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How can "smart cities" thinking benefit urban planning and development in South Africa? Learning from international smart city approaches

Matsubu Valentine Ragoasha

13116348

Supervisor: Mrs Engela Petzer

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Full names of student: Matsubu Valentine Ragoasha

Student number: 13116348

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ACKNOWLEDGEMENTS

ABSTRACT

South Africa's cities face numerous challenges relating to socio-economic and spatial inequalities, institutional deficiencies, and fault-lines in the planning system. Despite the manifold strides made by the democratic government to transfigure the apartheid planning and governance system, urban challenges persist. Covid-19 has highlighted some of these challenges and in some instances, has worsened them. Nevertheless, South Africa seems eager to adopt the smart city concept in an effort to address urban issues.

This study sought to investigate how South Africa can approach the smart city concept to best adopt it in planning and developing its cities. Because the concept is relatively new in Africa, and in South Africa in particular, the study recognised a great necessity in learning from countries that are already embracing the concept. The study deployed international comparative methodology, which was supplemented by case study approach to probe into Rwanda and Brazil's approaches to smart cities. The key findings from the two cases were compared in a bid to draw "valuable" lessons for South Africa.

It became clear from both case studies that context is important, that is, smart cities should respond to specific local challenges. Context in this regard was however found to extend to the current planning rationale; thus, approaches to smart cities should not neglect the planning principles and objectives as set out in the current plans and strategies. While both countries adopt smart cities within context, and in response to their unique challenges, how this was approached was found to be (justifiably) different. Rwanda approaches the concept within its national vision while Brazil lacks a national vision within which it pursue smart cities. Brazil's approach was thus found to be proactive and smart cities are seemingly approached in an ad-hoc manner. An approach such as this does not always translate to improved quality of life and in some instances, has exacerbated the pre-existing issues of inequality.

In its approach to the smart city concept, South Africa should not neglect its current policy context as well as the vision that was set out in the NDP. In this regard, smart cities initiatives can act as enablers of the national vison –just as Rwanda does. Moreover, at local level, smart cities should respond to the current goals of the IDPs. Bottom line is, smart cities should not set the country on an entirely new track, it should

synergise with the exiting plans and policies. To remain effective, roles need to be clearly defined at the onset of any smart city strategy. More importantly, the public should be meaningfully engaged in the smart cities proposals and in decisions making around the smart interventions. This can go a long way in responding to communities' specific needs.

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1   CHAPTER ONE: INTRODUCTION

There is a growing interest, both locally and internationally, around smart cities and the opportunities attached to this concept. Discourses on smart cities are increasingly mounting in South Africa and have earnestly gained momentum following President Cyril Ramaphosa's June 2019 State of Nation Address (SONA) where he expressed his dream of building a smart city in South Africa (www.gov.za/speeches/2SONA2019). The persisting institutional and spatial challenges that confront South Africa's cities are what primarily ignite the conversation as efforts to come up with approaches for addressing urban challenges continue. Some authors suggest that smart cities can provide the aid that is desperately (and urgently) needed to address South Africa's urban issues (see e.g. Crous *et al.*, 2017; Deloitte, 2014). Since a number of cities around the world, including those in the Global South, are embarking on a quest to become "smart", South Africa can perhaps learn from these cities. This study seeks to contribute to the growing pursuit of finding new approaches to address the urban challenges by inferring knowledge and lessons learned from other cities. This introductory chapter presents a background of the study and its significance, the research questions it intends to answer, and the aims and objectives intended to be achieved by the study.

1.1   Background of the study

Cities around the world are at the forefront of unpredictable change as a result of global forces and trends such as, globalisation, climate change, urbanisation and technological shift, inter alia. This change has put tremendous pressure on cities to (re)think their developmental path and strategies, and become more creative, competitive and innovative while simultaneously striving to meet the needs of a growing populace (Centre for Development and Enterprise, 2002). This is even more salient for African cities whose populations are growing at a rapid and unprecedented pace. Africa has in recent years gained the title of "the continent with the highest urbanisation rate in the world" (OECD/SWAC, 2020; Landman, 2019). Its urban population is projected to double by 2050 (Rogerson, 2014; Parnell and Pieterse 2014 in Landman, 2019).

Although urbanisation is said to present opportunities for cities to propel socio-

economic growth and development, as well as drive urban sustainability and transformation, uncontrolled rapid urban growth is infamously associated with many challenges of sustainable socio-economic development, and Africa is no stranger to the multitude of these urban challenges (Duminy *et al.*, 2020; Landman, 2019; World Bank, 2018; SACN, 2016; Rogerson *et al.*, 2014). According to Turok (2012), Africa's cities "are not performing to their potential or reaping the benefits of urban agglomeration". For Africa, urbanisation is currently presenting more challenges than opportunities (Duminy *et al.*, 2020).

Parallel to the array of complex issues facing most cities around the world, South Africa's cities face "supplemental" unique challenges as a result of the apartheid governance and spatial planning legacy (Rogerson *et al.*, 2014). The massive developmental challenges that the apartheid regime bequeathed upon the country has prompted the post-apartheid government to devise measures that will radically transform the apartheid city form and rectify the predicament that was attached to this legacy. The "new" government made manifold strides; a new developmental tune was set for the country, accompanied by a more "appropriate" planning system that emerged with emphasis on the principles of democratic, integrated, strategic and sustainable planning and development (Coetzee and Retief, 2012). Along with this planning system, a range of pieces of legislation, policies and strategic plans were successively introduced - all in the spirit of driving transformation and improving the lives of many in the country.

Considering the role that was played by urban planning in the spatial segregation of races during the apartheid era, the thorough change of the planning and government system at the dawn of democracy presented hope for "genuine" transformation in the urban environment (Harrison *et al.,* 2007). Thus, post-1994 planning assumed a dual mandate of transformation and development, and local government was re-arranged to drive this mandate. Given this fundamental role of planning, it seems appropriate as a prequel to this study to unpack (in the next section) the planning rationale in the democratic South Africa, particularly the key imperatives of planning as well as the notion of a developmental local government since this has become a central focus in municipal planning. Understanding the current planning environment that smart cities (will) operate in could perhaps shine light on how the country can pursue smart cities in line with the current planning principles and within the existing governance structures.

1.2   Understanding urban planning in South Africa

South Africa's planning system is rooted in the democratic principles of social planning and economic development; community involvement and public participation; sustainable development and environmental management; and strategic and integrated development (Rogerson, 2014; Coetzee and Serfontein, 2002). Planning in the democratic South Africa has therefore become an important tool to restructure the scarred urban landscape and facilitate inclusive and sustainable growth and development (Harrison *et al.,* 2007). To drive these endeavours, local government was (re)structured and posited by the Constitution "as a critical development agent" and has in turn assumed the tittle of developmental local government (De Visser, 2009). The White Paper on Local Government defines a developmental local government as "local government working with communities in decision making to find sustainable ways to deliver in the social and economic arenas" (see RSA, 2000; RSA, 1998). Local government has thus become an important driver of municipal planning and development. The key imperatives underlying developmental local government are briefly touched on below.

According to the White Paper on Local Government, access to basic services and job opportunities is (should be) at the forefront of any development strategy (RSA, 1998). This implies that local government should exercise its developmental role such that it "has a maximum-noticeable impact on the social development of communities" (RSA, 1998). The notion of "people-centred" development has become a buzzword of the post-1994 planning practice, and it primarily centres on creating socio-economic opportunities for all people across cultural and racial lines (Oranje, 2014). Alongside the notion of people-centred development is an embedded responsibility for local government to create an enabling environment for the public to participate in the developmental initiatives. This is deemed imperative for addressing the injustices of the past (Davids *et al.*, 2005).

The future of South Africa as expressed in the National Development Plan 2030 is one that is co-produced by government, civil society and other sectors of society (National Planning Commission, 2012). Thus, while development is (should be) driven by communities, there are other key role players contributing to the process of developing the country, viz. private sector, trade unions, and parastatals. Planning and development in South Africa therefore need to be done in a coordinated and integrated manner in order to realise efficiency and integration in spaces.

Coordinated planning and development has found prominence in municipal planning and is one of the key imperatives of a developmental local government. The way in which integrated and coordinated planning is facilitated is through the adoption of municipal Integrated Development Plans (IDPs) and their accompanying Spatial Development Frameworks (SDFs) – these planning instruments are provided for by the Municipal Systems Act of 2000. Integrated development planning is grounded on the SPLUMA principles of spatial justice, sustainability, efficiency, resilience and good governance (see the current spatial planning dispensation of South Africa, the Spatial Planning and Land Use management Act of 2013).

Coordinated and integrated planning has to be done in collaboration with other spheres of government as mandated in Chapter 3 of the Constitution. Key to this mandate is ensuring that municipal activities are in line with other plans and programmes of the provincial and national government spheres (see Chapter 3 of the RSA Constitution, 1996). The primary focus is to support the optimal allocation of limited resources between various sectors and areas within the municipality as well as combating the silo mentality that continues to pose issues in planning and developing efficient as well as functional urban areas. Cooperative governance is provided for by the notion of intergovernmental relations (IGR) - whose key objectives as espoused in section 5 of the Intergovernmental Relations Framework Act of 2005 relate to transparency, accountability, effectiveness and efficiency across all government spheres (RSA, 2005).

The above municipal planning and development imperatives are echoed in many plans and policies. It is however generally accepted that these imperatives remain on paper and their manifestation in urban spaces are limited, and how government actually functions does not seem to align with these aspirations (Coetzee, 2014; CoGTA, 2009; SACN, 2016). Over the years, a vast body of literature and reports on the state of South African cities and local municipalities have painted a very concerning picture of the challenges faced by urban spaces in the country (see Duminy *et al.* 2020; SACN, 2016; CoGTA, 2009). One thing that emerges clearly from literature is that, with all the attempts made to transform the scarred urban landscape and improve quality of lives, the new system of planning and governance has (in many respects) not been successful in delivering on its developmental and transformative mandates (Coetzee, 2012; Harrison, 2008; Merrifield *et al.*, 2008; Adam and Oranje, 2002; Oranje and Van Huyssteen, 2011). Twenty-six years into democracy, South Africa's urban challenges persist for reasons no longer traceable to the apartheid spatial planning legacy alone.

Many people are deprived while crime, inequality and unemployment are widespread.

1.3   Study rationale

Despite the challenges facing South Africa's cities and municipalities, there seems to be hope in the digital arena, and like many Global South countries, South Africa is beginning to explore smart cities interventions to address its urban challenges and is joining the move to brand its cities as "smart" (Boyle and Stains, 2019). The concept of smart cities remain relatively new in Africa and requires further exploration (Chourabi et al., 2012 in Boyle and Stains, 2019).

Although discourses on smart cities have proliferated both popular media and scholarly articles (see for example Aurigi and Odendaal, 2020; Serfontein, 2020; Musakwa and Mokoena, 2018), these discussions remain dominated by the Global North ideologies of what characterises a smart city (Musakwa and Mokoena, 2018). Notwithstanding, a number of scholars and researchers have shared their views on what should be the African (and South African) interpretation of smart cities and how the concept should be adopted to fit the unique African context (see CSIR, 2020; SACN, 2020; Serfontein, 2020). This research aims to contribute to this ongoing body of knowledge, specifically on how South Africa can approach the smart city concept. Considering that there are some Global South countries such as Brazil, Kenya, India and Rwanda that are already embracing the concept, the study recognises the value in drawing lessons from some of these countries.

In South Africa, efforts are being made to harness the smart cities interventions efficiently. For example, the Department of Corporative Governance and Traditional Affairs (CoGTA) is in the process of adopting the country's first smart cities framework that aims to guide cities in their journey of becoming "smart" (Naidoo, 2020: presentation). Alongside this, a masterplan for Lanseria, which is a key node identified by the President for the development of a smart city, is currently underway. South Africa in fact has a few initiatives that are classified under the umbrella of "smart"; for example, the Waterfall City in Johannesburg is classified as a smart city, and in the City of Cape Town, the various municipal strategies such as e-governance systems and a widespread public WIFI connectivity have been associated with smart cities interventions (Adjar, 2020; Boyle and Stains, 2019). These two cities are however characterised by major urban challenges, which makes one question what a smart city

is, what it intends to achieve and what are its characteristics.

There is no standardised definition or universal principles of what a smart city is, and smart city initiatives have often taken an ad-hoc approach. This study accepts a working definition of a smart city as, a city that equitably invests in human and social capital through modern communication (ICT) and traditional transport infrastructure to meet the developmental mandates that are espoused in the Constitution. These include fuelling sustainable economic development and high quality of life, through participatory action and engagement while taking into consideration the wise management of natural resources (adapted from Caragliu and Nijkamp 2009 cited in Smart Cities Blueprint for Africa, 2017).

1.4   Problem statement and research questions

South Africa's urban challenge as Duminy *et al.* (2020) put it "is at once, spatial and institutional". Despite exhaustive strides made to transfigure the firmly entrenched apartheid spatial and institutional arrangements, space remains fragmented while urban challenges persist. Commitments to radically transform the urban landscape and deliver improved quality of lives have failed (considerably). It has become clear that the development planning system in the post-apartheid South Africa is as some assert, "not optimally geared to facilitate the type of growth and development that the country requires" (see for example Coetzee, 2010; Coetzee and Serfontein, 2002). Undeniably, the challenges that are facing our cities require innovative forms of developmental planning, and a different "thinking cap" is needed, especially within this highly globalising and urbanising context.

Given the attention that the smart city concept is receiving as well as the increasing eagerness to some to adopt the concept in some South African cities, it is thus important to establish how urban planning and development can benefit from the smart city concept in a bid to address the urban challenges. Part of doing so recognises the importance of drawing lessons from other countries who have embarked on a similar journey. With this in mind, the research attempts to answer the following interrelated questions:
- How and why have other countries incorporated smart cities initiatives as part of their urban planning intervention approaches to address urban challenges?

- What key lessons can South Africa draw from these countries' smart cities approaches in order to improve urban planning and development to better address the country's unique urban challenges?

1.5   Aims and objectives

The quality of life and wellbeing of the society are, in part, impacted by how urban challenges are addressed, as well as how urban spaces are planned, developed and managed. With South Africa facing massive developmental and institutional challenges, a new way of planning and developing the urban landscape is advocated. Therefore, the primary aim of this study is to support the ongoing efforts that are aimed at assisting South Africa's cities (through research) to adopt the smart city concept in addressing urban issues. It is intended that with the lessons drawn from other countries, South Africa can be geared towards an improved way of planning, development and managing urban spaces, which will in turn translate into improved quality of lives.

To achieve the aim of this study, the following interrelated objectives are formulated:
- To provide a synthesised discussion of how other countries (with similar context to South Africa) have approached smart cities in addressing their urban challenges

- To provide consolidated lessons that could be applied to South Africa's urban planning and development challenges

1.6   Research significance

The study serves two purposes. Firstly, it contributes to the continuing efforts that aim to guide South Africa on how to best harness the smart city concept to better plan and develop its cities. This is done through learning from international example . Secondly, the study contributes to an international comparative methodology within a South African urban planning context.

1.7   Delimitation of the study

This study was undertaken under challenging times in light of the Coronavirus pandemic. The pandemic has shine light on, and in some cases, has worsened many challenges that exist in South Africa's cities. It has thus highlighted a great need for a study such as this, as some of the problems in our cities are in need of smart approaches. For example, the inequality gap that Covid-19 has highlighted, needs to be handled with extra compassion when implementing smart city initiatives. For the researcher, the pandemic has presented challenges both personally and academically, the latter included limited access to library materials, causing one to rely mainly on e-materials for a fair portion of this dissertation. The study was therefore limited to desktop research, and comprises mainly of literature review.

1.8   Report outline

The remainder of the dissertation is organised as follows:

Chapter 2 presents a **literature review** which is divided into three parts. The first part investigates South Africa's urban challenges under three broad categories of socio-economic and spatial inefficiencies, urban planning discrepancies, and leadership and governance fault-lines. The second part of the literature discusses the smart city concept in an effort to understand and uncover concepts and theories related to smart cities, and to elucidate the characteristics that make up a smart city. Lastly, the literature review presents the international comparative research and explains how this method has been applied in other studies in order to understand better its application to the present study.

Chapter 3 presents a **theoretical framework** within which the research problem is explored. It also explains how the smart city concept and approach is interpreted and understood in this study. Furthermore, the chapter explains the research paradigm underpinning the study.

Chapter 4 discusses the **methodology** followed in this study which comprises the research approach and design, as well as the methods for data collection and analysis. It explains why comparative and case study research was used in the study.

Chapter 5 presents the **findings** of the study in the form of two case studies. The case studies describe how Rwanda and Brazil have been approached smart cities. This is followed by a comparative analysis of the two countries' overall approaches to smart cities.

Chapter 6 evaluate and **discusses** the two countries' approaches to smart cities in a bid to draw key lessons for South Africa's urban planning and development approach.

Chapter 7 concludes with a short summary of the key findings and lessons for South Africa, it also puts forward considerations for future research.

2   CHAPTER TWO: LITERATURE REVIEW

PART A: South Africa's urban challenges

"*The road to success is paved with failure*"

– Joey Green

2.1   Socio-economic and spatial inefficiencies

The advent of democracy for many South Africans presented an opportunity to move (for the first time in history) "freely" in space in search for better life elsewhere. Since cities provide far better prospects compared to their rural counterparts, the first decade of democracy thus saw a significant peak in rural-urban migration following the eradication of the apartheid mobility and residency controls (Duminy *et al.,* 2020). External migration also began increasing as people from other African countries sought refuge in South Africa's cities (SACN, 2006). Undeniably, South Africa's future is as Duminy *et al.* (2020) put it, "increasingly urban". The United Nations estimates that nearly 80% of South Africa's population will live in urban areas by 2050 (United Nations, 2017).

The urbanisation phenomenon in South Africa as is the case in many other rapidly growing Global South countries is however taking a markedly different trajectory from what occurred during what is termed the "first wave of urbanisation" – which is the period associated with the industrial revolution of the Global North (UN-Habitat, 2013). This first wave of urbanisation was accompanied by growth in "formal" employment opportunities and advancement of economies (Rogerson *et al.,* 2014). What Africa (and South Africa) is now experiencing in what is termed the "second wave of urban transition" are massive and complex issues of sustainable socio-economic development (Duminy *et al.*, 2020). Africa's cities have now become centres of poverty proliferation because of the increasing urbanisation of the poor into the urban areas (Rogerson *et al.*, 2014; Turok, 2012; National Treasury, 2011).

South Africa's relationship with urbanisation is complex and ambiguous (CDE, 2014:2 in Rogerson *et al.*, 2014). The rate at which the population is growing is outpacing economic growth. What is now becoming apparent (and worrisome) is that the

staggering economy is not translating into improved livelihoods for the majority; many are trapped in poverty, job creation is steady, and employment opportunities (especially for the country's youth) remain scarce (CDE, 2014; Rogerson *et al.,* 2014).

Along with the challenges brought by the urbanisation phenomena, South Africa's cities still suffer from massive developmental challenges that the country inherited from the apartheid system. According to Rogerson *et al.* (2014), the majority of South Africa's urban challenges are still tainted by the legacy of the past. The urban landscape still today remain fragmented, racially splintered, with the majority of the black population marginalised in the urban peripheries. It is in these peripheries that exclusionary patterns of spatial development from the past legacy become evident. The urban peripheries, which are predominantly informal, are the most inefficient and unsustainable parts of South Africa's cities (SERI, 2018).

As the first point of entry for rural (and foreign) migrants in search of work (Mahajan, 2014), informal settlements have become the locus of major urban challenges. Extreme poverty accompanied by crime, poor access to basic services and social amenities, are some of the challenges that characterise life in the informal settlement (Mahajan, 2014). Moreover, informal settlements remain prone to environmental hazards such as flooding and heat stress (Duminy et al., 2020). Life in these areas for many, remain a daily struggle of survival (SACN, 2016; Du Plessis, 2013), and the Coronavirus pandemic has highlighted and in other cases, exacerbated this issue (Serfontein, 2020).

The township areas of South Africa are another reminiscent of the apartheid legacy. These areas were "strategically" demarcated by the apartheid government such that, as Oranje (2014) expresses "people in these areas are located close enough to be shepherded on a regular basis to serve the privileged inhabitants and sweep and polish its streets of gold, but far away enough to not spoil the view". Transport is inefficient in the township areas therefore the majority of the people have to travel long and often-costly hours to access opportunities in the city (SERI, 2018; Coetzee and Retief, 2014). The townships and informal settlements give away the massive socio-economic inequalities that exist in South Africa's cities which has gained the country an infamous title of "one of the world's most unequal societies" (World Bank, 2018).

The unfinished business of transformation met with the influx of urban migration has put a lot of strain on the limited resources and South African cities have not been able

to meet the needs of its growing populace (Duminy *et al.*, 2020). The bottom line is that many of the urban poor remain marginalised and deprived of basic services including clean running water, sanitation and adequate shelter. According to National Treasury (2011), South Africa is yet to find "an appropriate model for effectively harnessing the potential of its cities in order to drive economic growth and redress the spatial patterns that continue to marginalise poor people".

What becomes discernible from the literature is that South African cities are now faced with a double-edged mission (National Treasury, 2011; SERI, 2018; SACN, 2016). On one hand, the country needs to address the legacy of the past, while on the other, meet the more pressing needs of providing basic services to the growing populace. Studies show that South African cities are not succeeding in meeting these effectively (see for example Duminy *et al.*, 2020; SACN, 2016; National Treasury, 2011).

2.2   Urban planning discrepancies – a hole in the sky

Despite multiple attempts made to transform the apartheid planning system, there seems to be a prevailing series of challenges in the "new" democratic planning system that still holds the country from realising (effectively) the developmental and transformative goals that were set in the Constitution. It is argued that the post-apartheid system of planning is entrenched on international planning ideologies and principles, and therefore does not respond effectively to the object of our intervention –the urban space (Watson, 2007; Coetzee, 2012).

The new planning system is, as Coetzee (2012) argues "not properly geared to deal 'appropriately' with South Africa's unique urban context", and as the world becomes interwoven within the web of global dynamics, the planning system continues failing to respond to the ever-changing urban context (Duminy *et al.*, 2020; Watson, 2007). The planning practice on the other hand according to Harrison *et al.* (2007), reflects a gap between the current approaches and growing problems of inequality, poverty, informality, rapid urbanisation and spatial transformation. Many of the urban challenges have actually been attributed to the issues in the planning system itself (Watson, 2009).

South Africa's post-1994 planning system is based on the principles of strategic, integrated, democratic and sustainability (Coetzee, 2014). These principles as some

argue are not well articulated and understood by those who apply them in practice (Oranje, 2014; Coetzee and Retief, 2012; De Visser, 2009). Strategic planning in particular, has assumed a prominent role in the planning arena. This planning principle has however, come under scrutiny and has been accused of lacking the strategic focus and neglecting the future that it speaks about (Petzer, 2016; Coetzee, 2014). Strategic planning is further accused of not allowing innovative and opportune approaches (Coetzee and Retief, 2012), and as Coetzee (2012) puts it, for being "stuck in a singular utopia", that is, for providing a particular view of a good city. Coetzee (2012) further asserts that the strategic planning logic is becoming evidently limited in mainstreaming new innovative possibilities in a dynamic changing environment.

The strategic planning concept fundamentally bases its rationale on an unpredictable future, and this is then followed by the process of devising measures aiming at validating this assumed view of the future. This approach as Rogerson *et al.* (2014) argue is what makes strategic planning rigid and lack the strategic element because the approach assumes a particular "fixed" trajectory thus not allowing much creativity in dealing with an ever-changing urban environment. Furthermore, the "command and control" approach that strategic planning resembles, fail to consider cities as complex adaptive systems – this speaks against the notion that "any attempt to successfully influence change should acknowledge the built-in unpredictability of complex adaptive systems" (Coetzee, 2012; Oranje 2014; Watson, 2007).

The current planning instruments, specifically the Integrated Development Plans (IDPs) –as centrepiece for municipal planning, have also received criticisms for being cumbersome, confusing, costly, time-consuming and "trapped" in wishful thinking (Coetzee, 2012; Harrison 2008; Merrifield *et al.*, 2008; Adam and Oranje, 2002; Oranje and Van Huyssteen, 2011). Their accompanying Spatial Development Frameworks (SDFs) on the other hand, have received a backlash for their rigid blueprint qualities and lack of strategic focus (Oranje, 2014; Coetzee, 2012).

The IDPs and SDFs are considered (by many of their critics), inappropriate for reconstructing and developing South African cities (Oranje, 2014; Merrifield *et al.*, 2008). Tedious and time-consuming as they are to compile, these uninspiring plans (IDPs) as Oranje (2014) asserts, are hardly implemented because their budget is mostly never in line with the activities specified by the plan. Content wise, the IDPs are failing to articulate how the urban territory that was planned and developed for the

minority –pre-1994 will be transformed to cater for the growing population (Oranje, 2014).

Democratisation of planning has opened up public participation, which has become a fundamental component of integrated and strategic planning. The way this is being conducted however, resembles a "meaningless" form of participatory planning - conducted simply for legislative compliance (Duminy *et al.*, 2020). Participatory planning in South Africa is becoming a mere consultative process – where people are asked (often through referenda or surveys), about what they want or how they feel about certain development projects, while in other instances it has become a typical "public involvement" process where a community leader represents the views of wider groups (Theron *et al.*, 2007).

Public participation as Yadav (1980) describes, should focus on the participation of the public in an entire planning and development process i.e. in the decision-making, implementation of programmes as well as the monitoring and evaluation aspect of planning – simply put, communities should be part of the entire developmental process. Much of the onus however lies with local government. This sphere, which is considered closest to the people, has however been criticised for not being able to come to grip with the diverse needs of communities (De Visser 2009). As Fuo (2013) notes, local government is not accurately capturing and crafting community needs into measurable actions. Public participation has therefore been ineffective at driving development and transformative strategies at municipalities.

The bottom line is, while the planning principles that are entrenched by our planning system are eminently aspiring, they remain rhetorical and lack the developmental ambition. They are (mostly) practiced for legal compliance rather than for their developmental and transformative "higher calling"(Oranje, 2014; Coetzee and Retief, 2012). Efforts to draw up alternative spatial visions, aimed at co-creating equitable, integrated and sustainable cities, have largely remained on paper. These are the results of an imported planning system that was met with a different and much more complex urban context. What is becoming apparent in the literature regarding the planning system is a further perpetuation of the apartheid spatial planning logic – in other words, the very system that is put in place to drive the country's transformation agenda resembles a fragmented system of planning which reinforces the modernist planning ideologies that result in urban sprawling, spatial inefficiencies and disarrays

(Oranje and van Wyk, 2012). The planning approach needs to be fundamentally reviewed (Harrison *et al.*, 2007).

2.3   Institutional and governance fault-lines

According to Watson (2007), planning itself cannot always be blamed for the inadequacies of addressing complex issues in the cities. There are deep-rooted challenges in the governance and institutional systems that are hampering the realisation of the ambitious goal of transforming and developing the country (De Visser, 2009). Amongst the most pressing governance challenges, ineffective and incapacitated leadership find prominence in the literature (see Ayee, 2013; Coetzee, 2010; National planning Commission, 2012; Department of Cooperative Governance and Traditional Affairs, 2009; De Visser, 2009). According to Duminy *et al.* (2020), lack of visionary leadership and political will to make tough system-changing decisions, have contributed to problems of 'siloism' and have made spatial transformation a distant ideal.

South Africa's system of government, which is made-up of the three spheres of government that are considered distinct, interrelated and interdependent, has been questioned by a number of authors for its effectiveness and practicality (see for example Steytler and De Visser, 2007; Steytler and Fessha, 2007). There seems to be a general agreement amongst the authors regarding a lack of clear, distinct roles of each sphere, and in other cases, the Constitutional division functions between the national, provincial and local functions overlap (De Visser, 2009). De Visser (2009) elucidate this overlap by pointing to an example in the Constitution where in Schedule 4 of the Constitution, the national and provincial government is mandated to provide for public transport and municipalities for municipal public transport. This blur in the roles "require intensive cooperation between the spheres of government to avoid and address role confusion" (De Visser, 2009).

It was also noted by some authors that in some cases, the sectoral investments administered by the national and provincial government tend to avoid or neglect the municipal SDFs (Rogerson, 2014; Parnell and Pieterse 2014). This disregard of the key strategic areas of the SDF as Parnell and Pieterse (2014) assert, result in poor integration of the sectors.

Despite attempts made to strengthen the relationship and cooperation among the three spheres of government (i.e. through the enactment of the Intergovernmental Relations Act 13 of 2005 and by setting up various intergovernmental structures), the three spheres still struggle to achieve harmonisation, coordination, integration, planning budgeting, and implementation (Oranje *et al.*, 2014). Intergovernmental planning and coordination according to Oranje *et al.* (2014) remain poor and therefore "misses the opportunity to integrate and align development initiatives". According to Rogerson (2014), the IGR structures that the IGR Act establishes are weak at steering and coordinating coherent policy, and are not used for their intended purpose, which includes enabling integrated planning and development.

Even more concerning issues are reported at local government, 'more concerning' - because local government has an important mandate to drive development; therefore it can be asserted that much of the country's development progress rests (not solely) in the hands of the local sphere of government. It is generally accepted in the literature that the effectiveness of municipal governance institutions is a primary precondition for any country to reap the benefits of decentralisation (Olowu and Wunsch, 2004 in De Visser, 2009; COGTA, 2009; Duminy *et al.*, 2020). Unfortunately, in South Africa, municipalities are deeply rooted in a state of distress (COGTA, 2009; and more recently Wekerle, 2019). Numerous municipalities are crippled, financially strained with poor service delivery and persisting issues of inequalities. The root-cause of these municipal issues has been attributed to issues of low staff morale, political power struggle, corruption and maladministration (Duminy et al., 2020; Wekerle, 2019).

There is a concerning view that the powers at local government are mostly concentrated within the executive mayor who exclusively selects the committee (Fuo, 2013; De Visser, 2009; Atkinson, 2007). This according to De Visser (2009) is not in line with the spirit of integrated democratic governance. The system of appointing members of the committee has as Fuo (2013) puts it "opened doors for nepotism". According to Mulaudzi (2007), municipal positions are politically influenced such that "the need for qualified and experienced municipal personnel is being outplayed by the need to become politically relevant". Atkinson (2007) has also raised this concern, arguing that that this does not conform to the ideals of a democratic governance.

The deep-rooted governance and institutional challenges hamper South Africa from becoming a (fully) developmental state. Any smart city strategy that is adopted within this dysfunctional institutional and governance context is unlikely to realise the goals

that it intends to achieve. In the same breath, it is however recognised that smart cities can provide the aid that is required to address some of these issues.

PART B: Smart cities – hope for South Africa

Smart cities are emerging at a complex and fast pace, causing confusions and divided opinions amongst authors in the scholarly articles and popular media. What is discernible from discourses is mainly on whether cities should brand themselves as "smart" especially those who are pressured to address their pressing socio-economic challenges. Parallel to these "sceptical" discussions is a growing body of literature that seems to support smart cities as "panacea" to the long-standing urban challenges in cities. These divided opinions around smart cities arises mainly from the lack of a clear understanding of what really makes up a smart city and not having a set of guiding standards does not make it any better.

Unpacking these discourses can shine light onto the complex concept of smart cities hence the importance of this section of the literature review. The focus of this part of the literature is to look at some related (often nuanced) concepts to smart cities in a hope to understand what smart city is and what it is not; to look at the criticisms around the concept, and the opportunities or benefits that smart cities have to offer. Furthermore, the literature hopes to uncover the characteristics of smart cities in a bid to develop a set of criteria that will help to evaluate the smart cities approaches of other countries in order to later draw "appropriate" lessons for South Africa – this is the central objective of this study.

2.4   Understanding the concept of smart city

Although the concept of smart cities has received considerable attention across a broad spectrum of discourses (i.e. in business, popular media, academia and government), there still seems to be a lack of consensus on what constitutes smart cities (Musakwa and Mokoena, 2018; Deloitte, 2014). Different interest groups define the concept differently, quite noticeably to fit a specific context and drive a certain agenda. This lack of standardised definition and approach to smart cities is not startling because firstly, the concept has a relatively short history and therefore it is largely still an exploratory research domain (Gupta et al., 2019). Secondly, smart cities are emerging at a fast pace and are as Aurigi and Odendaal (2020) put it "context-sensitive", therefore posing a great difficulty to develop a framework of common understanding (Gastrow, 2018). The persisting fluidity of the concept as some authors note, has also added to the growing confusion about what smart cities entail. This

fluidity according to Camero and Alba (2019) is due to the ever-changing relationship between society and technology.

2.4.1   What is 'smart' and 'city'?

In understanding the smart cities concept, some authors unpack the two components that make up smart cities, namely, 'smart' and 'city' (see CSIR, 2020; Aurigi and Odendaal, 2020; Boyles and Strains, 2019; Backhouse, 2015). The term *smart* as Backhouse (2015) notes has many connotations. It is closely associated with appearance (from the Oxford dictionary definition), and as infused in the smart cities agenda, it often concerns beautification and gentrification projects that seek to replace the "grim" informal settlements with more attractive upmarket housing or public open spaces (Backhouse, 2015). Expressed differently, the Council for Scientific and Industrial Research (2020) notes that the term *smart* is closely associated with technological and digital concepts such as Internet of Things, Big Data, sensors and Artificial Intelligence (CSIR, 2020). A more "softer" connotation of *smart* has been linked to the term intelligence, and in the smart cities discourse, it refers to human intelligence (Backhouse, 2015). This latter connotation implies human capabilities to interact with technological devices or information systems and "live in a manner that does not worsen natural resource constraints" (Backhouse, 2015).

The term *city* on the other hand reveals interesting ambiguities in the smart cities discourse, and it deviates from the general perception of what most people understand about the term –which is typically accepted as a large town, or as an agglomeration of people, businesses, infrastructure, goods and services. From a socio-ecological paradigm, a city is a complex adaptive "living" system that is ever changing (Landman, 2019), and from the whole-systems thinking, a city is a system of systems with a unique social and spatial context (Mohanty *et al.*, 2017). In the smart cities discourse, the term city is "a catch-all phrase that includes various types of settlements, or parts of settlements" (CSIR, 2020). It could mean a business district, a precinct or gated community, or a "place" as referred to in (Mohanty *et al.*, 2017). A smart city initiative could therefore target either a city as a whole, parts of the city or specific sectors such as transportation or a new custom-built city.

2.4.2 Nuances of smart city – uncovering related concepts

There are other nuanced (and overlapping) concepts that are closely related to the smart city concept. The following are discernible in the literature: intelligent city, ubiquitous city, digital city, telicity, city of bits, wired city, knowledge city and information city (Mohanty, 2017; Nedovic-Budic and Williams, 2013; Harrison and Donnelly, 2011). These concepts have in some cases, been used interchangeably with the smart city concept (Boyles and Strains, 2019). However, unlike the smart city concept (which seems to still be in an infancy stage of inquiry), the above concepts have been explored over the years and ample literature is available on these concepts (see for example Nedovic-Budic and Williams, 2013; Maeng and Nedovic-Budic, 2008; Castells, 2006; Wegenar, 1987). The long-standing discourses around these concepts could perhaps share some light into the smart city concept –what it is (and not) and what it comprises.

What these concepts have in common (and with smart cities) is that they focus on ICT applications to enhance efficiency in managing the urban environment i.e. enhancing transparency and accountability in governance; strengthening effectiveness and efficiency in engaging citizens; and improving service delivery (Lee and Lee, 2014 cited in Gupta et al., 2019). This has gained them the title of "ICT-based cities" (Maeng and Nedovic-Budic, 2008). ICT is therefore regarded as an enabling key to transform traditional cities to ICT-based or smart cities (Mohanty *et al.*, 2017).

Some of these ICT-based cities (e.g. digital and city of bits) as noted in the literature, tend to emphasise technology as a starting point and not as an enabler, that is, they tend to overemphasise the role that technology can have in solving urban challenges. This approach to urban development and management has widely been criticised with Angelidou (2014) noting that technology alone is insufficient to solve the urban challenges (see also Gupta et al., 2019; Anthopoulos and Vakali, 2011; Odendaal, 2011). Boyles and Staines (2019) also note this in their criticism of the City of Cape Town's Digital City Strategy – the strategy that was put in place to drive the vision and the development of smart cities in the metro. This strategy as Boyles and Staines (2019) posit, fails to outline that smart does not necessarily mean digital or a smart city does not equate a technologically advanced city. Boyles and Staines (2019) add that, the strategy looks to ICT to improve city operations by simply adding a digital layer to the conventional practices.

According to Willis and Aurigi (2018), the technocratic approach to smart cities, that is,

the approach that treats urban challenges as technical problems that are given technical solutions, do not address the deep-rooted issues (Willis and Aurigi, 2018 in Boyles and Staines, 2019). Technology-driven solutions as Aurigi and Odendaal (2020) assert, do not promote social sustainability and address the complex social issues efficiently.

In the case of smart cities and urban planning and development, Musakwa and Mokoena (2018) make a crucial note pointing out that "smart cities are not only about the use of ICT in urban and regional planning, but it pertains planning that promotes relearning, adapting, collaboration, participation and planning for the future" (Ching and Ferreira, 2015 cited in Musakwa and Mokoena, 2018).

What emerges clearly from the literature is that, despite the many (often-working) definitions and approaches to the smart city concept, many authors seem to be in agreement with the notion that a smart city is a city that offers an improved quality of life, and its services are efficient and sustainable. It achieves this by integrating technology (usually ICT) into its operational systems (not as a starting point, but as an enabler); and to do this, it requires the commitment of the government, citizens, private sectors and other relevant stakeholders (see for example, CSIR, 2020; Deloitte, 2014; Caragliu and Nijkamp, 2009). This broad interpretation of smart city is accepted in this study and is considered as a suitable approach of how the concept should be approached, especially within the Global South context.

2.4.3 Theories in smart city discourses

Alongside literature on ICT-based cities, some authors have explored (more considerably in the context of Global North), how cities will possibly look like in a highly digitised and connected world (see for example Ching & Ferreira, 2015; Nedovic-Budic and Williams, 2013; Maeng and Nedovic-Budic, 2008; Castells, 2006; Graham and Marvin, 1996). Efforts to plan for smart cities have emphasised the relationship between smart technologies and urban form, as well as how these technologies shape the broader society (Nedovic-Budic and Williams, 2013). There seems to be general acceptance amongst scholars that, as technology and ICT alter our city operations and services, the urban form will inevitably be altered (Kline, 2015; Maeng and Nedovic-Budic, 2008). According to Kline (2015), it is imperative to understand this "new" urban form and its dynamics in order to plan and develop urban spaces better. How this is currently articulated in literature has usually implied that all cities (say Cape Town,

Athens, London, Johannesburg and Leeds) will somehow be impacted in the same way, and their urban form constructed in the same way (Kline, 2015). In attempting to understand how ICT will transform/shape the urban form in an ICT-based cities, some authors turn to theories of futurism, urbanism and utopianism (Castells, 2006; Maeng and Nedovic-Budic, 2008; Graham, 2002).

In their attempt to understand the future urban form, some scholars seek to redefine the city itself and the concept of space and distance in an ICT-based city (e.g. Graham and Marvin, 1996). Graham and Marvin (1996) turn to theories of futurism and utopianism in their approach, which (in the broadest sense of the theories) assume that ICT play a pivotal role in enhancing urban life. Although futurists and urbanists promise a better urban future, their view of the urban future remain idealistic and speculative. Furthermore, the two theories are limited in that they tend to oversimplify the complex dynamic relationship between urban form and ICT. To supplement this gap, technological determinism was also greatly explored (see for example Graham, 2002; Maeng and Nedovic-Budic, 2008). The logic behind this theory is that, advancements in ICT have been the primary determining growth factor in urban development and social transformation. This is rather an ambitious claim and though this theory is widely accepted amongst scholars (for example Castells, 2006; Maeng and Nedovic-Budic, 2008; Graham, 2002), it fails to provide proof that advancement in ICT has in fact been the primary transformative element of urban form, and how this urban form look like, remain obscure.

The crude technological determinism has been widely criticised for its general belief that technology is a major force constructing society; hence some turn to the so-called "soft determinism", which maintain that "technology is a major cause, but not the sole determinant of social change" (Kline, 2015, Maeng and Nedovic-Budic, 2008). In their study, Cooper and Sebake (2018) have explored the possible characteristics of future urban form of South African urban settlements (at neighbourhood level) within the advancements of 4IR technologies. This study paints us a picture of a possible future urban form. Though this probable urban future is at a precinct level, the study nonetheless offers a good starting point for planning this prospective urban form, which they call, Neighbourhood 4.0 (see Cooper and Sebake, 2018).

Manual Castells takes the discourse even further by exploring societal dynamics in what he refers to as an Informational City (Castells, 2006). He formulates a systematic theory (of urbanism in the Information Age), which is broadly about how ICT shapes

what he calls "an information/network society". He does so by explaining the constructs of new social and economic development within an Informational City. From a constructivist paradigm, he refutes the notion that space is tangible and visible and as he infers, "it is a concept constructed on the basis of experience" (see Castells, 2006). From this viewpoint, he introduces the new form of spatiality – the space of flows, which contributes to the new understanding of transformation of spatial forms. To sum it up, he rejects the popular belief that technology will lead to collapse of distance (Euclidean). In fact, he maintains that distance in the new Informational City will expand as activities become more decentralised. This gives a glimpse of what planning of the future urban form should consider. Thus, development concepts such as nodes and corridors for example, should be properly redefined within the context of smart cities.

In summary, whether referring to smart city, intelligent city or any of the ICT city metaphors that are dominating smart city discourses, one thing that emerges from literature is that our cities are as Gupta *et al.* (2019) put it, "constantly threatened by a new ever-changing urban form", one that is driven by ICT. This future urban form should be well understood for spatial development to thrive. Lastly, while all these speculations point to what a lack of standardised definition could mean for planning approach, an even more pressing question of "what exactly needs to be smart" or how to be smart, remain key and unanswered.

2.5   Smart city discourse: proponents and sceptics

The smart city concept has found itself split between the two (often-contradictory) views of proponents and sceptics. From the viewpoint of the proponents, smart cities are the epitome of utopian cities - presenting opportunities to make cities liveable, workable, resilient, sustainable, and structured to deal with the many challenges confronting cities (Gupta et al., 2019; Angelidou, 2014; Nedovic-Budic and Williams, 2013; Anthopoulos and Vakali, 2011). This group assumes that the current traditional approaches and urban models are not well equipped to tackle efficiently the complex challenges facing cities and they (proponents) see smart cities as the remedy to these long-standing challenges. Therefore, the proponents of smart cities call for cities to be "smarter".

Proponents however fail to establish soundly the answer to the question of how cities should go about becoming smart, what smart means or who is to drive the smart city

movement. In instances where they (proponents) provide insights on possible approaches to smart cities, their research mainly emphasise the technological offerings of smart cities which tend to neglect the existing spatial and socio-economic context (see for example Kummitha and Crutzen 2017; Nedovic-Budic and Williams, 2013). In addition to this, proponents have mainly been speculative and idealistic in their vision of future cities, thus exhibiting characteristics of futurists and utopianists.

Contrary to the viewpoint of the proponents, the sceptics argue that smart cities will further exacerbate the fragmentation in the urban spaces (Musakwa and Mokoena, 2018; Harrison, 2017). They point to a long-standing debate about how a city established on ICT aggravates social challenges as they often stand to benefit well-off neighbourhoods and leave the poor behind (Musakwa and Mokoena, 2018). This debate can be justified by how smart cities have been portrayed and marketed especially in popular media. In these cases, smart cities have become a city marketing strategy (often by multinational software and hardware firms); these strategies are usually far too divorced from the current urban conditions and unrealistic to achieve given the infrastructure of the cities they target as well as the available resources. The issue of digital inequality or digital divide as commonly referred to, is raised by a number of urban scholars (Kummitha and Crutzen 2017; Nedovic-Budic and Williams, 2013). As Boyle and Strains (2019) note, the digital divide is impacted by affordability and availability of the physical ICT infrastructure.

Sceptics make a point, particularly in a case of South Africa, that in order to adopt "fully" the concept of smart cities, the current socio-economic challenges will have to be at the forefront of the smart city movement (Musakwa and Mokoena, 2018). This seems to be in agreement with what some proponents advocate for (e.g. CSIR, 2020; SACN, 2020); and certainly in agreement with what the legislation provides for, particularly with regards to municipal planning and development strategies (i.e. see White Paper on Local Government 1998 and the South African Constitution 1996).

As Musakwa and Mokoena (2018) remark, for cities to succeed at being "smarter", the planning system needs to be readapted and redefined to suit a South African context. The authors add that plans for smarter and connected urban areas remain ineffective and insufficient if they fail to consider the existing local, non-technical elements such as socio-economic conditions, governance and the existing spatial fragmentations that might further be exacerbated by the advent of disruptive technologies (Musakwa and Mokoena, 2018). This view is also strongly expressed by CSIR (2020). A smart city

approach thus has to make sense of the unique city dynamics. Planning for smart cities as Anthopoulos and Vakali (2012) note, has been ad hoc in its approach, and planners tend to go for what they are often comfortable with, and in the case of smart cities, this has predominantly been established based on the Global North perspectives of what constitutes a smart city (Lee, 2014).

2.6   Smart cities components and characteristics

What has been established thus far in this Part B of the literature review is that the smart city concept is complex, it is closely associated with many ICT-related concepts, it has received both criticisms and favouritism, and there are many (often-divided) opinions around the concept hence the many definitions and approaches in the literature. Embedded within the definitions and discourses on smart cities is the many opportunities or offerings for cities that are embracing the concept.

As Backhouse (2015) point out, smart cities have been defined in terms of their performance or in terms of the role that ICT plays in transforming the city; therefore, it is within these definitions and discourses that we get a sense of what smart cities have to offer or what a smart city comprises –its characteristics. Since we cannot unpack every definition and discourse to reveal the smart city characteristics and opportunities, Hollands's three smart cities discourse categorisation seems appropriate to frame the discussion (see Hollands, 2008). Backhouse (2015) has accepted the categorisation by Hollands (2008) as similar to how smart cities discourse is playing out in the African continent; therefore the characteristics and opportunities that are presented here, are also appropriate to Africa (and South Africa).

The first category of discourse is focused on *infrastructure-based services*, particularly using ICT to enable efficiency in city services i.e., healthcare, education, transport, public safety, city administration and utilities such as water and electricity (Hollands, 2008 in Backhouse, 2015). The discourse is also focused on the sustainable use of the environment. The smart city initiatives or technologies in this regard usually target the operational aspects of a city to promote efficiency of the city operations and management. The examples around these discourses include: the use of sensor technology to monitor early warning signs to mitigate and anticipate the impacts of climate change; putting up CCTV cameras to combat crime; implementing a system to

extract real-time data to analyse and manage traffic, power and other utilities (Mohanty et al., 2017).

From an infrastructural perspective, a smart city runs efficiently, it is responsive, safer, greener, faster and sustainable (Mohanty et al., 2017). The different themes or components that emerge from this category of discourse include, smart infrastructure, smart mobility, smart technology, smart energy and smart planning. To simplify this category of discourse, it can be said that a smart city adopts ICT to enable the efficient delivery of basic services and manage the city's infrastructure and operations; this city "will be able to sustain its function and remain in operation for current and future generations" – it is sustainable (Mohanty et al., 2017).

The second category of discourse concerns *business-led urban development*. It is focused on providing the necessary infrastructure to create a conducive and vibrant environment to attract business and skilled labour to cities (Hollands, 2008 in Backhouse, 2015). According to Backhouse (2015), "this discourse recognises the need for education, research and development, as well as for a culturally diverse population to facilitate creativity and innovation". The role of smart cities is assumed in their ability to foster economic growth and development. In this regard, a smart city is one that continues to thrive in job creation and economic growth.

The third and perhaps the most dominant category of discourse is on *social inclusion, learning and development.* This discourse is focused on smart cities capability to meet community needs. The key message that emerge from this category of discourse is that a smart city is for its inhabitants and smart technologies or initiatives should aim towards improving people's quality of lives (Mohanty et al., 2017). An example of this discourse is reflected in the study conducted by the CSIR (2020) on what should be a South African interpretation of smart cities. The CSIR posits that a smart city in South Africa should be inclusive, and therefore any smart city initiative should be based on the principles of inclusivity (see CSIR, 2020). This interpretation places people at the centre of the smart city initiative. Thus, as the CSIR (2020) asserts, "the smart city initiatives should not be implemented at the expense of, or to the detriment the society" (CSIR, 2020). From this category of discourse, the following components or characteristics of smart cities emerge, smart education, smart citizen or smart people. Public participation has come at a fore of discussions under this category of discourse, since the general accepted approach is "people before technology" (Mohanty et al., 2017).

In additional to the above three categories of discourses by Hollands (2008), I note an additional discourse from literature, which focuses on *"informated" decision-making*. The term 'informating' as coined by Zuboff (1998) refers to "the process that translates descriptions and measurements of activities, events and objects into information" (Zuboff, 1988). In the context of smart cities, ICT or smart technologies support decision making through the generation of information from people's daily actions (Backhouse, 2015). For example, records collected as people swipe a card to gain access to public transport can reveal patterns of use that can inform transport planning in the future (Backhouse, 2015). According to CSIR (2020), smart cities promise to change the way cities are planned and managed. This implicates the role of government, planners and city managers in how smart cities are planned and managed. A smart city within a wider theme of governance is a city that is robust in its ability to administer policies (Mohanty et al., 2017). The key components identified in this discourse are smart planning and smart governance.

As a summary of the above categories of discourses: there seems to be a common understanding that "smart" technologies, more specifically those relating to ICT, present opportunities to manage city operations, address the most critical issues in cities and help cities in meeting key development objectives, which amongst the common themes include *inter alia* improving city living, managing the natural environment, creating an enabling environment for investment, and improving city governance (CSIR, 2020; Backhouse, 2015).

The way smart cities opportunities/ characteristics are presented in the literature is generally a theme of urban concepts/principles or components tagged with the "smart" adjective in front such as *inter alia smart* people, *smart* governance, *smart* transportation, *smart* energy, *smart* planning, *smart* environment, *smart* living and *smart* infrastructure (see Figure 1). These components afford cities the "smart" title; they are therefore considered as the characteristics of a smart city. How cities choose to drive the smart city movement is however dependent on their development agenda which is specific to their context. In other words, a city may choose to focus on achieving all the smart city components or just a few. According to Mohanty et al. (2017), "city need not have all the components to be labelled as smart".
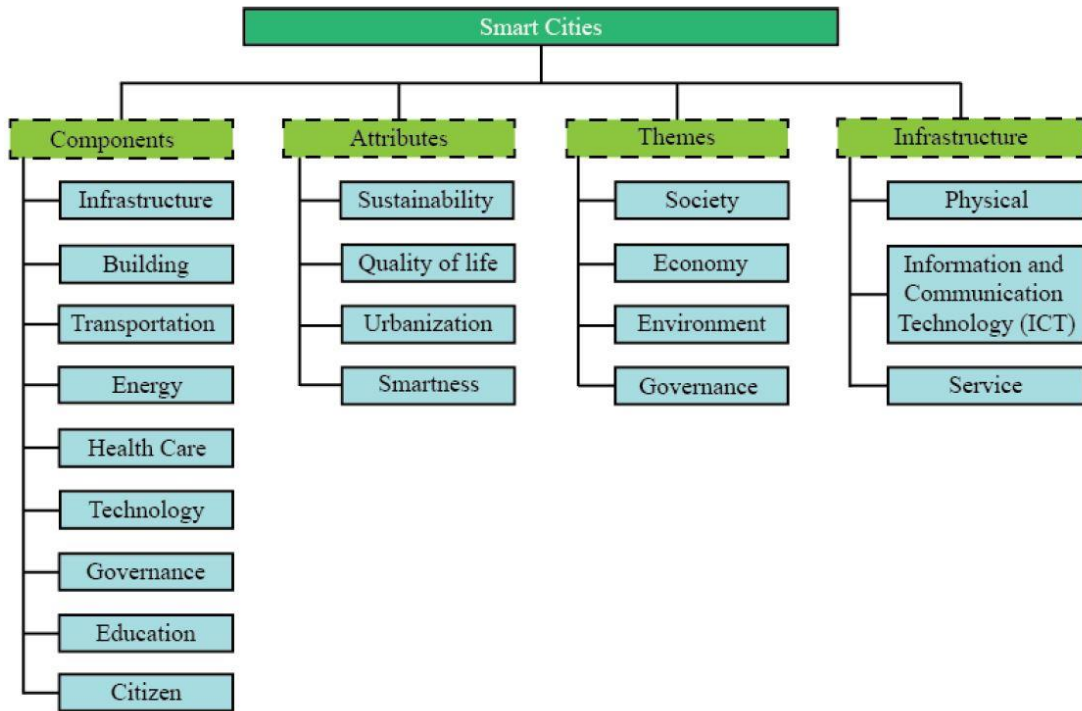
Figure 1: Components and characteristics of smart cities. Source (Mohanty et al., 2015).

PART C: Understanding international comparative studies

As the world becomes interconnected within a highly globalising and multicultural context, it becomes evident that national practices are seldom bound to national borders any more. Social and cultural practices are being imported and exported from elsewhere. This cognisance has sparked an interest amongst researchers especially in the field of sociology as they endeavour to study and compare the forces that drive the complex construct of society. Comparative approaches are becoming important instruments of researching relationship between approaches i.e. planning or policy approaches (Oyen, 1990). This chapter elaborates on international comparative studies from a methodological perspective, particularly on how it has been applied in the field of planning and in smart cities. The relevance of this final part of the literature review is ignited by the nature of the research problem in the present study which concerns a probe into international smart cities approaches. Elaborating on comparative research method can thus help in formulating an effective methodology for studying cross-national approaches to smart cities.

2.7   International comparative research in other studies

International or cross-country comparative research has its roots in sociology. It has however extended to other fields of research including planning. Planners according to Nadin (2012) are increasingly becoming more fascinated with exploring policies and methods of other countries and "from the outset, modern urban planning has shown a strong international spirit". However, as Alonso and Barredo (2013) note, the application of this method in planning research and practice remain dominated by the Global North (Simonofskia *et al.*, 2019; Kreukels and Pollé, 1997; Oyen, 1990).

The broad logic behind a comparative study (from planning perspective) involves comparing approaches to planning (including planning procedures and tools) between two or more countries or regions (Kreukels and Pollé, 1997). The method is therefore concerned with understanding alternative ways to planning methods and approaches (Hantrais, 2009). According to Nadin (2012), "planning practice and research is in fact rooted in international ideas".

As noted by Hantrais (2009), there are both external and internal forces driving a need for more comparative studies. According to the author, external forces such as the globalisation of problems, technological disruptions, export and imports of culture, social and economic manifestations are far more powerful that internal force of movement and co-existence within the country (Hantrais, 2009). Cities are essentially facing common socio-economic urban problems, which as Anthopoulos (2015) remark, may require benchmarking of solutions; however, context is emphasised with Simonofski *et al.* (2019) pointing out specifically within the smart cities domain, that any attempt to benchmark smart cities solution from elsewhere, must be tailored to local context.

Notably across European countries (e.g. Germany, France, United Kingdom and Netherlands), a wave of comparative studies on policy research has been triggered by extensive international exchange and cooperation on planning tools and policies (see Kreukels and Pollé, 2017). The grand purpose of these comparative studies was to evaluate the effectiveness of European Union (EU) spatial planning policies in the member states. In this example, Kreukels and Pollé (2017) compare the way that planning practices and tools are being adjusted to respond to the common challenges that exist in the member states. This study however fails to provide an insight of descriptions of official instruments and procedures applied in the comparative analysis. Avoiding insights on how things are being done in other places have limited the critical reflection on planning practices.

Technology is becoming another driving force of demand for more cross-country studies, within the smart cities research domain, comparative studies have emerged (Mattoni *et al.*, 2020; Simonofski *et al.*, 2019). These studies have however focused on comparing the smart cities initiatives within the country rather than comparing the overall approaches to smart cities (Anthopoulos *et al.*, 2015). There are examples of cross-country comparisons in the literature but these do not extend beyond the comparison of smart cities initiatives. For example, Simonofski *et al.* (2019) conducted a comparative research between Swedish and Belgium's smart cities. This research focused on citizen's participation strategies. The study sought to understand how public participation is implemented in the two countries –the comparison process applied five factors, which were identified as imperative for public participation in smart cities.

2.8   Limitations of comparative studies

Although comparative research has been highly favoured amongst scholars in the social sciences, a number of authors have also raised a number of limitations (Anthopoulos *et al.*, 2015; Kitchen, 2015). The most common as Alonso and Barredo (2013) remark, is that it tends to overlook the cultural and structural factors. This was also noted in planning research, with Gupta *et al.* (2019) pointing out that the style or model of planning in any country remains firmly rooted in their unique socio-economic challenges, historical or political and cultural patterns. Planning is a universal concept but its meaning is tied to a specific place and context. Another limitation as Mills *et al.* (2006) note is the related to the challenges of establishing or deciding on the variables/concepts that needs to be compared. Therefore, because of the difficulty in establishing this, most comparative studies according to the Mills *et al.* (2006), have been sloppy in their approach.

The worldviews of researchers was also noted to obscure their analysis of the elements under comparison (Alonso and Barredo, 2013; Ward, 2010; Mills *et al.*, 2006). For this approach to work in policy or adaptation for planning smart cities, it is important to be aware of the generic or universal concepts of planning that are tied to particular place and how to transpose them into our own context. Therefore, as Alonso and Barredo (2013) note, it is imperative to first analyse the national context before applying this method.

Within a South African context, Coetzee (2010) has criticized the planning system for its limited engagement with international best practices and benchmarking, he points out that, where the planning policies have attempted to apply best practices, they have mostly ignored the context. In the same vein, Harrison *et al.* (2006) have pointed out that South Africa's planning ideas have been entrenched in an Anglo-American context, which has dominated our contemporary planning system. This as Musakwa and Mokena (2018) argue, should be avoided when adapting smart city policies. To stress this, Musakwa and Mokena (2018) point to the way the Bus and Rapid Transit (BRT) system aka "smart" mobility was adopted in South Africa, raising that it was not done in an integrated manner. They elucidate saying, although the mini-bus taxis are the largest transporters of commuters, they have been neglected in planning for an integrated public transit system (Musakwa and Mokena, 2018). This raises an even greater concern regarding a "broken" relationship that exist between planning theory and practice.

2.9   Conclusion: take away from the literature review

This three-part literature review investigated the urban challenges that are most prevalent in South Africa's urban spaces (and most parts of the country for that matter); it elucidated on the smart cities concept from different viewpoints; and lastly, it shone light on the international comparative research, particularly its applicability to planning. Collectively, the three parts of the literature review have enlightened me on how to go about tackling the research problem.

Part A of the literature revealed that South African cities face a multitude of urban challenges and the current planning system is continuously failing to address these issues. The literature also revealed some discrepancies in the planning system itself. The challenges that the country faces goes beyond what the apartheid planning and government system has inflicted on the country. It would thus be irresponsible to put the blame solely on the legacy of the past for the predicaments of this country. The post-1994 government has shown to be incompetent, corrupt, unskilled and incapable of taking this country further in terms of development despite the plethora of legislation put in place. How the smart city concept navigate itself within this dysfunctional environment, remains to be investigated.

In light of the challenges uncovered in Part A, it became clear that South Africa needs "smarter" – more innovative approaches to how we plan and govern urban spaces, and smart cities can be the hope that South Africa needs. Part B of the literature however revealed far greater complexities associated with the smart city concept; one thing that becomes abundantly clear is that the road to "smartness" will not be smooth and easy. The concept of smart city is closely associated with quite a number of other (nuanced) concepts. Probing into these concepts brought me to an understanding of how I frame my own interpretation of the concept (more on this in Chapter 3). The viewpoints of the sceptics and proponents on the other hand, revealed how the concept can be approached, and what to be mindful of in the approach to smart cities, context was greatly emphasised by both group of authors.

Because of the complexities associated with both the interpretation and approach to the smart city concept, it can be of great value to learn from other countries –this is a central objective of this study. Part C of the literature has sharpened my understanding of international comparative studies and how to apply it better in this study. The

limitations of this, from the methodological perspective, were noted. This part of the literature has also helped in identifying a gap in research and how I can fill in that gap.

3   CHAPTER THREE: CONCEPTUAL FRAMEWORK

This chapter presents the conceptual framework within which the research problem is explored, and the concept of smart cities, interpreted. A conceptual framework according to Adom *et al.* (2018) presents an integrated way of looking at the problem under study (Liehr & Smith, 1999 in Adom et al., 2018); its primary objective is to give a broader understanding of the research problem. The research problem in the case of this study is concerned with a probe into international approaches to smart cities in order to draw lessons for South Africa in its endeavour to adopt smart cities for the country's urban challenges.

It is however noted that the research problem cannot be explored soundly without understanding the smart city concept first. Therefore, the conceptual framework presented here serves two main purposes; firstly, it seeks to elucidate my interpretation of the smart city concept based on what emerged from the theoretical basis and empirical findings in the literature; secondly, it seeks to explain how approaches to smart cities will be explored in order to draw "appropriate" lessons for South Africa.

My interpretation of the concept of smart cities and contemplation of the smart cities approach is not neutral, which means, it is not an assembly of scientific variables, it reflects my own understanding built on previous studies on the topic. This understanding is therefore located within an interpretative paradigm, which implies that others might interpret smart city (as a concept) and smart city (as an approach/process) differently. Although this study is descriptive in nature, having a conceptual framework according to Yin (1994) can help present the case study findings.

3.1   Conceptualising smart city

The smart city concept holds many interpretations and applications, and it is applied to different conditions and contexts. Despite its complexities and various meanings and applications, the concept is "pieced" together by two main concepts, which are 'smart' and 'city'. These two concepts can help in elucidating the broad notion of smart city. The conceptual framework therefore brings together these concepts and describe their

relationship to understand the smart city concept within the context of this study. What the framework (see Figure 2) seeks to elucidate is the following:

- In the context of this study, a **city** is conceptualised from the whole-systems paradigm, which considers a city as a complex system of systems. Within the smart cities discourse, this system embodies many challenges of social, economic, governance and global issues, which can be addressed through ICT or smart technologies. Every city has unique urban challenges, which would in turn require unique solutions.

- For the term **'smart',** I align closely with the CSIR's interpretation which associates *smart* with the technological and digital concepts such as Internet of Things, Big Data, sensors and Artificial Intelligence. However, I also align with, Backhouse's "softer connotation" that associates the term smart with people (Backhouse, 2015). Therefore, the interpretation in this study is that: there are varieties of ICT technologies or smart interventions that can be adopted to address the urban challenges; however, the people who drive their implementation play an even more important role. At times, a combination of different technologies may be required to address urban issues.

- A **smart city** is thus a web of interconnected ICT solutions that work to improve efficiency of city systems in order to address the urban challenges in an integrative manner (whole systems paradigm).
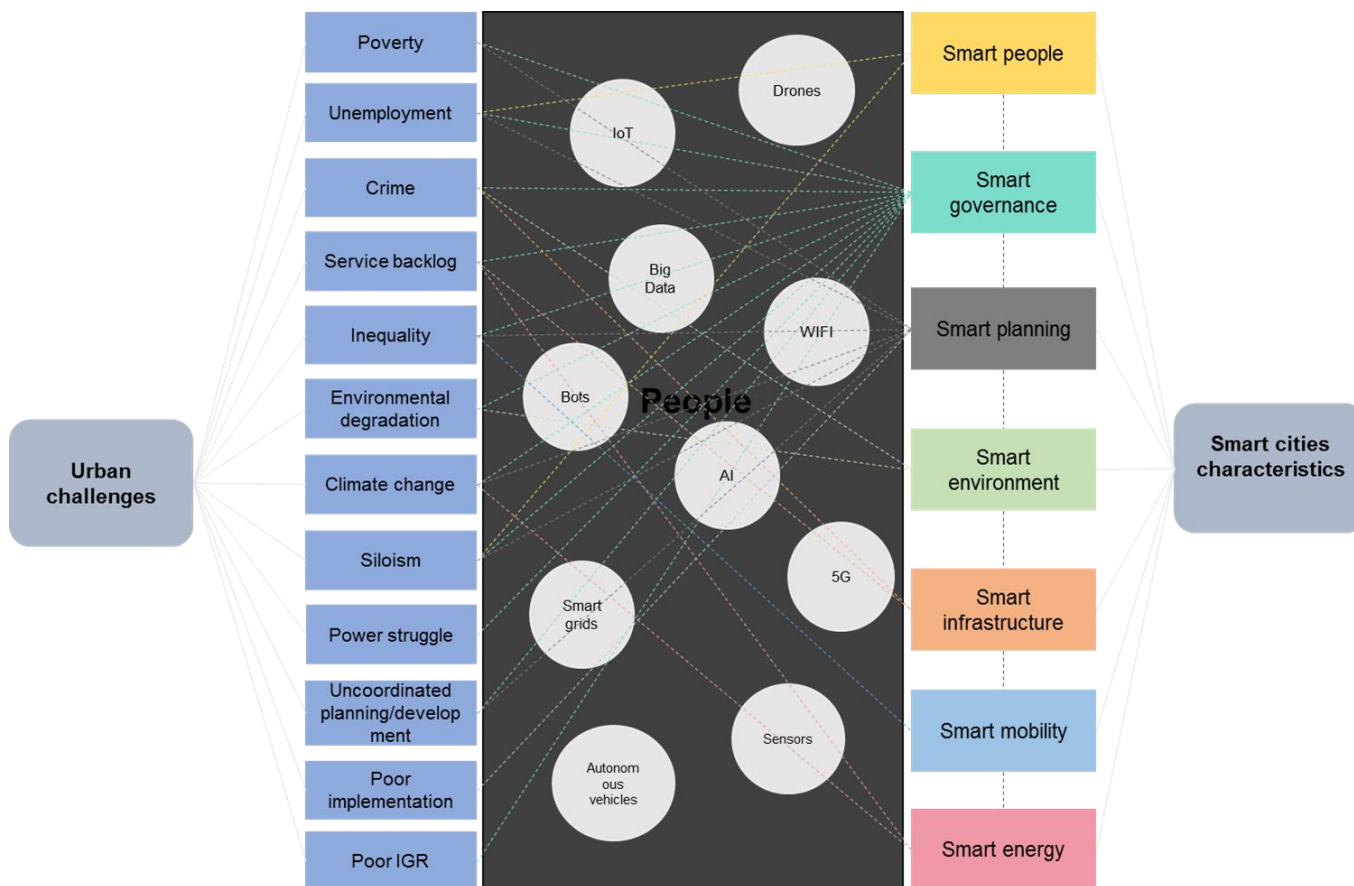
Figure 2: Conceptualisation of the smart city concept (Researcher's own, 2020)

3.2 Understanding smart city – from concept to approach

Understanding the research question requires a further probe into smart cities, which goes beyond the conceptualisation of the smart city concept as. In this study, approach to smart cities is considered as a journey that requires commitment; it is as CSIR (2020) asserts, "a means to an end, and not an end in itself". Therefore, the study recognises that the journey to "smartness" goes beyond adopting certain technologies to address urban challenges to "arrive" at a certain "state" of the city (i.e. achieve smart city characteristics). It is a journey/process that requires appropriate partnerships, it is driven and co-produced with the public, and it seeks to improve quality of life as well as sustainability in the city. With every decision or plan put in place throughout this journey, context is always considered. Figure 3 illustrates how these different constructs "feed" into the smart city approach or the journey to "smartness". Building upon the interpretation of smart cities in section 4.1, the second part of the framework seeks to elucidate on the following:

- The ICT technologies that are adopted to address urban challenges should be

informed by current urban planning principles that are already set out in various pieces of legislation, plans and strategies. This view stems from a general acceptance amongst various authors that 'smart' in the wider sense of the word could also include innovative, non-technological approaches to urban challenges. In this case, a smart city could be one that meets the basic principles of urban planning and development such as through equitable social and economic development, good governance or sustainable urban development through innovative non-technological solutions. It is important to recognise that not all urban challenges require technological solutions.

- The rationale for emphasising urban planning principles in smart cities discourse also stems from the notion that a smart city approach should not set the city on an entirely new track - it is (should be) driven/located within the current city visions and objections. Therefore, the five constructs, of sustainability, appropriate partnerships, public participation, context specificity and improved quality of life, were, for the purpose of this study, identified as appropriate to inform any smart city approach.
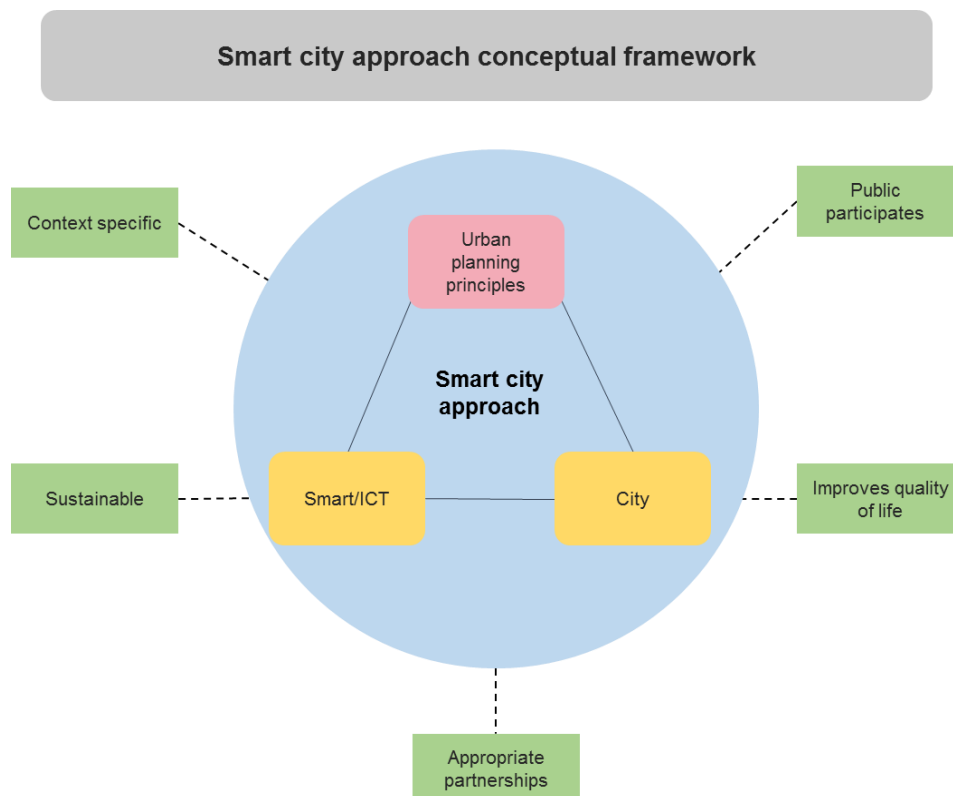
Figure 3: Understanding the smart cities approach. (Researcher's own, 2020)

4   CHAPTER FOUR: RESEARCH METHODOLOGY

The grand goal of this study is to understand how planning and development in South Africa could benefit from the smart cities concept to better address urban challenges facing cities. Elucidating this entailed an inquiry into what other countries that are embracing smart cities are doing as part of their nationwide strategy to tackle urban challenges. The study was concerned with answering two interrelated questions: 1) how have other countries adopted smart cities in urban planning and development and, 2) what lessons can South Africa draw from these countries to improve urban planning and development in a bid to better address urban challenges. The first research question is central to the study because it leads us to answering the second question. Therefore, the methodology I present in this chapter centres primarily on answering the first research question.

Part B of the literature review revealed the complexities and fluidity associated with the smart city concept; thus the need to understand the concept thoroughly, especially within the context of other countries (which is unknown to the researcher), cannot be overstated. In seeking to understand smart cities in this "unknown" context, the study adopted a range of methods. The selection of these methods was primarily guided by the nature of the research questions and the purpose of the study. Three methods were adopted to sufficiently answer the research questions and meet the study objectives namely, international comparative method, case study research and content analysis. In this chapter, I discuss these methods and justify my choice.

The chapter commences with an overview of the general research approach that was followed in conducting the study; and since it is generally accepted that the "how" and "what" research questions are best answered through qualitative research Caswell (1998), the study followed a qualitative research approach. The second section presents a research design, which outlines the plan to answer the research questions. The methods for data collection and analysis are discussed in section three, which is then followed by the theoretical frame within which I located the study and how I interpreted the findings.

4.1   Research approach and design

The study is descriptive in nature. Descriptive research according to Neuman (2014) is appropriate when the researcher has basic information about the social phenomena under study, and wants to describe it further in detail. It provides a systematic picture with specific details of the situation or activity and tries to answer the question: "how do things happen?" (Neuman 2014). Neuman provides the basic approach to descriptive research, which starts with a well-known question or issue followed by a study design to describe the situation accurately. The present study intends to evaluate and describe how the smart city concept has been adopted in urban planning and development in the context of other countries. Descriptive research according to Anastas and MacDonald (2000) generally follows a qualitative research method; therefore, the study was conducted using a qualitative research approach.

4.1.1   Qualitative research approach

According to Anastas and MacDonald (2000), qualitative research is concerned with a systematic, empirical inquiry intended to "define, explore or map the nature of complex and poorly understood phenomena". The researcher's intention in a qualitative research is, as Caswell (1998) asserts, to answer the "how", and the "what" of the study; it seeks to uncover how social experience is created rather than to reveal causal relationships -as is the case in most studies with a quantitative research approach. Owing to the nature of the research questions, a qualitative approach is therefore justified as the "how" and "what" questions were answered in the study; that is, in brief, how is smart cities adopted elsewhere and what are the lessons for South Africa?

The primary purpose in qualitative research is to illuminate understanding and extrapolate similar situations (Hoepfl, 1997). This aligns with the primary purpose of the research, which was to provide some insights into how and why other countries have adopted smart cities as a concept for urban planning. A qualitative approach is often multimethod, meaning it combines a number of methodological practices and perspectives to add to a thorough understanding of any inquiry (Flick, 1998); this affords the researcher the opportunity to adjust and combine a range of methods in a way best suited to address the research problem. The complexity of smart cities within a rapid ever-changing socio-economic (and political) context requires an in-depth

understanding, thus the flexibility that qualitative methods offer, made it an appropriate approach.

To understand a complex phenomenon such as smart cities (especially in a context of other countries) we cannot "skim" across the surface. Therefore, in drawing valuable lessons for South Africa, there needed to be rich information and a qualitative approach affords the researcher this opportunity as noted by Anastas and MacDonald (2000), it lets us "dig deep". The characteristics of qualitative research design according to Dezin et al. (2000) are:

i)   Naturalistic – studying real world situations as they unfold.

ii)   Emergent – adapt research as new insights emerge or as understanding deepens and situation changes.

iii)   Purposive – using cases for study. This is to illuminate on the insight to yield rich information. Purposive qualitative research "offers useful manifestation of the phenomena of interest" (Dezin *et al.,* 2000).

4.1.2   Research design

Research design helps us link the empirical research to a conceptual research problem; it is the logic that links the collected data to research questions (Leedy *et al.*, 2020; Phondej and Neck, 2011). The aim here is to articulate on the type of data used, the methods for gathering and analysing the data, and how the research questions were answered. As a basic methodology, the study deployed an international comparative approach to answer the prime question of how other countries have adopted smart cities into their urban planning strategies to address urban challenges. This question is however not straightforward and it is built on several other questions which needed to be investigated at the outset. Firstly, it needed to be clear from the onset as to which countries will be selected and how many. Secondly, how will these countries be evaluated? Both these questions required a set of criteria and a supplemental research approach to the international comparative method. Thirdly, what resources are we evaluating i.e. plans, policies, strategies or academic papers on smart cities and urban planning? Lastly, what is it that we are trying to uncover from these materials?

All these questions aided in answering the "grand" question of how other countries have adopted smart cities. In addition to answering the "how" the study also sought to

uncover the reasons or logic in adopting smart cities "the why"– this was important to guide the answering of the second research question that aimed to provide an insight into lessons for South Africa's urban planning and development. Case study research was therefore the appropriate method to use since it provides rich qualitative insight and knowledge about the research problem (Denzin *et al.*, 2000). It also allowed the researcher to investigate a topic in far more detail.

i.   International comparative approach

A comparative research approach (particularly in planning) affords a researcher the opportunity to examine best practices in order to improve planning processes or approaches to planning. It is often concerned with large microsocial units (i.e. countries, regions, nations), particularly in the world where the phenomenon of convergence and globalisation is a reality as is the case with the smart city movement (Hajer and Wagenaar, 2003). Nadin (2012) defines a comparative research method as "an act of comparing two or more things with a view to discovering something about one or all the things being compared".

In the context of this study, approaches to smart cities in urban planning between the selected countries were compared. The comparative approach has also gained considerable interest in policy research as it helps to understand policy paths of different countries or regions (Mills et al., 2010). This informs policy makers on alternative approaches when facing similar societal problems (Nadin and Stead, 2013). These merits made it a suitable approach for the study because the central focus of the research rests on smart cities best practices as documented in the planning policies and strategies of the selected countries.

A comparative research approach supports both qualitative and quantitative research methods and it is situated as a basic method in its own right alongside other methods such as content analysis, experimental, case study and statistical methods (Lor, 2011). The flexibility that the approach offers made it desirable for a complex multifaceted study such as this present study. Table 1 presents a basic approach to the method as applied in this study, it shows the type of comparative research design, a comparative strategy selected, general methodological approach and the paradigm through which I examined and interpreted the cases (i.e. countries selected).

Table 1. Method choice. (Researcher's own, 2020)

Research design	Research method
Comparative research design	Few country comparison
Comparative strategy	Case-orientated
General methodology	Qualitative
Research paradigm	Interpretivism

The case for selecting which country to analyse comprised its own process, which rests on specific set of criteria (explained in the next section). Having fewer countries is useful in studying each country intensively (Landman, 2008) hence the selection of only two countries in the study. Selecting fewer countries was also important in terms of managing the information gathering process. However, the limitation in selecting fewer countries in comparative studies is that the external validity of an in-depth comparative method is low, that is, other countries will need to develop their own set of criteria to consider in the analysis –it limits replicability.

ii. Case study research

Case study research typically follows a qualitative research approach (Phondej and Neck, 2011). It allows for an in-depth study into a research problem rather than a "sweeping statistical survey" (Anastas, 2000). According to Phondej and Neck (2011), a case study approach is good for describing, evaluating, comparing and understanding aspects of the research question, therefore it is the most appropriate strategy to answer "how" and "why" questions therefore suitable for carrying out this descriptive research.

From what could be established from research by Mills *et al*. (2010), case studies also found relevance in policy research and are often deployed to evaluate and extract "rich" information on policy practices. According to Mills *et al*. (2010), case studies excel at bringing the researcher to an understanding of a complex issue through a detailed

contextual analysis of a limited number of events or conditions. The approach is useful when not much is known about the phenomena or activities (Krehl and Weck, 2019). In investigating a complex notion such as the smart cities concept, case studies helped in narrowing down the broad research problem into researchable sub-questions that I referred to in the introductory part of this chapter.

Another advantage of case study research design is that it allows the researcher to apply a variety of methodologies and use a variety of sources to investigate the problem (Krehl and Weck, 2019). This was particularly important in unpacking how other countries have adopted smart cities. Various smart cities policy activities and strategies were assessed to gain an in-depth understanding of the context that is, smart cities in the context of urban planning in other countries.

Case study research according to Krehl and Weck (2019) in itself is not an overarching research method, other forms of research methods for data collection and analysis were therefore selected to generate materials suitable for case studies and in this case, content analysis was the approach used for data gathering and analysis. The process is explained in the next section. The case study research, as Yin (2003) explains, comprises the basic steps as discussed below. These were altered for the purpose of the present study.

a. Define and design

This step involves a case selection approach. For this study, two countries namely Rwanda and Brazil were the selected cases, and their smart cities approaches were assessed. The two countries were selected based on four set of criteria. Firstly, the countries had to be embracing the smart cities concept in addressing urban challenges. From what was gathered by scanning through the internet, Brazil and Rwanda (as it seems), are entertaining smart cities thinking in their approaches to urban planning and addressing challenges.

Secondly, the countries had to resemble a similar urban context to South Africa. In this case, the socio-economic challenges that the two countries face were identified to be similar to those of South Africa. Through the literature scan, Rwanda and Brazil (which are both countries in the Global South), were identified as appropriate for inclusion in this study. It is worth pointing out that the socio-economic conditions of these countries were not reported in this research report as this falls outside the scope of the research.

The third criteria in selecting the countries was informed by the availability of information on smart cities. Because the smart city concept has infiltrated popular media and has in other instances, become a city marketing strategy, in this case researched published materials on the research subject had to be available; thus the materials had to be outside the 'tech adverts'. Lastly, the selection was informed by the existence of a broader national smart city policy framework, strategy or a plan. It was noted that policy frameworks of different countries are at different stages of development, therefore whether the countries' framework/plan is still at an embryonic stage of development or it is still a draft document, this did not inform the selection process.

b.   *Prepare and collect data*

Here each case was conducted, and a synthesised discussion of the cases produced. The unit of analysis were the two countries: Rwanda and Brazil as well as the materials that were assessed. In this research, data was mainly drawn from documentation (i.e., published sources); these included wide-ranging materials namely smart cities master plans, policy, strategic documents and academic literature. In discussing the cases, popular media articles were also considered. National websites were primarily targeted to access the materials for assessing the cases. This step also included the design of data collection protocol, which is explained in section 4.2.1.

c.   *Analyse and discuss*

In this step, I drew cross-case conclusions, developed planning implications, and produced a wide-cross report. In uncovering how (and why) Rwanda and Brazil adopted smart cities, the two countries' smart cities approaches to urban planning and development as set out in the countries' documented materials, were thoroughly evaluated. A set of criteria were developed for the evaluation process. The criteria were informed by the smart cities characteristics or prospects that emerged from the literature review, specifically in the context of Global South. What also informed the selection of these criteria was their relevance to South Africa.

It should however be noted that smart cities around the world have many characteristics, which are specific to context, and not all smart cities will have all the characteristics. The criteria that were identified for the purpose of this study were thus

informed by their relevance to Global South context and especially South African context. Therefore, each smart city should strive to meet the following *inter alia*:

- **The approach is context specific/respond to specific local challenges:** smart cities need to respond to specific local challenges and needs (Aurigi and Odendaal, 2020). This implies that the pre-existing urban conditions need to be taken into account when developing and implementing any smart cities initiative. This is important and can help avoid selecting pre-packaged solutions that fail to address the pre-existing urban challenges and the needs of local community. Where smart cities avoid the local context, urban issues might be exacerbated or the initiative might be detrimental to other parts of communities.

- **The approach seeks to improve quality of life of the people in the city:** the people should be at the forefront of any smart cities strategy, any attempt to implement smart cities initiatives should aim to improve the quality of life of the people. One of the pre-conditions for becoming 'smart' is ensuring that the basics are in place (CSIR, 2020), and the basics in this case relate to services such as potable water, proper sanitation, housing and food. Any smart cities strategy that does not address basic challenges of development in the city seems rather wasteful.

- **The public participates in the smart city initiatives:** the public needs to be included in decisions on smart cities; it includes the identification, development and implementation of the smart city initiatives (CSIR, 2020). This is important for the sustainability of the initiatives.

- **The approach embraces partnerships with the private sector and other spheres of government:** partnerships are an important component of the smart cities strategies. Partners in the smart cities initiatives should have the same values and objectives and strive towards realising the same vision of the city. It is important to define the roles of each stakeholder as well as how the partnership is to take place.

- **The smart city initiatives aim towards sustainability:** sustainability in this case is not bound to environmental sustainability and it relates to socio-economic sustainability of the initiatives. The approach to smart cities should therefore indicated how it is to achieve the sustainability of the project itself and

how it will leverage technology to promote social and economic sustainability in the city.

4.2   Research method

This section presents the strategy that was used to implement the research design. The section explains how data was collected, analysed, interpreted, and from which paradigm lens the data was interpreted. The section also elaborates on the validity and reliability of the strategy used to collect as well as the limitations of the study.

4.2.1   Data collection method

The data collected for this study was from existing secondary sources; meaning the information had already been collected and publicly made available in documents. The method for data gathering was by means of a desktop study, primarily documents review. Although interviews are considered most appropriate for data collection in case study research (Yin, 2003), this study relied on secondary sources of information because of the conditions under which the research was conducted, that is, the global Coronavirus pandemic. Additionally, interviews would not have been feasible for a study such as this because I am based in South Africa and do not have the necessary permissions and funding to travel.

The method for generating and analysing data was content analysis. In content analysis, texts in documents are analysed and compared in order to generalise (Neuman, 2014). According to Anastas and MacDonald (2000), content analysis can be both qualitative and quantitative. In quantitative research, it focuses on counting and measuring, while in qualitative the focus is on interpreting and understanding the analysed text or content. In both types, the researcher "categorises or 'code' words, themes, and concepts within the texts and then analyse the results" (Anastas and MacDonald, 2000).

In this study, the focus was on qualitative data about the content in order to locate the meaning of smart cities as applied in urban planning and development challenges. This was done to better understand the intention of the concept in the context of urban planning and development in the countries under study. Content analysis helped to

discover the underlying message in the documents –this understanding aided in drawing valuable lessons for South Africa's smart cities journey. It also revealed the socio-economic challenges of the two cases since smart cities is often applied alongside the urban challenges (it is in fact applied as part of the strategy to address the urban issues).

It is important to establish from the onset how and which content was analysed to understand smart cities approaches in urban planning –the coding rule. Coding sets out "what will and will not be included in analysing the content" (Luo, 2019); and it comes after data is collected (Neuman, 2014). The main reason for deploying content analysis in this study was to locate smart cities characteristics (see section 1.1.2 (ii) (c)), in the master plans, policy strategic documents and academic literature on smart cities in Rwanda and Brazil. These characteristics however carry different meanings and are applied differently to different socio-economic and political contexts. For example, smart governance is not a universal term, it encompasses different elements that vary across countries and regions; in one strategy it could emphasise community participation while in another, could gravitate towards accountability or transparency.

Coding included deciding which specific concepts and phrases are related to smart cities. In coding, different concepts and themes were organised. The processes of data collection began with a Google search using the keywords "smart city", "smart cities", "intelligent city", and "digital city" - in Brazil - Rwanda. The search started with the published research materials (and not opinion pieces). It had to be made clear on what a smart city "approach" –that which needed to be compared was; thus the conceptual framework guided with this. For Rwanda, the Masterplan was mainly used for the case study; and for Brazil, it was mainly the published academic articles. Coding provided a framework for fair comparison between smart cities strategies in the two countries as well as retrieving relevant data from the content.

4.2.2   Data analysis method

The data that was collected from content analysis was examined to find patterns or emerging themes about how smart cities were adopted by the two countries. This was done to draw conclusions in direct response to the research questions. Data analysis according to Neuman (2014) is the process of searching for patterns across data, create connections from specific instances in the data, organise and interpret concepts

and themes. Furthermore, as Neuman (2014) infers, it also involves "examining, sorting, categorising, evaluating, comparing, synthesising, and contemplating the coded data as well as reviewing the raw and recorded data".

The analytical strategy deployed for data analysis was a narrative case study, where the researcher assembles data into descriptive picture. In this narrative, each case (being the countries' smart city approach) was described in depth. This was followed by a reflection/interpretation of each case. The interpretation was done within an interpretivist paradigm. In an interprevitism paradigm, the researcher's epistemological and ontological belief is that reality is socially constructed. Therefore, from this philosophical underpinning, reality is subjective (Brandie *et al.*, 2000). Interpretivists according to Brandie *et al.* (2000) "attempt to derive their constructs from the data they collected by an in-depth examination of the phenomenon of interest". In this study, approaches to smart cities were interpreted against the five set of criteria that I consider as the most relevant for any smart city strategy especially within a Global South context.

4.3   Validity and reliability

According to Phondej and Neck (2011), "reliability and validity are central issues in all measurement; both concern connecting measure to constructs". Reliability and validity are most common in quantitative research and are rooted in positivist perspective. The use of reliability and validity has found applicability in qualitative research, particularly in regards to the method of data collection. For this study in particular, Google translation for the majority of Brazil's document had to be relied on during data collection. The researcher could not verify the reliability and validity of Google translation functionality for accuracy of the translation.

4.4   Ethical considerations

This research did not include any human interaction or human related records (i.e. confidential information, it did not include interviews, focus group meetings etc.). Therefore, the researcher maintained the integrity of the study in the following manner:

i) by not fabricating the findings and interpretation of the original sources of information and;

ii) by acknowledging the source of information (secondary sources in the case of this research)

4.5 Study limitations

The collection of data for Brazil was limited by the number of documents available in English. Although national websites were initially targeted to access the materials for assessing the cases, for Brazil, these are mostly available in Portuguese. This was therefore a significant limitation for analysing and understanding the case study in depth. In this case, the study had to rely on the literature published in English for the cities of Brazil, particularly the city of Rio de Janeiro. It is important to point out that Rio's approach to smart cities does not generalise how Brazil (as a country) is approaching the concept; Rio's approach was only used as an example within the Brazilian context.

Considering the vast nature of Brazil (administration and geography), it was also not feasible to look up how each city in Brazil approaches the concept in order to generalise Brazil's smart cities approach; but it is unlikely that these documents would be available in English.

The stages of development of each country's approach as well as the availability of documents on the internet, limited a "fair" interpretation and comparison. For instance, Rwanda's smart cities approach is still mainly at an abstract level while Brazil (mainly Rio) has already implemented some of its strategies; this has also influenced how I drew conclusions on the cases, especially when comparing the cases.

Lastly, the Coronavirus pandemic, which has driven the country to implement lockdown, played a major limitation factor in terms of the materials that I could access. Furthermore, because of the lockdown and other unforeseen challenges that the University has experienced, the time that was assigned to carry out this study also limited the extent to which I could explore the case studies.

4.6   Synthesis of methodology used

The purpose of this study is to establish an in-depth understanding of how (and why) other countries have adopted smart cities in urban planning and development. This is done to provide insights for South Africa in its own quest of adopting smart cities to address urban challenges. In order to do this, the researcher carried out a scholarly review of South Africa's urban challenges as well as the concepts and characteristics related to smart cities in a bid to carry out international comparative research to draw lessons from Rwanda and Brazil's approaches to smart cities.

A comparative analysis research approach relies on selecting "appropriate" cases (i.e. in our case countries with similar socio-economic contexts to South Africa) as well as thoroughly evaluating the cases based on the smart cities principles. Because international comparative analysis is a basic methodology and alone could not answer the research questions and provide sufficient information on the research problem, a case study approach was used to aid in getting a deeper understanding of the research problem. From these case studies, analytical insight was developed into how and why certain approaches were taken regarding adopting the smart cities strategies. The next step was to carry out a content analysis of smart cities actions, policies, strategies and plans to gather information needed to evaluate the cases. Refer to Figure 4 for a synthesis of the methodology.
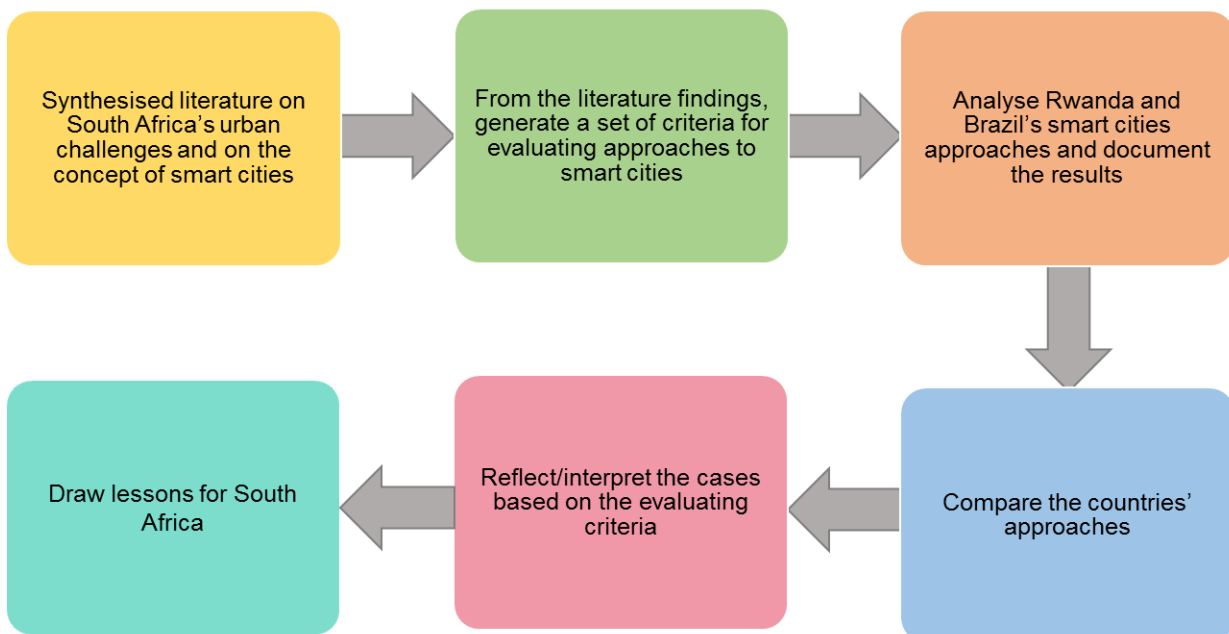

Figure 4: Synthesis of the methodology. (Researcher's own, 2020)

5   CHAPTER FIVE: FINDINGS

This chapter presents the research findings in two sections, which are structured around the two research objectives: 1) to provide a synthesised description of how Rwanda and Brazil have adopted smart cities, and 2) to provide lessons that could be applied to South Africa's urban planning and development challenges. In the first section, the findings are presented for the two case studies and each case study commences with a brief contextual overview of the case. The cases describe how Rwanda and Brazil went about adopting the concept of smart cities and what key domains/focus areas are emerging from the countries' approaches. In the second section, comparisons of the two cases (being the two countries) are done to uncover emerging similarities and differences of the countries' overall approaches to smart cities. This is done in an effort to later draw key lessons for South Africa (in Chapter 5).

In meeting the first objective, the findings from each case study is broken down into four sub-sections. Firstly, I establish whether the country has a framework guiding the implementation of smart cities (i.e. plan, strategy, policy etc.), and how such plan addresses the concept of smart cities. Secondly, I look into the institutional set-up that spearheads the smart cities agenda (if any) and how it is structured. Thirdly, I deal with the question of how the smart cities initiatives/strategies/plans are generally implemented or executed and I provide relevant examples where necessary. For each case, I seek to establish the key focus domain i.e. what the country mostly seeks to address through its smart cities interventions or initiatives.

It is important to point out that approaches to smart cities vary across cities and municipalities, meaning cities, though in the same country, have different priorities that inform how they adopt and implement smart cities. Therefore, in some instances such as the case of Brazil where there is no countrywide policy document guiding the implementation of smart cities, it was not easy to present a countrywide description of the country's smart cities approach. In this case, reference was made to the cities of Brazil that are embracing smart cities and which have made their documents available online in English. It is also worth mentioning that it is not the intention of this chapter (and this study) to discuss specific smart city projects or initiatives in detail (though reference is made to some examples). It is also not the intention here to analyse the successes of the two countries' smart cities approach although some criticisms and

commendations from various authors will be reflected on in the discussion chapter (Chapter 6).

CASE 1: RWANDA'S APPROACH TO SMART CITIES

5.1   Contextual overview: general aspects

Rwanda is one of the smallest landlocked countries in mainland Africa. It covers the land area of 24 670 square kilometres and has a population size of about 12.6 million (World Bank, 2019). A recent report by the Word Bank highlights Rwanda's impressive achievements since the 1994 civil war and genocide events (World Bank, 2020). According to this report, Rwanda experienced robust economic and social performances through its five-year Economic Development and Poverty Reduction Strategies. The impressive outcomes of these successive strategies have translated into improved living standards. The national poverty line was reported at 55% in 2017, a decline from 77% in 2001 (World Bank, 2020). The Gross Domestic Product (GDP) per capita according to the World Bank (2019) was 10.1 billion USD. Rwanda is considered one of the fastest growing economies in Central Africa (World Economic Forum, 2016). Agriculture is the primary economic activity and a key contributor towards the country's GDP and employment opportunities (World Bank, 2019).

Despite these recent impressive performances, Rwanda, like many countries on the African continent, faces numerous urban challenges as a result of the urbanisation phenomena. The increase in population densities in Rwandan cities is a major concern given the small land area of the country's major cities, especially in the country's capital city of Kigali (Rich et al., 2017). Growth in urban population puts a lot of strain on the existing infrastructure and services such as housing and transport, and it intensifies social inequalities (Rich et al., 2017). Notwithstanding, Rwanda has landed itself in the top position in the smart city movement on the African continent (Smart Africa, 2017).

5.2   Rwanda's approach to smart cities

Approaches to smart cities in Rwanda (as is often the case in cities of the Global South) are aimed at dealing with the challenge of urbanisation. Therefore, smart city initiatives

are often perceived as enablers for efficient service delivery and sustainable urban management. Rwanda recognises the power of ICT in addressing the challenge that comes with managing the increasing population and improving quality of life. The country is embracing the notion of transforming its cities into smart cities. In doing so, Rwanda acknowledges the importance of gearing up its population by equipping societies with relevant skills that are in line with the labour market. This serves as an effort to achieve Rwanda's vision of transforming its economy from agrarian into a knowledge–based society.

i. Emerging smart cities key focus area

In order to harness effectively the new opportunities of technology in a bid to develop a digital economy, Rwanda aims to invest greatly in education, digital literacy and ICT awareness programmes as set out in the 2017 Smart City Rwanda Master Plan (Rwanda, 2017:25) . Amongst the priorities of the smart cities programmes in Rwanda, localised social and economic development through education, innovation and digital literacy remain a central focus (Rwanda, 2017:28). To achieve this, Rwanda emphasises good governance amongst other key priorities. Although there are many other building blocks that have received attention in line with Rwanda's vision and smart cities approach, this case study delves only into the socio-economic development approach and governance, as these two key areas seem to be emphasised in the country's Masterplan.

ii. Framework guiding smart cities

The Rwandan government in collaboration with the UN-Habitat developed the Smart City Rwanda Master Plan in 2017– a framework that promotes the development of smart cities at national level as well as guiding Rwandan cities and towns in their process of developing their own smart city strategies and master plans. The Masterplan is an overarching document that guides the development of smart cities initiatives in Rwanda. It was developed in conjunction with the Smart African Cities Blueprint to offer a localised example of how African countries can transform their cities into smart and sustainable cities.

The Masterplan along with the sector plans that came before it, has been implemented to achieve the objectives of the government's ambition of transforming Rwanda from an agrarian to a knowledge-based economy as set out in Vision 2020, which was

adopted in 2000 (Rwanda, 2017:12). Although the Masterplan came 17 years since the adoption of Vision 2020, it actually builds upon a series of National Information and Communications Infrastructure (NICI) plans that were adopted between 2000 and 2015. These plans aimed to provide strategic frameworks for using ICT to achieve development.

The three national ICT strategies, NICI I, II and III, laid the foundation for the Masterplan by 1) putting in place the legal and regulatory framework to restructure the telecommunication sector and attract private sector investments - through NICI 1 (2000 – 2005); 2) prioritising infrastructure investment and connecting people through initiatives such as One Laptop Per Child Project - NICI II (2006 – 2010); and 3) transforming services to digital platforms such as e-government – NICI III (2011 – 2015) (see Rwanda, 2017:25). The NICI strategies have resulted in increased mobile and broadband penetration in Rwanda (that is, 95% internet penetration according to Rwanda, 2017:12). Thus, the new Smart City Masterplan is unfolding in an environment already highly penetrated by connectivity. With the foundation laid by previous NICI Plans, the goal of the Smart City Masterplan is to transform the economy, create jobs as well as increasing governance accountability (Rwanda, 2017:25).

To achieve the above three goals, the Masterplan sets out an action plan that identifies three pillars, nine building blocks and twenty-seven initiatives that are meant to guide cities (see Figure 5). Each strategic building block is supported by a number of smart city initiatives that cities can choose to implement, the choice depends on the cities' priorities and availability of resources. The initiatives in the Masterplan are intended to provide a starting point for cities and towns to become smarter, and they provide a comprehensive guide (at local level), for cities to implement the smart city projects. Local authorities can build on the initiatives in the Masterplan or develop their own initiatives to fit the local context (Rwanda, 2017:50). Linked to each initiative, the Masterplan identifies the level at which each initiative is to be implemented i.e. national level (comprising 10 million people), Kigali (capital city of 850 000 people), secondary cities (50 000 – 150 000 people), towns (5000 – 70 000 people), and rural settlements (of less than 5 000 people). Each initiative draws examples from international best practices.

To indicate how the framework (the Masterplan) guides cities in addressing socio-economic development, I use one example from the four initiatives that were identified

around socio-economic development; this falls under the pillar, *localized innovation for social and economic development* and it relates to *education, innovation and digital literacy* building block (see Rwanda, 2017:69). As part of the initiative strategy, Rwanda identifies the need to support innovation from primary school to higher education. This, according to the Masterplan, requires major transformation in the school system. Embedding practical projects that speak to real local problems into the school syllabus at primary school level, and equipping high schools and universities with innovation labs, were identified as key actions to realising the initiative. This is to be implemented at national level. Another element to innovation (that is outside the bounds of technology) include changing the teaching and learning processes, that is, moving away from traditional rote-learning practices and instead, engage the leaners with real life examples. The implementation of the initiative is through Rwanda's new competency-based curriculum, developed by the Education Board and it came into effect in February 2017.

With regard to transparent governance, one of the initiatives in the Masterplan is the development of *digital tools to engage all citizens*; this forms part of the *public engagement and open data* building block, under the pillar *smart governance and planning (*see Rwanda, 2017:58). The Masterplan identifies mobile engagement as the best option considering the growing number of mobile phones across Rwanda. The development and management of the mobile engagement applications, though it can be developed by the private sector, is the responsibility of the local authority; therefore, the level of implementation for this initiative is at city, secondary city and town levels. Furthermore, the creation of responsive websites was identified as one of the key considerations to engage with citizens. The engagement tools, as the Masterplan guides, should include urban complaint reporting, location-based news on, for example, maintenance and public events, municipal service registration including payments of taxes and fines, crowdsourcing of ideas regarding new approaches to planning, and lastly e-access to a service centre providing municipal services information. The feedback from these tools provide for efficient service provision that is targeted directly at citizens' needs.
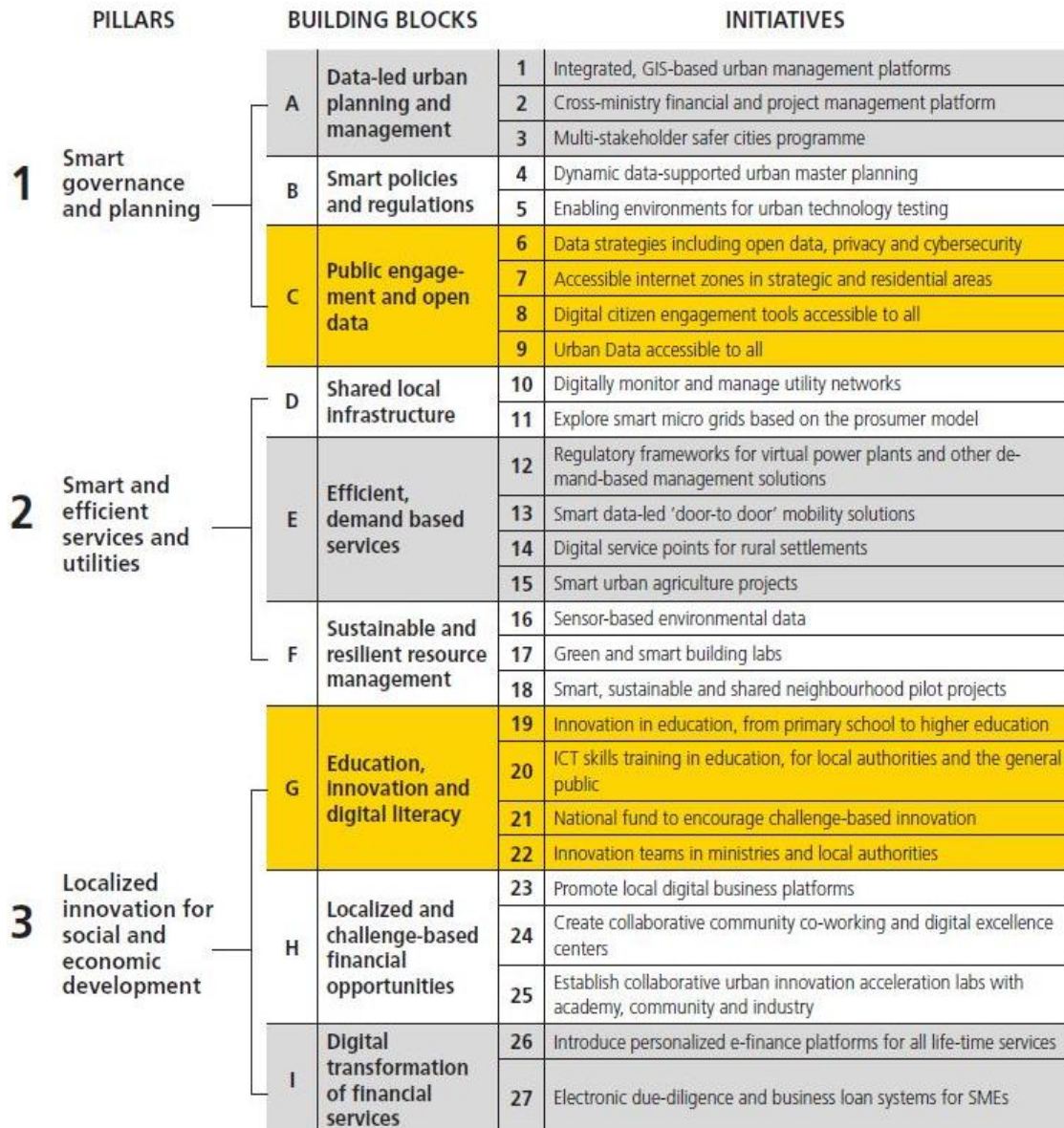
PILLARS	BUILDING BLOCKS			INITIATIVES
1 Smart governance and planning	A	Data-led urban planning and management	1	Integrated, GIS-based urban management platforms
			2	Cross-ministry financial and project management platform
			3	Multi-stakeholder safer cities programme
	B	Smart policies and regulations	4	Dynamic data-supported urban master planning
			5	Enabling environments for urban technology testing
	C	Public engagement and open data	6	Data strategies including open data, privacy and cybersecurity
			7	Accessible internet zones in strategic and residential areas
			8	Digital citizen engagement tools accessible to all
			9	Urban Data accessible to all
2 Smart and efficient services and utilities	D	Shared local infrastructure	10	Digitally monitor and manage utility networks
			11	Explore smart micro grids based on the prosumer model
	E	Efficient, demand based services	12	Regulatory frameworks for virtual power plants and other demand-based management solutions
			13	Smart data-led 'door-to door' mobility solutions
			14	Digital service points for rural settlements
			15	Smart urban agriculture projects
	F	Sustainable and resilient resource management	16	Sensor-based environmental data
			17	Green and smart building labs
			18	Smart, sustainable and shared neighbourhood pilot projects
3 Localized innovation for social and economic development	G	Education, innovation and digital literacy	19	Innovation in education, from primary school to higher education
			20	ICT skills training in education, for local authorities and the general public
			21	National fund to encourage challenge-based innovation
			22	Innovation teams in ministries and local authorities
	H	Localized and challenge-based financial opportunities	23	Promote local digital business platforms
			24	Create collaborative community co-working and digital excellence centers
			25	Establish collaborative urban innovation acceleration labs with academy, community and industry
	I	Digital transformation of financial services	26	Introduce personalized e-finance platforms for all life-time services
			27	Electronic due-diligence and business loan systems for SMEs

Figure 5: Rwanda smart city action plan. (Source, Rwanda, 2017:49)

iii. Institutional arrangement

The Rwandan Masterplan is not a standalone and rigid document; it was adopted within the existing organisational structures of government and it builds on, and is in synergy with, other policy frameworks. For example, the smart city initiatives in the Masterplan are aligned with Rwanda's National Urbanisation Policy (see Rwanda, 2017:26). This policy document was adopted in 2015 to enhance the institutional capacity to manage urbanisation in a coordinated manner, and urban planning and management in an integrated way in order to ensure sustainable growth, provide job opportunities, improve quality of life and increase urban productivity.

The Masterplan highlights how the smart city initiatives are to enable the pillars that are defined in the Urbanisation Policy. Therefore, at national level, the smart cities initiatives in the Masterplan concretise the National Urbanisation Policy, while at regional or municipal level, it elaborates on the initiatives presented in other strategies such as the Spatial Development Framework, 2016, National Strategy for Climate Change and Low Carbon Development, 2010, and the Masterplans developed in various municipalities.

The smart city action plan in the Masterplan was developed in consultation with a range of stakeholders including government ministries, local governments, private sector, civil society and academia. Although there is no indication of a new institutional set-up for spearheading the implementation of the smart city initiatives, it was noted that as key priority, Rwandan government seeks to strengthen partnership with the private sector and provide this sector a prominent role in the implementation of the initiatives; but local government remains in control (Rwanda, 2017:44). The Masterplan guides the local government on how they can establish a smart city partnership team, which it urges, should consist of smart city leaders in the local government, public and private sector champions, as well as other civil society stakeholders and private sector role players-relevant to the challenges identified.

iv. Implementation approach

The Masterplan highlights the roadmap or a guide to how cities can implement the smart cities initiatives. The road to becoming a smart city as the Masterplan indicates begins by making four early decisions (see Rwanda, 2017:36). The local government must first commit to becoming smart and part of this includes understanding what the city requires. Secondly, cities have to identify the smart city champions by first appointing a dedicated leader, which may be a senior elected leader or a senior director of that municipality as well as a dedicated team of digital champions.

The implementation of smart city projects according to the Masterplan follows the process of connected action plans, which are managed constantly. Thirdly, the city needs to create a shared vision, practical objectives, targets and indicators. The vision needs to relate to the vision in the masterplans of municipalities. Lastly, government

needs to choose to be transparent, that is, sharing the process with all city stakeholders. This includes communicating the vision, roadmap, targets and results.

The Masterplan draws ten steps for realising municipal vision: study the city, create stakeholder partnership team, identify challenges and opportunities, collect essential information, create strategic action plan, elaborate planned city extension plan, test localised pilot projects, monitor and evaluate the pilot projects, then scale them, build local capacity and apply dynamic management and coordination processes (Rwanda, 2017:38). Concerning testing the pilot projects, a series of projects need to be piloted in real-life relevant locations and include comparative trials of similar solutions. How this is to be facilitated is not elaborated on in the Masterplan.

CASE 2: BRAZIL'S APPROACH TO SMART CITIES

5.3   Contextual overview: general aspects

Brazil is the largest country in Latin America by area, population size and administration. It covers a vast land area of over 8.5million square kilometres and has 5 570 municipalities, making it the largest country on the South American continent (World Bank, 2019). The population of Brazil was estimated at around 211 million people in 2020 (Brazilian Institute of Geography and Statistics (IBGE), 2020). Brazil is also a highly urbanised country with 86.82% of the population living in cities (IBGE, 2020). This large number of people concentrated in cities pose a challenge in managing urban areas and maintaining the quality of life of many Brazilians. Providing services in various sectors of mobility, governance, health, infrastructure and education in an integrated manner has been highlighted as a major challenge (Junior, 2019).

Like many countries of the Global South, the challenge of managing urbanisation has propelled Brazil to search for solutions in the smart cities arena in order to help improve quality of life and agility of urban services. Three cities in Brazil namely Rio de Janeiro, Curitiba and Sao Paulo, have in fact received an international title of smart cities according to the IESE Cities in Motion Index 2014. These cities are taking the lead in the development of smart city initiatives and projects and have shown creativity in addressing the challenges generated by urbanisation. Business has been diversified

and innovative solutions such as the Bus Rapid Transit (BRT) system have emerged in these cities. In the Brazilian academy, research on smart cities has appeared lightly in conferences and rarely in national journal. Rio is the only city whose documents are mostly made public in English, therefore, to reflect on Brazil's smart cities approach, the case study turns mostly to Rio to reflect on some initiative examples.

5.4   Brazil's approach to smart cities

Brazil's smart cities or rather, digital journey can be traced from as far back as the early 2000s. From earlier on, the federal government stepped up efforts to invest in the digital infrastructure to reach the majority of the people across the country. The main rationale behind this was to improve the relationship between the federal government with its cities and citizens. Over the years, Brazil has developed an array of e-government systems to better interact with its citizens, such as the national citizens' portal, Portal de Serviços.

Brazil realises that the first step in becoming "smart" is to connect its citizens in order to enhance public participation in policy development, planning and urban management. It recognises that the ICT infrastructure is a basic condition for the development of *smart cities* actions (Przeybilovicz *et al.*, 2018). Through collaborative partnerships with both international and local private companies such as Intel, Cisco and Alvarion, amongst others, the federal government made strides towards expanding its ICT infrastructure. Intel, through its 'World Ahead' programme, rolled out wireless broadband programmes in a number of Brazilian cities between 2006 and 2009; while Alvarion has since 2010 been deploying wireless broadband across dozens Brazilians towns and cities to power e-government systems and public safety tools such as surveillance cameras. The 2013 IBGE Survey of Basic Municipal Information reveals that in 2013, for the first time, more than 50% of Brazilians had access to the internet (IBGE, 2013).

Over the last two decades, the national government had launched an array of plans and programmes in an effort to expand connectivity infrastructure across Brazil. Eminently, the federal government took a countrywide approach in 2009 and introduced the National Broadband Plan (NBP) to bolster internet access in the country

(Falch et al., 2018). The IBGE study showed that in Latin America, Brazil is the leader in the number of devices in use (cell phones or smartphones) (Schreiner, 2016).

In recent years, the government, through programmes such as Digital Cities and Telecentres, has sought to promote digital inclusion in small municipalities with little connection infrastructure as well as in more vulnerable areas (Vannini et al., 2017). Under the supervision of the then Ministry of Communications, the Digital Cities Programme was oriented to provide municipalities of up to 50,000 inhabitants with technological infrastructure to improve the management and the provision of public services.

i.   Brazil's smart cities key focus area

With the ICT infrastructure and broadband penetration strengthened, a number of Brazilian cities have begun the process of branding themselves as smart and have ultimately developed public policies aiming at maximizing the use and application of ICT. For example, the Smart City Plan of Rio de Janeiro focuses on employing ICT to connect its citizens with the government more efficiently. The basis for the development of the Plan was to strengthen the local government's relationship with its citizens. This is the same rationale that the federal government of Brazil strongly advocates. It is important to mention that the information about Rio's Smart Cities Plan was sourced from academic literature and the Plan itself could not be located on the internet (e.g., Schreiner, 2016).

Integrated management of cities as well as improving the relationship between government and citizens are the two themes that seem to be receiving lot of attention in Brazil's smart cities approach. Brazil's urbanisation and the poor quality of life in the largest cities and metropolitan areas have highlighted the need to strengthen integrated planning and management of cities, and the participation of the population in the decision-making process was indicated as even more essential. All of this requires an integrative approach. Brazil's integrated approach to city management does not only mean integration of information, technology, systems, infrastructure and services, but for sectoral policies as well.

Curitiba's transit-oriented development is often cited as a good example of integrated development approach. The city of Curitiba introduced a lower-cost bus rapid transit (BRT) system that was implemented in conjunction with a land-use policy. This has

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ultimately intensified land use within the proximity of the BRT corridor. Brazil's smart cities approach reflect the concept of systems of systems; where every aspect of the city ought to function as an integral part of the whole system.

The Operation Centre (COR) initiative of the city of Rio de Janeiro is perhaps the most well-known example of how the city is approaching integrated city management and fostering efficient public engagement. This integrated management system prioritises issues such as transport and mobility, citizen safety, responses to emergency, environment, energy efficiency, communication with citizens and citizen participation (see Schreiner, 2016). The COR's primary function is therefore to assess and control traffic, keep an eye on the weather, coordinate emergency responses, and coordinate the city's agencies. The initiative has received considerable attention under the smart cities umbrella. Through the COR, the government of Rio de Janeiro interact with its citizens because they believe that strengthening the relationship with the people contributes to smart development. The COR project is often cited as a good example of the institutionalisation of a close relationship with the citizens.

Set up in 2010, prior to the major sporting events i.e. FIFA World Cup in 2014 and the Olympics in 2016, COR operates as a centre where the local government continuously monitors the city using real-event data that is coming in from the public. It is the centralised system that has become a platform to guide smart city investments and foster innovation in urban management. To ensure that COR stays operational and that it is inclusive, the local government began with the expansion of its telecommunication networks and set up a Digital Inclusion Program to track the population's access to new technologies, particularly in disadvantaged communities.

ii. Framework guiding smart cities

Although there have been several references made about Brazil's smart cities initiatives over the years, Brazil had only recently (in July 2019) announced its smart cities national plan. This nation-wide program called the *Programa Nacional de Estratégias para Cidades Inteligentes Sustentáveis* (National Program on Strategies for Sustainable Smart Cities) was launched by the Ministry of Science, Technology, Innovation, and Communications. Alongside this plan, a national smart cities chamber, which will spearhead the smart cities initiatives, will be established. There is not much information publicly available on both the plan and the chamber. What could be gathered is that the plan is still in an embryonic stage; and it aims to establish indicators

and goals as well as implement solutions to turn Brazilian cities into smart cities; how this is to be facilitated, remains unclear (see AgenciaBrazil, 2019: *https://agenciabrasil.ebc.com.br/geral/noticia/2019-07/governo-lanca-programa-de-estrategias-para-cidades-inteligentes*). As mentioned earlier, the city of Rio also seems to have a Smart City Plan, which as indicated by Schreiner (2016), consists of initiatives and projects that integrate the strategic planning of the local government and further strengthen the relationship between the citizens and government. From the national government, initiatives such as the National Front of Mayors, My Intelligent City Program of the Ministry of Science, Technology, Innovation, and Communications, contributed as public policies for the implementation of the smart cities concept in interested cities.

iii.   Institutional set up / organisational structure

In the case of Rio, the local government is responsible for the Operation Centre under the control of the mayor. The leadership of local governments is highlighted, but with an important role of private initiative and entrepreneurship for the search and implementation of technological solutions. The COR centre provides decision-making support for over 30 organisations in both local government and the private sector (Gaffney and Robertson, 2018). It comprises a number of government departments and institutions and they include the state and the federal government. It also collaborates with private agents such as IBM and ORACLE (for technological and financial support). IBM is actually the developer of the COR initiative and has provided infrastructure at the COR centre. The financing of the initiative was through public-private partnerships with IBM. Citizens engage with COR via social media platforms such as Twitter and Facebook, mainly to request information and report local issues.

The main agencies and utilities integrated into COR include 17 municipal agencies from social development to urban cleaning, and seven state and federal agencies and utilities i.e. electricity, gas, civil defence, water and sewage, highway, and two transport agencies. The model of multi-agency cooperation and integration is clearly prioritised by the city of Rio (Schreiner, 2016).

An important actor in the integration of the state actions and federal institutions is the Command and Control Centre (CICC). It is the Secretary of State for Public Security, and is external partner of the COR. CICC however, acts within the state power. Its role at COR is to constantly manage and monitor the integration of actions as well as

enhancing integration between agencies and utilities in support of local government's decision making. This is an example of how the city of Rio (through institutional set-up) attempts to facilitate integration.

iv.   Implementation approach

The implementation of the COR initiative was supported by more than 15,000 public officials who were trained for coordinating activities between agencies. To achieve the officials' commitment, Rio embraced different approaches, which included a cultural shift in organization management, technical and political leadership, putting in place economic incentives that are attached to the performance and the achievement of the goals as set out by the strategy of COR. The incentive scheme includes professionals in the citizen support services such as teachers and doctors, as well as the policy makers (Gaffney and Robertson, 2018).

The COR operations are executed in a collaborative and coordinated manner where more than 300 local and state agencies and utilities are integrated in one environment. In this environment, nearly 500 professionals take turns in shifts, 24 hours a day, seven days a week, devoting full and close attention to everything that happens in Rio, hence the COR assumed the title "watchful eye" of the city (Gaffney and Robertson, 2018). The joint work also depends on the dedication and concentration of efforts of representatives of municipal agencies such as CET-Rio, which is the traffic management agency in the city, and the Municipal Guard, as well as of partners such as companies and utilities, with a permanent presence at the Operations Room of COR.

5.5   Comparison of Rwanda and Brazil's smart cities approach

Although Rwanda and Brazil's smart cities are unfolding in different contexts (spatial, social, economic, administrative and political), and are at different stages of development and implementation, there are some emerging similarities in the way these countries have embraced (are embracing) the concept. In this section, I unpack some of the emerging similarities and differences in how Brazil and Rwanda have approached smart cities. This is done in a form of a comparative analysis.

Two things prominently stand out from both countries in terms of how they have (earnestly) begun their smart cities journey. Firstly, both countries began by **expanding their ICT infrastructures** –throughout the country. They have developed programmes in attempts to ensuring that "no one is left behind" in the journey to "smartness". For example, Rwanda has rolled out the One Laptop per Child Programme under NICI II (national ICT strategy); while Brazil has adopted programmes such as Telecentres and Digital Cities to ensure inclusivity in access to ICT. Furthermore, as part of ensuring universal access to ICT, Rwanda has invested significantly in ICT infrastructure provision for all schools since 2008. The two countries' smart cities initiatives are thus unfolding in environments already highly penetrated with broadband and ICT infrastructure, even though this might not be evenly distributed across the countries. Furthermore, Brazil, more specifically the city of Rio, took an extra step to ensure that smart cities are inclusive, through the Digital Inclusion Program. Through this programme, the city tracked the citizens' access to technologies. In this way, the city could establish which communities are left out and how to respond appropriately to this.

Secondly, both countries have begun their "smart" journey by **selecting few domains or areas** that they identified as important to focus on. However, the way this is approached by the countries is of course different. For instance, Rwanda's smart cities seek to drive/realise its 2020 national vision of transforming its agrarian economy to a knowledge-based society whereas the smart cities approach in the case of Brazil seems to rather be taking an integrated approach. Brazil's integrated approach implements the smart initiatives to challenges as they unfold. For example, the operations at COR such as the monitoring of the city 24 hours, 7 days per week for crime and other emergencies through surveillance cameras, is a direct response to the high crime levels that the city of Rio is mostly known for.

The **role of national government** (federal in the Brazilian context), was also found to be different between the two cases. For Rwanda, the national government, through the Smart Cities Masterplan, is driving the smart cities agenda (although local government implements the initiatives); whereas in the case of Brazil, local government mainly drives the agenda and the implementation thereof, and as far as it could be established, the federal government is simply a partner in the smart city initiatives and not the driving agent. In the case of Rwanda, the national government had set out smart cities strategies and initiatives that cities can consider implementing. Rwanda's national approach to smart cities was also noted in how the country established, at the

onset, a nation-wide understanding of what smart cities entail for the Rwandan context. This approach seems to not be the case for Brazil.

Another key similarity in the approaches was identified in how both countries facilitate **partnerships with the private sector**. For both countries, the private sector is afforded a prominent role to play i.e., to provide technological solutions. However, both countries made it clear that government is to drive and remain in control of the initiatives with the support (financial and technical) from the private sector. In both cases, the local government or cities are to be the primary agent in the implementation of smart cities. Their role is to ensure that the technological solutions that are provided by private companies are effective and deliver quality services.

Both cases **emphasise the people** i.e. improving government relationship with the people, engaging the citizens in policy development, and creating platforms for communities to contribute in the smart city initiatives. Both Rwanda and Rio have platforms where the public takes part. In pursue of being people-centric, Rwanda took an "additional" step, which focuses on social development. This was noted by how the country set up various education and skills development programmes such as the One Laptop per Child programme. The country is also targeting the recent competency-based curriculum (2017) to introduce innovative processes in schools.

Table 2 summarises the key findings that emerged from the comparative analysis of the cases.

Table 2. Comparison of Rwanda and Brazil's mart city approaches

Aspect	Rwanda's approach to smart cities	Brazil's approach to smart cities
Availability of guiding framework	Rwanda has a nation-wide Masterplan that guides its cities' in branding themselves smart; and this sets out a countrywide contextualisation of what smart cities entail for Rwanda.	Brazil' smart city national plan as it seems, is still in an infancy stage of development. The plan could not be located on the internet.

Aspect	Rwanda's approach to smart cities	Brazil's approach to smart cities
Smart city focus domains	Key focus domains are good governance, and education and skills development.	Key focus domains include strengthening relationship between government and citizens, and integrated urban planning and management.
Overall approach of the smart cities agenda	Rwanda's smart cities projects are towards realising the country's Vision of transitioning the economy from primarily agrarian to knowledge-based society.	There is no clear countrywide Vision that smart cities initiatives aim to achieve. For Rio, the smart cities approaches are integrative to realise sustainable urban development and management.
Who is to spearhead smart cities	Local government is the primary driver of the initiatives, including the setup of financial models and sourcing of resources, national government provides strategic guide for local government to implement smart cities.	Local government is a driver of the initiatives with federal government as partner.
Role of private sector	Private sector plays supporting role in terms of finance and technology provision, but government remains in control.	The private sector (primarily IBM) is a primary provider of technological solutions.

5.6   Conclusion

There are various approaches to smart cities and as such, countries and cities choose what best suits their needs and context. In this chapter, Rwanda and Brazil's smart cities approaches were described (in section 1) and compared (in section 2). The findings of the first section were described under four broad categories where 1) I looked at the smart city key focus domain in the country's approach, 2) whether the country has a nation-wide strategy or a plan guiding its cities towards "smartness", 3)

if there is an institutional set-up for spearheading smart cities, and 4) how smart cities are generally implemented.

What emerged eminently from the findings was that the countries approaches were at different stages of adoption. Rwanda's smart city journey is at a relatively early stage of development while Brazil has been in the smart cities arena from as early as the 2000s. How the countries adopt the concept was also noted to be different. For Rwanda, the central aim of smart city approach is to realise its 2020 Vision of transforming the country from agrarian to a knowledge-based society. At the same time, Rwanda is adopting smart cities to manage the challenges that are presented by urbanisation. Brazil on the other hand, specifically Rio, is adopting smart cities to enhance integrated urban management.

There were various other differences and similarities (i.e. the role of local government) noted in the countries' approaches. These points to how the countries choose to approach the concept within their own context. It should be re-emphasised that Brazil's smart cities approach is mainly described from what could be gathered from the case of Rio since information on the country's approach was limited on the internet, and where available, the information was mostly in Portuguese. Rio's approach, is not a generalisation of how Brazil as a country approaches smart cities because each city in a country approaches (should approach) the concept differently.

6 CHAPTER SIX: ANALYIS AND DISCUSSION

This chapter presents the analysis of Brazil and Rwanda's approaches to smart cities as considered within an interpretivist paradigm. Part of the discussion seeks to reflect on some of the commendations and criticisms that the countries' smart cities approaches have received in the literature and public media. To frame the discussion, the smart cities approaches are analysed under the five criteria that have been identified (through the literature review) as relevant to assess any smart city approach particularly of the cities of the Global South (see the methodology Chapter for the synthesised description and rationale of the evaluating criteria).

The primary goal of the discussion is to provide a rigorous reflection of the two cases to better frame valuable lessons for South Africa's own journey towards "smartness". The criticisms of the approaches can thus caution South Africa's smart cities approach while the commendations can provide some positive direction of what South Africa can consider when adopting smart cities. In both cases, the country's unique context should be taken into consideration.

The chapter consists of two sections which are structured around the two research questions. The first section reflects on the overall approaches to smart cities, assessing them against the following criteria: (i) the approach is context specific/ respond to specific local challenges; (ii) it seeks to improve quality of life of the people in the city; (iii) the public participates in the initiatives; (iv) the approach embraces partnerships with the private sector and other spheres of government; (v) the initiatives aim towards sustainability. A synthesised discussion on the lessons for South Africa is presented in the second section.

6.1 Smart cities approaches of Rwanda and Brazil: some reflections

i. Context is important

Ample literature on smart cities, especially in the case of countries of the Global South, strongly advocate for smart city initiatives to be **context specific** and respond to specific local challenges (Aurigi and Odendaal, 2020; CSIR, 2020; Stratigea, 2012).

This group of authors call for a thorough understanding of the setting, as well as the unique requirements of the place where the smart cities ideas are to be implemented. The approach of selecting key focus domains in the case of Rwanda and Brazil reveal how both countries seek to respond to their unique urban challenges. At a high level, both Rwanda and Brazil through smart cities, seek to respond to the rapidly urbanising and competitive urban context that confront many cities in the 21st century. Rwanda's approach in responding to the local context however reveals an interesting trajectory that goes beyond addressing just the challenges brought along by the urbanisation phenomena; the country seeks to establish smart cities within the current policy and institutional context. The approach of implementing smart cities initiatives that respond directly to the national Vision and the pillars in the existing plans and strategies is worth applauding, as the journey to smartness in this case, does not set the country on an entirely new track.

On the contrary, even though Brazil's integrated smart urban management approach does seek to address the city's context specific challenges, the approach, specifically Rio's COR strategy, has received a number of criticisms for ignoring the current urban planning and policy context (Gaffney and Robertson, 2018; Jaffe, 2016; Singer 2012). Gaffney and Robertson (2018) have criticised the strategy for not having any traces of integration with urban planning, and for not revealing evidence that the data collected by COR is collected to inform the planning agenda. Rio's approach is thus reactive and not proactive –it is what I call an "ad-hoc" approach. Furthermore, the COR strategy has been accused of resembling pre-packaged technology solutions mainly by IBM (the primary technology provider of COR). Aurigi and Odendaal (2020) call this pre-packaged approach the "smart in a box", and they argue that this kind of approach ignores the urban context and is thus weakening the "ability of smart to be inclusive and make cities resilient".

There was an even more concerning gap noted in both countries smart cities approaches. What could be gathered from analysing both countries' approaches was that, there seems to be a neglect of the political context within which smart cities are to be implemented, and this context is usually unstable and can push smart cities on a very different trajectory. What emerges from both cases is a rather "de-politicized" approach to smart cities that does not shine light on how political rivalries, motives, corruption, and impunity are to be addressed. It would however be irresponsible to not acknowledge Rwanda's "recipe" which set out how local authorities must go about "becoming smart" – the 10 early decisions in the Masterplan. These unfortunately do

not address the higher political motives, influences and powers that are usually at play when we speak about urban strategies.

ii. Smart cities should aim to improve quality of life

Cities face many challenges that cannot (and should not) all be solved by putting in place smart technologies. It is however generally accepted that at the forefront of any smart city strategy, there should be an aspiration to improve **quality of life** of the people in the city (CSIR 2020; Aurigi and Odendaal, 2020; SACN, 2020; Gaffney and Robertson, 2018). This is evident in the smart cities approaches of both Rwanda and Brazil. Rwanda aspires to improve quality of life mainly through social and economic development while Brazil through integrative urban management. Rwanda set this aspiration at national level while Brazil at city level. Brazil's city level approach however raises a concern about how distributed the benefits of smart city initiatives are across the country. As asserted by Gaffney and Robertson (2018), an approach such as this (where there is no national vision guiding the smart cities strategies), may actually contribute to the fragmentation of urban spaces, exacerbate socioeconomic inequalities, and cause political divides in the country. For Brazil, the reality of the sprawling mega-city, which suffers from social inequality, high crime rates, and acute environmental issues should be cautioned under the 'smartness' brand.

Although the initial motive for setting up the COR centre back in 2010 was relevant considering the aftermath of the 2009 landslides, and in preparation of the two major sporting events, it can be argued that COR now needs some major "re-structuring" if it is to operate under the smart city umbrella. Under COR operations, Rio's smart cities approach has now become more about systems and their efficiency than it is about ensuring that the basics are in place and that quality of life is improved. As revealed in the research by Gaffney and Robertson (2018), Rio's emphasis on efficiency in city operations and utility management has not in most cases translated to equitable improved quality of life in the city.

Smart cities as described by Nam and Pardo (2011), should integrate human, institutional and technological aspects. What becomes discernible from Rio's integrative smartness approach, is however a greater focus on the technology than on the other two aspects. The approach seems to be treating the city as a technology itself, and the tools for urban management have become more important in the narrative than the actual impact and the management behind their implementation.

Even more worrying, the fieldwork study of the centre by Gaffney and Robertson (2018) revealed that most of the smart technologies that COR manages were concentrated in wealthy areas thus further exacerbating pre-existing inequalities.

iii. The public should participate in smart city strategies and initiatives

As with many urban planning and development strategies, **public participation** is an important element of the smart city discourse (Simonofski *et al.*, 2019). How both countries approached this was to start by expanding their ICT and broadband infrastructure, and setting up programmes for the public to partake in smart city policy development processes –more noted in the case of Rwanda than Brazil. For both countries, public engagement is closely linked to achieving transparent governance, which has found prominence in the smart governance domain. The questions of how inclusive, efficient, and at what level and how the public participates in smart cities, are unavoidable.

Rwanda's approach in the domain of public participation is still at an abstract level. The Masterplan fails to establish (practically) how public participation (as a process) is to be facilitated. What the Masterplan shines light on is only how the public can provide information that would inform "smart" urban planning and development. Similarly, Rio's citizens are only engaged in providing information, which in this case is done via social media platforms. As highlighted by Gaffney and Robertson (2018), Brazil's whole systems approach in large urban centres such as Rio has not been the subject of critical engagement with the public.

Brazil has not had a close relationship with its citizens. The tradition of widespread public participation in some Brazilian cities such as Rio is unconventional; this has in turn generated a culture of mistrust between residents and their government (Gaffney and Robertson, 2018). Even of greater concern is the fact that Rio seeks to privatise public services; this could limit the engagement of citizens in the services offered to them thus further exacerbating the strained relationship and mistrust between government and its citizens.

From both countries' approaches, there seem to be some level of neglect on how the citizens are to be "meaningfully" engaged, that is, from the start of the smart city initiative to the end; and how the public is to inform decision-making is even more unclear. Public participation in smart cities should go beyond just having the public

providing information i.e. traffic updates, utility reporting, crime alerts etc. The public needs to be exhaustively engaged in the decisions that are made around smart city initiatives, from the inception, the implementation and the management of the initiatives. This is essential in ensuring the sustainability of the initiatives.

iv. Appropriate partnerships are essential

Appropriate **partnerships** involve having a clear definition of the role of each partner in the endeavour. In this regard, partners should share the same values and objectives (CSIR, 2020). Partnerships in smart cities discourse often include two key aspects: financial and service provision support. Both Rwanda and Brazil have given the private sector a prominent seat in the smart cities arena to fulfil the two roles of financial and technological support. Rwanda advocates public-private partnership (PPP) rather than having the private sector drive the smart city agenda. How PPP is to be established and who play what role and how, is not as clear in the country's Masterplan. Moreover, how different levels of government are to collaborate on the smart cities agenda is also not clear. The Masterplan does not go any further than emphasising the need to attract private sector investments and highlighting that local government should remain in control of any financial and service provision model. A lack of clearly defined roles could create conflicts in how the initiatives are implemented; this could in turn jeopardise the success and impact of the initiatives.

Brazil's relationship with the private sector on the other hand is one that is greatly criticised in the popular media discourses (Singer, 2012; The Smartcity Journal, 2020). The COR centre is crippled by private sector interest and the role of local, state and federal government is obscure. COR is primarily driven by IBM; and how this was done is quite unsettling. According to Gaffney and Robertson (2018), IBM has asserted its vision of a smart city, identified Rio's problems and put forward its pre-packaged solutions to fixing those problems. The neglect in establishing appropriate partnerships and defining roles in this regard has resulted in a strategy that is technology- centric and not people-centric. Whom you collaborate with thus have a great impact on the route that the strategy will take and its impact thereof.

v. Smart cities should be sustainable

A smart city is one that also leverages technology to **promote sustainability** in cities. Sustainability in this regard goes beyond the bounds of environmental sustainability; it

extends to social and economic sustainability and it is closely linked to resilience of the smart projects. Both countries emphasise the term "smart sustainable cities". This is however not elaborated any further in the countries' published documents on smart cities, and it is not clear how they are going to ensure sustainability. The mentioning on this term in the documents resembles a "cliché" statement that requires further interpretation by the reader of these documents.

For Rwanda, my best interpretation of how the country aims to achieve long-term sustainability of the projects is by ensuring that projects are based on local financial models and resources; ensuring that the local government remain in control of the projects. The latter extends to Brazil, who also emphasises the role of local government in driving smart cities initiatives but what could be gathered from the case of Rio is far from this recorded statements.

6.2   What South Africa can learn from Rwanda and Brazil

The smart city concept has been placed on South Africa's development agenda by president Ramaphosa in his two consecutive State of Nation Addresses (SONA – June 2019 and February 2020: https://www.gov.za/state-nation-address). Inevitably, the country is joining the drive to brand its cities as "smart". This journey is unprecedented for our country, but considering that other countries such as Rwanda and Brazil have already embarked on the smart cities journey, we can seek (best) principles and practices that are applicable to our unique situation -this is the intention of this section -this is the intention of this section. It should be pointed out that the lessons set out here are not intended as a replica or a clone of any smart city strategy of any country. South Africa would have to work out its own smart cities strategies that is best for the specific needs of the country.

The lessons presented here merely serve to guide the overall approach and can either inform smart cities policy or framework development, implementation of the smart city initiatives, and the institutional set-up, amongst others. The lessons are also not based on the success stories of Rwanda and Brazil's smart city approach, as this was not evaluated. The following can be considered:
- At national level, South Africa should consider establishing the concept of smart cities within its current national vision and policy context as Rwanda did i.e.

within the Urbanisation Policy and the national Vision 2020. Smart cities initiatives in South Africa can therefore help enable and fast track the national vision of eliminating poverty and reducing inequality by 2030 as set out in the country's National Development Plan. Every smart city initiative should thus be aligned with the six pillars in the NDP, and the initiatives should not set the country on an entirely new track.

- The Constitution has already mandated local government to spearhead development and this sphere of government should therefore be the driving agent in the smart cities movement (with the support of other government spheres and private sector). Thus, smart cities should be implemented within the current institutional set-up of local government. It is paramount for municipalities to strengthen its institutions, build the capacity of its authorities and public servants, forge partnerships and clearly define roles of each role player.

- At local level, smart cities should support the current vision and development objectives that are set out in the current strategies and plans of local government i.e. the IDP. Ideally, the vision should be in line with the local vision that is stated in the IDP.

- To ensure that smart cities are inclusive and widespread, as a point of departure, South Africa should consider investing in providing universal access to ICT infrastructure as Rwanda and Brazil did. There can also be great value in tracking the progress of providing this essential service through programs such as the Digital Inclusion Program of Rio de Janeiro.

- Not all urban challenges require a smart cities approach. At the onset, the local government should set forth the most pressing needs in their municipality and then set out the key focus domains that can be addressed by smart city strategies. Improving quality of life should be at the fore of any smart cities strategy.

- Citizens should be engaged throughout the planning and development process of any smart city initiative, from the development of smart cities strategies and objectives, to the adoption of the initiatives, their implementation and all the

way through to the management and monitoring of the strategy. It is important here to set up a more effective medium of engagement or platform to engage the citizens.

- For the national framework that is to guide South Africa's cities, an important lesson can be drawn from Rwanda's Masterplan. The document starts by clearly stating what smart cities entail for the Rwandan context; defining this with various stakeholders including civil society can go a long way in ensuring a common understanding of what smart cities is and is not. For the citizens it can clarify any misconceptions and even more importantly, manage the expectations of what smart cities can deliver. Moreover, as the Masterplan does, for each initiative the framework sets out, it needs to be made clear on what level (i.e., city, town, secondary town) the initiative is to be implemented –this should however serve as a starting point and should not limit cities in what they can and cannot implement.

- The framework should also not resemble a rigid document that is out of tune with current planning thinking, it should indicate how it fits into the current planning context and how it synergises with existing plans.

- From Rio, we can certainly learn about the importance of integration of departmental projects, by having an actor (CICC in the case of Rio) who ensures that projects are well coordinated and integrated between sector departments and governments. This can go a long way in combating 'siloism'. As a starting point for South Africa, the intergovernmental structures have to be strengthened.

- Above all, South Africa should be cautious about not emphasising technology above citizens' needs and the existing urban challenges such as inequality and poverty. We must strive by all means necessary, to avoid the pre-packaged technology solutions – a lesson from Rio. The technological solutions we put in place must act as enabler to meeting the needs of residents and addressing the urban challenges and not serve as a starting point to how we shape an urban area.

6.3   Conclusion

In this chapter, Brazil and Rwanda's smart cities approaches were evaluated (against) and discussed (under) five criteria, which in this study are considered relevant and important for any smart city approach in the Global South context. Although the countries met some of the criteria, in some instances I had to make speculations on whether the criteria was met or not because this information was not clear from the documents that were sourced. Each country seems to be approaching smart cities within their own context, however for Brazil this "context" is not as clear because of the lack of a set Vision at national-level, or city level for that matter. Brazil, specifically seen in the case of Rio's COR, is implementing smart cities to urban challenges as they unfold, thus indicating a reactive and not proactive approach to smart cities. This was noted as one of the "mistakes" that South Africa should avoid. Embracing partnerships is important in the smart cities journey. Even more so important, is to clarify the role of each stakeholder in this partnership -something that South Africa can learn from Rio's "fault-line", whose smart city agenda is driven by the private sector even though documents states that the city is in control. On a last note, smart cities should strive towards achieving sustainability and more importantly, improve the quality of life of the citizens. Any approach to "smartness" that is detrimental to any member of the society or does not benefit the community, seems rather wasteful.

7 CHAPTER 7: CONCLUSION

7.1 Summary

South Africa is embracing "new" –more innovative approaches to addressing its urban challenges, and the country is entertaining the concept of smart cities. This study comes at a time when discourses in South Africa's urban planning arena are mounting as proponents of the concept seek the best approaches to the concept. The study sought to contribute to these ongoing endeavors by looking at how other countries, specifically Rwanda and Brazil have approached the concept of smart cities and then from this, it drew key lessons for South Africa on how it can approach the concept.

For Brazil, who lacks a broad national vision, its smart cities approach resembles a proactive approach rather than a reactive one; this is an important lesson for urban planning in South Africa to caution, considering that planning in this country has been accused of neglecting the future. It thus remain necessary to pursue the smart city concept within the set vision –a take away from Rwanda, who is pursuing smart cities within the current national vision. The study also noted that the complexities and ambiguities associated with the smart city concept itself have often created roles confusion, which has in some instances, opened up opportunities for the private sector to drive its own agenda that does not always look out to the best interests of the broader community. As an important lesson for South Africa, role definition should thus be clearly stated at the outset.

More eminently, the findings that came out of the two case studies highlighted the need to contextualise (from the onset) the concept of smart cities. This has also been advocated by a number of authors in the literature, mainly cautioning cities of the Global South to consider their unique context and to adopt smart cities such that they respond to specific local challenges. This is because the smart city concept has often been viewed through the Global North lens, which does not speak to the highly urbanising and greatly distressed Global South context.

7.2 Final thoughts

South Africa is confronted by numerous urban challenges which undoubtedly need smart but also sustainable, people-centric approaches. While the smart city concept

can be the aid that the country needs to address its challenges, it should be remembered that not every challenge requires a "smart-ICT"-based solution. Any smart city approach should thus aim at improving quality of life. We can learn from the current Coronavirus pandemic, which has posed a major thread to the quality of life of many South Africans; thus a study such as the present, remain relevant now more than ever.

This study met its set objectives. The lessons that are provided for South Africa, can be a foundation for any smart city strategy in South Africa, or any country with similar urban conditions; however, the lessons should be altered to fit specific local context that should be well understood before considering any smart city approach.

7.3 Future research

The concept of smart city remains relatively new in Africa and requires further exploration. Therefore, within the African context, future research can explore the following:

- The challenge of how smart cities can/should "navigate" around the issues of political instability, motives and powers, which have previously jeopardised many urban planning strategies, is worthy of exploring.
- Studies that have explored/speculated how ICT and smart cities will shape the urban environment have mainly based their research of theories; therefore, this can be expanded to empirical research.
- There remain a gap in comparative studies especially on comparing approaches to smart cities. As an area of consideration for future work, international comparative research can expand beyond the comparison of smart initiatives.

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