SMART CITY READINESS IN SOUTH AFRICAN MUNICIPALITIES: A QUALITATIVE STUDY

Prince Chukwuneme ENWEREJI[1]*

Dominique UWIZEYIMANA[2]

Abstract

This study investigated the meaning of a smart city concept, the limitations of municipal role players to adopt the smart city, and the recommendations to facilitate the adoption of a smart city concept in the municipalities of the North West province. A qualitative research approach was adopted to collect data from the participants, which facilitated adequate interactions with the participants through open-ended interviews. Twenty participants were selected purposively to participate in this study through an online platform. Data were analysed using Atlas-ti software (version 8.2), themes and categories were generated and discussed. Findings from the study depict that a smart city concept entails a city that enables communication using advanced technology, big data, the Internet of Things (IoT), and the Industrial Internet of Things (IIoT). Findings further revealed that the limitation of achieving a smart city in South African municipalities includes a lack of financial resources, inadequate infrastructure, delays in the decision-making process, lack of strategic leadership, corruption of role players, inability to implement research outcomes, and lack of investors. The study recommended, inter alia, that the municipal leadership should encourage techno-centric governance, a source for external funding, engage knowledgeable strategic leaders, facilitate public education, and SMME ICT inclusive strategy.

Keywords: Smart city; Information Communication Technology; Innovation; Governance; Municipalities.

1. Introduction

The smart city concept continues to gain acceptance as more connected innovations evolve. In the Fourth Industrial Revolution era (4IR), the smart city approach can be viewed as a major strategy to improve the quality of life of billions of people living in

[1] *School of Public Management, Governance & Public Policy, College of Business and Economics, University of Johannesburg, South Africa, prince.enwereji@yahoo.com*

[2] *School of Public Management, Governance & Public Policy, College of Business and Economics, University of Johannesburg, South Africa, dominiqueu@uj.ac.za*

* Corresponding author

cities worldwide (Echendu & Okafor, 2021). Smart city readiness entails the adoption of technological innovation, information, and communication technologies by the role players to disseminate information to the citizenry to improve performance, quality of services, and welfare maximisation. Smart city adoption assists cities and governments in meeting the challenges of urban and rural governance to become more competitive and address sustainability issues. In this regard, Monzon (2015) affirms that the smart city approach is emerging as a way of solving entangled municipal problems.

To improve municipal operations and services, the smart city concept integrates information and communication technology (ICT) with a large number of physical devices connected to the Internet of Things (IoT) network (Das, Sharma, & Ratha, 2019). This allows the local officials to communicate directly with the people and monitor what is happening in the communities (Caragliu & Del Bo, 2019). ICT can be used to increase the quality, performance, and interactivity of urban services while also lowering costs and conserving resources. Housing, transportation, sanitation, medical services, utilities, land use, production, and communication networks all benefit from a smart city adoption (Randhawa & Kumar, 2017). According to the United Nations (2018), urbanisation is likely to accelerate in the coming years. Currently, roughly 55% of the world's population live in a metropolitan or urban setting, with that percentage expected to rise to 68% in the coming decades. Smart technology will help cities maintain expansion while also enhancing the efficiency for the welfare of the citizenry.

Sikora-Fernandez and Stawasz (2016) affirm that rural communities in South Africa face various challenges, including a lack of ICT resources, limited formal education, insufficient training, and capacity building. Others include financial constraints, political, social, and cultural challenges. Due to these issues, smart city's potential contribution to poverty eradication and service delivery has not been known (Sikora-Fernandez & Stawasz, 2016). Recent studies on smart city readiness in general focus on concerns of infrastructure and skills availability with less emphasis paid to readiness of municipalities to adopt the concept. Therefore, this study aims at investigating the smart city readiness and the limitations of adopting the concept in South African local municipalities while focusing on the local municipalities in a district municipality of the North West province.

## 2. UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY (UTAUT)

This study is underpinned by the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh *et al*. (2003) theorised the Unified Theory of Acceptance and Use of Technology in 2003, which integrates different views on the user and innovation acceptability (Williams, Rana, & Dwivedi, 2015). The UTUAT theory, as postulated by Venkatesh *et al*. (2003) is based on the model presented in Figure 1, which includes four key constructs that shape the theory. These constructs include performance expectancy, effort expectation, social influence, and facilitating conditions. These constructs enhance behaviour intention and usage and these are also moderated by gender, age, experience, and the voluntariness with which they are used (Williams *et al.,* 2014: 444).

The four elements of the UTAUT model, according to Venkatesh, Morris, Davis, Davis (2003), are the major determinants of behavioural intention to use technology. The goal of adopting this theory is to better understand why users accept or reject a specific technology, as well as how technology design might promote user acceptability. The UTAUT assumes that the intention to use technology, which is invariably influenced by the four determinants, triggers the actual usage of technology. According to Venkatesh et al. (2003), the most important intervening variables that mitigate the effects of the four dimensions on the behavioural intention to use the system are gender, age, and experience. The users' willingness to use a system is also a moderating aspect of social influence on their behavioural intention to use it.

In the specific context of this study, the four constructs identified in the UTAUT are fundamentally adopted, considering that the emphasis is on the owner (municipalities) rather than the user (residents). This stems from the fact that the adoption and use of technology are driven by the municipalities who make soluble policies and take the final decision to adopt or not adopt a particular technology. Therefore, the focus on behavioural intention toward the adoption of a particular system is crucial in the adoption of emerging technologies in the municipal sectors of the North West province. The adoption of this theory will assist in explaining the intentions to adopt the smart city concept and will reveal subsequent usage behaviour of technologies in the municipalities of the North West province. Figure 1 presents the UTUAT.

Figure 1: Unified Theory of Acceptance and Use of Technology (UTAUT)
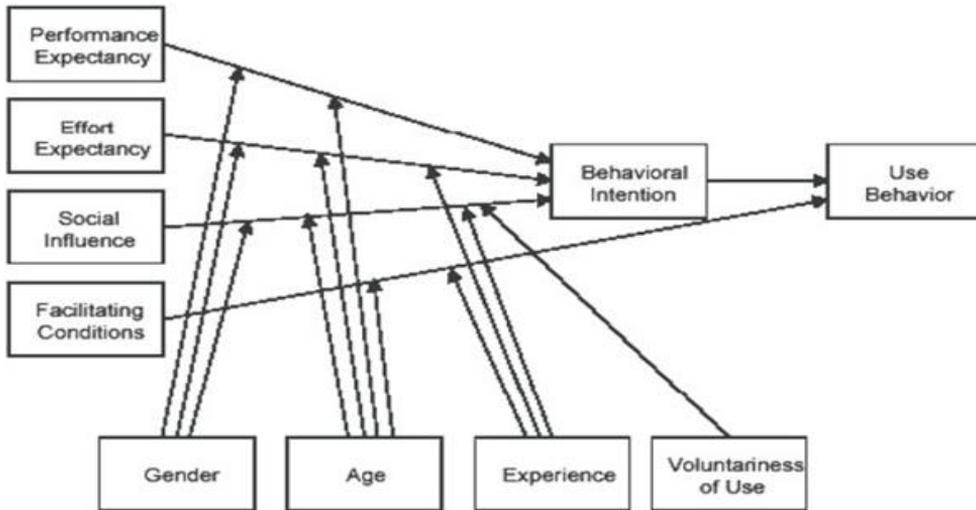
Source: Williams, Rana, and Dwivedi (2014).

3 Smart city perspective in local municipalities

A smart city does not have a common definition but has been defined by a number of scholars to include the adoption of information and communication technology (ICT),

universal connectivity, big data or open data, creativity, social capital to disseminate information and to address social issues (Praharaj & Han, 2019). Several schools of thought and approaches to developing smart cities have arisen, each with its own set of considerations and viewpoints. A smart city is modern creativity that uses contemporary and digital technologies to improve efficiency in all aspects of urban life (Cavada, Hunt & Rogers, 2015; Datta, 2015).

In many countries throughout the world, and in academic literature, terms like smart city, smart growth, digital city, and intelligent city have become more relevant in the last twenty-five years. Mori and Christodoulou (2012) opine that understanding these terms is critical since smart city adoption is one of the most important aspects in enhancing social, economic, and environmental growth. Smart cities may mean different things to different individuals, but it is paramount to understand that a smart city approach is linked to development (Echendu & Okafor, 2021). Several cities have attempted to use various strategies to create what is known as a smart city, but its implementation necessitates advanced methods for engaging with various stakeholders, managing resources, and providing services. Most modern towns, cities, and municipalities around the world have begun implementing 'SMART' programmes to deliver better services to people while saving money and increasing efficiency (Datta, 2015).

Making a smart city a reality is a method for addressing the issues posed by urban population increase and rapid urbanisation (Chourabi, Nam, Walker, Gil-Garcia, Mellouli, Nahon, Pardo & Scholl, 2012). According to the United Nations (2018), more than 55% of the world's population live in urban areas. This invariably indicates that the urban settlement amounts to 3.6 billion people. The United Nations (2018) predicts that by 2050, the number of people living in cities would have increased to 66% or 6.3 billion people. The United Nations further affirm that 60.62% of South Africa's population lived in urban settlements in 2007 and 65.85% in 2017. It is expected that 71.3% will reside in urban settlements in 2030. Invariably, the population increase in all cities impacts their functionality if they are unable to devise strategies to address underlying difficulties. Healthcare, education, safety, transportation, and the environment are all issues that many municipalities, towns, and provinces are dealing with, including the North West province. It is critical that cities/municipalities develop innovative solutions to increase sustainability, workability, and livelihood in these areas. Sikora-Fernandez and Stawasz (2016) assert that the smart city needs six characteristics to achieve the necessary smart city criteria:

Smart governance — This is a democratic style of government that includes Public-Private Partnerships (PPPs), which are characterised by the exchange of best practices through innovative open city platforms through trusted networks.

Smart living — This refers to a living environment that is both safe and healthy for occupants.

Smart economy — This is a functional economy with efficient organisations, firms, and companies that are also connected to local and global marketplaces.

Smart mobility — This refers to the movement of infrastructure and people from one location to another in a sustainable, and convenient manner.

Smart people — This entails fostering an inventive environment in which citizens are creative and comfortable with Smart City Applications.

Smart Environment — This is intended to provide residents with long-term sustainability, clean air, and clean energy by integrating smart natural resource management.

In South Africa, the local municipalities are responsible for providing services and infrastructure, as well as involving the people in various governing processes (Rodina & Harris, 2016). This necessitates effective communication with citizens on important issues, ranging from broad planning and policy decisions to where and how basic service issues can be resolved. The exchange of information is crucial in facilitating deeper community engagement (Enwereji & Uwizeyimana, 2019). While information sharing is not a sufficient way of engagement, such mechanisms are frequently considered the "foundation" of engagement (Wentzel, Vivier, Seabe, Wentzel, & Sanchez, 2015). Communication, for example, has been described by the South African National Department of Communications as a driving factor to develop a relationship between residents and the local municipalities (Wentzel *et al.,* 2015). Citizens commonly express their views and opinions through information interchange, which can be used to assess government responsiveness and accountability (De Kadt & Lieberman, 2020).

The concept of the smart city is gaining traction as more connected technologies emerge. Through the smart city concept, the municipal administration can successfully measure and manage the numerous services they provide within its surroundings in real-time and with a high level of precision (Younus, 2021). For example, smart metering for power and water can assist in this and prepare the way for the initial steps toward a smart city. Caragliu and Del Bo (2019) opine that smart cities have the potential to deliver several benefits to individuals and society at large. Improving the efficiency and management of utilities like power and water could lead to better service delivery, thus allowing more citizens to benefit from essential services (Praharaj, Han & Hawken, 2018). Prepaid meters and smart metering systems are all significant technology components that are already in use in many locations. In addition to smart meters or other smart devices, a communication mechanism to connect all of these devices to various cloud applications is required. While this has been a problem in the past, the internet is now more generally available in many locations, whether through fibre or mobile services (Phokeer Densmore, Johnson, & Feamster, 2016). The technology and infrastructure to implement the foundations of smart cities are already in place in South Africa (Odendaal, 2015). The integration of technology is critical to the actualisation of the smart city, which demands expertise and partnerships or collaborations between the local municipalities and the business sectors (Broccardo, Culasso & Mauro, 2019).

Through the actualisation of a smart city, local municipalities can better prepare for future demand and improve the delivery of key services to the citizens. Electricity

consumption may be projected in advance to avoid outages, water infrastructure upgrades can be recognised in advance, transportation services can be better planned, and many other benefits can be gained (Ismagilova Hughes, Dwivedi, & Raman, 2019). Smart cities are the way of the future, and they offer significant benefits to all parties involved. Public-Private Partnerships (PPP) and citizen's support can contribute significantly to the success of smart city initiatives. Kolandaisami (2020) affirms that the issue in South African municipalities isn't so much to do with technology but figuring out how to put it into practice and integrate it with the right partners, as well as ensuring that people are aware and understand the benefits a smart city provides.

4   Research methodology

This study adopted a qualitative research approach. According to Creswell (2014), qualitative researchers immerse themselves in a study and see meaning as context. Trainor and Graue (2013) affirm that qualitative research answers questions by inference, focusing on process, views, meaning, and interpretation, while also reporting in a narrative style. An exploratory research design was followed to achieve the aims of the study. Exploratory research designs, according to Labaree (2013), enhances a deeper understanding of a study where there is little or no knowledge about the phenomenon under investigation.

A district municipality in the North West province of South Africa was selected for this study. There are five local municipalities in this district municipality. However, the study selected two local municipalities due to time and financial limitations. To maintain anonymity in this study, the selected municipalities will be referred to as Municipality A and Municipality B. These municipalities were selected to understand their level of readiness and other factors that hinder the adoption of the smart city concept. A total of ten participants (five from each selected municipality) who work in the Information and Communication Technology Department in the two local municipalities were selected for this study. Due to the emergence of COVID-19, data were collected online through a mix of communication options such as Short Message Service (SMS), WhatsApp calls, emails, and phone calls. The reason for using these communication options was to abide by the COVID-19 regulations as specified by the South African Government. The interview session followed three research questions:

a) What is the level of your readiness to adopt a smart city concept in your municipality?
b) What are the challenges of adopting a smart city concept in your municipality?
c) What are the measures to actualize a smart city in your municipality?

A total of ten participants were selected to participate in the study. Fortunately, all participants were interviewed, which amounts to a 100% response rate. With the 100% response rate, this study collected enough data to arrive at valid conclusions. After data collection, the raw information was transcribed in a readable format, making it ready for

further analysis. Atlas-ti software (version 8.4) was used to analyse data. In the presentation phase, findings from Municipality A and Municipality B were combined. Findings emanating from the study were grouped into themes and categories, and are represented in the Atlas-ti network diagram. The themes and categories are subsequently discussed by triangulating them with the literature review findings, thereby providing answers to the research questions.

5. Presentation of results

This section presents the research results captured during the online interviews with the selected participants. The interviews focused on the three research questions of the study. During the interview sessions, the researcher used open-ended questions, which allowed the participants to freely express their views regarding the research questions. Note that all ethical considerations, such as informed consent, the anonymity of responses, protection of participants against harm, and voluntary participation and withdrawal, were maintained. The presentation of results in Atlas-ti software (version 8.4) was used to analyse the data in a comprehensible format. Also, to maintain the anonymity of responses in the study, the researcher represented the participants' names with pseudonyms such as PA1, PA2, up to the tenth participant - PA10. The next section presents the results of the first research question.

5.1   Presentation of findings: Research objective 1

This section perused the level of readiness of the municipalities to adopt the smart city concept. The participants' responses are presented in the Atlas-ti network diagram below.

Figure 2: The level of readiness to adopt a smart city concept
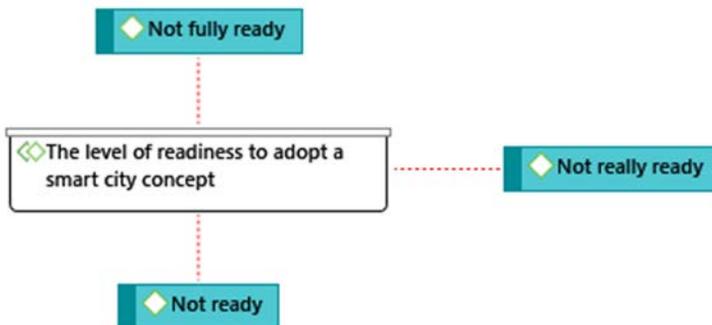
Source: capture Atlas-ti software

According to Figure 2, the participants concurred that municipalities are not fully ready to adopt a smart city concept. Direct excerpts from the participants are as follows:

> **PA1 said:** "*In this municipality, management and the political leaders do not focus on the emerging technologies. They don't want to go smart completely, but I think something new will happen soon.*"

> **PA8 said:** "*Our leaders must understand the new trends of governance, they heavily rely on the crude method of governance... they don't want to actualise the smart city concept.*"

5.2   Presentation of findings: Research objective 2

The researcher further enquired about the limitations of actualising a smart city. Their responses are summarised in Figure 3.

Figure 3: Limitations to adopting a smart city concept
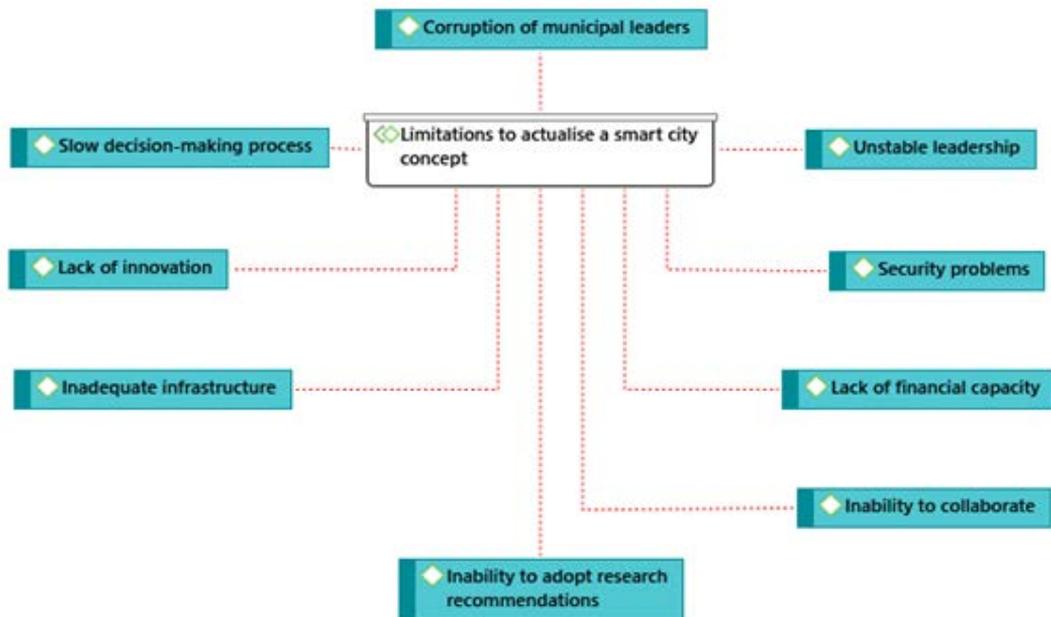
Source: capture Atlas-ti software

According to Figure 3, the participants indicated that corruption of municipal leaders; unstable leadership; security problems; lack of financial capacity; inability to collaborate; inability to adopt research recommendations; inadequate infrastructure; lack of innovation; and slow decision-making process contribute to the limitations of adopting a smart city. Some excerpts captured in the interview process are highlighted below:

The corruption of municipal leaders: This is viewed as the misuse of delegated power for personal gains. The corruption of municipal leaders reduces public confidence and undermines democracy. It can further stifle economic development and exacerbate inequality, poverty, social division, and mistrust. The participants attested that the corruption of municipal leaders has contributed to delaying the process of the smart project. Following is an excerpt from a participant.

> **PA2 said:** *"As we know that municipal leaders seem corrupt nowadays, the funds meant for municipal capital projects are being syphoned to personal gains, which limit the progress of the smart city concept."*

Unstable leadership

Unstable leadership refers to the level of inconsistency of leaders to change programmes and policies over time. This level of inconsistency prompts a lack of confidence and trust in the people. The participants concurred that different policies are being introduced by each political dispensation, which hampers the success of achieving the smart city concept. The excerpts from the participants are as follows:

> **PA3 said:** *"Each time we try approaching the government to adopt the concepts of the smart city completely, excuses are always given about continuous change in leadership, programmes and policies. New leaders are brought into power every five years and the policies and programmes are introduced to them. Sometimes, they do not endorse the programmes and policies as they start with their own plans. This absolutely delays and thwarts the progress of the smart city initiative."*

Security problems

This includes flaws in the servers and software that connect clients, as well as flaws in processes and personnel. Any unaddressed danger or weakness in a system that hackers could exploit to harm systems or data is referred to as a security issue. The participants attested that the lack of security poses a threat to actualising the smart city concept. Below is an excerpt from a participant.

> **PA6 said:** *"We have network security threats such as hackers who are determined to take advantage of any error in the system. Furthermore, adequate security should be guaranteed by the government to safeguard some of the physical components of the smart city concept to avoid theft."*

Lack of financial capacity

Participants affirmed that there are limited resources to fund the smart city concept. Others confirmed that the incoming financial resources have been channelled towards service delivery, while the little left would not be able to fund the smart city project. Some excerpts are as follows:

> **PA7 confirmed:** *"One of the problems we face here is the problem of funding. The fiscal capacity of the municipality is not enough for a smart city project; we are even struggling to deliver adequate services to the residents with the little financial resources in our possession. In my opinion, municipalities should seek external sources of funding to ensure that the smart city project will be a success."*

Inability to collaborate

Collaboration is the process where individuals, entities, or organisations cooperate to complete a task or achieve an agreed upon goal. Most collaborations necessitate leadership, albeit it might take the form of social leadership within a decentralised and egalitarian state. Participants in this study affirmed that there is a lack of collaboration between the government and the private sectors and this has hindered the process of actualising the smart concept. An excerpt from a participant states:

> **PA1 said:** "*The smart city project has not flourished due to the inability of the municipalities to introduce Public-Private Partnerships. In this regard, private firms can be engaged while their interests would be addressed to ensure that they provide the needed skills, motivation, and wherewithal to establish the smart city project.*"

Inability to adopt research recommendations

Research recommendations refer to the immediate measures to be adopted to solve a given problem over a period of time. A participant highlighted that research recommendations from Higher Institutions of Learning in South Africa fostering the possibilities of a smart city are being disregarded due to ignorance. It was concurred by another participant that their municipality neither acknowledges nor endorses studies conducted by students or takes their studies' recommendations seriously. Some excerpts are as follows.

> **PA8 said:** "*Research recommendations are ignored in my municipality, especially the outputs from studies in the Institutions of Higher Learning of this province. The leaders do not understand the need to consider such recommendations to ensure that they will comprehend recent dimensions to approach the smart city issue.*"

Inadequate infrastructure

This refers to the set of basic facilities and processes that enable families and businesses to function in the long run. Participants in the study concurred that more infrastructures are needed to make the smart city concept a reality in their municipalities. A participant highlighted that the issue of electricity should be urgently dealt with to ensure that the smart concept will be a success.

> **PA5 said:** "*Lack of infrastructure could be the barrier, difficulty in extending local imitations to multi-city projects due to the localised character of initiatives. The smart objective was based on the concept that we wanted to infuse… for an example; how to link the rural community to the urban market. Also, one should live in an urban area characterised by network coverage before receiving some services*".

> **PA2 added:** "*The issue of electricity needs to be addressed urgently. The load shedding issue is worsening as the days pass by…. the government should do*

something to guarantee steady power supply to the grassroots level… this will aid in fostering the smart city project."

Lack of innovation

This refers to the inability to provide practical ideas that will introduce new goods or services, or an improvement in the way goods or services are offered**.** The participants concurred that municipalities should be more innovative to ensure that they will create more opportunities to actualise the smart concept.

> **PA4 added:** *"We need adequate skills, (Smart, educated people will close the market), a solid framework that can encompass an array of devices, infrastructure - of which are novel… collaboration between municipalities and private companies… implementation of innovative ideas… new avenues of financial intermediation… good system management e.g. cloud storage… sector collaboration… IT industry… need free thinkers/innovative, and imitating best practices."*

The slow decision-making process

The decision-making process involves acquiring information and evaluating possible remedies to solve a problem at hand. A participant highlighted the level of red tape found in the decision-making process of the public sectors in South Africa. In this regard, the participant hinted that the process would have been a success but hindered due to slow decision-making processes. An excerpt from one participant is as follows:

> **PA10 confirmed:** *"The slow pace in the decision-making process in our municipality is one of the limitations to actualise a smart city concept. Some projects we have in this municipality have been delayed due to the slow decision-making process."*

5.3 Presentation of findings: Research objective 3

This section further asked the participants to know the measures to actualise a smart city in their municipalities. Their responses are summarised in Figure 4.

Figure 4: Measures to actualise a smart city concept in municipalities
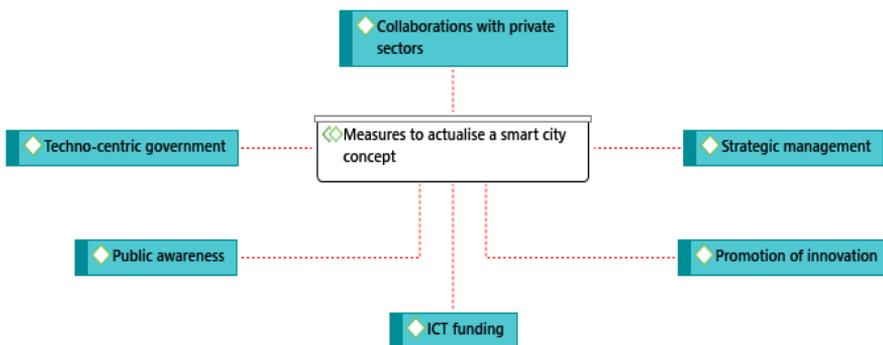
Source: capture Atlas-ti software

In Figure 4, participants indicated that a smart city could be actualised by the municipalities through the collaborations with private sectors; strategic management; promotion of innovation; ICT funding; public awareness; and techno-centric government. These factors are explained consequently.

Collaborations with the private sectors

This refers to the partnership between public and private institutions, resulting in improved public and private services and goods. Partners can trade and share their information, experiences, know-how, and expertise through collaboration**.** The participants of the study indicated that collaborating with the public sector will help make the smart city project a reality. An excerpt from a participant is as follows:

> **PA2 stated:** *"We need leaders who should foster collaborations between the private sector and the municipalities to make the smart city project a success. The problem we have is that some or leaders are not experienced and incapable of attracting collaborations and other external sources of funding for the smart city project."*

Strategic management

Strategic management entails the continuous planning, monitoring, analysis, and evaluation of all requirements that a business or organisation must meet to achieve its goals and objectives. Changes in the business climate will need firms to re-evaluate their success methods regularly. The participants concurred that strategic leaders are needed to drive the smart project forward. One participant stated the following:

> **PA7 said** *"We need strategic leaders who should assess the future needs of the people and seek solutions to resolving such issues in the long run. The smart city project is a long-term project aimed at serving humanity. We need strategic leaders who should opine practical measures to make it a reality."*

Promotion of innovation

Innovation is the practical application of ideas that introduce new goods or services or an improvement in the way those goods or services are offered**.** Participants attested that leaders should promote innovation in the Information and Communication Technology sector to ensure that the smart city is actualised. Following is an excerpt from a participant:

> **PA3 confirmed: "***We need leaders who are good promoters of innovation… this will help to concentrate on actualising the smart city project… leaders should be scrutinised before they are voted into power… they should have the capacity to drive innovation."*

ICT funding

This includes making monetary contributions to ICT sector beneficiaries with the goal of aiding and/or speeding up the development, sustainability, and ultimate financial and

operational independence of such beneficiaries. The participants indicated that a measure to actualise a smart city concept is to embark on ICT funding. An excerpt from a participant is as follows:

> **PA1 stated:** "*Funding of the ICT sector is a strategy that should be adopted by our leaders to ensure an easy step to smart city actualisation. The problem we have in the municipalities is that we only focus on manual service delivery and do not dedicate our resources to capital projects.*"

Public awareness

This entails a public dissemination of information, broad understanding, and acceptance of the challenges at a societal level. The participants indicated that there should be public awareness of the importance of initiating a smart city. An excerpt from a participant is as follows:

> **PA10 stated:** "*Public awareness should be facilitated to the grassroots level to create awareness to all the citizens about the importance of a smart city. This will enable the incoming leaders to hold the smart city project at a high esteem.*"

Techno-centric government

Technocentrism is a value system focused on technology's ability to govern and protect the environment. This sector enables humans to exert control over nature, allowing them to mitigate or resolve environmental hazards or issues. The participants concurred that the municipalities need leaders who should understand and drive the movement towards establishing a technology-centred government. An excerpt from a participant is as follows:

> **PA5 stated:** "*We need leaders who are technology-centred… people who are eager to drive innovation in all sectors of governance… that is the only way to achieve the smart city concept… we need serious leaders that are focused on technology building.*"

6. Discussion of results

The study revealed that municipalities investigated are not fully ready to adopt the smart city concept. This was attributed to many factors, as indicated in Figure 2. Kolandaisami (2020) highlighted that the inability of municipalities to adopt the smart city concept does not lie in the level of technology but in creating awareness about the benefits of a smart city and engaging in meaningful partnerships with the private sectors. The study discovered that the concept of a smart city has emerged to resolve municipal problems such as delivering equitable services to the grassroots level. This was confirmed by Caragliu and Del Bo (2019) and Praharaj, Han, and Hawken (2018), who concur that smart cities have the potential to deliver several benefits to individuals and society at large, such as improving the efficiency and management of utilities like power and water, thus allowing more citizens to benefit from essential services.

In Figure 3, the study highlighted the factors that have limited the adoption of the smart city concept. Perusing these limitations, it could be observed that leadership issues, lack of funding, and lack of infrastructure are the main factors contributing to the failure of smart city adoption. Broccado *et al.* (2019) affirm that technology integration is important for the realisation of the smart city, which necessitates extensive knowledge of the leaders, as well as partnerships or collaborations between local municipalities and the private sector. In the same direction, Odendaal (2015) confirms that South Africa has the needed technology and facilities to develop the foundations of smart cities, but the issue lies with the management and leadership of the municipalities.

Finally, in Figure 4, participants highlighted a number of factors that could be put in place to actualise the smart city concept in local municipalities. These factors include re-engineering the private sector, good strategic management, techno-centric governance, SMME inclusive strategy, and public education/enlightenment. The findings of Ahvenniemi, Huovila, Pinto-Seppä, Airaksinen (2017) revealed that a smart city could be actualised through education, good innovation culture, and Internet Communication Technology. More so, Clarke (2013) upholds that visionary and innovative leadership qualities should be embraced by the municipal leaders coupled with PPP collaborations and adoption of emerging technological options.

7. Conclusions

This study investigated the meaning of a smart city concept, limitations of municipal role players to adopt the smart city, and measures to facilitate the adoption of a smart city concept in the municipalities of the North West province. Findings from the study indicated that municipalities are not fully ready to introduce the smart city concept in their service delivery plans to the residents. It was also gathered that a lack of resources and strategic leadership are the main setbacks to actualising the smart city project. It was further revealed that the smart city project would be successful if the leaders would encourage techno-centric governance and pursue true leadership, which will be based on integrity and collaborations with the private sectors. The study concludes that the smart city concept is highly attainable if the municipal leaders would apply the prescripts of this study in their quest to provide smart services to the citizenry. The results could also be applied to other provinces of the country, as well as other provinces in other developing countries that may face the same situations. The results presented in this study may not be generalised due to diverse administrative measures, managerial practices, and circumstances of municipalities in South Africa and otherwise.

8. Recommendations

The following recommendations are proffered to the municipalities to actualise a smart city.

- The municipalities should focus on improving their level of technology and ensure that they welcome emerging innovation options.
- There should be public education to help citizens understand the benefits and consequences of smart city implementation.
- The government should allocate sufficient financial resources to fund smart city readiness.
- Some smart city concepts, such as mobile billing and payment, should be introduced by the municipality.
- Municipal management should engage knowledgeable staff to assist in the innovation process.
- Available infrastructure, such as mobile billing and payments, should be updated to serve the people, even at the grassroots level.
- To facilitate the smart city adoption, the decision-making process in the municipalities should be made easier.
- The municipalities should encourage Private Public Partnerships and encourage investors to invest in the smart city intervention.
- The municipalities should implement research findings from tertiary institutions to aid in bringing new insights to make the smart city project a success.
- Adequate security should be guaranteed to protect the technology and to prevent theft of the implanted electronic infrastructures.
- The local municipalities should emulate cities that are already smart to understand the techniques to apply.
- Leaders should learn to pick up where their predecessors left off rather than starting new projects from scratch.
- Leaders must have the ability to lead; they must be imaginative and have good strategic management skills.

References

Ahvenniemi, H., Huovila, A., Pinto-Seppä, I. & Airaksinen, M. (2017). What are the differences between sustainable and smart cities? *Cities*, *60*:234-245

Broccardo, L., Culasso, F. & Mauro, S.G. (2019). Smart city governance: exploring the institutional work of multiple actors toward collaboration. *International Journal of Public Sector Management*, 36(4). DOI: 10.1108/IJPSM-05-2018-0126.

Caragliu, A. & Del Bo, C.F. (2019). Smart innovative cities: The impact of Smart City policies on urban innovation. Technological Forecasting and Social Change, 142:373-383.

Cavada, M., Hunt, D.V. & Rogers, C.D. (2015). November. Do smart cities realise their potential for lower carbon dioxide emissions? In *Proceedings of the Institution of Civil Engineers-Engineering Sustainability*, 169 (6):243-252).

Chendu, AJ & Okafor, PCC. (2021). Smart city technology: a potential solution to Africa's growing population and rapid urbanization? *Development Studies Research*, 8(1): 82-93, DOI: 10.1080/21665095.2021.1894963.

Creswell, J.W. (2014). Research design: qualitative, quantitative, and mixed methods approach. 4th ed. CA: Sage Publications.

Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J.R., Mellouli, S., Nahon, K., Pardo, T.A. & Scholl, H.J. (2012). Understanding smart cities: An integrative framework. In *System Science (HICSS), 2012 45th Hawaii International Conference on* (pp. 2289-2297). IEEE.

Das, A., Sharma, S.C.M. & Ratha, B.K. (2019). The new era of smart cities, from the perspective of the internet of things. In *Smart Cities Cybersecurity and Privacy* (pp. 1-9). Elsevier.

Datta, A. (2015). New urban utopias of postcolonial India: 'Entrepreneurial urbanization' in Dholera smart city, Gujarat. *Dialogues in Human Geography*, 5(1):.3-22.

De Kadt, D. & Lieberman, E.S. (2020). Nuanced accountability: Voter responses to service delivery in southern Africa. *British Journal of Political Science*, 50(1):185-215.

Echendu, A.J. & Okafor, P.C.C. (2021). Smart city technology: a potential solution to Africa's growing population and rapid urbanization? *Development Studies Research*, 8(1):82-93.

Enwereji, P.C & Uwizeyimana, D. (2019). Enhancing payment for municipal services through communication dynamics and emerging innovation options: an empirical study. *Journal of Information, Gender and Development in Africa, Special Issue, September2019: 195-226*

Ismagilova, E., Hughes, L., Dwivedi, Y.K. & Raman, K.R. (2019). Smart cities: Advances in research—An information systems perspective. *International Journal of Information Management*, 47:88-100.

Kolandaisami, G. (2020). Drivers and barriers to the adoption of the smart city paradigm in developing countries: A South African perspective.

Labaree, R.V. 2013. Organising your social science research paper. http://www.oise .utoronto.ca/ctlsa/ UserFiles/File/Guide_to_Proposal_Writing.pdf. Date of access: 19 June 2021.

Monzon, A. (2015). Smart cities concept and challenges: Bases for the assessment of smart city projects. In *2015 International conference on smart cities and green ICT systems (SMARTGREENS)* (pp. 1-11). IEEE.

Mori, K. & Christodoulou, A. (2012). Review of sustainability indices and indicators: Towards a new City Sustainability Index (CSI). *Environmental impact assessment review*, 32(1), pp.94-106.

Odendaal, N. (2015). Getting smart about smart cities in Cape Town: Beyond the rhetoric. In *Smart urbanism* (pp. 71-87). Routledge.

Phokeer, A., Densmore, M., Johnson, D. & Feamster, N. (2016). A first look at mobile internet use in township communities in South Africa. In *Proceedings of the 7th Annual Symposium on Computing for Development* (pp. 1-10).

Praharaj, S. & Han, H. (2019). Cutting through the clutter of smart city definitions: A reading into the smart city perceptions in India. *City, Culture and Society*, 18, p.100289.

Praharaj, S., Han, J.H. & Hawken, S. (2018). Urban innovation through policy integration: Critical perspectives from 100 smart cities mission in India. *City, culture and society*, 12, pp.35-43.

Randhawa, A. and Kumar, A. (2017). Exploring sustainability of smart development initiatives in India. *International Journal of Sustainable Built Environment*, 6(2):701-710.

Rodina, L. and Harris, L.M. (2016). Water Services, Lived Citizenship, and Notions of the State in Marginalised Urban Spaces: The case of Khayelitsha, South Africa. *Water Alternatives*, 9(2).

Sikora-Fernandez, D. & Stawasz, D. (2016). The concept of smart city in the theory and practice of urban development management. *Romanian Journal of Regional Science*, 10(1), pp.86-99.

Trainor, A.A & Graue, E. (2013). Reviewing qualitative research in the social sciences. New York: Routledge.

United Nations. (2018). Urbanisation and population. https:// www.un.org/ development /desa/ en/news/ population/2018-revision-of-world-urbanization-prospects.html. Accessed on 20th Dec. 2021.

Venkatesh, V. & Davis, F.D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, pp.425-478.

Wentzel, M., Vivier, E., Sanchez, D. & Seabe, D. (2015). From information to engagement: exploring communication platforms for the government-citizen interface in South Africa: informatics for development. *The African Journal of Information and Communication*, *2015*(15):81-92.

Williams, M.D., Rana, N.P. & Dwivedi, Y.K. (2015). The unified theory of acceptance and use of technology (UTAUT): a literature review. *Journal of enterprise information management*.

Younus, AM. (2021). Smart city in urban innovation: Concept, management, policy and technology. International Journal of Advanced Engineering Research and Science, 8(10):