., Muñoz, L., Galache, J.A., Presser, M., Gómez, L.A.H. and Pettersson, J., (2011), May. Smart cities at the forefront of the future internet. In *The Future Internet Assembly* (pp. 447-462). Springer Berlin Heidelberg.
174. Herriott, R.E. and Firestone, W.A. (1983) Multisite qualitative policy research: Optimizing description and generalizability, *Educational researcher*, vol. 12, no. 2, pp. 14-19.
175. Hevner, A., March, S., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28*(1), 77-105.
176. Hevner, A., & Chatterjee, S. (2010). *Design Research in Information Systems - Theory and Practice*. New York, Dordrecht, Heidelberg, London: Springer Science+Business Media.

177. Hirschheim, R. (1985). Information Systems Epistemology: An Historical Perspective. *In:* Mumford, E., Hirschheim, R., Fitzgerald, G. & Wood-Harper, A. T. (eds.) *Research Methods in Information Systems.* (North Holland), Amsterdam, The Netherlands: Elsevier Science Publishers B. V.

178. Hirschheim, R. and Klein, H. K. (1994) Realizing emancipatory principles in information systems development: The case for ETHICS, *MIS Quarterly*, 18(1), pp. 83-109.

179. Hirschheim, R., Klein, R. K. & Lyytinen, K. (1995) *Information Systems Development and Data Modelling: Conceptual and Philosophical Foundations.* Cambridge University Press, Cambridge, UK.

180. Hitachi Data Sytems, (n.d.). *Can smart cities also be safer cities?*. Hitachi.

181. Hollands, R. (2008). *Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?*

182. Hollands, R., (2015). Critical interventions into the corporate smart city, *Cambridge Journal of Regions, Economy and Society*, 8(51), pp: 61-77.

183. Houston, D., Boarnet, M.G., Ferguson, G. and Spears, S., (2015). Can compact rail transit corridors transform the automobile city? Planning for more sustainable travel in Los Angeles. *Urban Studies*, *52*(5), pp.938-959.

184. Huang, J, Newell, S, Galliers, R and Pan, S L., (2003). Dangerous Liaison: Component-Based Development and Organizational Subcultures. *IEEE Transactions on Engineering Management* Vol. 50 No. 1, pp. 89-99.

185. Hussey, J. and Hussey, R. (1997) *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*, Macmillan, London.

186. *IBM offers smarter city assessment tool to help cities prepare for challenges and opportunities of unprecedented urbanization* (2009) Available at: http://www-03.ibm.com/press/us/en/pressrelease/27791.wss (Accessed: 18 February 2017).

187. Ibrahim, M. and Morsy, D. (2016). Smart Cities and Sustainability: A Set of Vertical Solutions for Managing Resources. *International Journal of Environment and Sustainability*, 5(3).

188. Ibrahim, M., Al-Nasrawi, S., El-Zaart, A. and Adams, C., (2015), June. Challenges facing E-Government and Smart Sustainable City: An Arab Region Perspective. In *Proceedings of*

The 15th European Conference on eGovernment ECEG 2015 University of Portsmouth (p. 396).

189. IEC, IA (2014), Smart cities preliminary report.
190. Irani, Z., Gunasekaran, A. & Love, p. E., (2006). Quantitative and qualitative approaches to information systems evaluation. *European Journal of Operational Research*, 173(3), pp. 951–956.
191. Irani, Z., Love, p. E. and Jones, S. (2008) Learning lessons from evaluating eGovernment: reflective case experiences that support transformational government, *The Journal of Strategic Information Systems*, vol. 17, no. 2, pp. 155-164.
192. Ishida, T. (2002), Digital city Kyoto, *Communications of the ACM*, 45(7), pp. 6-81.
193. ITU (2015) *Focus group on smart water management*. Available at: http://www.itu.int/en/ITU-T/focusgroups/swm/Pages/default.aspx (Accessed: 20 February 2017).
194. Ives, B. & Olson, M. (1984) User involvement and MIS success: A review of research. *Management Sciences*, 30, 586-603.
195. Janesick, V. (2000) *The Choreography of Qualitative Research Design*. In Handbook of Qualitative Research (Ed, Lincoln, Y. S.), SAGE Publications, Thousand Oaks, California, USA, 379-399.
196. Janesick, V.J. (2003) The Choreography of Qualitative Research Design: Minutes, Improvisations and Crystallisations in *Strategies of qualitative inquiry*, eds. N.K. Denzin and Y.S. Lincoln, Sage, London, UK, pp. 46.
197. Janesick, V.J., (1998). *Stretching Exercises for Qualitative Researchers*. Thousand Oaks, CA: Sage Publications Inc.
198. Jankowicz, A.D. (2005) *Business research projects*, Cengage Learning EMEA.
199. Jarratt, D.G., 1996. A comparison of two alternative interviewing techniques used within an integrated research design: a case study in out shopping using semi-structured and non-directed interviewing techniques. *Marketing Intelligence & Planning*, 14(6), pp. 6–15.
200. Jin, J., Gubbi, J., Marusic, S. and Palaniswami, M., (2014). An information framework for creating a smart city through internet of things. *IEEE Internet of Things Journal*, *1*(2), pp.112-121.

201. John-Green, M. and Watson, T. (2014) Safety and Security of the Smart City – when our infrastructure goes online. *System Safety and Cyber Security Conference*, UK.

202. Johnson, p. and Harris, D. (2002) Qualitative and quantitative issues in research design. in *Essential Skills for Management Research*, ed. D. Partington, Sage Publications, London, pp. 99-116.

203. Johnson, R.B. and Onwuegbuzie, A.J. (2004) Mixed methods research: A research paradigm whose time has come, *Educational researcher*, vol. 33, no. 7, pp. 14.

204. Kamal, M.M. and Alsudairi, M. (2009) "Investigating the importance of factors influencing integration technologies adoption in local government authorities", vol. 3, no. 3, pp. 302-331

205. Kanter, M., Rosabeth, and Stanley S. (2009). *Informed and interconnected: A manifesto for smarter cities*. Harvard Business School General Management Unit Working Paper, Pp. 09-141.

206. Kanter, R. M., & Litow, S. S. (2009). Informed and interconnected: A manifesto for smarter cities. *Harvard Business School General Management Unit Working Paper*, Pp. 09-141. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1420236.

207. Kaplan, A. (1964). *The Conduct of Enquiry: Methodology for Behavioural Research*, California, USA, Chandler.

208. Kaplan, B. & Maxwell, J.A., (1994). Qualitative research methods for evaluating computer information systems. *Evaluating health care information systems: Methods and applications*, pp. 45–68.

209. Kaplan, R. S. (1986). The role for empirical research in management accounting. *Accounting, Organizations and Society*, 11, 429-452.

210. Khanh, N.T.V., (2014). The critical factors affecting E-Government adoption: A Conceptual Framework in Vietnam. *arXiv preprint arXiv:1401.4876.*

211. Khansari, N., Mostashari, A., and Mansouri, M., (2013) Impacting Sustainable Behaviour and Planning in Smart City, International Journal of Sustainable Land Use and Urban Planning, 1(2), pp: 46-61.

212. Khouri, D. (2012), *eGovernment Strategies: The Case of the United Arab*.

213. Kitchin, R., (2016). *Getting smarter about smart cities: Improving data privacy and data security*.

214. Klein, H. K. & Myers, M. D. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly: Management Information Systems*, 23, 67-94.

215. Klischewski, R. (2011). *Architectures for Tinkering*?

216. Klievink, B. and Janssen, M. (2008) "Stage models for creating joined-up government: from local to nation-wide integration", *Proceedings of the 2008 international conference on Digital government research*Digital Government Society of North America, , pp. 117

217. Knapp, E.D. and Samani, R., (2013). *Applied cyber security and the smart grid: Implementing security controls into the modern power infrastructure*. Newnes.

218. Koch, V. (2003) Why is its impact in higher education so small? , *The TQM Magazine*, vol. 15, no. 5, pp. 325-333.

219. Kogan, N (2014), Exploratory research on success factors and challenges of Smart City Projects, *Asia Pacific Journal of Information Systems*, pp. 141-189.

220. Kokkala, M & Airaksinen, M. (2015), *Smart City Intro and Concepts*.

221. Komninos, N (2009), Intelligent cities: Towards interactive and global innovation environments, *International Journal of Innovation and Regional Development*, vol 1, no. 4, pp. 337-355.

222. Komninos, N., & Sefertzi, E. (2009). *Intelligent cities: R&D offshoring, Web 2.0 product development and globalization of innovation systems.* Paper presented at the Second Knowledge Cities Summit 2009. Available at http://www.urenio.org/wpcontent/uploads/2008/11/Intelligent-Cities-Shenzhen-2009-Komninos-Sefertzi.pdf

223. Komninos, Nicos (2013). "*What makes cities intelligent*?". In Deakin, Mark. *Smart Cities: Governing, Modelling and Analysing the Transition*. Taylor and Francis. p. 77.

224. Komninos, Nicos. "Intelligent cities: Variable geometries of spatial intelligence.". In Deakin, Mark; Al Waer, Husam. *From Intelligent to Smart Cities*. *Journal of Intelligent Buildings International: From Intelligent Cities to Smart Cities*

225. Komninos, N., Bratsas, C., Kakderi, C. and Tsarchopoulos, P. (2015). Smart city ontologies: Improving the effectiveness of smart city applications. *Journal of Smart Cities*, 1(1).

226. Komninos, N., Pallot, M. and Schaffers, H., (2013). Special issue on smart cities and the future internet in Europe. *Journal of the Knowledge Economy*, *4*(2), pp.119-134.

227. Komninos, N., Pallot, M., and Schaffers, H. (2013) Smart Cities and the Future Internet in Europe, *Journal of the Knowledge Economy*, 4(2), pp.119–134.

228. Komninos, N., PMASH, (2013), Special issue on smart cities and the future internet in Europe, *Journal of the Knowledge Economy*, pp. 119-134.

229. Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*: New Age International.

230. KPMG (2015), *Dubai - a new paradigm for smart cities*.

231. Krathwohl, D. (1997) *Methods of Educational and Social Science Research: An Integrated Approach*. 2nd edition, Addison Wesley Longman.

232. Kuechler, B., Park, E. & Vaishnavi, V., (2009). Formalizing theory development in IS design science research: learning from qualitative research. In *15th Americas Conference on Information Systems (AMCIS) 2009*. San Francisco, California.

233. Kumar, TMV (2014), *E-Governance for Smart Cities*, Springer.

234. Kuttab, J. (2016). *UAE to have lowest violent crime rate in the world*. [online] Khaleejtimes.com. Available at: http://www.khaleejtimes.com/nation/government/uae-has-lowest-recorded-violent-crimes-rate-in-the-world [Accessed 26 Apr. 2017].

235. Kvale, S. (2007) *Doing interviews*, Sage Publications Limited, London.

236. Lam, W., (2005). Barriers to e-government integration. J*ournal of Enterprise Information Management*, 18(5), pp.511-530.

237. Lee, A. S. (1989). Case Studies as Natural Experiments. *Human Relations*, 42(2): 117-137.

238. Lee, A.S. (1991) Integrating positivist and interpretive approaches to organizational research, *Organization science*, pp. 342-365.

239. Lee, J.H., Hancock, M.G. and Hu, M.C., (2014). Towards an effective framework for building smart cities: Lessons from Seoul and San Francisco. *Technological Forecasting and Social Change*, *89*, pp.80-99.

240. Lee, S., Han, J., Leem, Y., & Yigitcanlar, T. (2008). Towards ubiquitous city: Concept, planning, and experiences in the Republic of Korea. In T. Yigitcanlar, K. Velibeyoglu & S. Baum (Eds.), *Knowledge-Based Urban Development: Planning and Applications in the Information Era* (pp. 148-169). Hershey, PA: IGI Global.

241. Lee, T.W., (1998). *Using qualitative methods in organizational research*, Sage.

242. Leedy, p. D. and Ormrod, J. E. (2005) *Practical research: Planning and design*. 8th edn. New Jersey: Pearson Prentice Hall.

243. Lekamge, S. and Marasinghe, A., (2013), July. Developing a smart city model that ensures the optimum utilization of existing resources in cities of all sizes. *In Biometrics and Kansei Engineering (ICBAKE), 2013 International Conference* on (pp. 202-207). IEEE.

244. Letaifa, S.B., (2015). How to strategize smart cities: Revealing the SMART model. *Journal of Business Research*, *68*(7), pp.1414-1419.

245. Li, W., Chao, J. and Ping, Z., (2012), November. Security structure study of city management platform based on cloud computing under the conception of smart city. In *Multimedia Information Networking and Security (MINES), 2012 Fourth International Conference on* (pp. 91-94). IEEE.

246. Li, Y., Dai, W., Ming, Z. and Qiu, M., (2016). Privacy protection for preventing data over-collection in smart city. *IEEE Transactions on Computers*, *65*(5), pp.1339-1350.

247. Lillis, A. M. and Mundy, J. (2005) Cross-Sectional Field Studies in Management Accounting Research Closing the Gaps between Surveys and Case Studies, *Journal of management accounting research*, 17, pp. 119-141.

248. Lincoln, Yvonna S. & Guba, Egon, G. (2000). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), The handbook of qualitative research (second edition) (pp.163-188). London: Sage.

249. Lindskog, H. (2004). Smart communities initiatives. In Proceedings of the 3rd ISOneWorld Conference (Las Vegas, NV, Apr 14-16). Available at http://www.heldag.com/articles/Smart%20communities%20april%202004.pdf.

250. Littlejohn, S. (2000). *Theories of Human Communication*. Belmont, CA: Wadsworth

251. Liu, P. and Peng, Z., (2013). Smart cities in China. *IEEE Computer Society*, *16*.

252. Liu, P. and Peng, Z., (2014). China's smart city pilots: A progress report. *Computer*, *47*(10), pp.72-81.

253. Lom, M., Pribyl, O. and Svitek, M., (2016), May. Industry 4.0 as a part of smart cities. In *Smart Cities Symposium Prague (SCSP), 2016* (pp. 1-6). IEEE.

254. Lombardi, P. (2011). New Challenges in the Evaluation of Smart Cities, Network Industries Quarterly, Vol. 13. Web. Last accessed 8 Feb. 2017.

http://newsletter.epfl.ch/mir/index.php?module=epflfiles&func=getFile&fid=241&inline=1
.

255. Lombardi, P., Giordano, S., Farouh, H. and Yousef, W., (2012). Modelling the smart city performance. *Innovation: The European Journal of Social Science Research*, *25*(2), pp.137-149.
256. Lombardi, P., Giordano, S., Farouh, H. and Yousef, W., 2012. Modelling the smart city performance. *Innovation: The European Journal of Social Science Research*, *25*(2), pp.137-149.
257. Luftman, J., (2000). Assessing business-IT alignment maturity. *Strategic Information Technology: Opportunities for Competitive Advantage*, 6, pp. 105–134.
258. Luna-Reyes, L.F. and Gil-García, J.R., (2011). Using institutional theory and dynamic simulation to understand complex e-Government phenomena. *Government Information Quarterly*, *28*(3), pp.329-345.
259. Luthans, F. & Davis, T. R. V. (1982). An Idiographic Approach to Organizational Behaviour Research: The Use of Single Case Experimental Designs and Direct Measures. *Academy of Management Review*, 7(3): 380-391.
260. Madakam, S. and Ramaswamy, R., (2016). Sustainable Smart City: Masdar (UAE)(A City: Ecologically Balanced). *Indian Journal of Science and Technology*, *9*(6).
261. Maimbo, H., Pervan, G. & Perth, W.A., (2005). Designing a Case Study Protocol for Application in IS Research. In *The Ninth Pacific Acia Conference in Information Systems (PACIS) 2005*. Bangkok, Thailand.
262. Malanga, S. (2004). The curse of the creative class. City, 14(1). Available at http://www.cityjournal.org/html/14_1_the_curse.html.
263. Malek, J. A. (2009, Oct 17-19). *Informative global community development index of informative smart city*. In Proceedings of the 8th WSEAS International Conference on Education and Educational Technology. Genova, Italy.
264. Malhotra, M.K. and Varun, G. (1998) An Assessment of Survey Research in POM: From Constructs to Theory, *Journal of Operations Management*, vol. 16, no. 4, pp. 407-425.
265. Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The Lancet*, 358, 483-488.

266. Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J.K., Thaarup, R.K., Liebe, A., Wissner, M., Massink, R. and Kotterink, B., (2014). *Mapping smart cities in the EU*.

267. Marceau, J. (2008). *Introduction: Innovation in the city and innovative cities*. Innovation: Management, Policy & Practice 10.2-3, Pp.136-145.

268. Markus, M.L. and Robey, D. (1988) Information technology and organizational change: causal structure in theory and research, *Management science*, , pp. 583-598.

269. Marsal-Llacuna, M.L., Colomer-Llina, J. and Mele´ndez-Frigola, J., (2014) Lessons in urban monitoring taken from sustainable and livable cities to better address the Smart Cities initiative, *Technological Forecasting and Social Change*.

270. Marsal-Llacuna, M.L., Colomer-Llinàs, J. and Meléndez-Frigola, J., (2015). Lessons in urban monitoring taken from sustainable and livable cities to better address the Smart Cities initiative. *Technological Forecasting and Social Change*, *90*, pp.611-622.

271. Marshall, C. and Rossman, G.B. (2011) *Designing qualitative research*, 5th edn, Sage Publications, London.

272. Marshall, p. (2014). *Research Methods: How to Design and Conduct a Successful Project*. Hachette UK.

273. Martin, J. L., Varilly, H., Cohn, J., & Wightwick, G. R. (2010). *Preface: Technologies for a smarter planet*. IBM Journal of Research and Development, 54(4). DOI:10.1147/JRD.2010.2051498.

274. Maruyama, G., & Ryan, C. S. (2014). *Research Methods in Social Relations* (8 ed.). Somerset, NJ, USA: John Wiley & Sons.

275. Mason, J. (2002) *Qualitative Researching,* 2nd edn, Sage, London.

276. Mason, M. (2010) Sample size and saturation in PhD studies using qualitative interviews, *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*. Institute for Qualitative Research and the Center for Digital Systems, Freie University Berlin.

277. Masrek, M.N., Mohamed, I.S., Daud, N.M. and Omar, N., (2014). Technology trust and mobile banking satisfaction: a case of Malaysian consumers. *Procedia-Social and behavioral sciences*, *129*, pp.53-58.

278. Mattoni, B., Gugliermetti, F. and Bisegna, F., (2015). A multilevel method to assess and design the renovation and integration of Smart Cities. *Sustainable Cities and Society*, *15*, pp.105-119.

279. Maxwell, J. (2013). *Qualitative Research Design An Interactive Approach* (3rd ed., p. 232). Thousand Oaks, CA: SAGE Publications.

280. Maykut, p. and Morehouse, R. (1994) Beginning practical guide, a philosophic and qualitative research, London, UK, Falmer Press.

281. Mazen, A., Kurnia, S. and Johnson, R.B. (2011) Understanding the Progressive Nature of Inter-Organizational Systems (IOS) Adoption, in *E-Collaboration Technologies and Organizational Performance: Current and Future Trends*, ed. N. Kock, IGI Global, Hershey, PA, pp. 124-144.

282. McClure, R. D. (2002). *Common Data Collection Strategies Effective in Qualitative Studies Using Action Research in Technical /Operational Training Programs* [online] Available from: http://evokedevelopment.com/uploads/blog/commonData.pdf [21 January 2016]

283. McGrath, J. E. (1984) *Groups: Interaction and Performance*, Englewood Cliffs, Nj: Prentice-Hall.

284. Meijer, A. and Bolívar, M. (2016). Governing the smart city: a review of the literature on smart urban governance. *International Review of Administrative Sciences*, 82(2), pp.392-408.

285. Meijer, Albert, Bolívar, Rodríguez, M. P., (2013) Governing the Smart Sustainable City: Scaling-Up the Search for Socio-Techno Synergy, T EGPA (Edinburgh, September) Permanent Study Group on E-Government, Web. Last accessed 15 Feb. 2017. https://www.scss.tcd.ie/disciplines/information_systems/egpa/docs/2013/BolivarMeijer.pdf

286. Merriam, S. B. (2014). *Qualitative Research: A Guide to Design and Implementation* (3 ed.). Somerset, NJ, USA: John Wiley and Sons.

287. Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative Data Analysis: A Methods Sourcebook* (3rd ed., p. 408). Thousand Oaks, CA: SAGE Publications.

288. Miles, M.B. & Huberman, A.M., (1994). *Qualitative data analysis: An expanded sourcebook* Second Edition., London: Sage.

289. Mintzberg, H. (1996). MANAGING GOVERNMENT GOVERNING MANAGEMENT. *Harvard Business Review*, 74, 75-83.

290. Mishra, M.K., (2013). *Role of Technology in Smart Governance: 'Smart City, Safe City'*.

291. Missi, F. (2005) *An Exploration of Data Quality and Data Integration Issues Associated with CRM Efforts*, PhD Thesis, Department of Information Systems and Computing, Brunel University, London, UK.

292. Morgan, G. & Smircich, L. (1980). The Case For Qualitative Research. *Academy of Management Review*, 5(4): 491-500.

293. Morse, J. (1999) Myth #93: Reliability and validity are not relevant to qualitative inquiry. Qualitative Health Research, 9 (6), pp. 717-718.

294. Moser, M. A. (2001). What is smart about the smart communities movement? *E-Journal*, 10/11(1). Available at http://www.ucalgary.ca/ejournal/archive/v10-11/v10-11n1Moser-print.html.

295. Mostert, J. (2010), *Challenges and opportunities of e-government in south Africa*.

296. Mukhopadhyay, S. and Gupta, R. K. (2014) Survey of Qualitative Research Methodology in Strategy Research and Implication for Indian Researchers, *Vision: The Journal of Business Perspective*, 18(2), pp. 109-123. doi: 10.1177/0972262914528437.

297. Munier, N. (2007). *Handbook on Urban Sustainability*, Springer.

298. Myers, M. (1997). Qualitative Research in Information Systems. *MIS Quarterly* 21(2): 241-242.

299. Myers, M.D. & Avison, D., (2002). An introduction to qualitative research in information systems. *Sage*, pp. 3–12.

300. Myers, M.D. (2009) *Qualitative Research in Business and Management*, Sage Publications Limited, London.

301. Nachmias, C. & Nachmias, D., (1996). *Research Methods in the Social Sciences* 5th ed., Frankfort: Hodder Arnold.

302. Nam, T. and Pardo, T.A., (2011a), June. Conceptualizing smart city with dimensions of technology, people, and institutions. In *Proceedings of the 12th annual international digital government research conference: digital government innovation in challenging times* (pp. 282-291). ACM.

303. Nam, T. and Pardo, T.A., (2011b), September. Smart city as urban innovation: Focusing on management, policy, and context. In *Proceedings of the 5th international conference on theory and practice of electronic governance* (pp. 185-194). ACM.

304. Nam, T. (2013) Conceptualising smart city with dimensions of technology, people, and institutions., *In Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times*, ACM.

305. Nam, T, (2014), Smart city as urban innovation: Focusing on management, *In Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance*, ACM.

306. Neirotti, P. (2014), Current trends in Smart City initiatives: Some stylised facts, *Cities* 38.

307. Neirotti, P., De Marco, A., Cagliano, A.C., Mangano, G. and Scorrano, F. (2014) Current Trends in Smart City Initiatives: Some Stylised Facts, *Cities.* 38, pp.25–36.

308. Neuman, W. (2003) *Social Research Methods: Qualitative and Quantitative Approaches*, Pearson Education, London.

309. Nissen, H. E. (1985) *Acquiring Knowledge of Information Systems-Research in Methodological Quagmire*. In E. Mumfird, R. Hirschheim, G. Fitzgerald, and T. Wood-Harper (Eds), Research Methods in Information Systems, North-Holland, New York, 36-52.

310. Novotný, R., Kuchta, R., and Kadlec, J. (2014) Smart City Concept, Applications and Services. *Journal of Telecommunication and system management*. 3, pp:117. doi: 10.4172/2167-0919.1000117

311. O'Leary Z. (2004) *The essential guide to doing research*. Sage.

312. Oates, B. (2006) *Researching Information Systems and Computing*. London: Sage.

313. Ojo, A., Curry, E. and Zeleti, F.A., (2015), January. A tale of open data innovations in five smart cities. In *System Sciences (HICSS), 2015 48th Hawaii International Conference on* (pp. 2326-2335). IEEE.

314. Omari, A. (2013), TECHNOLOGY ADOPTION IN THE ARABIAN GULF COUNTRIES: THE CASE OF E-GOVERNMENT.

315. Orlikowski, W.J. and Baroudi, J.J. (1991) Studying information technology in organizations: Research Approaches and Assumptions, *The Institute of Management Sciences*, 2(1), 508-525.

316. Pardo, T.A. and Tayi, G.K.f. (2007) Interorganizational information integration: A key enabler for digital government, pp. 691-715.

317. Paré, G. (2004) Investigating Information Systems with Positivist Case Research, *Communications of the Association for Information Systems*, vol. 13, no. 1, pp. 18.

318. Paroutis, S., Bennett, M. and Heracleous, L., (2014). A strategic view on smart city technology: The case of IBM Smarter Cities during a recession. *Technological Forecasting and Social Change*, *89*, pp.262-272.

319. Paskaleva, K., 2009, Enabling the smart city: The progress of e-city governance in Europe. International Journal of Innovation and Regional Development. 1 (4): 405–422(18).

320. Paskaleva, K., Cooper, I., Linde, P., Peterson, B. and Götz, C., (2015). Stakeholder engagement in the smart city: making living labs work. In *transforming city governments for successful smart cities* (pp. 115-145). Springer International Publishing.

321. Pateman, C. (1970). *Participation and democratic theory*. Cambridge: Cambridge University Press. Available from Cambridge Books Online. Retrieved from http://dx.doi.org/10.1017/CBO9780511720444

322. Patton, M., (1990), Qualitative Evaluation and Research Methods, California, CA: Sage Publications.

323. Patton, M.Q. (2015). *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. 4th edn. Los Angeles: SAGE.

324. Paul, D.A., Cleverley, M., Kerr, W., Marzolini, F., Reade, M. and Russo, S. (2011) *Smarter Cities Series: Understanding the IBM Approach to Public Safety*. IBM Corp.

325. Peak, M. L., (2008). *Organizational change and the research university: The exploration of technological transformation in an academic research library*, PhD thesis, University of Virginia

326. Pelosi, M.K., Sandifer, T.M. and Sekaran, U. (2001) *Research and evaluation for business*, John Wiley, New York, NY.

327. Phillips, E.M. and Pugh, D.S. (2010) *How to get a PhD,* 5th edn, Open University Press, England, UK.

328. Piro, G., Cianci, I., Grieco, L.A., Boggia, G. and Camarda, P., 2014. Information centric services in smart cities. *Journal of Systems and Software*, *88*, pp.169-188.

329. Plumb, D., Leverman, A., & McGray, R. (2007). *The learning city in a 'planet of slums'*. Studies in Continuing Education, 29(1), Pp. 37-50.

330. Polkinghorne, D. E. (2005) Language and meaning: Data collection in qualitative research, *Journal of counseling psychology*, 52(2), pp. 137. doi: 10.1037/0022- 0167.52.2.137.

331. Popper, K. (1963) *Conjectures and Refutations: The Growth of Scientific Knowledge*. Harper Row, New York.

332. Punch, K. (2003). *Survey Research*: *The Basics*. Sage, London, UK.

333. Ranjit Rajan, (2016), Future Cities: Time to Smarten Up. *IDC*.

334. Reckien, D., Flacke, J., Olazabal, M. and Heidrich, O., (2015). The Influence of drivers and barriers on urban adaptation and mitigation plans - An empirical analysis of european cities. *PloS one*, *10*(8), p.e0135597.

335. Remenyi, D., Williams, B., Money, A. and Swartz, E. (1998) *Doing research in and management: an introduction to process and method*, London, UK, Sage.

336. Renata, P., Dameri, F. R., (2015) Smart city intellectual capital: an emerging view of territorial systems innovation management, *Journal of Intellectual Capital*, 16(4), pp.860-887, doi: 10.1108/JIC-02-2015-0018

337. *Retrofit for commercial program* (2017) Available at: https://saveonenergy.ca/Business/Program-Overviews/Retrofit-for-Commercial.aspx (Accessed: 20 February 2017).

338. Ribina, E. (2015), Organizational and economic methods for development of smart cities. *Economic Systems Management*, 82, pp: 27.

339. Robey, D. (1996) Research commentary: diversity in information systems research: threat, promise and responsibility, *Information Systems Research*, vol. 7, no. 4, pp. 400-408.

340. Robson, C. (2002) *Real world research: A resource for social scientists and practitioner researchers*, Wiley-Blackwell.

341. Rodríguez-Bolívar, M. P. (2015) Transforming City Governments for Successful Smart Cities, *Public Administration and Information Technology* 8, DOI 10.1007/978-3-319-03167-5_2.

342. Rodríguez-Bolívar, M.P., (2015). *Transforming city governments for successful smart cities*. Springer.

343. Roscia, M., Longo, M. and Lazaroiu, G.C., (2013), October. Smart City by multi-agent systems. In *Renewable Energy Research and Applications (ICRERA), 2013 International Conference on* (pp. 371-376). IEEE.

344. Rowley, J. (2002) Using case studies in research, Management Research News, 25(1), pp. 16-27.

345. Rudestam, K.E. and Newton, R.R. (2007) *Surviving your dissertation: a comprehensive guide to content and process,* SAGE Publications, London, UK.
346. SKorea, (2012), *A Look into the Smart City. Korea IT Times*. [Online]. Available from http://www.koreaittimes.com/story/20111/look-smart-city
347. Sairamesh, J., Lee, A., & Anania, L. (2004). *Information cities*. Communications of the ACM, 47(2), Pp.28-31.
348. Sarantakos, S. (2005) *Social research, edn*, 3rd edn, Palgrave Macmillan, New York.
349. Sartori, P, M. (2013) *Connected cities: Smart sustainable cities*. Available at: https://itu4u.wordpress.com/2013/09/15/connected-cities-smart-sustainable-cities/ (Accessed: 20 February 2017).
350. Saunders, M., Lewis, p. and Thornhill, A. (2000) *Research Methods for Business Students*, 2 nd edn, Prentice Hall. Essex, UK.
351. Saunders, M., Lewis, p. and Thornhill, A. (2003) *Research Methods For Business Students*, 3rd edn, Person Professional Limited, Prentice Hall, Essex, UK.
352. Saunders, M., Lewis, p. and Thornhill, A. (2007) Research Methods for Business Students, 4 th edn, Prentice Hall.
353. Saunders, M., Lewis, p. and Thornhill, A. (2009) *Research methods for business students,* Financial Times/Prentice Hall. Essex, UK.
354. Saunders, M.N.K., Lewis, p. and Thornhill, A. (2012) *Research methods for business students*, 6th edn, Pearson Education Limited, Essex, England.
355. Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M. and Oliveira, A., 2011, May. Smart cities and the future internet: Towards cooperation frameworks for open innovation. In *The Future Internet Assembly* (pp. 431-446). Springer Berlin Heidelberg.
356. Sekaran, U. (2003) *Research Methods for Business: A Skill Building Approach*, Fifth edition John Wiley & Sons Ltd west Sussex UK
357. Sekaran, U. and Bougie, R. (2010) *Research Methods for Business: A Skill Building Approach*, 5th edn, John Wiley & Sons Ltd., West Sussex, UK.
358. Seogjun Lee, SWOAKN (2016), *Transformational and Transactional Factors for the Successful Implementation of Enterprise Architecture in Public Sector*.
359. Seybold, A. (2011) *9/11 safety update: Why First Responder communications Hasn't improved in 10 years*. Available at: https://www.forbes.com/sites/investor/2011/09/08/911-

safety-update-why-first-responder-communications-hasnt-improved-in-10-years/#a4be47563b4b (Accessed: 19 February 2017).

360. Shah, A. (2010) *Water and development — global issues*. Available at: http://www.globalissues.org/article/601/water-and-development (Accessed: 21 February 2017).

361. Shelton, T., Zook, M. and Wiig, A., (2015). The ‘actually existing smart city’. *Cambridge Journal of Regions, Economy and Society*, *8*(1), pp.13-25.

362. Shichiyakh, R, A., Klyuchnikov, D, A., Balashova, S, P., Novoselov, S, N., and Novosyolova, N, N. (2016) Smart City as the Basic Construct of the Socio-economic Development of Territories, *International Journal of Economics and Financial Issues*, 6(SI), pp: 157 – 162.

363. Silcock, R. (2000), *What is e-government?* Parliamentary Affairs, [online] Available from: http://catedras.fsoc.uba.ar/rusailh/Unidad%202/Silcock%202001,%20What%20is%20E-gov.pdf

364. Silverman, D. (2010) *Doing qualitative research*, 3rd edn, Sage Publications Limited, London.

365. Silverman, D. J. (2001). *Interpreting qualitative data: Methods for analyzing talk, text and interaction.* Thousand Oaks, CA: Sage Publications.

366. Snieška, V., and Zykiene, I. (2014) The Role of Infrastructure in the Future City: Theoretical Perspective, *Procedia - Social and Behavioral Sciences*, 156(26), pp: 247-251.

367. Söderström, O., Paasche, T. and Klauser, F., (2014). Smart cities as corporate storytelling. *City*, *18*(3), pp.307-320.

368. Sofiane, S., (2005). E-Government In The Arabian Gulf: Government Transformation Vs. Government Automation. *In eGovernment Workshop.*

369. Speak, TCAG (2012), *Developing a 'smart city': Understanding Information Technology Capacity and Establishing an agenda to change*. Center for regional research and innovation, [online], available from http://trevorcairney.com/wp-content/uploads/2012/11/IT_Audit.pdf

370. Sproull, L., & Patterson, J. F. (2004). *Making information cities livable*. Communications of the ACM, *47*(2), Pp. 33-37.

371. Stake, R. E. (1995). *The art of case study research*, Sage Publications, Inc.

372. Stone, E. F. (1978). *Research methods in organizational behavior*, Scott, Foresman Glenview, Il.
373. Straub, D., Boudreau, M. C. & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information Systems,* 13: 380-427.
374. Straub, D., Gefen, D. & Boudreau, M. C. (2005). Quantitative Research. *In Research in Information Systems: A Handbook for Research Supervisors and Their Students.* Avison, D. & Pries-Heje, J. (Ed.), Elsevier. Amsterdam.
375. Strauss, A. and Corbin, J. (2008) *Basics of qualitative research: Techniques and procedures for developing grounded theory,* 3rd edn, Sage Publications, London.
376. Streitz, N. (2009). Ambient intelligence landscapes for realizing the cities of the future: Introduction and overview. *In Proceedings of the 3rd European Conference on Ambient Intelligence.* Salzburg, Austria. Available at http://www.smart-future.net/14.html.
377. Su, K., Li, J. and Fu, H., (2011), September. Smart city and the applications. In *Electronics, Communications and Control (ICECC), 2011 International Conference on* (pp. 1028-1031). IEEE.
378. Sutton, M (2016), *Smart Dubai shaping the city's future*, ITP.net.
379. Švob-Đokiæ, N. (Ed.). (2007). T*he Creative City: Crossing Visions and New Realities in the Region.* Zagreb, Croatia: Institute for International Relations, Available at http://www.culturelink.org/publics/joint/cultid08/Svob-Djokic_Creative_City.pdf.
380. Szabó, R., Farkas, K., Ispány, M., Benczur, A.A., Bátfai, N., Jeszenszky, P., Laki, S., Vágner, A., Kollár, L., Sidló, C. and Besenczi, R., (2013), December. Framework for smart city applications based on participatory sensing. In *Cognitive Infocommunications (CogInfoCom), 2013 IEEE 4th International Conference on* (pp. 295-300). IEEE.
381. Taniguchi, E., (2014). Concepts of city logistics for sustainable and liveable cities. *Procedia-social and behavioral sciences,* 151, pp.310-317.
382. Tema (2014), Smart City, *Planning For Energy, Transportation And Sustainability Of The Urban System.*
383. Teufel, S. and Teufel, B., (2015), December. Crowd Energy Information Security Culture-Security Guidelines for Smart Environments. *In Smart City/SocialCom/SustainCom (SmartCity), 2015 IEEE International Conference* on (pp. 123-128). IEEE.
384. *The Greenest City 2020 Action Plan* (no date).

385. The Telegraph. (2015). *One surveillance camera for every 11 people in Britain, says CCTV survey*. Retrieved from http://www.telegraph.co.uk/technology/10172298/One-surveillance-camera-forevery-11-people-in-Britain-says-CCTV-survey.html

386. Thite, M. (2011). Smart cities: implications of urban planning for human resource development. *Human Resource Development International*, 14(5), pp.623-631.

387. Townsend, A.M. (2013). *Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia*, New York, W.W: Norton & Company,

388. Trauth, E. M. & O'Connor, B. (1991) A Study of the Interaction between Informations, Technology and Society: An Illustration of Combined Qualitative Methods.*In Nissen, H. E., Klien, H. K. & Hirschheim, R. (Eds.) Information Systems Research: Cotemporary Approaches and Emergent Traditions.*(North Holland), Amsterdam, The Netherlands, Elsevier Science Publishers B. V.

389. Treiman, D. J. (2014). *Research Methods for the Social Sciences: Doing Social Research to Test Ideas*. Somerset, NJ, USA: John Wiley & Sons, Inc.

390. UAE Rankings in International Studies and Reports. (2016). [ebook] Dubai: Telecommunications Regulatory Authority. Available at: https://www.tra.gov.ae/assets/PwgchUe7mLW.pdf.aspx [Accessed 24 Jul. 2017].

391. UN Government Survey (2012), *UAE in UN eGovernment Survey 2012*. Public administration, [online], Available from https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2012-Survey/unpan048065.pdf

392. United Nations (2014), World Urbanization Prospects.

393. Vaishnavi, V. K., & Kuechler, W. (2007). *Design Science Research Methods and Patterns: Innovating Information and Communication Technology* (Edition 1 ed.): Auerbach Publications.

394. Vaishnavi, V. K., & Kuechler, W. (2004). Design Research in Information Systems. Retrieved 27 August 2017, from http://alturl.com/zg9jx

395. Van Bruggen, G., Lilien, G. and Kacker, M. (2002) Informants in organizational marketing research: why use multiple informants and how to aggregate responses, *Journal of Marketing Research*, vol. 39, no. 4, pp. 469-478.

396. Van den Bergh, J. and Viaene, S., (2015), January. Key challenges for the smart city: Turning ambition into reality. In *System Sciences (HICSS), 2015 48th Hawaii International Conference on* (pp. 2385-2394). IEEE.

397. Van der Voet, J., (2014). The effectiveness and specificity of change management in a public organization: Transformational leadership and a bureaucratic organizational structure. *European Management Journal*, *32*(3), pp.373-382.

398. Van Horn, R. L. (1973) Empirical studies of management information systems, *Data Base*, 5, 172-180.

399. Vanolo, A., (2014). Smartmentality: The smart city as disciplinary strategy. *Urban Studies*, *51*(5), pp.883-898.

400. Vilajosana, I., Llosa, J., Martinez, B., Domingo-Prieto, M., Angles, A. and Vilajosana, X., (2013). Bootstrapping smart cities through a self-sustainable model based on big data flows. *IEEE Communications magazine*, *51*(6), pp.128-134.

401. Voss, C., Tsikriktsis, N. and Frohlich, M. (2002) Case research in operations management, *International journal of operations & production management*, vol. 22, no. 2, pp. 195-219.

402. Walliman, N. S. & Walliman N. (2011) Research methods: the basics, Taylor and Francis.

403. Walsham, G. & Waema, T., (1994). Information systems strategy and implementation: a case study of a building society. *ACM Transactions on Information Systems (TOIS)*, 12(2), pp. 150–173.

404. Walsham, G. (1993) *Interpreting Information Systems in Organisation*.Wiley, Chichester, UK.

405. Walsham, G. (1993) Interpreting Information Systems in Organisations. Chichester, Wiley.

406. Walsham, G. (2006) Doing interpretive research, *European Journal of Information Systems*, vol. 15, no. 3, pp. 320-330.

407. Walsham, G., (1995). The emergence of interpretivism in IS research. *Information systems research*, 6(4), pp.376-394.

408. Walsham, G., (1995b). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4(2), pp. 74–81.

409. Washburn, D., Sindhu, U., Balaouras, S., Dines, R. A., Hayes, N. M., & Nelson, L. E., 2010. *Helping CIOs Understand "Smart City" Initiatives: Defining the Smart City, Its Drivers, and the Role of the CIO.* Cambridge, MA: Forrester Research, Inc.

410. *Water facts: Facts about the global water shortage* (2015) Available at: http://water.org/water-crisis/water-sanitation-facts/ (Accessed: 20 February 2017). In-line Citation:
411. Webb, M, (2011), *Strategies for Smart Cities: Mining the Surplus City*.
412. Weber, R. (2004) Editor's comments: the rhetoric of positivism versus interpretivism: a personal view, *MIS Quarterly*, vol. 28, no. 1, pp. iii-xii.
413. Weitzman, E.A. (2000) Software and qualitative research, in *Handbook of Qualitative Research*, eds. N. Denzin and Y. Lincoln, 2nd edn, Sage Publications, London, pp. 803-820.
414. Why Dubai. (2017). [ebook] Dubai: Dubai DED. Available at: http://www.dubaided.ae/StudiesandResearchDocumentsinArabic/Dubai%20FDI%20Why%20Dubai%20report.pdf [Accessed 24 Jul. 2017].
415. Widmayer, P. (1999). *Building digital metropolis: Chicago's future networks*. IT Professional, *1*(4). Pp 40-46.
416. Williams, M. (2010). 2010 digital cities survey winners announced. *Government Technology*. Available at http://www.govtech.com/e-government/2010-Digital-Cities-Survey-Winners-Announced.html.
417. Wilson, J. (2010) *Essentials of Business Research: A Guide to Doing your Research Project*, Sage Publications Ltd, London, UK.
418. Winters, J. V. (2010). *Why are smart cities growing?* Who moves and who stays. Journal of Regional Science, *20*(10), Pp. 1-18.
419. Woods, E. (2013). *Smart Cities. Infrastructure, Information, and Communication Technologies for Energy, Transportation, Buildings, and Government: City and Supplier Profiles, Market Analysis, and Forecasts, Pike Research*.
420. Wooten, M. and Hoffman, A.J., (2016). *Organizational Fields Past, Present and Future*.
421. World Food Programme, *Emergency Food Security Assessments, Technical Guidance Sheet #8*, Introduction to qualitative data and methods for collection and analysis in food security assessments, February 2009.
422. Worldometers.info. (2017). *United Arab Emirates Population (2017) - Worldometers*. [online] Available at: http://www.worldometers.info/world-population/united-arab-emirates-population/ [Accessed 26 Apr. 2017].
423. Yarosh, N. (2014), A smart city - A city of tolerance. Moscow, *Economic Journal*, 2, 76-84.

424. Yigitcanlar, T., & McCartney, R. (2010). Strategising knowledge-based urban development: Knowledge city transformations of Brisbane, Australia. In *Proceedings of the 14th International Planning History Society* (*IPHS*) *Conference*, (Istanbul, Turkey, Jul 12-15).

425. Yigitcanlar, T., O'Connor, K. and Westerman, C. (2008), The making of knowledge cities: Melbourne's knowledge-based urban development experience, *Cities*, 25(2), pp. 63-72.

426. Yin, R. (2009) *Case Study Research: Design and Methods*. London, Sage Publications.

427. Yin, R.K. (2014). Case study research Design and Methods. 5 th ed. London, UK: Sage Publications.

428. Yin, R.K., (2003). Case study research: design and methods, Applied social research methods series. *Thousand Oaks, CA: Sage Publications, Inc. Afacan, Y., & Erbug, C.(2009). An interdisciplinary heuristic evaluation method for universal building design. Journal of Applied Ergonomics*, *40*, pp.731-744.

429. Yovanof, G. S., & Hazapis, G. N. (2009). *An architectural framework and enabling wireless technologies for digital cities & intelligent urban environments*. Wireless Personal Communications, *49*(3). Pp 445-463. Available at http://www.springerlink.com/content/g1v63025217mt8x0/

430. Zahlan, R.S., (2016). *The origins of the United Arab Emirates: A political and social history of the Trucial States*. Routledge.

431. Zhao, J. (2011a). *Towards Sustainable Cities in China*, Briefs in Environmental Science, Springer, Pp. 2. Web.

432. Zhuhadar, L., Thrasher, E., Marklin, S. and de Pablos, P. (2017). The next wave of innovation Review of smart cities intelligent operation systems. *Computers in Human Behavior*, 66, pp.273-281.

433. Zikmund, W.G. (2003) *Business Research Methods*, 7th edn, Thomson Learning, Ohio, USA.

434. Zook, M. A., & Graham, M. (2007). Mapping digiplace: Geocoded Internet data and the representation of place. *Environment and Planning B: Planning and Design*, 34(3), Pp. 466-482. Available at http://www.envplan.com/epb/fulltext/b34/b3311.pdf.

435. Zubizarreta, I., Seravalli, A. and Arrizabalaga, S. (2016). Smart City Concept: What It Is and What It Should Be. *Journal of Urban Planning and Development*, 142(1), p.04015005.

436. Zygiaris, S., (2013). Smart city reference model: Assisting planners to conceptualize the building of smart city innovation ecosystems. *Journal of the Knowledge Economy*, *4*(2), pp.217-231.

9 Appendix

CONSENT FORM

This form should be filled by participant by acknowledging on the appropriate point.

Note: consent form should be 2 copy (1 for researcher and 1 for participant)

Statement	Yes	Partly	No
I have read Research Participant Information Sheet and I understood the study purpose			
I acknowledge that my participations on this study is voluntary and I can withdraw at any time			
I understand that my participations is part of the PhD research			
I understand that my participation is voluntary and that I am free to withdraw at any time			
I understand that I am free to withdraw at any time without giving any reasons for withdraw			
I understand that all my details and information will be anonymous and will not be disclosed or reported on the study			
I do agree to record the interview			
I agree to the use of non-attributable direct quotes when the study is written up or published.			
I have received an answers to all my questions and up to satisfactory level			
I agree to participate on this study			

Participant Name	Participant Signature	Date
Researcher Name	**Researcher Signature**	**Date**

Semi-structured Interview

Section #1: Demographical Information

Section # 1 is aiming to examine the purposes are to assess the current state and the followed practices on managing the projects

Name (optional)					
Position					
Gender	□ Male		□ Female		
Age	□ 18 to 24 years		□ 45 to 54 years		
	□ 25 to 34 years		□ 55 to 64 years		
	□ 35 to 44 years		□ Age 65 or older		
Total years of experience					
Total years of experience on current position					
Total years of experience on Information Technology					
Total years of experience working on/ with government					
Education level	□ High School	□ Diploma	□ Bachelor	□ Master	□ PhD

Section # 2: General Background

Section # 2 is aiming to examine the purposes are to assess the current state and the followed practices on managing the projects

2.1 Approximately how many employees work at your company?		
□ 1 - 100	□ 100 - 250	□ 250 - 500
□ 500 - 1000	□ 1000 - 10,000	□ 10,000+ specify if possible
Note:		
2.2 Approximately how many employees work on the IT Department?		
□ 1-10	□ 10 - 20	□ 20 - 50
□ 50 - 100	□ 100 - 200	□ 200+ specify if possible
Note:		
2.3 Approximately how many employees work on smart safe city project?		
□ 1-10	□ 10 - 20	□ 20 - 50
□ 50 - 100	□ 100 - 200	□ 200+ specify if possible
Note:		
2.4 How long have you been participating on smart safe city?		
□ Less than 1 year	□ 1 to 2 years	□ 2 to 3 years
□ 3 to 4 years	□ 4 to 5 years	□ More than 5 years

2.5 Do you have a strategy for a safe city?	□ Yes	□ No
2.6 Do you smart safe city strategy and planning team?	□ Yes	□ No
2.7 Do you have a strategy of technology adoptions and implementations for smart safe city?	□ Yes	□ No

2.8 What is your role on the smart city / safe city initiatives?

2.9 What are the main drivers for safe city adoption?	
□ Terrorism	□ Public Disorder
□ Disaster / Crises	□ Road Accident
□ Extremism	□ Crime
□ Critical Incident	□ Urbanizations
□ Citizens Happiness	□ Economic Growth
□ Cyber Attack Threats	□ Others Please specify

Section # 3: Characteristic of smart safe city

Section # 3 is aiming to examine the characteristic of smart safe city in terms of benefits, risks and barriers

3.1 In your opinion, what are the benefits of having smart safe city implementations / brings to city on specific from the technology used? Please select and indicate the other	
□ Reduce overall cost of the corporate	□ Reduce and improve the response time
□ Improve collaborations between relevant and concerns departments	□ Helping on future accelerations and shaping future governments
□ Response to any resilience	□ Citizens happiness
□ Quick information availability for proper decision	□ Improving the relationship with smart safe city participant/ government
□ Support decision making process	□ Increase organization/ city effectiveness
□ Increase organization/ city efficiency	□ Support of work coordination
□ Increasing productivity of employees	□ Increasing city quality
□ Global alliance	□ Improve the business process
□ **Others, please specify:**	

3.2 In your opinion, What are the risks of having smart safe city	
□ Reduce full control of information	□ Information security concerns
□ Limit of the accessibility of information from other entities,	□ Delayed of accessing required information
□ Lack among system integrations within the entity	□ Lack among system integrations within the other entity
□ **Others, please specify:**	

3.3 In your opinion, what are the considerations / strategic actions been taken to avoid the mentioned risks?

3.4 In your opinion, what are the barriers and challenges of having safe city?	
□ High skills and experience of employee	□ High skills and experience from technology providers
□ High skills and experience from system integrators	□ The complexity on technology integrations
□ The readiness of IT infrastructure	□ Information security concerns
□ Current systems capabilities to integrate with the new systems and other entity systems	□ Difficulties on understanding the currents processes and IT systems
□ Collaborations and partnership with Public Private Partnership (PPP)	□ lack of ownership of smart city and safe city
□ lack of updating the strategy and services	□ Require investment
□ Resistance from authorities participating on smart safe city	□ commitment, motivations and support from leadership
□ Others, please specify:	

Section # 4: Smart Safe City Implementations Factors

Section # 4 is aiming to examine the factor affecting smart safe city implementations

4.1 In your opinion, please indicate how the following External Factors of smart city / safe city initiatives will affect the implementations an

External Factor	*Factor Description*	*Implications*		*Feedback and comments*
		Yes	*No*	
Organizational	Top management and the stakeholders, decision making process will support safe city initiatives and the required technology adoptions.	◻	◻	
Politics	in your opinion , do you have a pleasure from federal government influenced your decision on implementing smart safe city	◻	◻	
Economic	how do you manage to get the required budget for implementing	◻	◻	
Critical mass	Where you knowledgeable about other agencies participating on safe / smart city initiatives?	◻	◻	
Other	Other External Factors, if you select Yes, please answer 4.2	◻	◻	

4.2 Please list other External Factors

SR#	*Other External Factors*	*Descriptions*

4.3 Based on your experience, please rate the ***External Factors*** level of importance which affect smart safe city implementations

SR#	*External factors*	*Level of Importance*			*Justifications / note*
		High	*Medium*	*Low*	
	Organizational	◻	◻	◻	
	Politics	◻	◻	◻	
	Economic	◻	◻	◻	
	Critical mass	◻	◻	◻	

4.4 In your opinion, please indicate how the following ***Internal Factors*** of smart city / safe city initiatives will affect the implementations?				
Internal Factor	***Factor Description***	***Implications***		***Feedback and comments***
		Yes	***No***	
Strategic objectives an deplaning	The strategy planning and responsibility to overseeing the smart safe city implementations progress.	◻	◻	
	Considering smart safe city as part of the corporate strategic objectives.	◻	◻	
	Alignment of technology adoptions with smart safe city	◻	◻	
Leadership	The managerial capability of the leadership, support and commitment on implementing smart safe city	◻	◻	
Technology adoptions and collaborations	Adopting the appropriate technology which serving the smart safe city with the capability to integrate with other systems	◻	◻	
	Relations and collaborations among other entities participating on smart safe city	◻	◻	
Financial issues	The organizational financial capability will impact the deployment of smart safe city initiatives	◻	◻	
Business process	Organizations business process changing to meet the initiatives	◻	◻	
Other	Other Internal Factors, if you select Yes, please answer 4.5			

4.5 Please list other External Factors		
SR#	***Other Internal Factors***	***Descriptions***

4.6 Based on your experience, please rate the ***Internal Factors*** level of importance which affect smart safe city implementations					
SR#	***Internal Factors***	***Level of Importance***			***Justifications / note***
		High	***Medium***	***Low***	
	Strategic objectives an deplaning	◻	◻	◻	
	Leadership	◻	◻	◻	
	Technology adoptions and collaborations	◻	◻	◻	
	Financial issues	◻	◻	◻	
	Business process				

Section # 5: Change Management

*Section # 5 is aiming to examine the role of **Change Management** on the initiatives of smart safe city implementations*

5.1 Based on your experience, please rate how importance **Change Management** on smart safe city implementations and the level of effect				
Importance and effect	***High***	***Medium***	***Low***	***Justifications / note***
Level of importance	◻	◻	◻	
Level of effect	◻	◻	◻	

5.2 From the followings points, please select the main reasons for change resistance				
SR#	***Change Resistance***	***Yes***	***No***	***Justifications / note***
1	Majority of the employees don't like the implications of changes	◻	◻	
2	Majority of the employees do not consider the changes as part of the organization development			
3	Inadequate information and lack of the communications			
4	Low tolerance to change			
5	Other, change resistance, if you select Yes, please answer 5.3			

5.3 Please list other *Change Resistance*		
SR#	***Other Change Resistance***	***Descriptions***

5.4 From the followings points, please select the approaches of changes				
SR#	***Change Approach***	***Yes***	***No***	***Justifications / note***
1	Open communications	◻	◻	
2	Educations and Awareness			
3	Involvements, Participations and Involvements			
4	Manipulations and cooperation			
5	Leadership			
6	Other, change approach, if you select Yes, please answer 5.5			

5.5 Please list other approaches of *Change*		
SR#	***Other Changes approach***	***Descriptions***
1		
2		
3		

Section #6: Development Life Cycle of Smart Safe City

*Section # 6 is aiming to examine the **Development Life Cycle of Smart Safe City, (pre, during and post implementations)***

6.1 Please select the factors to be considered on the stage of pre implementation on the ***Development Life Cycle of Smart Safe City*** as a good practices to be followed***?***				
SR#	***Pre Implementations factor***	***Good practice***		***Justifications / note***
		Yes	***No***	
1	Setting a clear objectives	◻	◻	
2	Design the projects requirements and needs with clear road map			
3	Stakeholders support			
4	Collaborations with the participants (government entities, department, technology providers,..etc)			
5	Understanding the needs from the technology providers			
6	Establishing division responsible for smart safe city implementation			
7	Others, if you select Yes, please answer 6.1			

6.2 Please list other ***Pre Implementations*** Factors		
SR#	***Other Pre Implementations***	***Descriptions***
1		
2		
3		
4		
5		

6.3 please rate the ***Pre Implementations Factors*** level of importance which affect smart safe city implementations					
SR#	***Pre Implementations Factors***	***Level of Importance***			***Justifications / note***
		High	***Medium***	***Low***	
1	Setting a clear objectives	◻	◻	◻	
2	Design the projects requirements and needs with clear road map	◻	◻	◻	
3	Stakeholders support	◻	◻	◻	
4	Collaborations with the participants (government entities, department, technology providers,..etc)	◻	◻	◻	
5	Understanding the needs from the technology providers	◻	◻	◻	
6	Establishing division responsible for smart safe city implementation	◻	◻	◻	
7		◻	◻	◻	
8		◻	◻	◻	

6.4 Please select the factors to be considered on the stage of ***During Implementation*** on the ***Development Life Cycle of Smart Safe City*** as a good practices to be followed***?***				
SR#	***During Implementations factor***	***Good practice***		***Justifications / note***
		Yes	***No***	
1	Maintenance and operation cost of the technology	◻	◻	
2	Technology fit to the desired objective			
3	Solutions sustainability			
4	Achieving operational efficiency			
5	Liaising with other governmental entities participating on smart safe city to simplify integrations and procedures			
7	Others, if you select Yes, please answer 6.5			

6.5 Please list other ***During Implementations*** Factors		
SR#	***Other During Implementations***	***Descriptions***
1		
2		
3		
4		
5		

6.6 please rate the ***During Implementations Factors*** level of importance which affect smart safe city implementations					
SR#	***During Implementations Factors***	***Level of Importance***			***Justifications / note***
		High	***Medium***	***Low***	
1	Maintenance and operation cost of the technology	◻	◻	◻	
2	Technology fit to the desired objective	◻	◻	◻	
3	Solutions sustainability	◻	◻	◻	
4	Achieving operational efficiency	◻	◻	◻	
5	Liaising with other governmental entities participating on smart safe city to simplify integrations and procedures	◻	◻	◻	
6		◻	◻	◻	
7		◻	◻	◻	
8		◻	◻	◻	

6.7 Please select the factors to be considered on the stage of ***Post Implementation*** on the ***Development Life Cycle of Smart Safe City*** as a good practices to be followed***?***				
SR#	***Post Implementations factor***	***Good practice***		***Justifications / note***
		Yes	***No***	
1	Staffing skills resources	□	□	
2	Adopting advanced technology			
3	Technology integrations among other entities			
4	Financial and budget support			
5	Public Private Partnership (PPP)			
6	Others, if you select Yes, please answer 6.8			

6.8 Please list other ***Post Implementations*** Factors		
SR#	***Other Post Implementations***	***Descriptions***
1		
2		
3		
4		
5		

6.9 please rate the ***Post Implementations Factors*** level of importance which affect smart safe city implementations					
SR#	***During Implementations Factors***	***Level of Importance***			***Justifications / note***
		High	***Medium***	***Low***	
1	Staffing skills resources	□	□	□	
2	Adopting advanced technology	□	□	□	
3	Technology integrations among other entities	□	□	□	
4	Financial and budget support	□	□	□	
5	Public Private Partnership (PPP)	□	□	□	
6		□	□	□	
7		□	□	□	
8		□	□	□	

Section #7: Smart Safe City Development Life Cycle Actors

Section # 7 is aiming to examine the ***Actors*** *involved on the* ***Development Life Cycle of Smart Safe City*** *implementations*

7.1 please rate the level of importance of the ***Actors*** involved on the ***Development Life Cycle of Smart Safe City implementations***					
SR#	***Actors***	***Level of Importance***			***Justifications / note***
		High	***Medium***	***Low***	
1	Government	□	□	□	
2	Companies/ Partnership with Private Sector (PPP)	□	□	□	
3	Users	□	□	□	
4	Advanced Technology	□	□	□	
5	Others, if you please list them	□	□	□	
6		□	□	□	
7		□	□	□	
8		□	□	□	
9					
10					

7.2 Based on your experience please map the actors with the influences of smart safe city pre implantations on ***Pre Implementation*** stage on the ***Development Life Cycle***									
SR#	***Influences***	***Actors***							
		Gov	AT	Users	PPP				
1	IT infrastructure key	□	□	□	□	□	□	□	□
2	Telecommunications Infrastructure	□	□	□	□	□	□	□	□
3	Training and awareness	□	□	□	□	□	□	□	□
4	Technology readiness	□	□	□	□	□	□	□	□
5	Hardware and software cost	□	□	□	□	□	□	□	□
6	Overcome of the barriers and challenges of partnership with private sectors and technology providers	□	□	□	□	□	□	□	□
7	Smart safe city strategy	□	□	□	□	□	□	□	□
8	Others, please list them	□	□	□	□	□	□	□	□

7.3 Based on your experience please map the actors with the influences of smart safe city pre implantations on ***During Implementation*** stage on the ***Development Life Cycle***									
SR#	***Influences***	***Actors***							
		Gov	AT	Users	PPP				
1	Change the business concept and culture	□	□	□	□	□	□	□	□
2	The new strategy for the smart safe city	□	□	□	□	□	□	□	□
3	Encouraging expertise to come over and participate on the smart safe city initiatives and implementations	□	□	□	□	□	□	□	□
4	Information security practice and procedure for secure system integrations	□	□	□	□	□	□	□	□
5	Educations and training	□	□	□	□	□	□	□	□
6	Others, please list them	□	□	□	□	□	□	□	□

7.4 Based on your experience please map the actors with the influences of smart safe city pre implantations on ***Post Implementation*** stage on the ***Development Life Cycle***									
SR#	***Influences***	***Actors***							
		Gov	AT	Users	PPP				
1	Security / Information Security	□	□	□	□	□	□	□	□
2	Educations and training	□	□	□	□	□	□	□	□
3	Monitoring	□	□	□	□	□	□	□	□
4	Update and Patching	□	□	□	□	□	□	□	□
5	System integrations	□	□	□	□	□	□	□	□
6	Process improvements	□	□	□	□	□	□	□	□
7	Others, please list them	□	□	□	□	□	□	□	□
8		□	□	□	□	□	□	□	□
9		□	□	□	□	□	□	□	□
10		□	□	□	□	□	□	□	□
11		□	□	□	□	□	□	□	□
12		□	□	□	□	□	□	□	□
13		□	□	□	□	□	□	□	□
14		□	□	□	□	□	□	□	□
15		□	□	□	□	□	□	□	□

Section #8: Challenges and best practices for establishing Smart Safe City along with technology adoptions

This part will offer visibility on the challenges, barriers and best practices to implement proper smart safe city along with technology adoptions.

8.1	What are the main challenges facing government participating on smart safe city implementations?
8.2	What are the main Barriers and difficulties facing government participating on smart safe city implementations?
8.3	What are the critical factors that influence the success or failure smart safe city implementations by the governments?
8.4	What do you think how important smart safe city for citizen happiness, future accelerations and shaping future governments? Also how technology will help to achieve that?
8.5	What are the strategical actions should be adopted by the government for success smart safe city initiative?
8.6	What are the technology Components and architecture for smart safe city?

8.7 What are critical success factors of technology adoptions for smart safe city along with the level of the importance and impact the adoptions					
SR#	***Factors and Impact***	***Level of Importance***			***Noted and comments***
		High	***Medium***	***Low***	
1	IT skills required for using new technology				
2	Compatibility and integrations with existing systems				
3	Integrations with other entities				
4	Stakeholders support				
5	mandates from the government				
6	Technology providers and supplier				
7	Readiness of the employee to use new technology				
8	Reliance on IT for processing large information data				
9	Pothers, please specify				
10					
11					
12					
13					
14					
15					

8.8 What are the challenges for technology adoptions for smart safe city?

8.9 What are the barriers for technology adoptions for smart safe city?

8.10 What are the strategical actions should be adopted by the government for success technology adoptions for smart safe city initiative?

8.11 What is best road map for having / establishing smart safe city? Or what is Holistic Approach for Smart Safe Cities Development

8.12 In your opinion, Please describe, how important is to match between the adopted technologies' functions and smart safe city task requirements?

8.13	What are the benefits of having technology adoptions for smart safe city along with the level of importance?				
SR#	***Technology adoptions benefit***	***Level of Importance***			***Noted and comments***
		High	***Medium***	***Low***	
1	Reducing operational cost of smart safe city				
2	Increasing city productivity				
3	Increase citizens happiness				
4	Support future governments				
5	Support future accelerations				
6	Improving the relationship with smart safe city initiatives				
7	Support work coordination				
8	Enhancing competitive advantage				
9	Improve knowledge				
10	Increasing response quality				
11	Others, please identify				
12					
13					
14					

8.14	Who are the people involved in IT adoption decision making process for smart safe city?

8.15	What are the recommended evaluation criteria for technology adopting to be used for smart safe city?	
SR#	***Evaluations Criteria***	***Descriptions***
1		
2		
3		
4		

8.16	What are the main technology integrations functional benefits within the organization and other participant on smart safe city? (Please indicate all that implies)				
SR#	***Integrations benefit***	***Level of Importance***			***Justifications / note***
		High	***Medium***	***Low***	
1	Collaboration	□	□	□	
2	Coordination	□	□	□	
3	Control	□	□	□	
4	Information processing	□	□	□	
5	Role resolution	□	□	□	
6	Others, please specify	□	□	□	
7		□	□	□	
8		□	□	□	

8.17 Based on your experience; can the smart safe city enhanced governments process and efficiency and how?	
□ Yes, Please justify why?	□ No, Please justify why?

Part # 9 Suggestions, feedback and comments

Please identify if any further suggestions, feedback and comments or other views on the events domain.

Thank you for the time you spent and the support as well to answer the questionnaire. Please indicate your interest as well as your information to get a copy of the study results.

□ Yes	□ No
Delivery Information	
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