OPENING SMART DOORS TOO SOON: AN ANALYSIS OF THE CITY OF CAPE TOWN'S STRATEGIC PRIORITIES

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ABSTRACT

Although smart cities offer technological solutions to urban challenges, many cities do not comprehend what a smart city entails and as a result, often adopt utopian, far-reaching visions and aims, shaped by the global north, which in turn lead to unsuccessful urban development. Inspired by this, the purpose of this paper was to investigate the potential for smart cities within Cape Town, South Africa, and to determine a refined approach to smart cities within the context of Cape Town, that will alleviate the challenges and enhance the city. This paper commences by studying the utopian smart city vision of South African cities by President Cyril Ramaphosa, thereafter the City of Cape Town's socio-economic state is investigated as well as the smart city strategies currently in place in the city. The paper proceeds by studying the strategies in place within the CoCT's Integrated Development Plan (IDP) and the capital investment budget to determine the city's main development priority. Thereafter, the socio-economic and smart city strategies are compared to the official International Organization for Standardization (ISO) smart city indicators. The research route of this paper eventually allows the identification of the potential of smart cities within the City of Cape Town and determines a smart city vision that is more suited to the needs of cities within South Africa.

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OPSOMMING

Alhoewel slim stede (“smart cities”) tegnologiese oplossings vir stedelike ontwikkeling bied, begryp baie stede nie duidelik wat ‘n slim stad in werklikheid behels nie, en neem hulle gevolglik ‘n utopiese benadering aan met verreikende doelstellings en visies, gevorm deur die globale noorde, wat tot gevolg lei, tot onsuksesvolle stedelike ontwikkeling. Voortspruitend hieruit, is die doel van hierdie artikel om die potensiaal van die slim stede beginsel in Kaapstad, Suid-Afrika te ondersoek met ‘n verfynde benadering tot slim stede binne die Stad Kaapstad konteks te bepaal, ten einde die uitdagings van die stad te verlig en te verbeter. Hierdie artikel se inleiding begin met die bestudering van die utopiese-slimstad visie van Suid-Afrikaanse stede en sluit aan by die visie van President Cyril Ramaphosa, waarna die sosio-ekonomiese toestand van die Stad Kaapstad ondersoek word asook die slimstad-strategie soos die Stad Kaapstad dit tans hanteer en benader. Die referaat handel verder met die bestudering van die strategie wat binne die Stad Kaapstad (“CoCT”) se Geïntegreerde Ontwikkelingsplan (GOP) raamwerk en kapitaal-begroting bestaan ten einde die Stad Kaapstad se ontwikkelings prioriteite te bepaal. Die sosio-ekonomiese en slimstad-strategieë word daarna vergelyk met die amptelike Internasionale Organisasie vir Standardisasie (ISO) vir slimstad-aanwysers. Die navorsings-roete van hierdie artikel identifiseer uiteindelik die potensiaal van slim stede binne die Stad Kaapstad konteks, en bepaal 'n slim stadsvisie benadering wat meer geskik en doelmatig is ten einde die behoeftes van stede in Suid-Afrika aan te spreek.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIM	Amsterdam Innovation Motor
BRT	Bus-rapid Transportation
CoCT	City of Cape Town
DFA	Development Facilitation Act
EPWP	Expanded Public Works Programme
ICT	Information and Communications Technology
IDP	Integrated Development Plan
IPTN	Integrated Public Transport Network
ISO	International Organization for Standardization
IT	Internet Technology
LED	Light-emitting Diode
MENA	Middle East and North Africa
NCB	National Computer Board
NDP	National Development Plan
NMT	Non-Motorised Transport
NUDF	National Urban Development Framework
ODTP	Organisational Development and Transformation Plan
RDP	Reconstruction and Development Programme
SAPS	South African Police Service
SDF	Spatial Development Framework
SDG	Sustainable Development Goals
SEZ	Special Economic Zone
TCs	Technical Committees

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TMS	Transversal Management System
TOD	Transit-oriented Development
UN	United Nations

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CHAPTER 1: RESEARCH CONTEXT

1.1 INTRODUCTION

Smart cities represent a modern conceptual urban development design based on the use of technology and information and communications technology (ICT) for the development of urban agglomerations (Angelidou 2014). The innovations of ICTs have been able to increase various cities' performance within an urban environment, allowing cities to be more sustainable, efficient, reliable, and smart (Batty 2012). Smart cities have been driven by the idea around how technology can be used to influence urban planning and economic development (Cugurullo 2013; Angelidou 2015). In joining the quest to establishing themselves as world cities, several countries such as South Africa have been moving towards acquiring the "smart city" status through the vision expressed by President Ramaphosa which involves the development of entirely new democratic cities, fueled by smart development which includes bullet trains and skyscrapers (IOL 2019).

The rapid increase in population and fast-paced urbansation has placed cities under great pressure to expand services and accommodate the increasing number of citizens and inhabitants. According to Musakwa & Mokwena (2017), the adoption of technology has become quicker and easier, therefore giving space to the rise of smart cities to provide advanced services to urban inhabitants. However, the success of smart cities relies on the ability of cities to create smart solutions and the ability of these cities to obtain real-time goals. Also, the success of smart cities heavily relies on whether these smart solutions address the real challenges of cities and provide value to the urban citizens (Musakwa & Mokwena 2017). Although smart cities offer technological solutions to urban challenges, many cities do not comprehend what a smart city entails and as a result, often adopt utopian, far-reaching visions and aims, shaped by the global north, which in turn lead to unsuccessful urban development.

As stated by Nfuka & Rusu (2010) and Chourabi et al. (2012), smart cities in the African context are still new and require exploration. It can, therefore, be added that African cities, in this case, South African cities, need to realise that smart cities are not merely about the use and development of ICTs. It can also be argued that the development of new cities is not the solution to the urban

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challenges within South African cities, but purely a costly distraction from the real problems our cities face every day.

This study digs deeper into the smart city initiatives within South Africa, particularly Cape Town, and argues that initiatives should focus on solving existing socio-economic problems within the city before advancing into the smart city race as suggested by President Ramaphosa.

1.2 FRAMING THE RESEARCH PROBLEM AND RATIONALE

"We want a South Africa that has prioritised its rail networks and is producing high-speed trains connecting our megacities and the remotest areas of our country. We should imagine a country where bullet trains pass through Johannesburg as they travel from here [Cape Town] to Musina, and they stop in Buffalo City on their way from Ethekwini back here"

- President Ramaphosa 2019

Development trends spread like wildfire within cities around the world. New technological innovation has become more common within the development – the concept of Smart Cities has become the latest trend in the last two and a half decades. Smart cities have been emerging within cities particularly in the global north to achieve more efficient cities, and enhance social, economic, and environmental aspects. Several development approaches in urban planning have been developed to achieve innovative smartness within cities around the world (Abbas 2017).

South Africa has shown interest in joining the smart city wave and has since been championing smart city strategies more regularly within potential city developments across the country through the utopian vision of President Ramaphosa. Critics on this vision, particularly by Professor Vanessa Watson from the Department of Architecture and Planning at the University of Cape Town argue that instead of developing new cities, land within existing cities can be upgraded and accommodate the housing backlog in cities (Luckhoff 2019; Watson 2019), as stated by Watson "To build an entirely new city from scratch, is hugely expensive - think of the infrastructure, roads, public facilities… this is no way to achieve spatial justice and integration with the vision that the president has mentioned" (Watson 2019).

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Cape Town, in particular, has been implementing smart city and innovative development strategies within the City of Cape Town's (CoCT) Integrated Development Plan (IDP) since 2000 known as the "The City of Cape Town's Smart City Journey" (CoCT s.a). Together with the IDP (2017-2022), the CoCT has introduced socio-economic as well as smart city strategies, these strategies have however have not been evaluated against the official ISO 37120 indicators which ensure sound smart growth within cities; as a result, these strategies may stray away from the guidelines of achieving a successful smart city. The excitement of potential smart cities within South Africa often prevents us from actually considering what this innovative development entails. Therefore, the purpose of the research will be to compare the CoCT's IDP strategies aimed towards socio-economic and smart city development with the ISO smart growth indicators to determine the quality of these strategies; the study will also determine the priority that socio-economic and smart city principles receive within the IDP. Also, the CoCT's official capital investment budget will be studied to determine and compare the budgetary priorities between socio-economic and smart city development within the IDP. In this way, the study can determine the potential for smart cities within Cape Town and conclude whether the approach by the CoCT will successfully alleviate challenges and enhance the city.

1.3 DESCRIPTION OF STUDY AREA

The CoCT metropolitan municipality is situated in Cape Town, South Africa, and governs Cape Town city centre as well as the suburbs found within the city (see Figure 1). The CoCT is 2 461 km^2 in size and is home to a population of 4 232 276 people as well as 1 264 849 households with an average size of 3.17 members per household (CoCT 2017).

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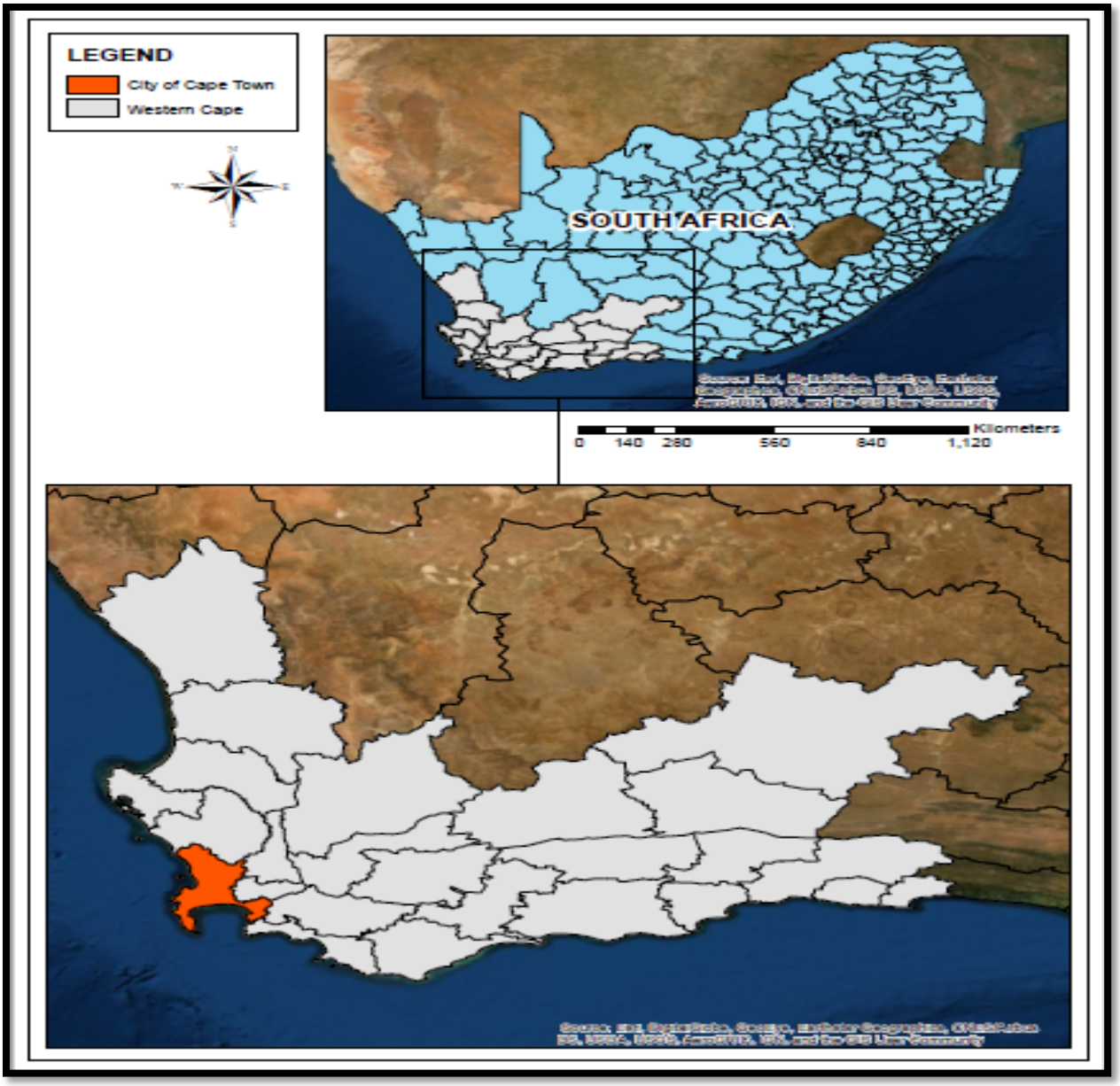

Figure 1 City of Cape Town Study Area

The CoCT is deemed most suitable for this study as it has been applying ICT strategies since 2000 with the implementation of the smart city strategy, which has been the beginning of the CoCT's smart city journey and in turn initiated the current interest in joining the smart city race through further development.

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1.4 AIMS AND OBJECTIVES OF THE THESIS

This study aims to investigate the potential for smart cities within Cape Town, South Africa, and to determine a refined approach to smart cities within the context of Cape Town, which will alleviate the challenges and enhance the city.

To achieve the aim, the following objectives were formulated:

1 To compare the CoCT's smart city strategy to the ISO indicators for smart cities;

2 To determine the priority received by smart city principles and strategies in CoCT's planning policy within the IDP, compared to socio-economic principles;

3 To determine the municipal budget dedicated to smart city principles compared to socio-economic principles;

4 To illustrate the balance of priorities in CoCT between smart city objectives and addressing poverty and inequality.

4.5 METHODOLOGY

The research methodology adopted for this study comprised several components. These components are divided into five phases (see Figure 2): developing the aims and objectives of the research; developing data collection tools, analyzing the obtained information; and finally writing up the results. Relevant literature on smart cities, the development of South Africa, relevant policies, strategies, and budgets within the CoCT was studied throughout the research process.

Data was obtained through the CoCT official online website regarding smart city policies, socio-economic status, and budgets. From these data tables and graphs were produced using Microsoft Word 2016. The study map for this paper was created using ArcMap 10.4.1.

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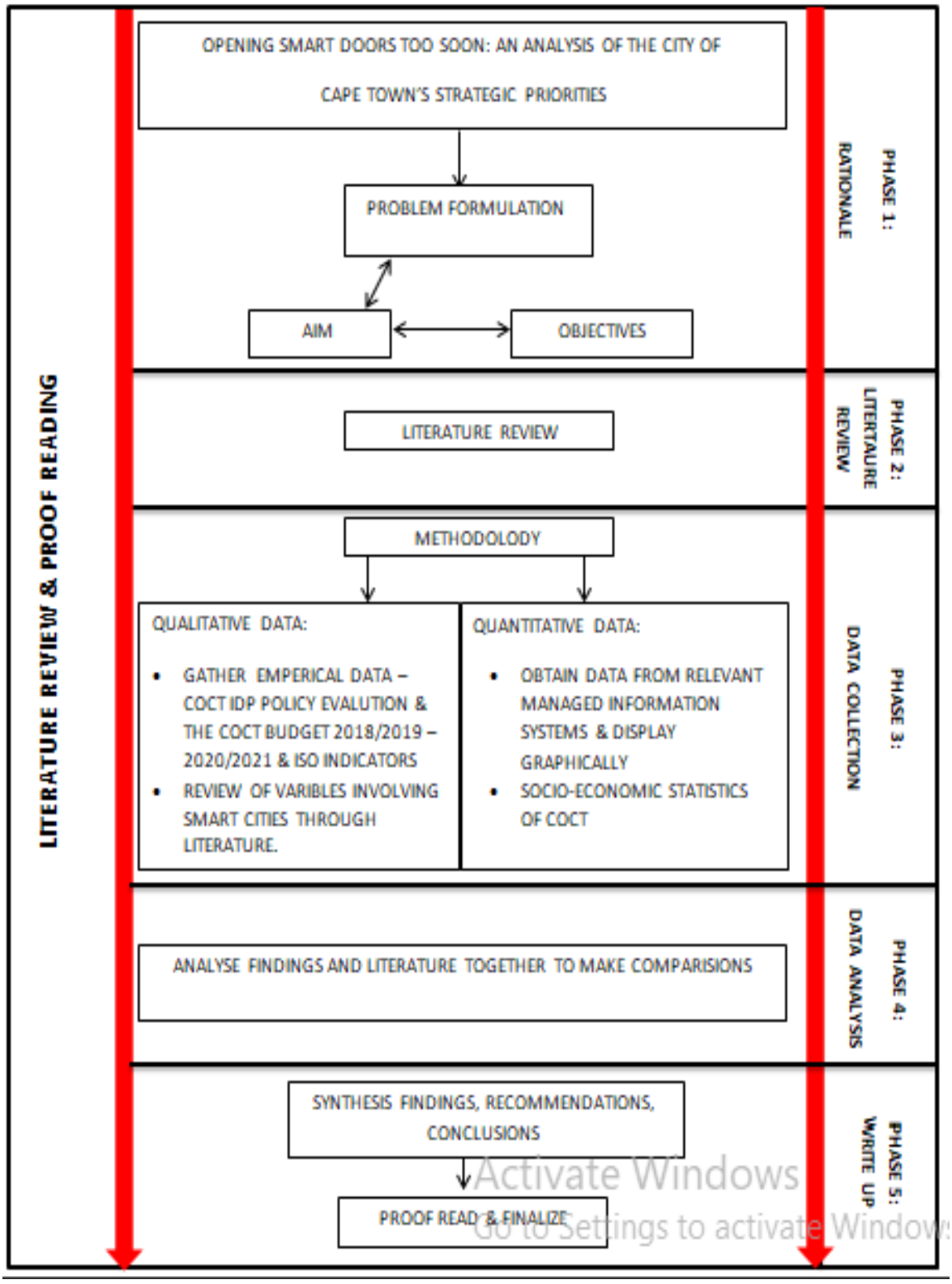

Figure 2 Research Design

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CHAPTER 2: LITERATURE REVIEW

Variables that contribute to smart cities, ISO indicators, smart city services, the development of South Africa, critiques on smart city development, the CoCT smart city initiatives as well as the smart city vision of President Ramaphosa has been examined in the literature below. It is important to understand the factors influencing smart city development as well as recognizing the potential and challenges that smart city development has.

2.1 CONCEPTUALIZING A SMART CITY

Despite the intensive discussion, there is no agreed definition on the concept “smart cities” and as a result, the term is used interchangeably throughout literature. It is useful to revise several definitions of the unfolding concept "smart cities", to determine a sound definition through all of its complexity (Angelidou 2014). One thing is certain, smart cities represent a multidisciplinary field that has been shaped by several human and technological advancements (Angelidou 2015).

The definition of smart cities varies according to the development of a particular country, these definitions however carry the same core characteristic that defines smart cities – ICTs (Angelidou 2014). Taking on a more technological approach; Washburn et al. (2010:2) defines smart cities as “the use of smart technologies to make the critical infrastructure components and services of a city—which include city administration, education, public safety, healthcare, and utilities—more intelligent, interconnected and efficient”. Steria (2011: 3), also takes on a technological approach and defines smart cities as "…the integration of technology into a strategic approach to sustainability, citizen well-being, and economic development. The key industry and service sectors for smart cities include smart grids, smart transport, smart buildings, and smart government".

Caragliu (2011: 6) on the other hand, approaches the concept of smart cities relating to ICTs -“the city which invests in people and social capital, builds conventional transportation and modern ICT infrastructures; provides sustainable economic growth and high standard of life-quality, and administrates its natural sources with participative governance”. Another definition which takes an ICT stand is defined by Cosgrave et al. (2013: 669), “…it broadly refers to a city that is using

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new ICTs innovatively and strategically to achieve its aims. Smart city investment might include, for example, implementing a network of sensors".

Smart cities have also been defined by integrating technology directly with human capital investment as well as innovation. These definitions believe that technology and ICTs are not the only bases for cities to be "smart" but instead require a high capacity of human capital investment to form intelligent cities as well as spark innovation within cities (Komninos 2002 & Angelidou 2014). The World Foundation for Smart Communities defines smart cities as a community that has made a conscious effort to use information technology to transform life and work within its region in significant and fundamental rather than incremental ways. The goal of such an effort is more than the mere deployment of technology. Rather it is about preparing one's community to meet the challenges of a global knowledge economy" (World Foundation for Smart Communities 2012).

Overall, smart cities are carried by the idea of a utopian future, in an attempt to achieve a promising future of urban development and planning that will meet the needs of both the technological communicative side together with uplifting human capital investment and innovation as well as achieving a prime quality of life and well-being for all citizens (Angelidou 2014). Ideally, a smart city upholds the vision of strategic, forward-looking planning through a prism of human capital and knowledge together with the utilization of digital technology.

According to the South African Local Government Association's publication "*In.KNOW.vation"* on the importance of smart city development within South African cities, defines the concept of smart cities as "the use of digital technologies to enhance performance and well-being, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens. Key 'smart' sectors include transport, energy, health care, water, and waste" (SALGA 2015). More locally, the CoCT's Digital Strategy tends to focus on a more digital vision of the concept of smart cities – "… harnessing digital tools to stimulate innovation in service delivery" (CoCT, s.a.).

It is therefore important to adopt a strategic vision of smart cities that will ensure human innovation, priorities, and constraints are considered when physical planning and policies are implemented, to better conquer a promising future of the "ideal smart city". Figure 3 illustrates the smart city factors that are needed to achieve smartness within a city – *smart living* involves a city

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goal to enhance the quality of life of all city inhabitants, *smart economy* is guided by the objective to improve economic growth within the city, through the promotion business and increased domestic products as well as job creation (Kompasina 2015 & Abbas 2017). *Smart people* refer to increased human capital and knowledge; people with diversity, creativity, and education enhances the growth of a smart city (Nam & Pardo 2011). *Smart governance* is fundamental for a smart city as it includes the involvement of various stakeholders which are engaged in decision-making on the future of urban development, service delivery, public services as well as the incorporation of ICT's within city life (Abbas 2017). *Smart mobility*, involves the movement of goods, services, and people from one location to another. According to Foxx (2015:24), in a smart city, "we want to move ourselves or our things from one place to another efficiently, reliably and safely". This also involves daily commuting using public transportation, as well as reliable transportation infrastructures such as roads, railways, pavements, and harbours (Foxx 2015 & Abbas 2017). Finally, a *smart environment* refers to the efficient design of a city that will enhance sustainability, by incorporating various "green" elements that will reduce pollution, and enhance the city environment (Abbas 2017). Moreover, the use of technology in promoting and incorporating city sustainability forms one of the important characteristics of a smart city.

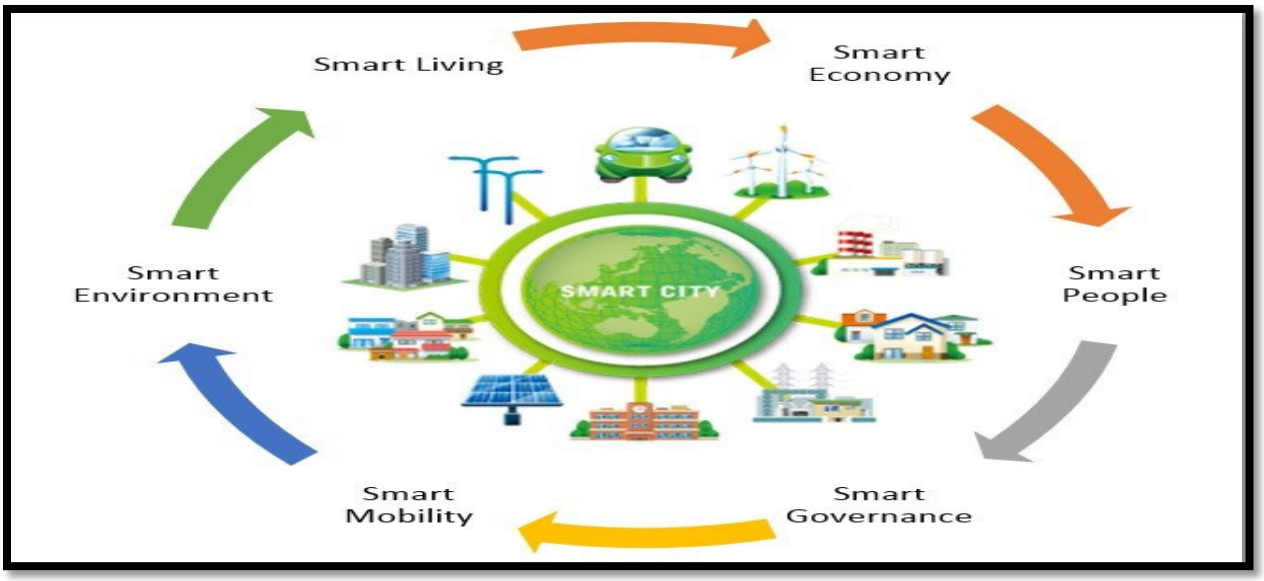

Figure 3 Smart City Factors Source: Kompasina (2015)

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2.2 THE RISE OF THE SMART CITY

Smart cities represent a strategic model of urban development driven by the basis of human, technological as well as various collective capitals for the utilization of the development of urban agglomerations (Angelidou 2015). The rise of the strategic model of urban development spans from the early 20th century, growing in parallel with the evolution of technologies (Cugurullo 2013; Angelidou 2014). The historical timeline of the development of smart cities has shown that the economic, spatial, and social makeup of cities has affected its' driving and development systems. Furthermore, although cities' physical structure may have impeded on development transitions within the space, "fast-forward" thinking and lavish utopian visions by various futurists of the time were not hindered (Hall 2002; Angelidou 2015).

These utopian visions appeared during the late 19th century but gained popularity from the early 20th century being inspired by the latest advancements in science and technology of the time (Angelidou 2015). One of the first coherent visions were illustrated by E.Howard, his vision included a healthy and functional city which was published in 1898 in his book "*The Garden Cities of Tomorrow*" (Hall 2002). Howard's vision was developed as an answer to solve the development problem during the industrial era; his ideal city included a balance of community and individual needs in a capitalist economic system (Hall 2002; Angelidou 2015). Inspired by the latest technological advancements during 1904, on hydroelectric power, photography, cinema, automobiles, and air navigation, the work of functionalist T Garnier was developed to contribute to the utopian visions of an ideal city (Hall 2002). Garnier's ideas on an ideal city included future cities that embraced industry and technological advancements simultaneously (Hall 2002).

The Futurist movement during 1909-1916 also contributed to shaping smart cities of today (Angelidou 2015). Visions illustrated by the work of an Italian futurist and architect, A Sant'Ella, were inspired by the technological advancements of the time and imagined future cities that would be shaped by highly industrialized and mechanized developments which included multi-level traffic routes, skyscrapers, bridges and aerial pedestrian walkways (Angelidou 2015). Contributions by the German Baulhaus movement (1919-1932) had also made prominent contributions to the vision of smart cities at the time. Walter Gropius, the founder of the movement, stated that "We want an architecture adapted to our world of machines, radios and fast motor cars",

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which also is evidence that technological advancements greatly shaped future thinking of cities away from ordinary urban planning (Honour & Fleming 2005: 89). In addition, urbanist and architect Le Corbusier went ahead and named many of his buildings after manufacturing brands such as “Plan Voisin” –a French aircraft company- which implied that cities and housing should be produced to encompass modern technological and industrial methods (Angelidou 2015). Le Corbusier's ideas were inspired by utopians' visions of cities which would solve multiple urban crises as well as social crises of their time (Fitting 2002). The radiant city forms one of Le Corbusier's ideas and specifically conceptualizes a modern city design that maintained the idea of high-rising housing blocks, skyscrapers as well as abundant green spaces to enhance the quality of life within the city (Fitting 2002). The contributions of Frank Lloyd Wright, similarly to Le Corbusier, take on city ideals formed around utopian planning. Wright's ideas include visions of a new democratic city which would be shaped by modern technology and communication networks to create an environment that would allow for all inhabitants to flourish within the city; this idea formed an integral part of Wrights work and is known as the Broadacre city (Frank Lloyd Wright Foundation 2017).

The 'New Towns' movement which took place at the end of WWII was one of the most influential urban development advancements, and ought to bring immense change in the minds of planners, sociologists, and economists (Atkinson 1998; Hall 2002). The New Towns movement was shaped under the influence of a variety of technological advancements which could accommodate ideas that could develop current overcrowded and polluted cities that were affected by the expanding population in cities, and increased need for shelter, to cities built with modern materials, construction methods and "ideal city" planning ideas (Atkinson 1998; Hall 2002).

Technological advancements of the 1960s further inspired urban scholars and planners to offer more efforts in highlighting new information systems within city planning (Atkinson 1998). Work by architect T Zenetos *–electronic urbanism-* was inspired by radical ideas based fully on mechanized cities and embraced a city model networked by technology that favoured creativity and social equity and also, incorporated the natural environment and sustainability (Zenetos 1969; Angelidou 2015). The urban hierarchy of communications and inter-urban information flow began to spark interest in conversations of planners during the time. Particularly, urban planner R Meier’s publication “*Communications theory of urban growth*” focused explicitly on the effect of

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communications and the way it affects spatial development networks in urban agglomerations (Angelidou 2015). J Gottman went ahead to popularize the notion of the 'Megatropolis' which created the idea of 'super-cities' which included visions of sprawling cities that would be controlled by transportation and telecommunication systems (Angelidou 2015).

The 1980s was an era that birthed multiple concepts that represented visionary cities – *digital cities, intelligent cities*, and *cybercities* amongst others – these concepts were developed as a means to describe what cities in the future will potentially look like at the time (Batty 1987; Dutton et al. 1987; Angelidou 2015). During the era, the advancement of digital technology enabled the popularization of ICTs. As a result, by the mid-1990s, visions of the ideal city by planners, architects and futurists began to include ICTs as the way to everyday life, through vast communication networks empowered by the World Wide Web (Angelidou 2015).

Today, the innovations of ICTs have been able to increase various cities' performance within an urban environment, allowing cities to be more sustainable, efficient, reliable, and smart (Batty 2012). Smart cities have been driven by the idea around how technology can be used to influence urban planning and economic development (Cugurullo 2013; Angelidou 2015). According to innovation theories inspired by the writings of Schumpeter (1947) & Schmookler (1966) smart cities are shaped by two distinct forces: *technology push* and *demand-pull*. The technology push refers to a new solution introduced into the market due to the advancing technology; it is driven by supply and not by the demands or needs of society (Schumpeter 1947; Schmookler 1966; Angelidou 2015). Demand-pull on the hand implies solutions developed to respond to the demanding market of society (Schumpeter 1947; Schmookler 1966; Angelidou 2015).

In essence, smart city markets are rapidly expanding in the 21st century, having an estimated $100 billion spent to support smart city development worldwide (Navigant Research 2011). Figure 4 displays investments in smart city infrastructure that had occurred from 2010, and what will possibly be spent on further smart city infrastructure investment by 2020 worldwide. Figure 4 has been based on a forecast of expanding markets, through undertaken market research on the development of smart government, building, transport as well as entities, encompassed by various methodologies to predict the worldwide investment of smart cities by 2020.

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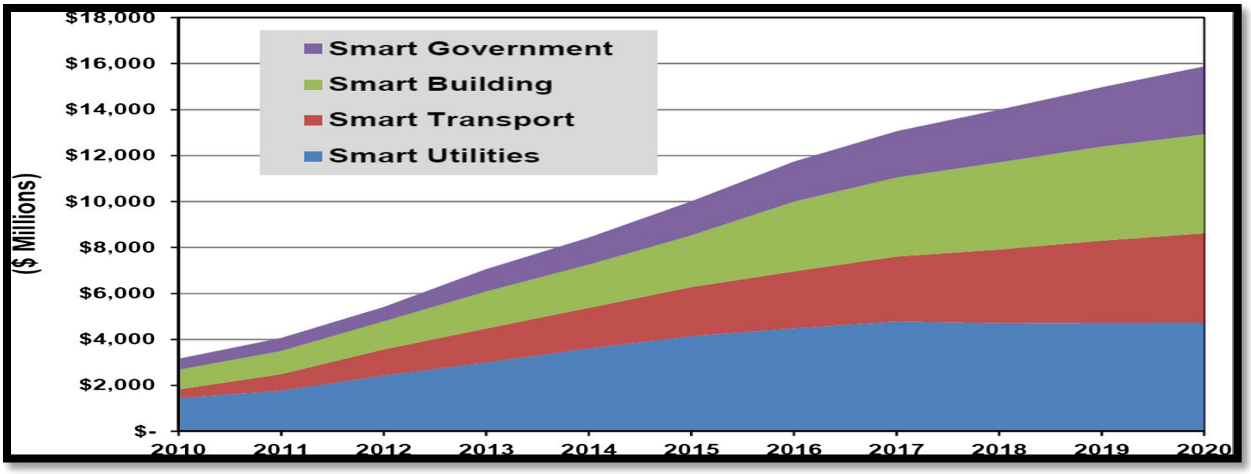

Figure 4 Smart city infrastructure investment in world markets: 2010-2020 Source: Navigant Research (2011)

2.3 ISO INDICATORS

The International Organization for Standardization (ISO) plays a critical role in the development of smart cities and achieving a sustainable, efficient city. ISO is an independent non-governmental organization and provides a platform for the development of sustainable objectives and strategies by groups of experts within technical committees (TCs) (ISO 2018). These TC's are made up of various representatives from non-governmental organizations, industry experts as well as selected government stakeholders put forward by ISO members (ISO 2018). ISO standards represent the international consensus on a wide range of aspects that contribute to making cities function efficiently and fulfill the Sustainable Development Goals (SDG) that have been set to alleviate poverty, achieve global sustainability and ensure prosperity for all (ISO 2018). Furthermore, the ISO standards include frameworks that guide planners and stakeholders during policy-making and strategizing to include sustainable goals into their city goals.

Various ISO strategies and standards have been developed since 1946, delegating in 164 countries which includes 780 TCs and subcommittees responsible for the development of the ISO standards (ISO 2018). Today, developing smart cities are guided by the ISO 37200 range of international

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standards which ensures that cities become more sustainable, resilient, and 'smart'. The ISO 37122 standards on *Sustainable cities and communities – indicators for smart cities*- have been drawn up to evaluate and measure smart city performance and allow for comparative lessons from other smart cities (ISO 2018). The ISO 37123 standards on *Sustainable cities and communities – indicators for resilient cities*, have been developed to reduce risks within cities and promote resilience in cities globally (ISO 2018). The ISO 37122 and ISO 37123 indicators complement another set of standards for smart cities – ISO 37120: *Sustainable cities and communities – Indicators for city services and quality of life* – which outlines measurements for the evaluation of a smart city's service delivery and quality of life (ISO 2018). Together, these ISO standards and indicators respond to urbanization issues within cities through developing standards that offer effective guidance to achieving various goals which include smart city development, innovation, and growth that help improve the quality of life of citizens and additionally achieve sustainable development within cities (ISO 2018). Figure 5 demonstrates the intertwined relationship of the ISO indicators for the development of smart and sustainable cities.

Figure 5 Relationship between the family of ISO indicator standards Source: ISO (2018)

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2.4 SMART CITIES TODAY

2.4.1 Dubai

As discussed by Kahn et al. (2017), Dubai has been marked as a very popular emerging tourism destination, driven by the smart city as well as smart tourism platforms. Within the tourism context, tourism destinations enabled by smart city initiatives can offer a unique and convenient experience to tourists (Kahn et al. 2017).

Located within the Middle East and North Africa (MENA) region, Dubai has experienced ample amounts of development over the past two decades, which include economic growth enhanced by travel and tourism (Kahn et al. 2017). The rapid development that Dubai has been experiencing has enabled governments and stakeholders to realize the strategic importance of smart city initiatives and smart tourism within the country (Kahn et al. 2017). Wam (2017) reveals that tourism arrivals in Dubai are estimated to reach 20 million by the year 2020, and thus it is important for advance technologies to be incorporated to achieve Dubai's smart city initiative that aims to integrate the use of technologies for creating 'a city of the future' (Kahn et al. 2017).

'Happiness' has been behind the driving force behind the development of the 'Smart Dubai', it focuses on strategic objectives aimed at ensuring the well-being of both citizens as well as tourists (Kahn et al. 2017). Smart solutions such as the online renewal of licenses, integrated transportation systems, smart-parking as well as e-gate services are aligned to create positive experiences and in turn, create a sense of happiness (Kahn et al. 2017).

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"Smart Dubai" –Dubai's smart city objective- was officially launched in March 2014, it had been guided by numerous smart city concepts since 1999 which led to the development of Smart Dubai (Boes et al. 2015). In 1999, Dubai's ICT strategy took form and was soon followed in 2000 by Dubai's e-Government initiative which has been one of the major milestones of the road to becoming smart (see Figure 6). The development of the ICT strategy as seen in figure 6, which illustrates the major milestones of the development of Dubai as a smart city thematically, has played a role development of various smart committees which have since been implemented.

Year	Events
1999	Dubai ICT Strategy was planned.
2000	Dubai e-Government Initiative was announced.
2009	Dubai e-Government Department was open.
2013	Smart Dubai Higher Committee was formed. Higher Committee for the implementation of Dubai Smart City was formed.
2014	Smart Dubai Executive Committee was formed. Open Data Committee was formed.
2015	Dubai Data Law was announced. Smart Dubai Office was open.

Figure 6 Development of Dubai as a smart city Source: Kahn et al. (2017)

Following the international recognition of Dubai as one of the major cities within the MENA region, the development of world-renowned infrastructure began to take place, which includes tourist attractions such as the Dubai Metro and the Burj Khalifa (Balakrishnan 2008; Kahn et al. 2017). The successful inauguration of the world's tallest building, the Burj Khalifa as well as the Dubai Metro (which has been the world's longest driverless single metro line before being surpassed by the Vancouver Sky Train and Singapore Mass Rapid Transit), significantly enhanced the Dubai's smart city and smart tourism profile and position (Fang 2004; Balakrishnan 2008; Wam 2014; Briginshaw 2016).

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To reach the ultimate goal of Smart Dubai –to become the happiest city on earth- the city has developed the *Happiness Vision* which consists of four pillars and six dimensions of aims guided by technology that will allow for its citizens and residents to raise their living standards and enhance their quality of life. Moreover, the vision also includes that tourists have a happy experience and at the same time, the city aims to become one of the world's best-connected cities guided by the Happiness Vision (Smart Dubai 2015; Salemn 2016). According to the Smart Dubai Strategy as well as the 2021 Dubai Plan, to become the smartest city in the world, the Happiness Vision includes four pillars:

- **Efficient:** "To become a city where resources are used in an optimized manner"
- **Seamless:** "To integrate day-to-day life services across the city and its inhabitants"
- **Safe:** "To carefully anticipate risks and protect people and information"
- **Impactful:** "To make a difference through an enriched life and fulfilling business experiences".

These four pillars of the Happiness Vision of Dubai span six specific dimensions of Smart Dubai (Dubai Strategy 2015; Dubai Plan 2021):

- **Economy:** "Where intelligent and innovative economic conditions and tools are provided to fuel entrepreneurship and competitiveness"
- **Governance:** "Where transparent government services exist for both public and private sectors"
- **Environment**: "Where asset management is used intelligently to minimize pollution and resource wastes. Examples are smart grid and buildings integration, smart water irrigation, smart sewage water, smart stormwater management, and smart waste management"
- **Living:** "Where an exceptional quality of life is present as it relates to education, healthcare, and cultural lifestyle. Examples are smart buildings, smart home, building, and facility management, eHealth, and total healthcare stations"
- **Mobility:** "Where the transport of people, things, and ideas is seamless and efficient. Examples are infrastructure for smart roads, bridges and tunnels, Intelligent Transport System (ITS), and smart traffic and parking management"

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- **People:** "Where people welcome a culture of continual learning, involvement, and innovations. Examples are smart education and smart security".

Although ICTs are not included as one of the six dimensions, it forms an integral part of the technological advancement of Smart Dubai. As noted by Kahn et al. (2017), ICTs form the building blocks of smart city development and have been encompassed in the development of the Smart Dubai through broadband and vast Wi-Fi connectivity. For example, ICTs have played a major role in service delivery, due to the lack of physical street addresses in Dubai; ICTs enables emergency services as well as daily service delivery through technological solutions (Kahn et al. 2017).

Anthopoulos (2015) suggests that smart cities have to be measured by five classes: smart city progress measurement, smart city monitoring, city capacity, sustainability, and policy. Currently Dubai's 'Smart Dubai' strategy and 'Happiness Vision' successfully incorporates the five classes by Anthopoulos (2015), and can be considered to be one of the most competitive and efficient growing smart city in the world. Ultimately, Dubai has topped the ranks of the cities within the MENA region and is ranked 14th on the Smart Cities Index 2019 (Murphy 2019). In the same vein, Dubai has ranked higher than Stockholm, Los Angeles, Tokyo, Vancouver, Shanghai, Melbourne, Copenhagen, Beijing, and Brussels – the ranking of the smart cities were determined by how the particular city address social, environmental and economic challenges through ICTs (Murphy 2019). Dubai's socio-economic profile has also seen significant progress due to the digital transformation, having made social growth one of the city's major priorities, particularly the development of education and healthcare has been the key socio-economic building blocks (Ndlovu-Gatsheni 2013). In addition to the education and healthcare development within the city, a comprehensive welfare system has also been identified as another priority for the creation of a healthy and happy society that will contribute the future of Dubai's smart transformation (Ndlovu-Gatsheni 2013)

2.4.2 Singapore

Mahizhnan (1999:13) describes Singapore as "an island state with no natural resources, which has always lived by its wits". The transformation of Singapore from an industrial state to a technological hub, which embraces ICT's in its dream of being "an intelligent island", has created a smart city dream, with the final goal of not only achieving vast economic growth but also ensure

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an enhancement in the quality of life of all citizens and residents, essentially not only creating a smart city but a quality city-state (Mahizhnan 1999).

The small island, which contains little to no natural resources of its own, had always been depended on trading to meet the needs of its citizens (Mahizhnan 1999). It is therefore understandable why the drive to becoming an "intelligent island" was necessary to establish an independent economy. Becoming a less attractive investment to other countries placed the Singaporean economy in trouble as growth could no longer be achieved by trading (Choo 1997). In the same vein, high unemployment rates grew and required immediate economic restriction in order to mitigate the current rise in unemployment, an acute need in higher-value activities was needed to save the economy (Choo 1997). After the trading economy of Singapore of the pre-1960s and the industrial economy of the pre-1990s, Singapore recognized the vast opportunities of the information economy to meet the dire needs of citizens and began its entry into the technological market, which has, in turn, prompt the Singapore's concept of an "Intelligent Island" (Choo 1997; Mahizhnan 1999). The enabling power of the technological and information economy was the key restricting process that Singapore needed to increase its productivity and enter a high-wage, technologically intensive market that would place Singapore in a position to compete with neighbouring countries and eventually, compete globally (Rapaport 1993; Choo 1997).

The National Computer Board (NCB) was developed in 1981 and initiated Singapore's entry into the information market (Mahizhnan 1999). ICT’s were the driving force to enhance economic competitiveness and increase the quality of life of citizens as well as residents (Droege 1988; Mahizhnan 1999). The NCB successfully launched the National IT Plan of Singapore in 1986, which has paved the road to becoming one of the smartest cities the world has seen to date (Delacharlerie 2018). With the launch of the National IT Plan of Singapore, apart from the enhancing economy, the overall quality of life of citizens showed tremendous improvement (Delacharlerie 2018). Taking a deeper look into the information economy, the IT2000 master plan was introduced and initiated Singapore's dream to become an intelligent island (Choo 1997). According to the IT2000 vision, Singapore is to develop to be the world's first intelligent island, where technological infrastructure will be able to permeate every aspect of society, connecting every home, school, and workplace, apart from the interconnecting economy (NCB 1992; Choo 1997).

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At the forefront of the development of a smart Singapore, was using technology to further improve the quality of life of residents and citizens. The aim of the IT2000 strategy aimed to provide people with more discretionary time on their hands, which will create a state of happiness amongst all. This included the introduction of ICTs and digital technologies to complete tasks such as tax submissions, license applications, and shopping through cashless transactions (Gurbaxani 1990; Choo 1997). Additionally, smart cards had been introduced which provides essential information relating to the health and medical needs of an individual (Connors 1993). World-renowned transportation systems had been introduced to control congested roads, such as the Singapore Mass Rapid Transit, which today, is one of the longest driverless metro lines in the world (Delacharlerie 2018).

Figure 7 illustrates the spatial domains of the IT2000 strategy where overlapping domains include smart buildings, homes, corporations, IT townships as well as even hinterlands. The spatial domain correlates to the aim of the IT2000 strategy, to improve the quality of life of all, through technology. In essence, the strategy caters to every population group, including the lower-income townships and hinterlands, creating sound information and communication services that will provide services to each spatial domain and meet supply as well as the demand of all residents and citizens (Connors 1993; Choo 1997).

The IT2000 strategy acknowledges and invests in human innovation and capital. Conners 1993:168 describes the future of Singapore as one that will "maintain and improve standards in the learning of basic communication and numerate skills by children, their business corporations will be committed to the intellectual development of their employees and, above all, they will create large subcultures which work at the creation of an advanced info-structure with such energy that their enthusiasm spreads to their fellow citizens."

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Figure 7 Spatial domains of the IT2000 strategy Source: Choo 1997

Today, ranked to be the smartest city in the world according to the Smart Cities Index 2019, Singapore has developed to become an indisputable leader when it comes to advanced technology, smart mobility, healthcare, safety, administrative services and most importantly, the quality of life of all citizens (Delacharlerie 2018; Young 2019). Singapore's cutting edge technology has created a city which collaborates with all stakeholders and government as well as a bottom-up strategy through information-sharing networks where locals can participate in the development (Delacharlerie 2018).

The development of cutting edge infrastructure such as the arrival of station less shared bicycles – oBikes, Ofo and Mobikes – as well as the introduction of the world's second-largest electric vehicle car-sharing programme after Paris – BlueSG – has enhanced the sustainability of Singapore and in turn, created a happy environment not only for residents and citizens but for investors and tourists too (Young 2019). In addition to the sound transportation system, Singapore ranks 2nd in the Safe Cities Index 2017, making it one of the safest cities in the world (Young 2019).

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Ultimately, the development of Singapore as an "intelligent island" has shown the importance of enhancing standards of living and the quality of life of citizens. Additionally, creating a space to use technology to innovate and incorporate human knowledge into the advancement of the city provides a sustainable competitive advantage which in turn spread enthusiasm amongst citizens, creating a city that is ranked the smartest in the world (Corey 1991; Choo 1997). With regard to the socio-economic profile of Singapore, great emphasis has been placed on the development of education since 1965 as it would be the key to the nation's wealth and progress (Haskins 2011). Through the provision of free education, Singapore aims to develop low-income families through educational achievements. Also, Singapore's social policy, which includes pensions, healthcare, and housing are served by the national government and provides citizens the opportunity to access public housing, efficient healthcare as well as participate in saving initiatives guided by the state to achieve financial wellness (Haskins 2011). These priorities are aimed at achieving self-reliance, social responsibility as well as a healthy society which will, in turn, increase the quality of life within the city (Haskins 2011).

2.4.3 Amsterdam

According to a study conducted by Mona & Bolici (2017), *How to become a Smart City: Learning from Amsterdam*, he writes that the city's smart city strategy began developing in 2007, much later than Dubai and Singapore. Although initiatives stared in the early 1990s such as electric vehicle sharing, aimed towards CO^2 alleviation within the city as well as enhancing sustainability. Presently, Amsterdam has developed to become one of the smartest cities in Europe -being named the European Capital of Innovation by the European Commission in 2016- supported by vast ICT enablers as well as cemented smart city strategies that had been developed to best suit the city (Mona & Bolici 2017; Amsterdam Smart City 2019).

The Dutch capital was one of the first adopters of the smart city concept in Europe. With the adoption of the smart city strategy in 2007, "Amsterdam Smart City programme", a holistic strategy taking on a quadruple helix concept which included business, government, universities, research institutions as well as citizens. The aim of the holistic strategy was aimed at including all aspects as it was the key to the creation of the ideal smart city (Bee Smart City 2017). With the collaboration between the Amsterdam Innovation Motor (AIM), Liander as well as municipal administration, the Amsterdam Smart City programme was launched and supported by the belief

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that “ICTs improve the way cities function" (Amsterdam Smart City 2010; Amsterdam Smart City 2011; Annen 2011; Baron 2012; Mona & Bolici 2017:3). Moreover, the Amsterdam Smart City realized the need to adopt a bottom-up approach to smart growth, to achieve social inclusion and enhance the quality of life of all (European Commission 2016). The aims of the strategy include the five indicators of smart cities - smart economy, smart environment, smart government, smart living, smart mobility, and smart people (European Commission 2016).

Supported by both political commitment as well as strong motivation, the transformation of Amsterdam to a smart city was driven by the use of ICTs to solve the city's environmental problems and build an urban environment that is not only productive but sustainable too (Gemeente Amsterdam 2011). According to Brinkman & Meuwissen (2010), the strategy identified technology as the main enabler to achieve success and address various issues within the city in a much faster way than traditional methods. Also, the strong bottom-up approach of the smart city strategy has played an important role in the development of "smart" Amsterdam, according to the Brinkman, Manager of the Amsterdam Smart City programme between 2009 and 2011, “Involving […] citizens is essential […] since the tested technologies are useless without [their] acceptance and experience". Brinkman (2011) confirms that by public participation, the success of the smart city strategy of Amsterdam was dependent on, to one day be one of the smartest cities in Europe.

The Amsterdam Smart City Foundation participated in more than 50 national and international conferences to further plan in-depth objectives and priorities for the future of the city (Amsterdam Smart City 2011; Schuurman 2011). This led to the launch of the Smart City Platform in 2009, which lies at the heart of the Smart City programme. The idea behind the platform was to create an online platform consisting of public and private partnerships, as well as a marketplace that would provide anyone – companies, agencies, start-ups, universities, or private citizens – to become partners (Amsterdam Smart City 2018). The online platform provides partners to initiate various smart ideas and solutions on six main areas (Bee Smart City 2017):

- Infrastructure & Technology
- Energy, Water & Waste
- Mobility
- Circular City

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- Governance & Education
- Citizens & Living

Further technological advancements have provided Amsterdam a space to enhance its development through various ICTs. A collaboration of various public and private companies has managed to place Amsterdam as a technological hub, such as the development of the Internet of Things (IoT) Living Lab, which was developed to provide a network of connection throughout the entire city through smart city applications to complete daily tasks (Yenlo 2015). To encourage further engagement and enhance social inclusion within the city, the *StartupAmsterdam* initiative was launched in 2015, connecting various stakeholders to strengthen Amsterdam's economy and ecosystem. The online tool was initiated to provide all citizens access as well as tourists, information about employment opportunities, environmental and sustainable projects, as well as information for tourists on various activities within the city that will enhance their overall experience (I Amsterdam 2019). Also, to include children in the success of the smart city initiative of Amsterdam, the *Amsterdam Smart Citizens Lab* and *Smart Kids Lab* was launched to provide children with an opportunity to engage and contribute to the development of the city's future by engaging on the open-source (Bee Smart City 2017).

On a more physical approach, the smart development of mobility initiatives within Amsterdam has grown to be one of the most environmentally friendly in the world. Due to the lack of space within the city, congestion levels as well as city pollution levels, the Smart Flow strategy was launched as a platform for smart traffic management (Mona & Bolici 2017; Yazemtec 2018). The smart traffic management strategy aims to "enable cities to achieve new mobility and parking experience, based on technologies that reduce traffic congestion, air pollution, road risks, and parking operational costs" (Yazemtec 2018). Also, to further reduce the city's traffic, the application, *"Toogther"* was launched, to simplify and promote carpooling by matching passengers with potential drivers based on their employment, working hours and location (Bee Smart City 2017). This platform has become one of the most innovative globally, enabling Amsterdam to compete with numerous neighbouring countries within Europe and other continents.

According to Harmsen (2018), today smart city initiatives within Amsterdam are successful due to the strengths that the city demonstrates. These strengths include:

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- **Strong leadership**: "Amsterdam's political leaders continued to pursue the Smart City project despite changes occurring after an election, modest early results and pressure on elected officials to show concrete benefits" (Harmsen 2018:1).

- **Tailoring products to customer needs:** "Amsterdam's Smart City managers have learned that even though they can do very sophisticated presentations of data, the consumers of that data will influence the best style of communication… learning to listen to customers and cater to their needs is an essential lesson for analytics practitioners in every industry" (Harmsen 2018:2).

- **Building a talent pool: "**…attracting and retaining talented people to do the work. The Amsterdam Smart City initiative demonstrates how a city can embrace public and private sector best practices to pursue analytics programs that benefit its citizens" (Harmsen 2018:2).

Today, Amsterdam has been ranked the third smartest city in the world, the fourth safest city in the world, and aims to be emission-free by 2025 (I Amsterdam 2019). The record numbers of electric vehicle operations within the city alongside the development of various social applications makes the city's goal to be emission-free by 2025 reachable. The city's combination of groundbreaking policies, bottom-up approaches, financial technology, energy efficiency, social inclusion as well as the enhancement of the quality of life of citizens has contributed to the sound development of a smart Amsterdam (I Amsterdam 2019). Lastly, the socio-economic profile of Amsterdam has been more diverse than ever since the smart transformation of the city. Housing within the city has been more diverse than previous years and achieving a social balance which in turn has controlled the spread of gentrification within inner neighbourhoods (Savini et al. 2016). Economic growth and the provision of housing has been characterized as the main priorities of the city, although being an on-going challenge, the city has recognized the potential of economic growth as well as the promotion of affordable housing development that will achieve social cohesion which will, in turn, contribute to the welfare of all inhabitants within the city (Savini et al. 2016).

2.5 SMART CITY SERVICES FOR THE URBAN CONTEXT

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The following section deals with the offered smart city services within cities to improve the city's services and quality of life.

2.5.1 Better mobility

The continued growth of smart cities is evident globally, therefore cities need to develop to enhance the quality of life of its population and at the same time, incorporate smart initiatives to meet goals. Smart city projects focused on transportation is particularly important for a transforming city. The introduction of sustainable modes of transportation into the daily lives of people is essential for a developing smart city; these modes of transport are developed to achieve sustainability which is required for a city to be identified as "smart" (Yuan & Li 2014). This can be achieved by increasing transportation options such as efficient and safe public transportation, pedestrian and cycling infrastructure, electric transportation modes as well as car-sharing (Van der Jeugdt 2014 & Geotab 2018). Successful smart mobility can be seen in cities like Barcelona – “Bicing” in Barcelone- which is a bike-sharing system for about 1.6 million inhabitants (Geotab 2018).

As population and urbanization increase rapidly in cities, road traffic congestion has become a huge issue in many parts across the globe (Geotab 2018). Different solutions have been introduced to combat the problem by engineers and planners such as building more highways to expand the capacity of the roads, but this has however led to even more traffic and congestion (Geotab 2018). ICTs and advanced technologies provide cities with the opportunity to alleviate augmenting transportation problems, a solution away from the traditional ways of thinking (Singh 2015). The introduction of sensor networks and communications has been used to control traffic congestions, as well as improve and enhance the safety of travel. As suggested by Geotab (2018), for successful smart transportation and mobility, a transforming city’s mobility should follow the following principles:

- **Flexibility:** By introducing multiple modes of public and private transportation, it allows commuters a wide range of options for any given situation.
- **Efficiency:** Commuting should have minimal disruption and be time-efficient for the traveller.
- **Integration:** Transportation should be easily accessible for all groups within society, regardless of their economic status.

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- **Clean Technology:** Transportation should include sustainable and efficient approaches and maintain little to zero emissions.
- **Safety:** Transportation, especially public transportation, should provide safety and protect commuters from fatalities and injuries of any manner.

By integrating the latter principles into smart city planning, it is possible to successfully identify and address hanging issues in a city in terms of transportation. The technological foundation of smart mobility also makes it easier for issues to be addressed. Essentially, smart mobility forms the backbone of successful smart city development as it plays an important role in the daily lives of every individual in a city, in turn, the success of a city's transportation system is critical for the enhancement of the quality of life within a city (Litman 2008).

2.5.2 Smart Environment

According to the Energy and Environment Guide to Action (2015), a developing smart city needs to develop and build any activity with the concept of smart environmental protection. With a smart city, sustainability, and a low ecological footprint enhance the quality of life within the city, not only of the human population but also ecosystems (Abbas 2017). For a city to achieve a smart environment, policies and frameworks of government should be underlined and guided by clean, safe, and green principles that have to be considered in any development and activity within the city (Jaipur-Phulera-Ajmer 2017). Advanced technologies provide the opportunity for the city's the means to incorporate recycling initiatives, anti-pollution approaches as well as various sustainable management tools to alleviate problems with waste and water pollution and strengthen master city plans (Jaipur-Phulera-Ajme 2017).

According to Jaipur-Phulera-Ajme (2017), in the transformation of cities towards being smart, planners should consider the following principles to ensure for a smart environment with a low ecological footprint:

- Reduce solid waste generation through sustainable approaches, as well as improving waste management.
- Improve water efficiency and provide free access to all populations.
- Introduce recycling methods in everyday life.

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- Reduce emissions of traditional air pollutants in the city through adequate "green" methods empowered by ICT's and citizen participation.
- Increase the number of parks and green open spaces.
- Increase the usage of smart energy by introducing renewable energy and decreasing the consumption of fossil fuels.
- Enhance and incorporate human innovation in possible solutions and educate people on protecting the environment.

Smart energy solutions within a city are essential to achieve a sustainable and smart future. It is therefore important for cities to incorporate cost-effective, flexible, and 100% renewable energy systems in the lives of the inhabitants (Karunakaran, Shanmugasundaram & Kumar 2018). Safe and efficient energy distribution from the core of the city to its hinterlands is required to enhance the quality of life for all, efficient energy in buildings, medical facilities, public institutions, shopping centres as well as transportation systems are the key drivers of achieving a smart environment (Karunakaran, Shanmugasundaram & Kumar 2018). Furthermore, the operation of smart grids- re-engineered electrical systems through smart meters and smart appliances to attain better energy efficiency- as well as the introduction of smart LED street lighting- controlled light sensors and communication devices that allow for periodic lighting- all contribute to effective energy supply (Karunakaran, Shanmugasundaram & Kumar 2018).

2.5.3 City safety

Smart services within cities should ensure for the safety and protection of its inhabitants. Smart public safety consists of two dimensions – the protection of data and the real-time and public safety of people (Tokody & Schuster 2016).

The security risk of trenchless infrastructure and cyber networks is extremely important to protect. Therefore, security and risk practices are vital for the confidentiality and integrity of transmitted data of private and public institutions (Tokody & Schuster 2016). Due to the digital structure and layout of smart cities, information security is often overlooked during the development phase of smart cities; this can be seen during the establishment of smart grids in cities that are known to have numerous security leaks (Washburn & Sindhu 2010). Thus, a strong security system is important to protect the transmission of data across various networks and communication networks.

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Public safety of city inhabitants is enhanced through real-time communication technologies within smart cities (Washburn & Sindhu 2010). Empowered by innovative surveillance analytics, enhanced communication applications for first responders as well as integrated command and control centres contribute to the overall safety levels and reduces crime within a smart city (Tokody & Schuster 2016). The innovative smart service provides police and emergency services real-time information when a threat occurs and enables emergency services to stay on top of overall crime. New York has brought crime down by 27% through an instant, real-time dashboard which provides a single view of emergency needs (Tokody & Schuster 2016).

Therefore, to be completely transformed into a smart city, it is important for cities planning to include public safety networks and real-time geolocalization information, to ensure the safety of all city inhabitants.

2.5.4 Efficient healthcare

Improving the quality of life of city inhabitants is one of the pillars of a successful smart city. Through the enhancement of accessible technology, healthy and cohesive communications become more achievable in cities (Angelidou 2014). Achieving pristine smart healthcare services is enabled through various stems of smart services such as smart environments that contribute to maintaining a healthy and clean environment within a city (Caragliu et al. 2009).

Innovative enabling technologies establish healthy living conditions, which are aimed to achieve democracy where everyone's needs are instantly and intuitively satisfied (Angelidou 2014). Through better healthcare services known as "e-healthcare", clinics can make use of cost-efficient remote monitoring applications; city inhabitants can access instant and comprehensive medical services (Batagan 2011).

ICTs in healthcare have allowed physicians to examine common and rare health conditions and understand health trends across subpopulations (Cook et al. 2018). Also, high-quality mobile clinics can be set up, one healthcare clinic has to be available for every 5000 residents, and at least one hospital for every 20000 residents according to international standards (Angelidou 2014). For the successful development of these healthcare and biomedical services and facilities requires a strong system which includes reliable and dedicated service deliverers, high-quality clinical care, strong clinical research as well as cost-effective solutions and services (McNerney & Zhang 2011;

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Angelidou 2014). Also, ICT based systems provide efficient healthcare services, electronic health records of patients enable swift diagnosis; enhanced access to real-time and granular patient data also enhances the quality of the healthcare system of smart cities, as it increases the quality of life as well as the life expectancy of the entire population (Cook et al. 2018).

2.5.5 E-governance and citizen engagement

Transforming into a smart city requires firm governing structures, for smart cities, this is known as "e-governance". Successful e-governance within a city can be perceived to be built on electronic democracy, through ICTs, as well as an electronic government (Tripathy et al. 2016). Furthermore, e-governance within smart cities also includes all forms of electronic communications between government structures and citizens, such as polling, voting, and discussions, this also provides for active public participation in policy and decision making within the city (Tripathy et al. 2016). The biggest challenges which each nation confronts are issues dealing with poverty reduction, maintaining inclusive and active societies, as well as economic development (Mooij 2003).

To alleviate these challenges, smart cities adopt holistic e-governance to accomplish these far-reaching goals through collaborative efforts with the utilization of ICT's. E-governance also provides smart cities the opportunity to strengthen democracy and public welfare, making the system more informative and transparent (Tripathy et al. 2016). It is therefore essential for governing structures to remain as transparent and uncorrupted as possible; as formal administrative boundaries outgrow the city, actors within the government need to maintain and build positive relationships with all tiers of government as well as neighbouring metropolitan areas (Tripathy et al. 2016).

According to the United Nations (UN), smart cities need to develop and improve the status of e-governance by following five stages of implementation:

- **Emerging:** Through the development of electronic platforms for service delivery for citizens, official online government presence has to be established through official sites.
- **Enhanced:** Service delivery the government increases its' capabilities though regular upgrades, making governance more trustworthy and powerful.
- **Interactive:** At this stage, the interactive platform through online sites provides for active public participation in policy and decision-making.

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- **Transactional:** Improved transparency and accountability of government through e-governance provides people the opportunity to conduct financial transactions such as paying taxes and various chargeable services on the provided online platforms.
- **Seamless:** The final stage claims full integration of all the e-services that have been introduced by the government through e-governance. Administrative services and service delivery ultimately improves the efficiency of a smart city.

By integrating the latter principles into smart city e-governance, smart cities can successfully identify and address issues through a bottom-up approach, and in turn, enhance the overall quality service delivery in a city, as well as increase the quality of life of all city inhabitants (Tripathy et al. 2016).

2.6 DEVELOPMENT OF SOUTH AFRICA

An estimated 71% of South Africa's population lives in urban areas across the country (Republic of South Africa 2009). It is, however, widely recognized that South Africa is characterised by inequality with regards to economic and social opportunities, poorly serviced public transport, and inefficiently located lower-income settlements, all stemming from the policies established during the apartheid-era (du Toit 2007; Du Plessis 2013). During the first decade of democracy, spatial planning frameworks have undergone multiple changes which include the introduction of the IDP system as well as the implementation of spatial development frameworks (SDFs) to carry out the developmental goals of municipalities across South Africa (Du Plessis 2013). Despite the implementation of forward-planning and restructuring frameworks across provinces in the country, South African cities remain, to this day, highly segregated and fragmented and according to Du Plessis (2013), among the most inefficient urban environments globally. In the same vein, cities are still characterized by a high level of inequality, limited political engagement, high levels of unemployment, enduring poverty and high crime rates- all of which have negatives effects on the quality of democracy and contribute to further fragmentation, social exclusion and social conflict (Bermeo 2009; Bhorat & van der Westhuizen 2012).

According to the National Urban Development Framework (NUDF), restructured, democratic driven policies drawn up after 1994 have seemingly failed to accomplish its goals within South African cities and towns which yet continue to marginalise the poor (Republic of South Africa

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2009; Du Plessis 2013). The Reconstruction and Development Programme (RDP) and the Development Facilitation Act (DFA) – which focused on settlement development and investment in basic services as well as achieving compact cities to mitigate apartheid policies and the effects thereof - has put forward that densities within some urban areas have increased and very little regeneration has been achieved, but little progress has been made in reversing the apartheid legacy gleaming over South African cities (National Planning Commission 2012; Du Plessis 2013).

The apartheid era was characterized by forced removals based on racial groups and the development of large scale townships, which in many cases continue to form in South African cities, which Hindson (1985) argues has had the biggest impact on the shape of urban areas as well as areas on the urban periphery such as Khayelitsha in Cape Town (Du Plessis 2013).

Integrated planning and service delivery from 2000 onwards, has been the core vision of all policies and planning initiatives such as the National Urban Renewal Programme and the National Spatial Development Perspective by the South African government (Du Plessis 2013). Spatial visions on paper and policies however have been a challenge to carry out in practice and achieve meaningful outcomes, this can be seen in the continuous urban challenges that face cities and towns within South Africa (National Planning Commission 2012; Du Plessis 2013).

2.6.1 Socio-economy

Social inequalities and high levels of unemployment continue to exist in South Africa (Robins 2002). According to the integrating principles of the DFA, rural and urban areas need to be close to both residential and employment opportunities (Republic of South Africa 2011b). Also, the current NDP 2030 suggests that each municipality across South Africa should at least incorporate an "explicit spatial restructuring strategy" to identify priority restructuring and redress past segregation (National Planning Commission 2012: 286). Finally, the national guidelines for SDF's require municipalities to develop guidelines built around social-economic integration (Republic of South Africa 2011b).

As suggested by Du Plessis (2013: 9), "functional integration is advocated through the walking-distance principle and recommends that at least 50% of urban activities should be within walking distance (approximately 1,000 m in 20 min) of where people live". However, by studying the planning of numerous towns and cities across South Africa, little progress has been made since

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1994 to integrate urban and rural areas and improve the distance between economic opportunities and the strategic location of urban settlements (Du Plessis 2013). In essence, significant restructuring of spatial plans is required to achieve integration recommended by the NDP 2030 (National Planning Commission 2012).

2.6.2 Infrastructure Development

Investment in infrastructure plays an important role in shaping urban areas around the world. Doxiadis (1970) argues that complex problems within cities cannot be solved through physical development alone, but expressed the need for development plans to be supported by administrative, economic, social, political as well as technological strategies.

Guided by the IDP process, municipalities have the opportunity to achieve integration through spatial planning and incorporate capital and infrastructure investments in the development of the particular municipality (Du Plessis 2013). As suggested by a study put forth by Du Plessis (2013), it is important to consider how the IDP capital and investment programmes of municipalities are interpreted and whether it has been integrated into SDF's and from a spatial perspective. Results from the study confirmed that the integration of infrastructure and capital investments with spatial development planning is not common within municipal plans across South Africa.

Therefore, the planning of infrastructure and capital investment of cities and towns across South Africa needs to consider spatial proposals to restructure, re-image, and re-allocate investments strategically to improve recurring issues in cities.

As displayed in Figure 8, as a result of a lack of adequate communication and collaboration between local government and communities as well as the misplaced priorities from the state due to a lack of understanding has resulted in frequent community protests. Service delivery issues are common throughout South African municipalities, and owing to a lack of coordination of infrastructural development within communities' an increase in protests spread throughout South African municipalities have increased since 2004, reaching a high of 191 protests in 2014, protests have however decreased from 2015-2016, but increased once again in 2017 (State of Local Governance 2018).

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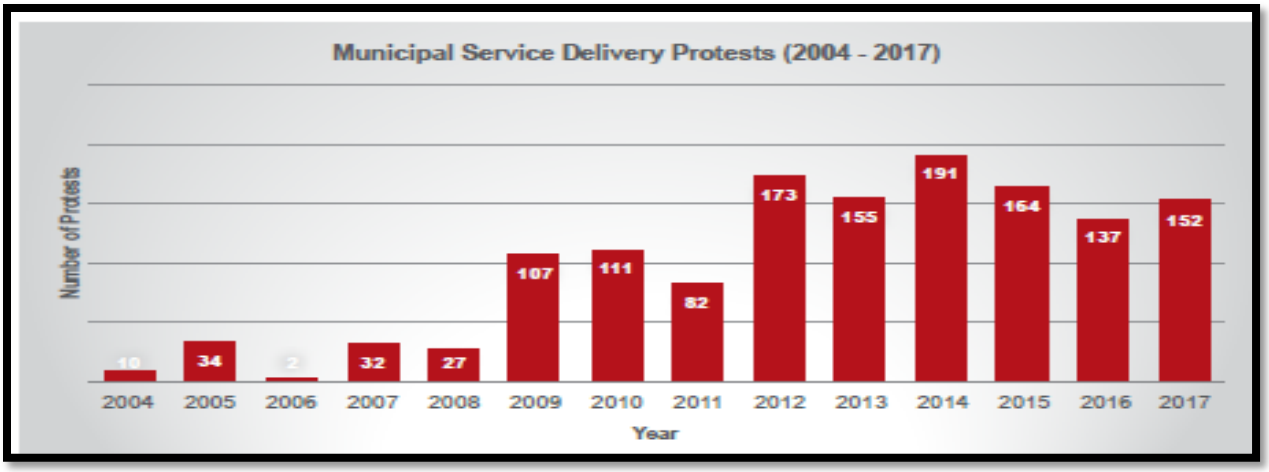

Figure 8 Major municipal service delivery protests, 2004-2017 Source: State of Local Governance (2018)

2.6.3 Sustainability

Spatial planning has fused the concept of sustainability in developmental policies and frameworks of cities since 1992 (Winston & Eastaway 2008). South Africa has attempted to reorientate its development path towards a sustainable route, guided by the National Strategy and Action Plan for Sustainable Development (Republic of South Africa 2010).

Challenges have however been identified with the alignment of the sustainability criteria and principles found within spatial planning policies. Shortcomings such as the limited integration of environmental initiatives as well as "green" principles within the provision of services and management have been common throughout IDPs (Sowman & Brown 2006). Moreover, decision-making has been predominantly led by a top-down political approach and often disregard the importance of sustainability principles within SDFs and IDPs (Retief 2007; Du Plessis 2013). According to a study conducted Du Plessis (2013) on the commitment of municipal authorities towards the incorporation of sustainability principles within SDF proposals, concluded that strategic environmental techniques are not widely applied within municipalities and therefore not considered important during decision and policymaking.

2.6.4 Informality

Urban informality in South Africa has been an increasing factor since the apartheid era, stemming from the Group Areas Act 1950; also, informality can be associated with the informal economic sector which together with informal housing, often takes on illegality (Ligthelm & Masuku 2003). The number of informal housing has nearly doubled since 1996 to an estimated 713 000 for

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backyard dwellings as well as 1.25 million for single standing informal structures by 2011 (Statistics South Africa 2011 & Du Plessis 2013). Together with the increasing number of informality in South Africa, poverty and unemployment have grown in tandem (Turok & Parnell 2009).

The NDP recognizes the need to enhance and restructure informal settlements as it provides the poor with affordable access to housing but lacks sufficient basic service delivery and supportive policies (National Planning Commission 2012). Harrsion et al. (2008) note that informal settlements are still subject to marginalization, poverty, and high levels of informality despite the recognition of the NDP and remain unrecognized in spatial planning. As noted by Horn (2011), urban informality will remain an important component of South African cities, and it is, therefore, necessary to place a stronger focus on practically resolving the issue instead of polishing policies and strategies on paper.

2.7 CRITIQUE ON SMART CITIES

Besides the bright development achievements that smart cities have been known to offer to obtain objectives, cities are faced with a variety of issues and subjected to multiple critics (Joe 2017). Smart cities offer opportunities to create efficient cities and create positive change, but amid success, conflicts of interest arise, which in turn leads to misplaced decision-making in urban development, inequalities, and also further entrenches deeming issues within societies which many seem to overlook (Joe 2017).

2.7.1 Gentrification

In some cases, cities may become victims of their success. With the aim of smart cities to create visionary, utopian cities, the idea of displacement of many communities cannot be ignored (Teng 2013). The revitalization of cities, lead to the rise of property prices and can climb by 12%-40% in certain neighbourhoods, resulting in many business and residents being driven out due to the inability to “keep up” (Teng 2013).

It is acknowledged that smart city investment in cities help spur economic development, and aims to enhance the quality of life of citizens as well as contribute to environmental sustainability (Teng

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2013). It can be argued that smart cities drive revitalisation, but according to Teng (2013), revitalization may only benefit people who can cope with the rising prices and increased taxes brought along with smart development. As explained by Slater (2010), gentrification commonly occurs in areas where prior disinvestments in urban areas create opportunities for profitable redevelopment. The needs and desires of the "new coming" business elites in the area are met at the expense of current residents- these residents rather have a shattering experience than reap the benefits of redevelopment (Slater 2010).

The marketing of smart cities tend to cover all disadvantages brought along with the redevelopment of a city. In addition, public policy that has been erected to support and guide smart cities rather seem to foster the idea of the ideal city, and tend to practically ignore displacement of societies (Marcuse 1985). Furthermore, the goal to enhance the quality of life through smart city development through the provision of services empowered by digital technological advancement tend to "leapfrog" underlying issues within cities such as homelessness increased taxes and unemployment (Slater 2010).

It is therefore the civic duty of planners, particularly 'smart' planners, as well as developers to understand and be sympathetic towards the issue of gentrification, not only on paper but practically too (Slater 2010). As stated by Slater (2010: 580) "If the pain, bitterness, and even the humiliation that come with being forced out of one's home is not a central component of critical studies of gentrification, then it is unlikely that critical studies will make much difference".

2.7.2 Utopian Designing – The Global South

The development of smart cities takes on the image of creating an ideal place or community (Albert 2019). These strategies try to divert attention away from the demanding challenges of urbanisation such as poverty and housing security, and as a result as faced many critics in many city initiatives attempting to re-image themselves. Critics have described these technological developments as inauthentic designs that do not include a community-engaged design that promotes inclusion but instead, creates an enlarged gap between rich and poor (Albert 2019). In developing Nigeria, the smart city initiative of the Eko-Atlantic project has also taken on a utopian vision. The six million square meters waterfront financial center is expected to house a population of 250 000 inhabitants

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as well as accommodate for 150 000 commuters (Albert 2019). The project, however, has lacked transparency and is largely developed to accommodate wealthy inhabitants, excluding the poor from any participation. Also, the development of the infrastructure was proposed to withstand winds and waves from the Atlantic Ocean and has instead pushed waves into surrounding areas resulting in disastrous flash floods (Albert 2019). Furthermore, smart city initiatives within the developing world tend to take on a mimicked vision of developed and successful cities with urban form, structures, and challenges that greatly differ from the global south. As a result, the overarching, utopian designing of developed countries tend to fail in developing cities like the Zendai Developments in Johannesburg, which failed due to the unrealistic vision of the development (Businesstech 2019).

2.8 SMART FOCUS ON CAPE TOWN

Forming part of the CoCT metropolitan municipality, Cape Town is located in the Western Cape and the primate city of the province. Cape Town is also the second-largest city in South Africa with a population of 3.7 million and therefore the legislative capital of the country (StatsSA 2011). With a GDP per capita 40% higher than the rest of the nation, Cape Town has been able to increase its share of national output since the diminishment of the apartheid government (Marvin et al. 2015). The rich Mediterranean climate, and extensive coastline, rugged mountain ranges as well as coastal plains which the region is characterized by, has enabled a successful tourism and hospitality industry which continues to obtain substantial growth through international recognition (Marvin et al. 2015). Although the illuminating growth that the city seems to have been experiencing, serious inequalities persist, driven by multiple socio-economic and difficulties (Marvin et al. 2015).

2.8.1 Socio-economic state of the CoCT

The CoCT state report of Cape Town published in 2016 was designed to provide an overview of the development status of the city by giving a snapshot of the most pertinent issues that influence the socio-economic state of Cape Town. The report also outlines the challenges and opportunities faced by CoCT administration, and provide a real sense of the city and its inhabitants.

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Within Cape Town, social inequalities have been inherited from the apartheid ruled South Africa, although the democratic trend tries to move away from this history, inequalities and high levels of poverty persist. The average increase in the number of households from 1996 to 2011 in Cape Town was recorded at 63.6%, with Black African and Coloured populations remaining the poorest and most unequal population groups within the city (CoCT 2016). The constant trend within these groups has been further enhanced by the high Gini coefficient of Cape Town (0.62), which has resulted in higher levels of inequality and poverty since 2014 (CoCT 2016). Coupled with high levels of poverty and inequality, the quality of healthcare has also been affected as segregated areas where households with a lower or very low socio-economic status are located, are subjected to traveling great distances to access healthcare. While affluent neighbourhoods, on the other hand, maintain better access to public medical care within 30 minutes or less to the inhabitants, while rural and more segregated areas are subjected to making use of clinics that are only open from 7 am to 4 pm, with no medical services available after hours (Abrahams et al. 2018).

According to the 2011 Census, Cape Town has seen an increased number of people due to the process of urbanisation, receiving the largest number of national and international migrants than the rest of the country (CoCT 2016). During 2001 and 2011 the city experienced an increase in population growth by 40% (CoCT 2016). For this reason, economic growth in Cape Town can be associated with high population growth rates. Economic growth in Cape Town has been healthy over the past years, contributing 40.5% to the GDP compared to South Africa's 33.6% (CoCT 2016).

Affluent residents continue living in well-located areas, close to employment opportunities, low density, and highly serviced areas such as the City Bowl and the Southern Suburbs (Abrahams et al. 2018). Segregated from these flourishing neighbourhoods, overcrowded townships and informal settlements are located where high density and low municipal services are what characterizes these areas such as the Cape Flats and informal areas located on the urban edge (Abrahams et al. 2018). These areas are segregated and tend to be located a great distance from employment opportunities, with scare and unsafe public transportation opportunities. These segregated areas are usually occupied by previously disadvantaged population groups- Black African and Coloured groups, as well as international migrants usually from neighbouring countries that have migrated for job opportunities (Abrahams et al. 2018). Furthermore, the quality

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of education in Cape Town's segregated areas indicates a very brittle education system due to the large drop-out rates between 1995 to 2015 (CoCT 2016).

Despite the efforts through policies and funding allocations to township schools during the democratic era, the quality of education yet remains poor and in turn, fails to provide these learners with the necessary skills to be able to develop and compete in the labour market and contribute to the human innovation and knowledge that developing South Africa requires (CoCT 2016).

Another concern is the high levels of crime and violence in the city, posing a major concern for the development of the city and the well-being of all its inhabitants. These increased rates in crime can be driven by high levels of poverty within the city where crime is chosen as the solution to obtain daily necessities (CoCT 2016). Crime rates have had a detrimental effect on the city's ability to attract foreign investments, high skilled workers as well as tourists. The quality of life of the city's inhabitants has also been affected by the level of crime as it prevents social cohesion due to the lack of trust amongst society and creates stressful as well as unsafe living conditions. Also, it increases further segregation, as a range of responses to high crime rates includes the development of safe residential developments such as gated communities, which only caters for a particular level of income, and further divides the city socially (CoCT 2016).

The rapid population increase within Cape Town has increased the responsibility of the state to deliver basic services to all, develop sound urban and social policies, and manage the environment successfully (CoCT 2016). As a result, the increased pressure for local government to deliver has resulted in poor living environments and segregated communities which reflect poor urban management. A majority of informal settlements, as well as backyard dwellings, experience connection backlogs and service connections that fail, although the city's Electricity Services Department and Eskom try to address these challenges, the problem with the provision of service infrastructure within informal areas remain and in turn exclude many households from electrification (CoCT 2016).

2.8.2 City of Cape Town smart city initiatives

According to Marvin et al. (2015), 37.9% of Cape Town's population has no access to computers and just over 50% with no access to the internet. In 2000, the CoCT introduced the Digital Strategy of Cape Town, which then initiated a "Digital Divide Assessment entitled 'Taking Stock and

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Looking Ahead' in 2002 which aimed at understanding the constraints to technology access in the city (Marvin et al. 2015). The initiative was guided by four objectives: identify opportunities and constraints of ICTs in Cape Town, access needs of people in the city, the current access to ICTs, and lastly identify future ICT services (Bridges.org 2002). The 'One Cape 2040' was then launched with a vision that stipulates that local government can provide cost-effective ICT services to its citizens through vast household and public connections (Marvin et al. 2015). Also, the Western Cape Economic Development Partnership (2013) has planned to establish integrated service nodes and hotspots in public places. These initiatives have all been developed to connect citizens, government as well as the infrastructure through the expansion of ICT infrastructure (Marvin et al. 2015).

Facilitated by the CoCT as well as the Western Cape provincial government, broadband connectivity is planned to be rolled out in various phases over the next ten years at schools and according to Western Cape Government (2013), "some of the city's disadvantaged areas". Figure 9 illustrates the smart city journey of the CoCT, focusing especially on the broadband fibre, which commenced in 2009, and completed the first phase in 2014.

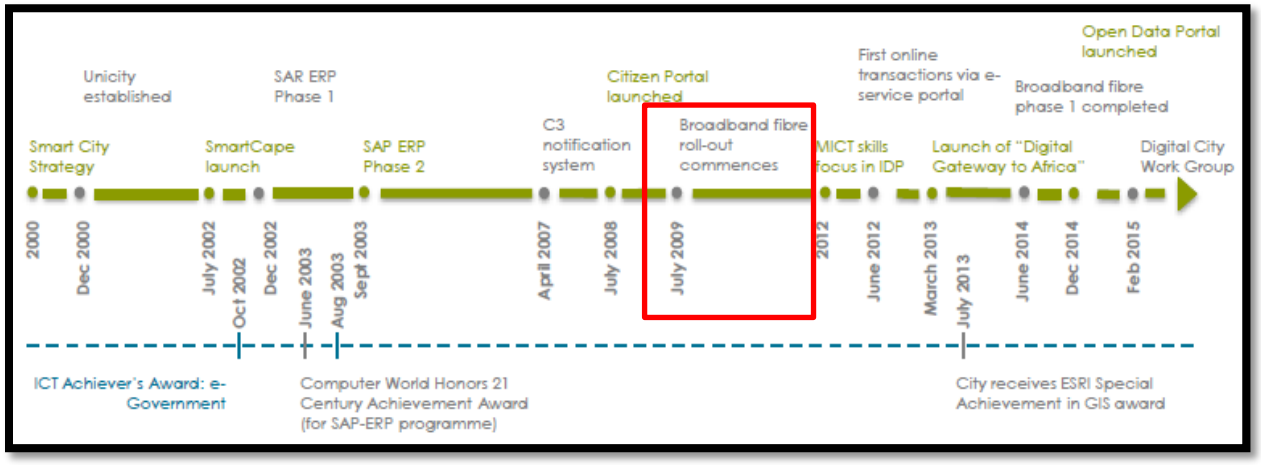

Figure 9 The CoCT's smart city journey Source: CoCT (2017)

Furthermore, the language of the city's smart city strategies takes on an ambitious vision such as – "to completely change the way in which society and local government interact and collaborates to enhance the quality of life and economic opportunities of all citizens" (Marvin et al. 2015). In essence, ICT policies and strategies see digital knowledge as a chance to create new forms of

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urbanity and achieve social transformation (Marvin et al. 2015). Initiatives such as Smart Cape recognize the importance of a knowledge-based economy in repositioning and reimagine the city. This smart strategy aims to narrow the digital divide, empower citizens, and promote effective citizen involvement by providing access to public computer facilities which provides people with internet access for free.

As noted by Marvin et al. (2015), climate change initiatives have been largely absent from implemented smart city strategies in the city. The concept of sustainability and climate change has however only been evident as a marketing tool for effective planning by companies such as Siemens, and it has failed to be incorporated in the city's smart city policy (Marvin et al. 2015). Furthermore, the Digital strategy and Smart Cape have become influential in the city's digital access and highlight the importance of digital administrative governance, and therefore it is also essential to maintain a steady political body within local government (Odendaal 2006).

CoCT digital strategy

The digital strategy of the CoCT, implemented in 2000, takes on a strong digitalized approach, as seen in Figure 10. The digital strategy focuses mainly on providing residents with a broadband connection through digital infrastructure. Guided by four visions, *Digital Governance, Digital Inclusion, Digital Economy, and Digital Infrastructure* which all focus on digital service delivery through ICTs to enable growth and enhance the quality of life of people.

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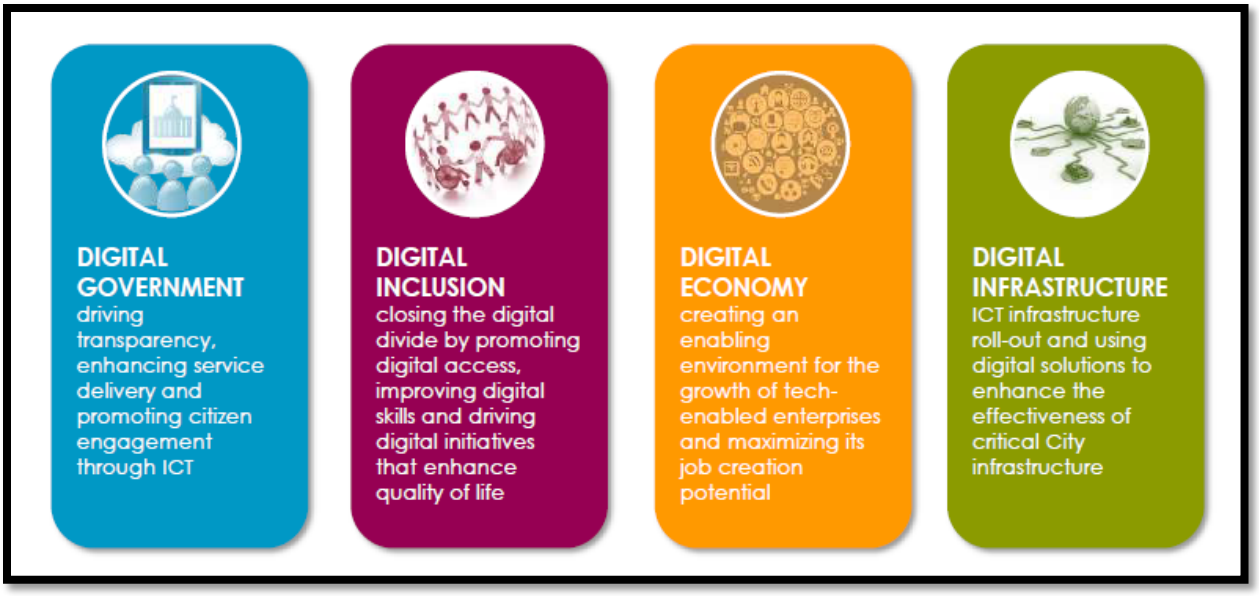

Figure 10 CoCT Smart Digital Strategy Goals Source: CoCT (2017)

The strategy put forward by the CoCT is solely focused on the digitalization and connection of areas within the region over ten years, which includes phases of broadband implementation at schools, businesses, residential areas as well as several disadvantaged areas. Figure 11 displays the areas where digital infrastructure will be implemented. The digital infrastructure consists of fibre-optic cables, which is aimed at providing accelerated internet access to over one million people through a number of free Wi-Fi zones within the area indicated in Figure 11. The digital strategy aims at making Cape Town the most digitally connected city in Africa by 2021.

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Figure 11 Digital infrastructure layout Source: CoCT (2017)

CoCT Smart Cape Strategy

Another smart initiative carried out by the CoCT, the Smart Cape project provides free computer access and internet connectivity to the residents of Cape Town. Figure 12 displays the access points (five in total), these provide free of charge, time-limited internet access- the network will extend from Atlantis in the north to Simon's Town in the south, and from Gordon's Bay and Kuils River in the east to Sea Point and Hout Bay on the Atlantic seaboard. Each access point provides six internet-enabled computers to the surrounding areas within the buffer zone. This smart strategy aims to narrow the digital divide, empower citizens, and promote effective citizen involvement. It is important to note that this smart strategy also places a strong focus on digitalization through the provision of pilot access library points as seen in Figure 12. The launch of the Smart Cape strategy is in line with the Digital Strategy, following a strong focus on technological upliftment through ICTs.

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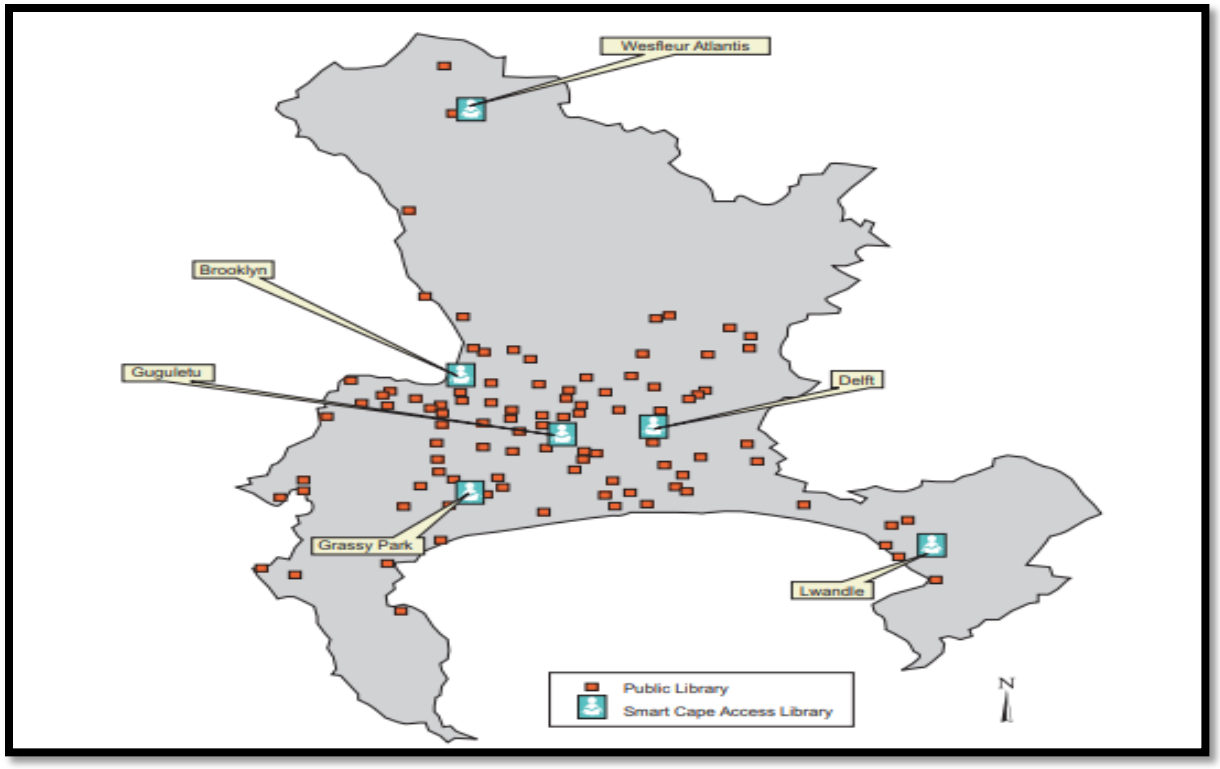

Figure 12 COCT Smart Cape locations Source: Valentine (2004)

2.9 PRESIDENT RAMAPHOSA'S VISION

"I dream of a South Africa where the first entirely new city built in the democratic era rises, with skyscrapers, schools, universities, hospitals and factories."

-President Ramaphosa 2019

President Cyril Ramaphosa delivered his third State of the Nation Address on 20 June 2019. During his speech, President Ramaphosa portrayed his vision of building a 'smart' South Africa, by building new cities across South Africa. According to President Ramaphosa, since the dawn of democracy South Africa has not built new cities, and it is time to create a South Africa where "bullet trains pass through Johannesburg as they travel from here [Cape Town] to Musina, and they stop in Buffalo City on their way from eThekwini back here" (Ramaphosa 2019). President Ramaphosa also emphasized that cities need to accommodate the growing population and therefore

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by being “bold” and “reach beyond ourselves” to include technologies of the 4th revolution (IOL 2019).

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CHAPTER 3: METHODS

The methods adopted for this study were employed to determine the smart city strategies within the CoCT's IDP, ISO indicators for smart cities, the socio-economic state of Cape Town, and the municipal budget dedicated to smart city and socio-economic principles. Official municipal documentation from the CoCT was collected and analysed to determine the potential for smart cities in Cape Town and attempt to redefine the approach to smart cities to alleviate the current challenges within the city. The data and information from the CoCT formed the most important data which was used to portray all research results.

3.1 RESEARCH QUESTIONS

- Which of the ISO indicators for smart cities are addressed in the Cape Town smart city strategy?
- What other objectives are listed as part of the Cape Town smart city strategy?
- What is the number of strategies relating to smart cities contained in the City's IDP compared to strategies relating to addressing socio-economic challenges?
- What percentage of the municipal budget is dedicated to smart city strategies compared to budget dedicated to strategies pursuing socio-economic development?
- How big of a priority are smart city principles for the City of Cape Town?

3.2 DATA GATHERING

As outlined in the research design (Figure 2), data was gathered using a mixed-method approach. A qualitative approach was deemed most appropriate due to the secondary data nature of the study and the flexible nature of the qualitative approach (Paraskevas & Altinay 2008). A number of data sets were obtained by official CoCT publications- the official municipal budget (2018/2019 – 2020/2021), the Cape Town Digital Strategy (2000), Smart Cape (2002), the CoCT's IDP (2017-2022) as well as the State of Cape Town Report (2016). Although the data obtained was primarily qualitative in nature, some data were quantitatively analysed through the representation of graphs

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and tables. Also, spatial maps were obtained through secondary data, mainly from the official mentioned CoCT publications that were used to obtain the relevant data.

3.3 ANALYSIS OF DATA

Data was analysed empirically as an evidence-based approach. This method was selected to best study and interpret the secondary information from the CoCT, as it relies on real-world data and results rather than theories and concepts. The exploration of data through empirical analysis as enabled a real-world approach to understanding the CoCT's socio-economic state, the current smart city strategies as well as the ISO indicators. A comparative analysis approach was also adopted to compare the current smart city strategies to the ISO indicators to measure the performance of Cape Town towards becoming a smart city. For the sake of measuring the incorporation of the smart city factors and the ISO indicators within the current smart city strategies of the CoCT, results were displayed through a series of graphs, figures, and tables. Maps were also used to visually display results; these maps were sourced from published CoCT documentation. For the sake of evaluating the CoCT IDP (2017-2022), a secondary policy analysis approach has been adopted to study the objectives and principles dedicated to smart city and socio-economic development within the IDP. This particular method has been adopted to determine the impact and importance which smart city and socio-economic development has within the city. A policy analysis approach is analytical and descriptive and aims to explain policies, which are appropriate for the study of the CoCT IDP.

CHAPTER 4: RESULTS

This investigation is set out to portray the current smart city strategies utilized by the CoCT, through the inclusion of smart city strategies within the IDP (2017-2022) as well as the socio-economic objectives of the CoCT by using detailed figures to portray the findings. Following this, an analysis of the municipal budget (2018/2019 – 2020/2021) towards socio-economic and smart city investments is investigated portrayed through quantifiable figures. Furthermore, a comparison between the ISO indicators towards smart city development against the set-out objectives of the IDP of the CoCT is done.

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CoCT SMART CITY VS SOCIO-ECONOMIC STRATEGIES

4.1 IDP (2017-2022)

Guided by Section 29 (1) (b) (i) (ii) of the Municipal Systems Act, Act 32 of 2000, the IDP has to be guided by the local community through various public participation approaches to gain an in-depth insight into the development needs and priorities of the community. The CoCT's vision for the 2027-2022 IDP signifies that Cape Town will take on development that will enhance the economic and social potential of the city through a well-run government which is responsive and guided by clean and uncorrupt methods, as well as through an environment of economic growth and prosperous investment opportunities that will improve the quality of life of all citizens and inhabitants (IDP 2017).

Six core guiding principles have been developed based on the vision, which should inform all strategies and activities within the city:

1. **Transformation of the built environment through transit-oriented development (TOD) –** To undo the unjust of the apartheid system, the city intends to develop a more inclusive and vibrant city that will rectify past imbalances in the distribution of residential areas. Through the implementation of the TOD, the city aims to respond to rapid urbanisation and population growth in the city. Furthermore, the TOD strategy also aims to locate new development strategically to optimize efficient service provision.
2. **Sustainability -** The city aims to include sustainability as a key factor in present and future development and to preserve natural resources to be able to provide services for future generations.
3. **Resilience –** To achieve urban resilience the CoCT aims to achieve an inclusive, sustainable, and safe city through the goals of the UN SDG. The city views urban resilience as a core factor in alleviating urban challenges in the city, and therefore resilience strategies should be incorporated into planning and decision-making mechanisms.

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4. **Governance reform** – Through the CoCT's Organisational Development and Transformation Plan (ODTP), the city aims to improve service delivery expected by inhabitants whilst maintaining necessary oversight to ensure compliance. The city's administration will be aligned towards enhanced service delivery objectives through an adequate operations system.
5. **Customer-centricity**- The city aims to redesign its' structures and procedures to be able to be more responsive to inhabitants' needs through a supportive area-based service delivery model to improve satisfaction in the city by making use of online services to monitor results.
6. **Transversal approach**- The city's transversal management system (TMS) aims to improve integration and coordination of service delivery. Through cross-directorate communication and decision-making, the approach aims to achieve collaboration of all departments to identify issues in multiple divisions of the city.

Through the guiding principles, the IDP has retained five focus areas to achieve the vision, focusing on implementation and service delivery. The first area includes the opportunity city, which focuses on the creation of a sustainable and fruitful economic environment that will attract economic growth and stimulate job creation. The second area includes a safe city, which focuses on creating a city where inhabitants feel safe, through disaster and risk management services, rescue services, and traffic services. The third area includes the caring city which focuses on the actual feeling of welcoming in the city, through various assistant approaches for people in need. The fourth area includes the inclusive city, focusing on achieving an environment where access to economic opportunities is integrated. The last area includes the well-run city, where the city aims to be responsive to all inhabitants' needs through human resource development, service provision as well as organizational restructuring.

The CoCT further identified eleven objectives that span from the five focus areas that will fully shape the development of the city. These objectives are aimed towards achieving socio-economic and smart city improvement within the CoCT (see Table 1).

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Table 1 Smart city and socio-economic objectives within the IDP 2017-2022

Objectives		**Supporting programmes and projects**
Positioning Cape Town as a forward-looking, globally competitive business city	– By launching "Invest Cape Town", the city aims to create an attractive space which ensures collaborative growth between government and private sections in Cape Town that will enable job creation and inclusive growth. – Through the establishment of high-quality support services within targeted areas such as the Atlantis Investment Facilitation Office which will be developed into a Special Economic Zone (SEZ), the city aims to establish global competitiveness that will create business investments and new job opportunities.	– Cape Town Business Brand Programme – Infrastructure investment programme – Road infrastructure investment programme – Economic development and growth programme
Leveraging technology for progress[1]	– Through the intervention of ICT's the CoCT aims to transform into the most digital city in Africa through improved internet speeds; the use of greater digital platforms to improve service delivery as well as the implementation of universal internet services. – Through the implementation of the Digital Strategy of Cape Town as well as the SmartCape project, the city has already made significant advances in broadening access to high quality digital services; created a platform to bring new service delivery and management systems as well as empowered residents through the provision of internet connectivity. – The CoCT will further leverage technology to strengthen digital government capabilities to enhance service delivery and improving citizen engagement through ICT channels; emphasise digital inclusion through the growth of the digital economy and lastly, invest in digital infrastructure	– Digital city programme – Digital Strategy of Cape Town, SmartCape and the Last Mile project

[1] Smart city objective

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	that will meet the digital goals of the city.	
Economic inclusion	– The CoCT aims to improve the quality of life as well as promote a greater and enabling environment for economic growth. – Through the investment of the Expanded Public Works Programme (EPWP) the city will address real service needs and address unemployment. – The EPWP intends to address issues within communities as well as encourage small-business development to satisfy the labour market demands.	– Skills investment programme – EPWP job creation programme
Resource efficiency and security	– The city aims to promote the provision of sustainable goods and services in the city though resource-efficient processes that will enhance the environment and promote social inclusion which will in turn contribute to the resilience of the communities in Cape Town.	– Energy-efficiency and supply programme – City resilience programme
Safe communities	– The city aims to provide personal safety through the deployment of comprehensive approaches which will include the South African Police Service (SAPS). – By applying appropriate technological systems, prevention operations will be established to inform optimal service delivery and tracking of safety. – Through the implementation of social crime prevention programmes, the city aims to determine the root cause of crime in the communities.	– Safety technology programme – Holistic crime prevention programme – Neighbourhood safety programme

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Excellence in basic service delivery	– The city will try and achieve transit-oriented and dense development to allow integrated spaces for effective service delivery. – By committing to achieve excellence in customer engagement, the city will create an area-based model to respond to service faults and complaints through a digital platform.	– Excellence in service delivery – Housing programme
Mainstreaming basic service delivery to informal settlements and backyard dwellers	– In order to provide access to opportunities and improve the quality of life the CoCT aims to explore appropriate models of service delivery to improve living conditions in informal settlements. – Improve the security of tenure within the informal areas; increase transversal management and service integration. – Create resource-efficient solutions to ensure prompt service delivery.	– Basic service delivery programme – Human settlements programme
Dense and transit-oriented urban growth and development	– Through the implementation of the TOD Strategic Framework, the city aims to bring a new approach that will guide the development of Cape Town as well as transportation planning to achieve a well-connected system. – The TOD will strategically locate new development around existing transport; maintain and upgrade infrastructure and services to promote a more efficient urban corridors and to ensure densification and intensification of development.	– Spatial integration and transformation programme – TOD catalytic projects programme
An efficient, integrated transport system	– To achieve integrated transport planning the CoCT developed the Integrated Public Transport Network (IPTN). – The city aims to continue with the roll-out of the BRT systems and incorporate scheduled minibuses and buses; implement congestion reduction programmes which includes investments in road capacity and infrastructure; upgrade and rehabilitate	– Integrated public network 2032 programme – Travel demand management programme – Non-motorised transport (NMT) programme

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	road networks and direct human settlement development within 500m of rail and BRT systems. – Design and roll-out bike share systems across Cape Town.	– Efficient, integrated public transport programme
Building integrated communities	– The city aims to achieve social transformation within communities through the facilitation of programmes that addresses inclusive land use and housing policies; dedicate resources to improve the quality of life within poor and vulnerable communities and restructure service delivery interventions.	– Built environment integration programme – Citizen value programme – Public participation programme
Operational sustainability	– To achieve a more responsive system that is resilient and sustainable services the city aims to enhance service delivery through the adoption of the ODTP. – Through the ODTP, the city aims to make optimal use of existing facilities to promote cultural events and sporting activities; create a diverse pool of communities though inclusion and exploration of experiences.	– Efficient, responsible and sustainable city service programme – Value awareness programme – Service delivery skills programme

As set out by the IDP, only one objective - leveraging technology for progress- is aimed at smart city development within the city, compared to the remaining ten objectives which are all aimed at socio-economic development. The socio-economic objectives are all aimed at improving the quality of life of the city's inhabitants through addressing unemployment in the city by job creation initiatives, implementing crime prevention strategies to alleviate the high levels of crime in the city, improve service delivery within segregated and informal areas, provide interconnected transportation systems that will ensure densification and create well-connected corridors, restructuring communities as well as improving sustainability and resilience within the city. The smart city objective is aimed at ICT development through the Digital Strategy of Cape Town, Smart, Smart Cape, and the Last Mile project, which will in turn also contribute to the socio-economic improvement of inhabitants in the city.

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In essence, based on the results of the IDP objectives in Table 1, one out of eleven objectives is aimed at smart city development, therefore making socio-economic development and improvement a bigger priority for the CoCT to achieve compared to smart city development.

4.3 CITY OF CAPE TOWN BUDGET

According to the official published budget by the CoCT for 2018/2019 – 2020/2021, the total budget quantum is set at R47 672 million, of which R39 264 million (82.40%) is allocated to the operating budget and R8 407 million (17.60%) to the capital budget (see Figure 13). As depicted in Figure 13, the smaller portion (17.60%), the capital budget includes all spending on municipal assets such as land, infrastructure, and vehicles which will be the main focus for this study as it takes into account all development while the operating budget focuses on maintenance instead.

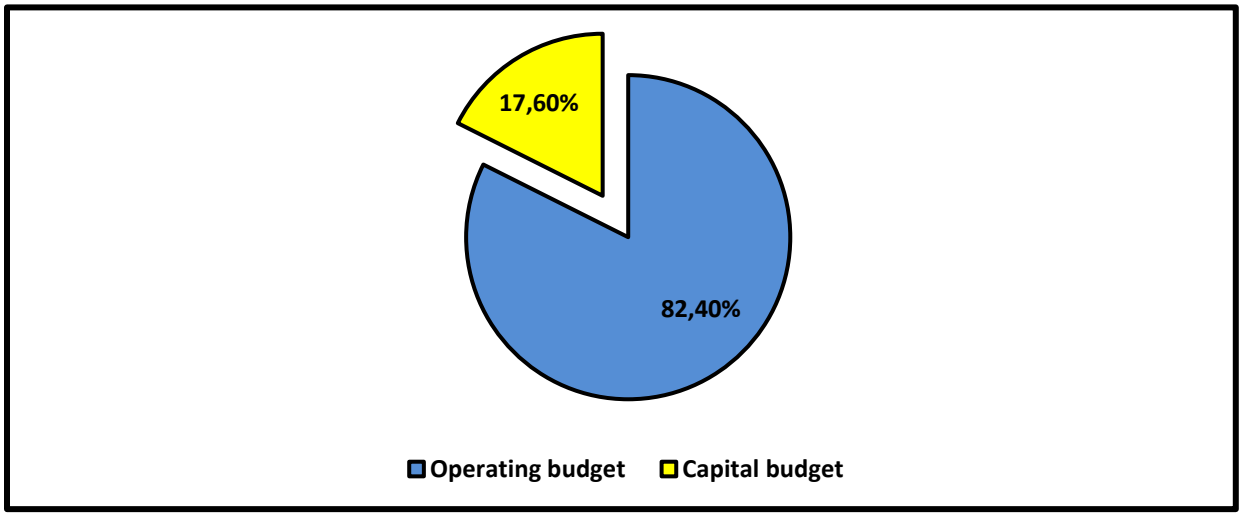

Figure 13 Total budget of CoCT

Table 2 provides detailed investments towards smart city development as well as socio-economic development by the CoCT for 2018/2019 – 2020/2021. The budget has been determined by a process of votes responsible for infrastructure development within each section. According to the results, smart city development only includes two investments which account for R12 594 784, 25.92% of the total budget. The investment goes along with the single objective toward smart city development within the IDP, the Smart City Strategy falls within the objective -Leveraging Technology for Progress- by extending the project, the city aims to provide digital infrastructure to all remaining areas that need ICT channels. The remaining 74.08%, which makes up the majority of the CoCT's capital investment includes socio-economic development within the city. The R36

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002 914 dedicated by the CoCT's budget accommodates for the improvement of the current socio-economic state of Cape Town, where informal settlements, water, and waste services have been allocated the majority investment (R19 510 583). According to the ten set out objectives of the IDP, the improvement of informal areas as well as the restructuring of service delivery form the core principles of the objectives. Transport and urban development authority (R6 533 225) also forms an important part of the IDP objectives and is provided the second-highest investment in the budget aimed at developing integrated transport planning through the extension of the BRT system as well as the implementation of the bike share system in the city. The remaining investments which include: area-based service delivery, assets and facilities management, corporate services, energy, finance, safety, and security, and social services, are all aimed to enhance the quality of life of inhabitants within the city. Although great emphasis has been placed on the restructuring of service delivery, as well as the enhancement of safety and security within communities within the IDP objectives, area-based service delivery has only been allocated R190 498 and safety & security only R477 836.

Table 2 Detailed smart city and socio-economic investments by the CoCT

Smart city development investments	**Outlined budget**	**Socio-economic development investments**	**Outlined budget**
Leveraging Technology for Progress	R594 784	**Area-Based Service Delivery**	R190 498
Extension of the Smart City Strategy	R12 000 000	**Assets & Facilities Management**	R1 236 782
		Corporate Services	R1 413 063
		Energy	R5 458 693
		Finance	R135 989
		Informal Settlements, Water & Waste Services	R19 510 583
		Safety & Security	R477 836
		Social Services	R1 046 245
		Transport & Urban Development Authority	R6 533 225

The allocated budget for 2018/2019 – 2020/2021 accommodates for the setout objectives of the IDP for both smart city development as well as socio-economic development. As portrayed in Figure 14, the CoCT capital investment budget provides the majority priority to socio-economic development (R36 002 914) which correlates with the majority of IDP objectives which are aimed

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towards socio-economic development compared to smart city development (R12 594 784) with only one objective within the IDP aimed towards the investment of smart city strategies within the city.

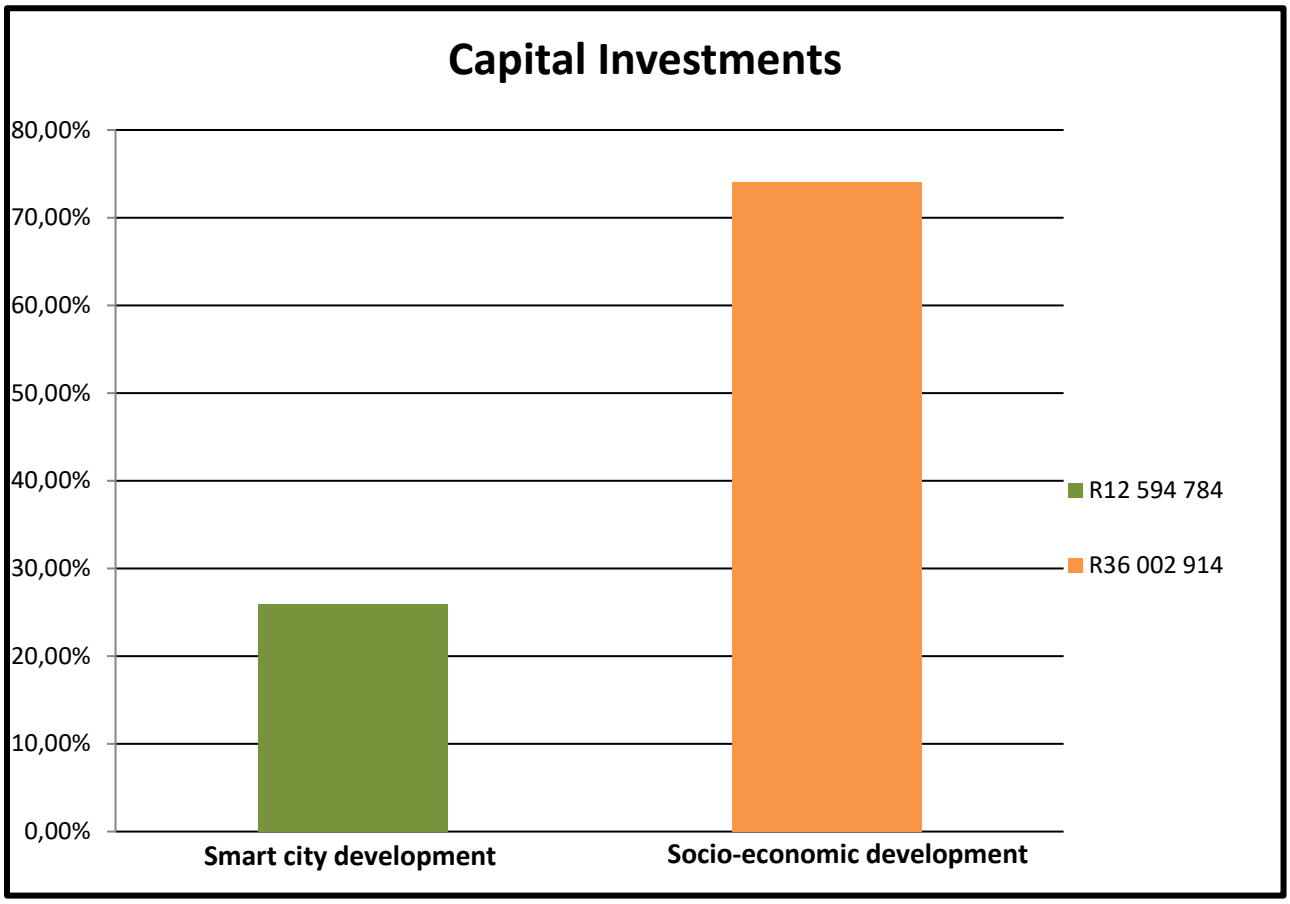

Figure 14 Total capital investments by the CoCT for 2018/2019 – 2020/2021

4.4 ISO INDICATORS

The following ISO indicators (Table 3) are a combination of methods from the ISO 37200, 37122, 37123, and 37120 strategies. The ISO indicators have been measured against the set out IDP objectives in Table 1.

Table 3 Measuring Cape Town's performance towards becoming a smart city

ISO INDICATORS	DEFINITION	IDP OBJECTIVES
Economy	– City's gross domestic product per capita – Median disposable annual household income – Unemployment rate in a city	– Positioning Cape Town as a forward-looking, globally competitive business city & Economic inclusion.

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		– Both objectives are aimed at improving and promoting a greater environment for economic growth which will in turn enhance the city's GDP as well as decrease unemployment rates.
Education	– The extent to which the city provides easy access (either physically or digitally) to a wide coverage of educational resources – The percentage of schools with environmental education programs	– Within the provided IDP objectives, no objective is directly aimed at education development. – The socio-economic objectives which are directed at achieving social transformation, the improvement of the transportation network as well as enhancing safety in communities all indirectly contributes to providing easy access to educational programme but do not completely solve the fragmented education system in the city.
Energy	– The percentage of total energy derived from renewable sources, as a share of the city's total energy consumption – The percentage of households unable to afford the most basic levels of energy	– Resource efficiency and security as stated in the IDP objectives, promotes the provision of sustainable goods and services as well as enhancing resource-efficient practices in the city.

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Environment and climate change	– The extent to which the city has developed and implemented a climate resilient strategy	– Resource efficiency and security as stated in the IDP objectives aims to achieve resilience of communities within the city through the City resilience programme
Finance	– Annual expenditures by the municipality for a transition towards a smart city	– The only smart city objective within the IDP - Leveraging technology for progress – aims at improving ICT platforms within the city, and found within the CoCT budget, the total budget of R12 594 784 has been allocated to smart city transition.
Governance	– The extent to which the progress towards a smart city and compliance with requirements is being monitored and reported – Number of public participation processes per 100.000 per year	– The smart city objective (Leveraging technology for progress) aims at developing ICT and digital infrastructure across the city but does not include any information on the monitoring and reporting on the success of these initiatives. – Public participation in the city has been a challenge, and has resulted in numerous service delivery protests by inhabitants, the IDP objectives does however fail to address the improvement of public

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		participation in the city. – The implementation of the area-based service model (Excellence in basic service delivery) provides customer engagement, to gain insight on the complaints from inhabitants but does not offer a bottom-up approach essential for public participation.
Health	– Share of population with access to basic health care services within 500m	– According to the eleven IDP objectives, no objective has been aimed at improving health care services within the city. – Through the Efficient, integrated transport system and the dense and transit-oriented urban growth objectives, the access to basic health care services can be improved especially for segregated areas.
Housing	– Percentage of social dwellings as share of total housing stock in the project area – Square meters of public outdoor recreation space per capita	– The objectives: Mainstreaming basic service delivery to informal settlements and backyard dwellers within the IDP are all aimed at improving the quality of life of inhabitants in informal and segregated areas through enhancing service delivery and improving service integration by implementing the

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		human settlements programme
Safety	– Number of violence, annoyances and crimes per 100.000 population – The level of cyber security of the cities' systems – Response rate from police	– The Safe Communities objective within the IDP aims to establish programmes to provide personal safety to all inhabitants through comprehensive approaches by the SAPS and to determine the cause of crime within the city. Cyber security systems will also be introduced to inform optimal service delivery and to track safety.
Solid Waste	– City population with regular solid waste collection – Percentage of city's solid waste that is recycled	– Through the excellence in basic service delivery objective within the IDP, the city aims to achieve engagement by inhabitants through the area-based model to respond to service faults and complaints. – No objective has been aimed around improving the city's recycled solid waste practices.

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Telecommunications & Innovation	– Fixed (wired)-broadband subscriptions per 100 inhabitants – Incorporation of human innovation	– The only smart city objective -Leveraging technology for progress- aims to improve the use of digital platforms to improve service delivery and empower residents' engagement that will in turn achieve the goal of becoming the most digital city in Africa.
Smart city policy	– The extent to which the city has a supportive smart city policy	– The IDP objectives only include one smart city objective (Leveraging technology for progress). – This objective only aims to improve ICT and digital access across Cape Town through the implementation of the Digital Strategy of Cape Town, SmartCape and the Last Mile project.
Transportation	– Share of population with access to a public transport stop within 500m – % of bicycle paths and lanes in relation to the length of streets (excluding motorways) – Level of traffic congestion	– The efficient, integrated transport system and the dense and transit-oriented urban growth and development objectives within the IDP aims to achieve integrated transport access within 500m to direct human settlements. – The objective also aims to implement bike share systems across

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		the city to enhance the level of NMT.
Urban planning	– Share of population with access to at least six types of commercial amenities providing goods for daily use within 500m – Size of informal settlement areas – Level of social and economic segregation	– Through the objectives: Mainstreaming basic service delivery to informal settlements and backyard dwellers, dense and transit-oriented urban growth and development, building integrated communities and operational sustainability, the city aims to restructure the city to achieve an integrated network where residential areas are provided improved service delivery, connected through serviced corridors as well as decrease social segregation by building integrated communities through the creation of diverse pools of communities.

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CHAPTER 5: DISCUSSION

This discussion combines the research results with the literature, to determine the potential for smart cities within Cape Town and the various factors outlined in the results that have contributed to the outcome. Furthermore, a discussion on the challenges within the vision of smart cities in Cape Town will be done, followed by the way forward to achieving a smart city.

5.1 SMART CITY VS SOCIO-ECONOMIC PRORITIES IN CAPE TOWN

Although the government should be applauded for recognizing the importance of urbanisation in cities, by taking the bold step into joining the smart city world, the overachieving vision of President Ramaphosa tends to ignore the challenges within South Africa's urban areas.

The socio-economic status of the CoCT has remained a persisting challenge to the development of the city. Through the studied literature, socio-economic challenges paint a rather daunting picture when imagining the future development of smart cities in the city. Poverty, inequality as well as informality have been the core drivers in degrading the overall socio-economic stature of the CoCT. The growth of informal areas maintains being a hindrance to achieving the ideal smart city, due to the high-density levels, segregation as well as inequality found within these areas. Furthermore, the high Gini coefficient of 0.62, making Cape Town one of the most unequal cities in South Africa due to imbalanced growth trajectory in the city. Both informality, as well as inequality, has contributed to the level of service delivery in the city, where the highly unequalled distribution of healthcare in the city has also rather reduced the quality of life of disadvantaged inhabitants which are segregated from healthcare facilities. In addition, segregated areas with little access to public transport have also been subjected to the lowest standards of living. The alarming crime levels of Cape Town have further affected the city's ability to attract foreign investments and have affected the quality of life of inhabitants due to unsafe living conditions and as a result, enhance social segregation due to the development of safe residential developments for a particular level of income.

As portrayed in the results, the IDP (2017-2022) is driven by firm socio-economic strategies that aim to salvage the socio-economic challenges within the CoCT. Out of a total of eleven strategies, ten are aimed at socio-economic improvement within the city. While only one objective is aimed at smart city development and digital improvements across Cape Town. It can, therefore, be argued

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that the CoCT's IDP strategies have taken more priority within the IDP, this could be due to the persisting challenges that have been stemming from the dawn of democracy. It is however important to note that democratic policies that have been erected to undo the unjust of the apartheid government have also come across as gleaming as the current strategies within the IDP, and yet failed to mitigate the socio-economic problems as reflected in the literature.

The socio-economic priorities of the CoCT are further strengthened by the designated capital investment budget, with 74.08% of investments allocated to socio-economic development. It is therefore mandatory to practically apply these socio-economic strategies offered through the IDP and coupled with a strong budget to place Cape Town in position to even consider achieving the overarching vision of President Ramaphosa. With the current state of "happiness" in the city, which is shaped by the daily socio-economic challenges as well as a high level of distrust by citizens and inhabitants towards the state, the ability to achieve the ideal smart city that President Ramaphosa dreams of, without successfully applying the offered strategies by the IDP seems all the duller.

Concerning smart city development objectives within the CoCT, out of eleven objectives, only one has been allocated for smart city development within the city. The objective thrives to enable access to Wi-Fi and provides improved access opportunities for citizens and inhabitants in the city. Through the implementation of the Digital strategy of the CoCT and Smart Cape specifically, the city aims to join the smart city race. These strategies, however, do not include services for the urban context – smart mobility, smart environment, city safety, and smart healthcare - which make up the core of an ideal smart city. These strategies thus only provide for the basic implementation of broadband and Wi-Fi locations across the city. The strategies do however provide for e-governance and provide inhabitants that chance to participate in digital platforms provided by the state to enhance public participation. Furthermore, when studying the budget of the CoCT as displayed in the results, the provision for smart city initiatives has been accounted for, and make up 25.92% of the allocated capital investment budget. Within the allocated budget toward smart city development, the CoCT aims to extend the access to broadband and Wi-Fi across the city, which is arguably much more realistic than the vision of President Ramaphosa.

When studying the ISO indicators, which form an integral part of smart city development globally, the eleven IDP strategies have managed to incorporate most of the indicators, although not entirely.

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Indicators such as solid waste, health, and education are not addressed directly within the IDP strategies, and therefore require necessary refinement to achieve the socio-economic goals that will pave the way to a successful smart city. The smart city strategy within the IDP has also been accounted for through the ISO indicators, but also requires a more supportive smart city policy that will guide smart city development, that does not only focus on digital development through broadband and Wi-Fi but through the development of smart services that run in parallel to the socio-economic needs of the city. In this way, a more realistic, and bottom-up smart policy can be adopted that has been molded by both smart city and socio-economic IDP strategies of the CoCT.

Through the adoption of a smart city policy that takes into account the persisting socio-economic challenges within the city, challenges can be solved using smart, realistic solutions. Although the current smart city strategies of the CoCT ensures for the development of ICTs and closing the digital divide in the city, it also begs the question, does indigent households subjected to unemployment, segregation, informality, poor sanitation, high crime rates, and the list goes on, need polished, top-down smart approaches or merely the required basic service to be delivered equally throughout the city and across South Africa? This question can be answered through a compromised smart city policy that includes for the provision of smart urban services suited for the current situation within the city; this can be developed together with the suggested socio-economic and smart city strategies within the IDP.

5.2 ATTAINING THE IDEAL SMART CITY IN THE COCT

As discussed, it can be agreed that the current state of the CoCT reflects a rocky foundation to be built upon. It is, therefore, necessary for national and local governments to address the undying urban challenges before attempting to take on smart city goals from successful cities in the global north such as Dubai, Amsterdam, and Singapore. What our cities need are realistic solutions that provide value to all citizens and inhabitants equally, instead of pursuing grand smart designs that overlook the urban challenges. Through the vision of President Ramaphosa, it is clear that joining the smart bandwagon is merely transplanting smart development from the developed world, and applying the vision through a "copy-paste" method without considering the unique situations in which cities in South Africa face.

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Joining the smart city wave is however not impossible. What we need is to create our vision which will guide the bottom-up development of smart cities through the unique state in which cities across South Africa, and in this case, Cape Town is subjected to. The socio-economic and smart city strategies within the IDP as well as the capital investment budget of the CoCT has the potential to achieve prosperous smart development within the city, only if the strategies are practically applied, particularly the socio-economic strategies. The strategies of the CoCT can achieve the basic requirements of a smart city: citizen well-being and the enhanced quality of life, or just "happiness". It can also be argued the CoCT strategies are more realistic than the vision of President Ramaphosa, which instead is just an unrealistic vision which does not take into account the state of urban and socio-economic challenges across South African cities but instead attempts to join the smart city trend of the global north without trying to solve the current challenges in cities. According to Musakwa, Tshesane & Kangethe (2017), the vision of President Ramaphisa could also be as a result of political pressure to obtain votes and attract foreign investments into the country.

Ultimately, the CoCT's socio-economic and smart city priorities displayed throughout the results have the potential to carry the city to great heights if applied successfully but do still however need polishing to avoid taking a similar path of previous unsuccessful socio-economic strategies that have not been practically applied. Therefore, by adopting a smart policy that takes the suggested socio-economic and smart city strategies of the IDP into consideration as well as satisfies the ISO indicators for smart cities will be the key to achieving a successful smart city, suited for Cape Town. Through a bottom-up approach and collaboration between national and local government as well as the participation of citizens in the development of the city which is transparent, and based on a clear distribution of roles and responsibilities can provide a sense of trust amongst all citizens and inhabitants. This will in turn create a more efficient and successful response with the introduction of e-services, creating better participation in problems and service delivery.

Figure 15 illustrates the interventions that require great attention to achieve a successful smart Cape Town. **People**: to achieve a successful city, the inclusion of all citizens and inhabitants is essential, enhancing the capabilities of people through human innovation particularly through an improved education system and standards of living that are required for investing in the future of the city. **Place**: by creating more inclusive, compact, and livable cities which promote social

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cohesion and ensure for the safety and access to all public services is essential for establishing a successful smart city. Through the development of segregated areas and the upgrade of informal areas, as well as the provision of basic services which include education, healthcare, safe and reliable public transportation, access to water, adequate sanitation, and electricity is particularly important for building the future of the city. **Economy**: planning for employment and improving economic opportunities, as well as creating more resilient and productive cities contribute to the capacity of the city to achieve an integrated and vibrant city

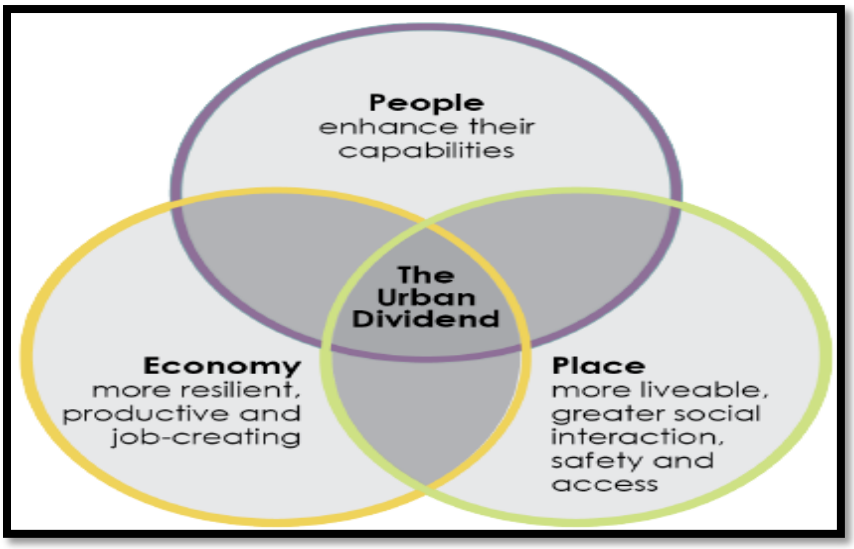

Figure 15 What a successful smart city needs

With the adoption of a smart policy that includes the provision of smart urban services suited for the current situation within the city, together with the strong foundation of the eleven IDP strategies, Cape Town can successfully solve the persisting socio-economic challenges whilst introducing smart urban services that will together ensure a successful city as suggested by Figure 15. In this way, the performance of the city will be more inclusive of both the needs of its' citizens and inhabitants as well as meeting the requirements of the ideal smart city (adapted to the unique situation of Cape Town). Furthermore, build upon good governance, which will ensure peace, a boosted economy, efficient service delivery and good administration, social cohesion and environmental sustainability, all which will result in the enhanced quality of life for all citizens and inhabitants of Cape Town. Lastly, with the creation of a unique vision, shaped for our city, that caters for our current socio-economic state as well as realistic, and not far-reaching smart city

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goals, it is all the more possible to convert this vision into reality, instead of chasing utopian dreams groomed for the global north.

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CHAPTER 6: CONCLUSION & RECOMMENDATIONS

There is no doubt that the current vision of President Ramaphosa takes on an unrealistic and misprioritised path to urban development. As a result, these top-down strategies without clearly understanding the needs of inhabitants often results in disconnected initiatives which fail to tackle the city's challenges in a cohesive manner.

It is evident that the CoCT's IDP strategies carry immense potential for the city to joining the smart city bandwagon if strategies are polished and practically applied successfully. It is also important to realize that pressing socio-economic needs however require adverse attention in order to solve these persisting issues to enhance the quality of lives of all inhabitants of the city.

Therefore, as depicted in this study, the underlying socio-economic challenges of the CoCT hinder adequate smart development. Through the suggested IDP strategies which fall in line with the ISO indicators, as well as the majority of investments within socio-economic development, the city can attempt to recover from the past unjust and pave a way forward in joining a smart future. Furthermore, by adopting the suggested smart city policy which compromises the IDP socio-economic and smart city strategies, the city can further enhance its potential to succeed and achieve more realistic goals suited for its stature.

This study therefore confirms that before hastily applying developed countries smart city solutions which do not suit the unique situation of the Cape Town, local authorities should consider adopting a bottom-led strategy which takes "people", "place" and "economy" into account instead of trying to fit into a puzzle that has only been shaped for unique situations of the developed world. Therefore, instead of trying to create entirely new cities from scratch, through the utopian vision of President Ramaphosa, we can rehabilitate our current cities and yet still be "bold" and "reach beyond ourselves" through a purely South African suited vision.

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6.1 LIMITATIONS

Upon studying the provided CoCT 2018/2019 – 2020/2021 budgets, the document appears to be rather difficult to understand from a non-financial background. Additionally, the ISO indicators publications have been difficult to access due to the subscription that has to be bought in order to fully access the document. This poses a challenge when trying to obtain more in-depth information about the different indicators.

6.2 RESEARCH CONTRIBUTION

For future research, the limitations as discussed above, could act as a guide for research in the field of smart city development in the CoCT. The research contribution of this study will provide insight and guidance in future urban and regional planning initiatives not only in the CoCT but within all municipalities across South Africa. For the purpose of adapting and drawing up new strategies for smart cities within the CoCT, this study could provide insight into the adoption of a bottom-led approach guided by smart city principles and the ISO indicators as studied throughout this research.

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REFERENCE LIST

Abbas R 2017. A comparison of smart city indicators for three top ten US cities. Masters Dissertation. Texas: University of Texas at Arlington, Department of Civil Engineering.

Abrahams C, Everatt D, van den Heever A, Mushongera D, Nwasu C, Pilay P, Scheba A & Turok I 2018. South Africa: National Urban Policies and City Profiles for Johannesburg and Cape Town (Research Report). Johannesburg: University of the Witwatersrand and Human Sciences Research Council.

Albert S 2019. Smart cities: The promises and failures of utopian technological planning [online]. Available from: https://theconversation.com/smart-cities-the-promises-and-failures-of-utopian-technological-planning-114405 [Accessed 1 October 2019].

Amsterdam Smart City 2010. Climate Street Amsterdam [online]. Available from: https://youtu.be/g4SoFQkYcmw [Accessed 27 September 2019].

Amsterdam Smart City 2011. Amsterdam Smart City: Smart Stories [online]. Available from: https://www.urenio.org/2011/04/20/amsterdam-smart-city-smart-stories-2011/ [Accessed 27 September 2019].

Amsterdam Smart City 2019. Action Program Smart Mobility 2016-2018 [online]. Available from: https://amsterdamsmartcity.com/themes/mobility/projects [Accessed 25 September 2019].

Angelidou M 2014. Smart city policies: A spatial approach. Cities 41: 3-11.

Angelidou M 2015. Smart cities: A conjuncture of four forces. Cities 47: 95-106.

Annen DM 2011. Amsterdam Smart City. Smart stories: How they will change the world [online]. Available from: http://smartgridaustralia.com.au [Accessed 28 September 2019].

Anthopoulos L 2015. Understanding the smart city domain: A literature review. Vol 3. New York: Springer Science & Business Media.

Atkinson R 1998. Technological change and cities. Cityscape: A Journal of Policy Development and Research 3, 3: 129-170.

Balakrishnan M 2008. Dubai—A star in the east: a case study in strategic destination branding. Journal of Place Management and Development 1, 1: 62–91.

Stellenbosch University https://scholar.sun.ac.za

Baron G 2012. Amsterdam smart city: from holistic view to concrete projects. Amsterdam Smart City 20-25.

Batagan L 2011. Indicators for economic and social development of future smart city. Journal of Applied Quantitative Methods 6, 3: 27-34.

Batty M 1987. The intelligent plaza is only the beginning. The Guardian. 17 September: 19.

Batty M 2012. Smart cities, big data. Environment and Planning B: Planning and Design 39: 191-193.

Bee Smart City 2017. Amsterdam Smart City: A World Leader in Smart City Development [online]. Available from https://hub.beesmart.city/city-portraits/smart-city-portrait-amsterdam [Accessed 25 September 2019].

Bermeo N 2009. Does electoral democracy boost economic equality? Journal of Democracy 20, 4: 21-35.

Bhorat & van der Westhuizen 2012. Poverty, inequality and the nature of economic growth in South Africa. Working paper, Cape Town: University of Cape Town, Development Policy Research Unit.

Boes K, Buhalis D, Inversini A 2015. Smart tourism: Ecosystems for tourism destination competitiveness. International Journal of Tourism Cities 2, 2: 391–403.

Bridges.org 2002. Spanning the Digital Divide. Understanding and Tackling the Issues [online]. Available from: www.bridges.org/files/active/1/spanning_the_digital_divide [Accessed 1 October 2019].

Brinkman J. & Meuwissen C 2010. Webinar - Amsterdam Smart City. 2degrees [online]. Available from: https://www.2degreesnetwork.com [Accessed 28 September 2019].

Businesstech 2019. Here's what happened to South Africa's R84 billion smart city [online]. Available from: https://businesstech.co.za/news/property/297422/heres-what-happened-to-south-africas-r84-billion-smart-city/ [Accessed 1 October 2019].

Caragliu A, Del Bo C, & Nijkamp P 2011. Smart cities in Europe. Journal of Urban Technology 18, 2: 65-82.

Choo C 1997. IT2000: Singapore's Vision of an Intelligent Island. Amsterdam: Elsevier Science.

Chourabi H, Nam T, Walker S, Gil-Garcia JR, Mellouli S, Nahon K, Pardo TA & Scholl HJ 2012. Understanding smart cities: An integrative framework. 45th Hawaii international conference on system sciences 2289-2297.

Stellenbosch University https://scholar.sun.ac.za

City of Cape Town 2012b. City of Cape Town: 2011 Census Data Sheet. Strategic Development Information and GIS Department (SDI&GIS) [online]. Available from: www.capetown.gov.za/en/stats/Documents/2011%20Census/2011_Census_Cape_Town_Profile.pdf [Accessed 1 October 2019].

City of Cape Town 2017. Socio-Economic Profile. Main Report. Cape Town.

City of Cape Town s.a. Digital Strategy City of Cape Town. Cape Town.

CoCT 2016. State of Cape Town Report. Main Report. South Africa: Cape Town.

CoCT 2017. Socio-Economic Profile. Main Report. South Africa: Cape Town.

Connors M 1993. The Race to the Intelligent State: Towards the Global Information Economy of 2005.Oxford: Blackwell.

Cook DJ, Duncan G, Sprint G & Fritz RL 2018. Using smart city technology to make healthcare smarter. Proceedings of the IEEE 106, 4: 708-722.

Corey KE 1991. The Role of Information Technology in the Planning and Development of Singapore. London: HarperCollins Academic.

Cosgrave E, Arbuthnot K. & Tryfonas T 2013. Living labs, innovation districts and information marketplaces: A systems approach for smart cities. Procedia Computer Science [online], 16, 0: 668-677. Available from: https://www.sciencedirect.com/science/article/pii/S1877050913000719 [Accessed 12 September 2019].

Cugurullo F 2013. How to build a sandcastle: An analysis of the genesis and development of Masdar city. Journal of Urban Technology 20, 1: 23-37.

Delacharlerie C 2018. Why is Singapore the smartest city in the world? [online]. Available from: https://www.innovationiseverywhere.com/why-is-singapore-the-smartest-city-in-the-world/ [Accessed 20 September 2019].

Doxiadis CA 1970. Ekistics, the science of human settlements. Science 170, 3956: 393–404.

Droege P 1988. Future Places. Places 5, 3: 3-5.

Du Plessis DJ 2013. A critical reflection on urban spatial planning practices and outcomes in post-apartheid South Africa. Urban Forum 25, 1: 69-88.

Du Toit J 2007. Is spatial integration socially sustainable? Town and Regional Planning 51: 37–45.

Stellenbosch University https://scholar.sun.ac.za

Dubai Plan 2021. 2021 Dubai Plan [online]. Available from: https://www.dubaiplan2021.ae/dubai-plan-2021/ [Accessed 19 September 2019].

Dubai Strategy 2015. 2021 Dubai Plan [online]. Available from: https://www.dubaiplan2021.ae/dsp-2015-2/ [Accessed 19 September 2019].

Dutton WH, Blumler JG & Kraemer KL 1987. Wired cities: Shaping the future of communications. Annenberg Schools of Communication: Washington, D.C.

EPA 2015. Energy and Environment Guide to Action. Main Report. United States Environmental Protection Agency.

Fang F 2004. Sustainable Urban Transportation Planning and Development — Issues and Challenges for Singapore. Republic of Singapore: National University of Singapore, Department of Civil Engineering.

Foxx A 2015. Beyond Traffic. Main Report. U.S Department of Transportation.

Hall P 2002. Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century. 3rd ed.Oxford:Wiley-Blackwell.

Harrison P, Todes A & Watson V 2008. Planning and transformation: learning from the post-apartheid experience. London: Routledge.

Haskins R 2011. Social Policy in Singapore: A Crucible of Individual Responsibility [online]. Available from:https://www.brookings.edu/articles/social-policy-in-singapore-a-crucible-of-individual-responsibility/ [Accessed 30 September 2019].

Hindson D 1985. Orderly urbanization and influx control: From territorial apartheid to regional spatial ordering in South Africa. Cahiers d'Études Africaines, 25: 401-432.

Honour H & Fleming J 2005. A World History of Art. London: Laurence King Publishing.

Horn A 2011. Who's out there? A profile of informal traders in four South African city central business districts. Town and Regional Planning, 59, 1–6.

IDP 2017. Five year Integrated Development Plan. Main Report. South Africa: Cape Town.

ISO 2018. Online Browsing Platform [online]. Available from: https://www.iso.org/obp/ui/#iso:std:iso:37120:ed-2:v1:en [Accessed 19 September 2019].

Jaipur-Phulera-Ajmer 2017. Jaipur-Phulera-Ajmer Smart City: Everything Smart [online]. Available from: http://www.dreamvalue.org/smartcity.html [Accessed 30 September 2019].

Stellenbosch University https://scholar.sun.ac.za

Joe J 2017. The Rise of Smart Cities: Will It Do More Harm Than Good? [online]. Available from: https://medium.com/swlh/the-rise-of-smart-cities-will-it-do-more-harm-than-good-e142346563ba [Accessed 1 October 2019].

Karunakaran K, Shanmugasundaram N & Kumar SP 2018. Analysis of smart energy supply to smart city- review. International Journal of Pure Applied Mathematics 118, 20: 757-762.

Khan MS, Woo M, Nam K & Chathoth P 2017. Smart City and Smart Tourism: A Case of Dubai. Sustainability. 9, 12: 1-24.

Komninos N 2002. Intelligent Cities: Innovation, Knowledge Systems and Digital Spaces. London and New York: Routledge.

Kompasina 2015. Kota Balikpapan Menuju Smart City [online]. Available from: https://www.kompasiana.com/ridhanurhuda/584402eb6723bd2f09b3b5a0/kota-balikpapan-menuju-smart-city [Accessed 22 September 2019].

Lighthelm AA 2004. Profile of informal micro enterprises in the retail sector of South Africa. Southern African Business Review 8, 1: 39–52.

Ligthelm AA & Masuku T 2003. Size, structure and profile of the informal retail sector in South Africa. (Research report no. 323). Pretoria: Bureau of Market Research.

Litman T 2008. Smart transportation emission reduction strategies: Identifying truly optimal energy conservation and emission. Transportation Research 47: 153-166.

Mahizhnan A 1999. Smart cities: The Singapore case. Cities 16, 1:1-66.

Makhafola G 2019. #SONA2019: Ramaphosa dreams of building a new 'smart city. IOL. 20 June 2019.

Marcuse P 1985. Gentrification, abandonment, and displacement: connections, causes, and policy responses in New York City. Wash. UJ Urb & Contemp L 28: 195.

Marvin S, Luque-Ayala A. & McFarlane C 2015. Smart urbanism: Utopian vision or false dawn? Routledge.

McNerney PJ & Zhang N 2011. Smarter Cities: Making societies smarter. The ACM Magazine for Students - Computer Science in Service of Democracy 18, 2: 48-48.

Mooij J 2003. Smart Governance? Politics in the Policy Process in Andhra Pradesh, India [online]. Available from: http://www.odi.org/sites/odi.org.uk/fil es/odi-assets/publications-opinionfiles/ 2464.pdf [Accessed 1 October 2019].

Stellenbosch University https://scholar.sun.ac.za

Murphy D 2019. Dubai ranked among the smartest cities in the world [online]. Available from: https://www.timeoutdubai.com/news/397711-dubai-ranked-among-the-smartest-cities-in-the-world [Accessed 20 September 2019].

Musakwa W, Tshesane RM & Kangethe M 2017. The strategically located land index support system for human settlements land reform in South Africa. Cities 60: 91-101.

Musakwa W & Mokoena B 2017. Smart cities in South Africa! A case of misplaced priorities? Conference Paper, South Africa

Nam T & Pardo T 2011. Smart city as urban innovation: Focusing on management, policy, and context. ACM International Conference Proceeding Series 185-194.

National Planning Commission 2012. National Development Plan: vision for 2030. Pretoria: National Planning Commission.

Navigant Research 2011. Smart Cities; Intelligent Information and Communications Technology Infrastructure in the Government, Buildings, Transport, and Utility Domains (Research report).

Ndlovu-Gatshen SJ 2013. An analysis of Dubai's socio-economic development strategies and performance between 1998-2008. Doctorate Dissertation. South Africa: University of South Africa, Department of Development Studies.

Nfuka EN. & Rusu L 2010. Critical success factors for effective IT governance in the public sector organizations in a developing country: The case of Tanzania. European Conference on Information Systems 1-17.

Odendaal N 2006. Towards the digital city in South Africa: issues and constraints. Journal of Urban Technology 13, 3: 29–48.

Rapaport R 1993. Singapore: Still Onward and Upward? Forbes ASAP Supplement 78-88.

Republic of South Africa 2009. Development Indicators. Main Report. South Africa.

Republic of South Africa 2011b. Guidelines for the formulation of Spatial Development Frameworks. Version 8. Pretoria: Department of Rural Development and Land Reform.

Republic of South Africa, Department of Environmental Affairs 2010. Draft on National Strategy on Sustainable Development and Action Plan 2010–2014. Government Gazette no. 33184.

Retief F 2007. Effectiveness of strategic environmental assessment (SEA) in South Africa. Journal of Environmental Assessment Policy and Management 9, 1: 83–101.

Stellenbosch University https://scholar.sun.ac.za

Robins S 2002. At the limits of spatial governmentality: a message from the tip of Africa. Third World Quarterly 23, 4: 665-689.

Savini F, Boterman WR, van Gent WPC & Majoor S 2016. Amsterdam in the 21st century: Geography, housing, spatial development and politics. Cities 52: 103-113.

Schmookler J 1966. Invention and Economic Growth. Cambridge: Harvard University Press.

Schumpeter JA 1947. Capitalism, Socialism and Democracy. New York: Harper & Brothers Publishers.

Singh D, Singh M, Singh I & Lee H 2015. Secure and Reliable Cloud Networks for Smart Transpiration Services. South Korea: Dongeo University, Department of Information Network Engineering.

Slater T 2010. Gentrification of the City. Blackwell Publishing Ltd.

South African Local Government Association 2015. In.KNOW.vation: sharing municipal knowledge, innovation and excellence. Main Report. Pretoria.

Sowman M & Brown AL 2006. Mainstreaming environmental sustainability into South Africa's integrated development planning process. Journal of Environmental Planning and Management 49, 5: 695-712.

State of Local Governance 2018. Developmental local government: Dream deferred? Main Report. South Africa: Cape Town.

Statistics South Africa 2011. Census 2011: Community profiles in super cross .Swilling, M., Humphries, R., & Shubane, K. (Eds.) Apartheid city in transition. Oxford: Oxford University Press

StatsSA 2011. City of Cape Town Municipal Profile [online]. Available from: www.statssa.gov.za/?page_id=1021&id=city-ofcape- town-municipality [Accessed 1 October 2019].

Steria S 2011. Smart Cities [online]. Available from: https://www.soprasteria.es/docs/librariesprovider51/default-document-library/brochure_smart_cities9ccd1c95e93c64d785faff0000851219.pdf?sfvrsn=56f0785b_0 [Accessed 12 September 2019].

Teng F 2013. Will Smart Cities be Gentrified Cities? [online]. Available from: https://meetingoftheminds.org/will-smart-cities-gentrified-cities-10088 [Accessed 1 October 2019].

Stellenbosch University https://scholar.sun.ac.za

Tripathy P, Gupta G, Chauhan KA & Patel DA 2016. E-governance is a critical success factor for any Indian smart cities –status, challenges and issues. ELK Asia Pacific Journals – Special Issue 1-12.

Turok I & Parnell S 2009. Reshaping cities, rebuilding nations: the role of national urban policies. Urban Forum 20, 2: 157-174.

Valentine S 2004. E-Powering the People: South Africa's Smart Cape Access Project (Research Report). Washington DC.

Wam 2015. How many passengers used Dubai Metro in 2014 [online]. Available from: https://www.railjournal.com/passenger/metros/uitp-forecasts-2200km-of-automated-metros-by-2025/ [Accessed 19 September 2019].

Wam 2017. Number of Tourists to Dubai Grows 11% to 4.57 m in First 2017 [online]. Available from: https://www.emirates247.com/business/number-of-tourists-to-dubai-grows-11-to-4-57m-in-first-quarter-2017-2017-04-24-1.651881[Accessed 19 September 2019].

Washburn D, Sindhu U, Balaouras S, Dines RA, Hayes NM & Nelson LE 2010. Helping CIOs understand smart city initiatives: Defining the smart city, its drivers, and the role of the CIO. Cambridge 11 February: 2.

Western Cape Economic Development Partnership 2013. OneCape 2040: From Vision to Action [online]. Available from: www.wcedp.co.za/news/onecape-2040-from-vision-to-action [Accessed 2 October 2019].

Winston N and Eastaway MP 2008. Sustainable housing in the urban context: international sustainable development indicator sets and housing. Social Indicators Research 87, 2: 211-221.

World Foundation for Smart Communities 2012. The Smart Community Concept [online]. Available from: http://www.smartcommunities.org/concept.php [Accessed 22 September 2019].

Zenetos T 1969. Electronic urbanism. Architectural Themes 3: 114-125.

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APPENDICES

APPENDIX A: ETHICAL CLEARANCE

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

APPROVED WITH STIPULATIONS
REC: Social, Behavioural and Education Research (SBER) - Initial Application Form

14 October 2019

Project number: GEO-BA-2019-11023

Project title: SMARTING THE SOUTH AFRICAN CITY: AN ATTAINABLE SOLUTION FOR A SUSTAINABLE SOUTH AFRICA?

Dear Miss Amber Willemse

Your REC: Social, Behavioural and Education Research (SBER) - Initial Application Form submitted on **06 August 2019** was reviewed by the REC: Humanities on and approved with stipulations.

Ethics approval period:

Protocol approval date (Humanities)	Protocol expiration date (Humanities)
14 October 2019	13 October 2022