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A Feedback Loop Model to Facilitate Communication Between Citizens and Local Government in a Smart City

By

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2016

A Feedback Loop Model to Facilitate Communication Between Citizens and Local Government in a Smart City

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201008894

Dissertation

submitted in fulfilment of the requirements for the degree

Master of Commerce

in

Information Systems

in the

Faculty of Management and Commerce

of the

University of Fort Hare

Supervisor: **Dr Wayi**

January 2016

ABSTRACT

In recent years, an increasing number of people move into cities to search for better opportunities for themselves and their families. This movement is known as urbanisation and makes it difficult for the local government to fully understand citizens' needs particularly pertaining to public safety matters.

During the first phase of the Public Safety Smart City project, it was identified that there is a need for feedback loop to facilitate effective communication of public safety issues between citizens and local government. This means that EL citizens do not have a better channel in place to address their public safety issues to the local government. This could lead to the decisions made by the local government in public safety not fully communicated back to the citizens. The primary objective of the study is to develop a feedback loop model that will assist in more effective reporting of public safety issues between citizens and the local government.

The study followed an interpretivism paradigm and the research methodology employed is the qualitative approach. This was influenced by the existing De Fleur model of communication, secondary data and also semi-structured interviews. The interviews were conducted with eleven citizens and four managers from the Department of Public Safety.

It was ascertained that the lack of a feedback loop about public safety issues between citizens and local government is likely to increase public safety issues. Findings revealed that this is because citizens are not continuously updated about their reports and also about the state of public safety matters. Furthermore, the methods of communication utilised lead to poor communication of public safety issues.

The study concludes that the introduction of an Information and Communication Technology enabled feedback loop between citizens and local government can help in reducing public safety issues and make public safety officials proactive rather than reactive.

Keywords: Smart city; Buffalo City Metropolitan Municipality; Public safety; Feedback loop; East London

DECLARATION

I, Amanda Gopeni, 201008894, hereby declare that:

- The work in this dissertation is my own work.
- All sources used or referred to have been documented.
- I am fully aware of the University of Fort Hare's policy on plagiarism and I have taken every precaution to comply with the regulations.
- I am fully aware of the University of Fort Hare's policy on research ethics and I have taken every precaution to comply with the regulations.
- This dissertation has not been previously submitted in full or partial requirements for an equivalent or higher qualification at any other recognised educational institution.
- This study was supported by funding from the National Research Foundation (NRF) and International Business Machines Corporation (IBM). Any opinions, findings, conclusions, or recommendations expressed in this research are those of the author(s) and do not necessarily reflect the views of the aforementioned institutions.

Signature : .....

Date : .....

ACKNOWLEDGEMENTS

I would like to express my gratitude to:

- God the Father, God the Son, and God the Holy Spirit for His unfailing love, mercy and grace. I know that I would have not completed this project without Him; indeed you are my Baal Perazim.

- My supervisor, Dr Wayi, for her guidance and supervision throughout the project. It has been a long and tiring journey but you kept me going throughout, may God bless you.

- Prof Flowerday for involving me in the Public Safety Smart City Project and for financial assistance.

- Information Systems staff, Masters and Doctoral students for their objective criticism and thoughtful support.

- Interviewees who participated in this study, and contributed to the achievement of its objective.

- All my friends and family, especially my granny, Mary Vena for the prayers, love, and patience and for making me believe that I can do everything that I set my mind on.

- IBM and NRF for the funding of this research project.

- Lauren Wainwright, for her proofreading and language editing skills.

Thank you all for your time and effort.

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CHAPTER 1: INTRODUCTION

Chapter 1

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Chapter 2

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Factors to be Considered When Developing a Feedback Loop Between Citizens and the Local Government

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1.1 Background

In recent years, an increasing number of people move into cities to search for better opportunities for themselves and their families. This movement is known as urbanisation and is growing such that it is expected to be 70% of the total world population by 2050 (IBM, 2013).This increases the number of people living in cities and results in local government not clearly understanding citizens' needs. South Africa is one of the developing countries that are faced with urbanisation and this problem is now becoming slowly visible in the provincial and regional spheres (Kotze, Rogerson, & Rogerson, 2014). Looking at regional spheres, in particular the local municipalities, the problems associated with urbanisation include poor living conditions, lack of access to municipal services and misallocation of municipal resources (Turok, 2012).

In light of these challenges, institutions like International Business Machines (IBM) and University of Fort Hare in the Department of Information Systems came up with ways of making cities smarter to assist government in improving access of public safety information and delivery of services. These two institutions collaborated to introduce the concept of smart city in East London (EL). The first phase of the smart city project focused on ensuring high quality of data used in public safety and it was completed in 2013. The second phase of the project consists of nine people, of which four are students and five are staff members in EL campus. For this phase of the project an Interactive Voice Response (IVR) system was used to collect public safety data from the citizens of EL. This was done by motivating citizens through airtime incentives into reporting public safety matters, and then all the public safety reports would be typed and some translated in to English to be sent to the local authorities in order to provide feedback to the citizens. EL is used as a test bed since the smart city concept is still new in the Buffalo City. EL is one of the towns in Buffalo City Metropolitan Municipality (BCMM) together with King William's Town and Bhisho (South African Cities Network, 2014).

The BCMM is situated in the Eastern Cape Province and characterized by three main areas East London, King William's Town and Bhisho. EL is the second largest city in the Eastern Cape with a population of over 400 000 inhabitants (Tankard, 2014). The main languages spoken are Xhosa, English and Afrikaans (Property 24, 2013). The schematic representation of BCMM is shown in Figure 1 below. IBM and the University of Fort Hare are in the process of introducing smart living, which is transforming the city of EL with the focus on public safety, as the city's

vision is “a responsive, people centred and developmental city” (BCMM, 2014, p. 7). Public safety is a challenge in EL since a number of people move to the city every day which results in increased urbanisation, misallocation of resources and poor service delivery, amongst other problems.

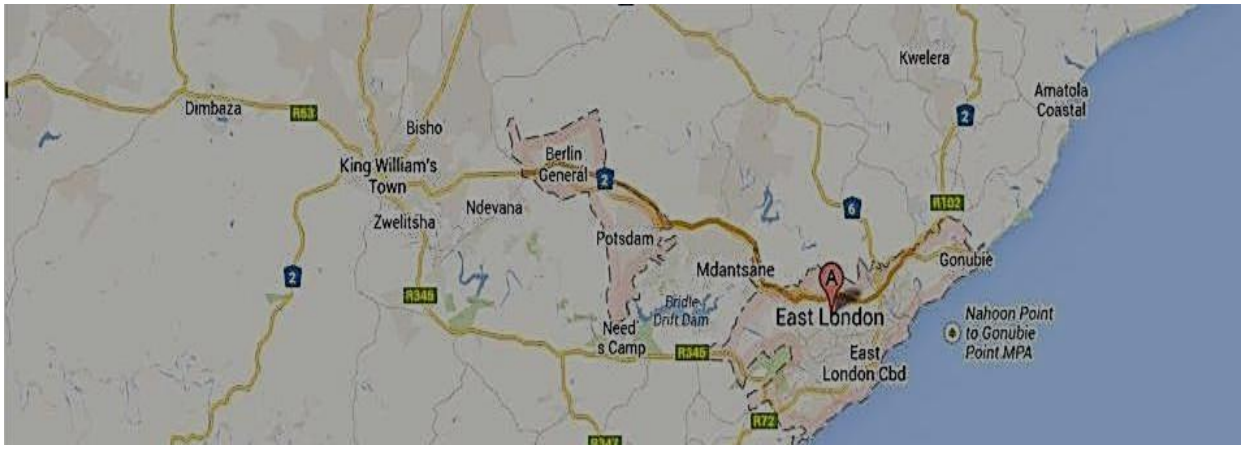


Figure 1: Diagrammatic representation showing the location of East London (Property 24, 2013)

Smart city is an initiative aimed at using information technology to improve the quality of life of citizens (Christen, Georgkopoulos, Perera, & Zaslavsky, 2014). According to Dirks and Keeling (2009), a city is smart when it regards its citizens as leaders and sources of information, and then uses technology to analyse and understand data provided by the citizens in order to improve allocation of resources, hence making the city managers more proactive than reactive in decision-making. Though ICT’s have their “dark side”, it should be taken into account that these technologies when managed appropriately they offer tremendous benefits particularly in communication of public safety issues. The focus of this study is on public safety, with the purpose of ensuring that public safety agencies respond to citizens’ needs. The IVR system was used to collect information about public safety issues from the citizens of EL. The information collected will then be used to assist the local government in making informed public safety decisions about the city.

Although smart city is a new and emerging concept there are cities that have successfully deployed the concept in to making their cities smart, these cities are listed in the table below:

Table 1: The list of smart cities (Adapted from Nam & Pardo, 2011)

Region	Cities
Africa	**Cape Town (South Africa); Nelson Mandela Bay (South Africa); Johannesburg (South Africa)**
Asia	Bangalore (India); Chongqing (China); Doha (Qatar); Gangnam District, Seoul (Korea); Hong Kong; HwaSeong, DongTan (Korea); Hyderabad (India); Ichikawa (Japan); Jaipur, Rajasthan (India); Jia Ding (China); Kabul (Afghanistan); Mitaka (Japan); Shanghai (China); Seoul (Korea); Singapore; Suwon (Korea); Taipei (Taiwan); Taoyuan County (Taiwan); Tel Aviv (Israel); Tianjin (China); Yokosuka (Japan)
Europe	Besancon (France); Birmingham (UK); Dundee, Scotland (UK); Eindhoven (Netherlands); Glasgow, Scotland (UK); Hammarby Sjostad (Sweden); Issy-les-Moulineaux (France); Karlskrona (Sweden); Malta (Malta); Manchester (UK); Reykjavik (Iceland); Sopron (Hungary); Stockholm (Sweden); Tallinn (Estonia); Sunderland (UK); Trikala (Greece)
Middle/South America	Barcelona (Puerto Rico); Curitiba, Parana (Brazil); Pirai (Brazil); Porto Alegre (Brazil)
Oceania	Ballarat (Australia); Gold Coast City (Australia); Ipswich, Queensland (Australia); State of Victoria (Australia); Whittlesea, Victoria (Australia)

The smart city initiative has six core functions: Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living. Smart Living is then divided into three elements which are: healthcare, infrastructure and public safety (Axhausen, et al., 2012). For the purpose of this study public safety is a way of engaging citizens with public safety issues through the of a feedback loop; these issues include crime, traffic congestion, natural disasters, and waste management. The study aims to investigate how a feedback loop can be used to improve communication of public safety matters between the citizens and local government in EL. A feedback loop is a systematic method for gathering information such as complaints, suggestions and satisfaction about public safety issues from the citizens (Jacobs, 2010). With an effective feedback loop, there will be a two-way flow of information between the citizens and local government concerning public safety matters. This information will not only assist the local government officials in responding to citizens' issues, but it will also encourage citizens to be partners in developing the city (De Graaf & Michels, 2010). The outcome of this study is a model to encourage a continuous feedback loop about public safety matters between

the citizens and local government. This study describes the role of a smart city in a developing country; discusses ways of how the feedback loop can reduce public safety issues, and also identifies factors that should be considered when developing a feedback loop between the citizens and local government.

1.2 Problem Statement

In Lancaster, Los Angeles in the United States, the city implemented a crime prevention and prediction solution that integrated the data from the police department and emergency response systems to forecast areas likely to require the most policing (IBM, 2011). This is an example of how a feedback loop should encourage communication between citizens and the local government in the Buffalo City. According to Joseph (2015) and Writing (2015) a lack of effective communication whether oral or written often leads to conflicts and creates a number of problems in this case, in the local government sector including poor team work, lack of efficiency, decreased innovation, and employee morale. However, Writing (2015) further adds that when developing a strong relationship between citizens and local government, effective communication practices must be put in place.

There are other existing initiatives like Crime Spotter in EL, which share the same vision with the smart city research project – that is aiming to make communities safer for everyone (Kaizania, 2014). The disadvantage with these initiatives is that citizens can only report crime activities to Crime Spotter's Facebook page; if a person does not have a Facebook account he or she cannot report or be updated about crime activities in the area (Kaizania, 2014). With the design of a feedback loop, data will be analysed and interpreted to ensure that it is accurate before it is being sent to the local government authorities. This will make citizens' voices to be heard more in the local government spheres by not only sending complaints, but also by sharing ideas that could help prevent public safety issues in future (Jacobs, 2010).

During the first phase of the Public Safety Smart City (PSSC) project, it was identified that there is a need for feedback loop to facilitate effective communication of public safety issues between citizens and local government. This means that EL citizens do not have a better channel in place to address their public safety issues to the local government. This is a problem because it is

making local government reactive rather than proactive. This could lead to the decisions made by the local government in public safety not fully communicated back to the citizens.

1.3 Research Questions

The main research question and the sub-questions for the study are as follows:

1.3.1 Main Research Question

- ***What feedback loop mechanisms can be applied in a smart city to support effective communication of public safety issues between citizens and the government?***

The above question is broken down into three sub-questions in order to answer the research question:

1.3.2 Sub-questions

a) What is the role of a smart city in a developing country?

This sub-question discusses in detail the functions of smart cities in developing countries. These functions will help to explain the importance of making cities 'smart', i.e., empowering the citizens by regarding them as leaders and sources of information in order to improve the quality of life and achieve the citizens' vision. Furthermore, the benefits of a smart city are identified.

b) How can a feedback loop reduce public safety issues in a smart city?

This sub-question aims at discussing how a feedback loop can help to reduce public safety issues. When citizens report public safety issues the reports will help the local government spot the areas that need immediate attention based on the number of reports made. This means that communication will then be improved between the citizens and local government.

c) What factors should be considered when developing a feedback loop between citizens and the local government?

The last sub-question explores the different tools to be used when reporting to the system and discusses what factors need to be considered before and after the feedback loop has been developed.

1.4 Objective of the Study

The primary objective of the study is to develop a model to ensure a continuous feedback loop between EL citizens and the local government in a public safety environment. The study will evaluate appropriate tools that could be used to present the reported data to the local government officials and the feedback given back to the citizens. Reasons that can cause ineffective feedback loops between the citizens and the local government will also be explored.

1.5 Significance of the Study

Migration of people to cities increases a city's population and indirectly increase public safety issues (IBM, 2011). According to Malik and Team (2013) in the Human Development Report, South Africa's human development index (HDI) is expected to rise by 2050 to 52 percent. This means that people will be moving in seeking better opportunities. The development of a feedback loop is worth doing because if there is no feedback loop, the research project will fail and there could be unresolved public safety issues, hence the De fleur communication model is utilised to ensure continuous flow of information until results are met. In De fleur communication model the source and the destination exchange roles during the communication process; furthermore, the model introduces two-way feedback during the communication process and sends the relevant information to the target audience (Raza, 2012).

According to the findings from first phase, a feedback loop will assist in integrating data from the SC research project to the local government authorities in order to forecast areas that would likely require more consideration or policing in the city (Breetzke, 2014).

1.6 Summary of the Literature Review

The next section presents the summary of the literature reviewed in trying to understand the phenomena in question.

1.6.1 Role Played by a Smart City in a Developing Country

Smart cities provide the benefits of instrumented, intelligent and interconnected cities in one city (Donnelly & Harrison, 2011). These cities help in finding patterns that can be leading indicators, for example in preventing or reducing crime activities in a specific area through information transparency (Donnelly & Harrison, 2011). However, according to Transparency International

(2012) cited in (Kirkby, GIDD and Team, 2012, p. 3) transparency is "being open in the clear disclosure of information rules, plans, processes and actions". Encouraging transparency in public data can help citizens to know government activities and thus increase citizen participation and empower citizens to communicate their needs with the government. This means that smart cities are about interconnectedness of systems (Guest 2014), which promotes maximum use of data management systems to improve public safety matters including crime, traffic congestions, and waste management and activities in a city.

Escher Group (2014) argues that smart cities allow the government not only to regard the physical planning of a city, but also to consider developing the economy and the environment through technology in developing countries in order to make the city more efficient and effective. Smart cities also create attractive environments that motivate cities to become digital and interact with its citizens through instant access (Donnelly & Harrison, 2011). The next section will discuss ways of how the feedback loop can reduce public safety issues.

1.6.2 Using a Feedback Loop to Reduce Public Safety Issues in a Smart City

A feedback loop is the means of soliciting citizens' input and involvement about public safety matters in order for the local government to understand the city better (Heirman, Ling, & Pinto, 2012). With the use of an ICT enabled feedback loop, public safety matters will be reported anytime, anywhere and using any type of phone or the Mobi site which is the SC research project website. This will increase chances of incidents being reported to the local government without in-person interactions and this can help overcome barriers such as time, cost and distance (Custer, 2012).

The local government will then use the public safety reports to check how well services are delivered to the people and whether they meet their needs (Speer, 2012). Linking the citizens and the local government directly with their services is the evident advantage of the feedback loop (Heirman et al., 2012). The feedback loop data will rely on qualitative data in order to thoroughly understand the citizens' needs. The purpose of a feedback loop in a smart city is to assist the local government to put first the needs of the citizens and satisfy the cities they service by transforming words into deeds (Jacobs, 2010; Pretorius & Schurink 2007).The feedback loop will provide real-time information which will lead to timely actions, since the feedback will be both from the local government and the citizens. The effective feedback loop will also be based

from the De fleur communication model, which is the underlying theory for this study. The next section will identify factors that should be considered when developing a feedback loop between the citizens and local government.

1.6.3 Factors to be Considered When Developing a Feedback Loop Between Citizens and the Local Government

A feedback loop can take different forms depending on the purpose it will serve (Jacobs, 2010). The factors that need to be considered when developing a feedback loop system between citizens and the local government include purpose, people, process, tools, and environment (Asad, Bailur, Custer, Dodds, Gagieva, & Gigler, 2014). This study will only use formal feedback to serve the purposes because the information collected will aid in making EL a smarter city. According to Heirman et al. (2012, p. 5), a formal feedback loop can be defined as the "information elicited, stored, analysed and interpreted by the researcher in more or less structured ways".

1.7 Research Design

The study made use of accredited secondary sources which were collected from academic journals, conference proceedings, books, papers and websites. Primary data was also collected from the research participants and utilized to meet good academic standards and present accuracy. The study made use of inductive logic, which is the process of beginning with information from secondary sources and then determining what general conclusions can be derived from that data (Bailey, Hennink, & Hutter, 2011). According to Greener (2008), inductive method is an approach that starts by understanding a problem, thereafter interpreting and analysing various research methods, and then developing a theory from the solution foundation. The research design for this study is adapted from the onion model by (Lewis, Saunders, & Thornhill, 2009). This makes it easy for the researcher to clearly understand the design of the research study. This is shown in Figure 2 of the onion model below (Lewis et al., 2009).

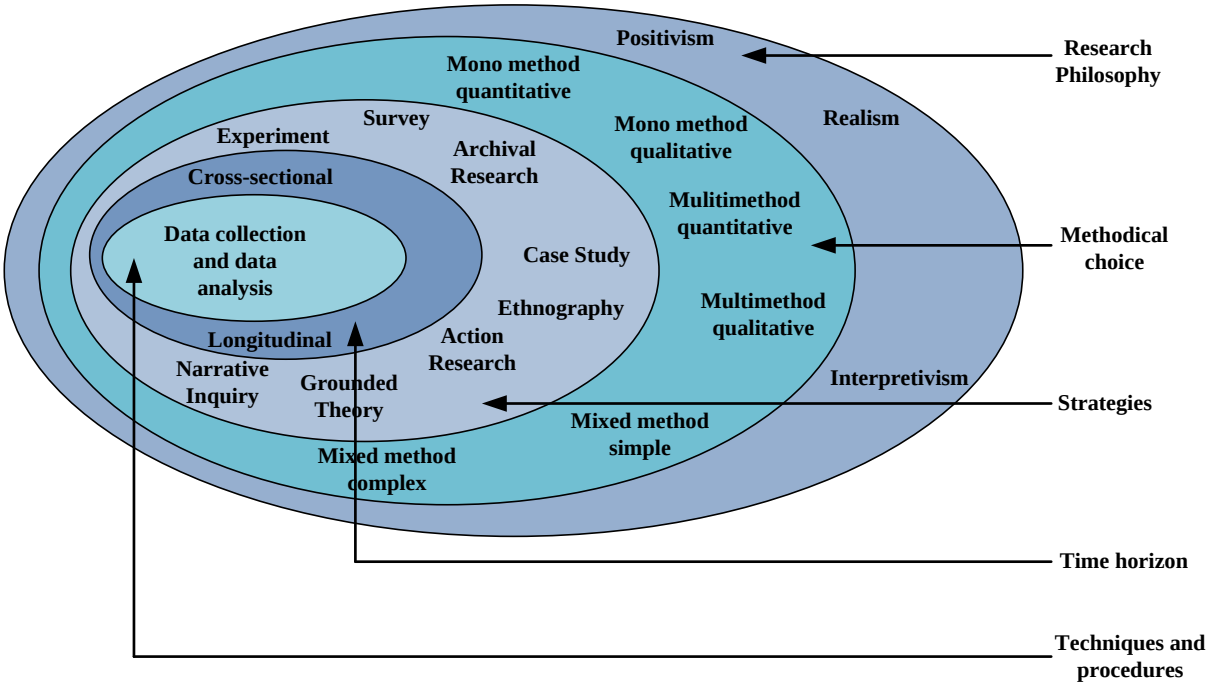


Figure 2: The onion model (Lewis et al., 2009)

1.7.1 Research Paradigm

Interpretive research paradigm aims to answer questions about why and how something is happening; it can also address questions about what is happening now and what will happen in the future (Cryer, 2006). Interpretive paradigm views the world as a subjective entity, which will help in the study to understand citizens' perspectives in a broad structure (Cryer, 2006). The study centres its attention on the fourth stage of the continuum model, which states that the "social world is a pattern of symbolic relationships and meanings sustained through a process of human action and interaction" (Collis & Hussey, 2014, p. 49). This is illustrated in Figure 3 below. Furthermore, the positivism paradigm for this study is deemed unsuitable because its emphasis is on quantitative data and positivist philosophy (Clarke, 2009). Positivism paradigm views the world as an objective entity that is not influenced by personal feelings (Olivier, 2009).

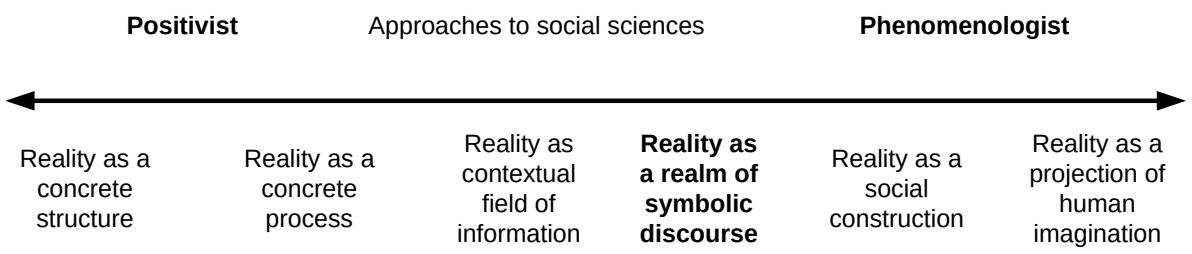


Figure 3: Continuum Ontological Assumptions (Adapted from Collis & Hussey, 2013)

1.7.2 Research Philosophy

Philosophy is about understanding forms of reasoning to be used in order to understand the phenomenon investigated better, and revolves around four pillars of metaphysics, logic, epistemology and ethics (Chia, 2002). To achieve the objectives of this study, the research philosophy chosen, amongst others, is the qualitative approach. The qualitative approach allows the researcher to obtain thorough meaning of the phenomenon at hand by putting the researcher in the perspectives and experiences of the participants (Silverman, 2011). This suggests that qualitative research offers a platform for a researcher to gain understanding of the problem investigated and come up with ways of addressing the problem in a subjective manner (Hartas, 2010). Since the study is a pilot study, qualitative research will be applicable in acquiring more insight about how citizens and local government relationships can be improved. The study employed the qualitative approach because the philosophy is concerned with quality rather than quantity, unlike with the quantitative approach (Silverman, 2011).

1.7.3 Research Methodology

Research methodology is a route that a researcher needs to follow when investigating and solving a research problem. It consists of procedures that a researcher must understand when describing, explaining and predicting a particular situation whose explanations are in question (Chinnathambi, Philominathan, & Rajasekar, 2006). Qualitative data about public safety matters was collected from EL citizens and from the city managers in public safety. The qualitative data was then sorted and interpreted in order to find the answers to the problem investigated.

1.7.4 Data Collection Methods

Collection of data is a way of gathering information about the research problem in order to find an explanation or new useful knowledge (Headlam & McDonald, 2008). Qualitative data was collected for this study using semi-structured face-to-face interviews. Some of the interview questions used comes from other secondary sources who have investigated a similar problem. The reason for choosing interviews as the data collection method is because they are useful for gaining insight about the problem investigated (Krosnick & Pasek, 2011). Interviews also encourage flexibility that allows respondents to describe what is important to them, unlike a structured questionnaire (Krosnick & Pasek, 2011). Interviews consisted of questions about public safety matters in the EL area. However, interviews can be time consuming compared to other data collection methods (Evaluation Tool Box, 2010).

1.7.5 Population and Sample of the Study

Sampling is a quicker way of gathering information from a group of people that represents the whole population (Latham, 2007), and is done in research because in reality there will not be enough time, energy and resources to investigate the whole population (Neubauer & Schilling, 2009). Purposive non-probability sample was employed in this study because it is a good method to use when carrying out a pilot study (Macnee & McCabe, 2008). The advantage of purposive sampling is that it allows the researcher to gain in-depth data by including participants who have knowledge and understanding about the subject in question. The disadvantage, however, is that purposive sampling focuses data collection on one's experience or understanding (Macnee & McCabe, 2008). The sample was drawn from citizens of EL at large and public safety officials in local municipalities.

1.7.6 Data Analysis Methods

Data collected for this study was qualitative data that was gathered through the use of semi-structured interviews; thus qualitative analysis method was used. After the empirical data was obtained from the interviews; the researcher transcribed each interview and sorted the data using Microsoft Excel spreadsheet. Thereafter, the data was organised into categories which in turn was grouped into themes in order to find meaning and for simple analysis. Qualitative analysis was the most suitable for this study as it aims to understand the in-depth meaning of what has been said by the respondents. The data was analysed following the thematic analysis process

which is divided into six stages namely familiarizing yourself with your data; generating initial codes; searching for themes; reviewing themes; defining and naming themes and producing the report (Braun & Clarke, 2006).

1.8 Underlying Theory

The underlying theory used in this study is the De fleur communication model. The model is discussed in detail below.

1.8.1 Communication Model

According to Gregor (2006, p. 616), a "theory is an abstract entity that aim to describe, explain and enhance understanding of the world and, in some cases, to provide predictions of what will happen in the future and to give basis for intervention and action". Theories must fulfil four goals in general: analysis, explanation, prediction, and prescription of a phenomenon (Gregor, 2006). The role of a theory in a research is important because it helps to explain the process that the researcher will undergo and directs the researcher to a solution (Williamson, 2002).

The theory used for this study is the De fleur communication model (Folorunso, 2013), shown in the figure below. The model consists of the following constructs: source, transmitter, channel, mass media device, receiver and destination on the top level, and also source, transmitter, channel, feedback device, receiver and destination on the bottom level. Furthermore, the model allows the source and destination to swap during the communication process (Raza, 2012). The De fleur model was chosen for this study because communication is cyclical, meaning that the communication process is continuous until the results are met. This theory is applicable to this study because it encourages continuous two-way feedback between citizens and local government involved in the communication process.

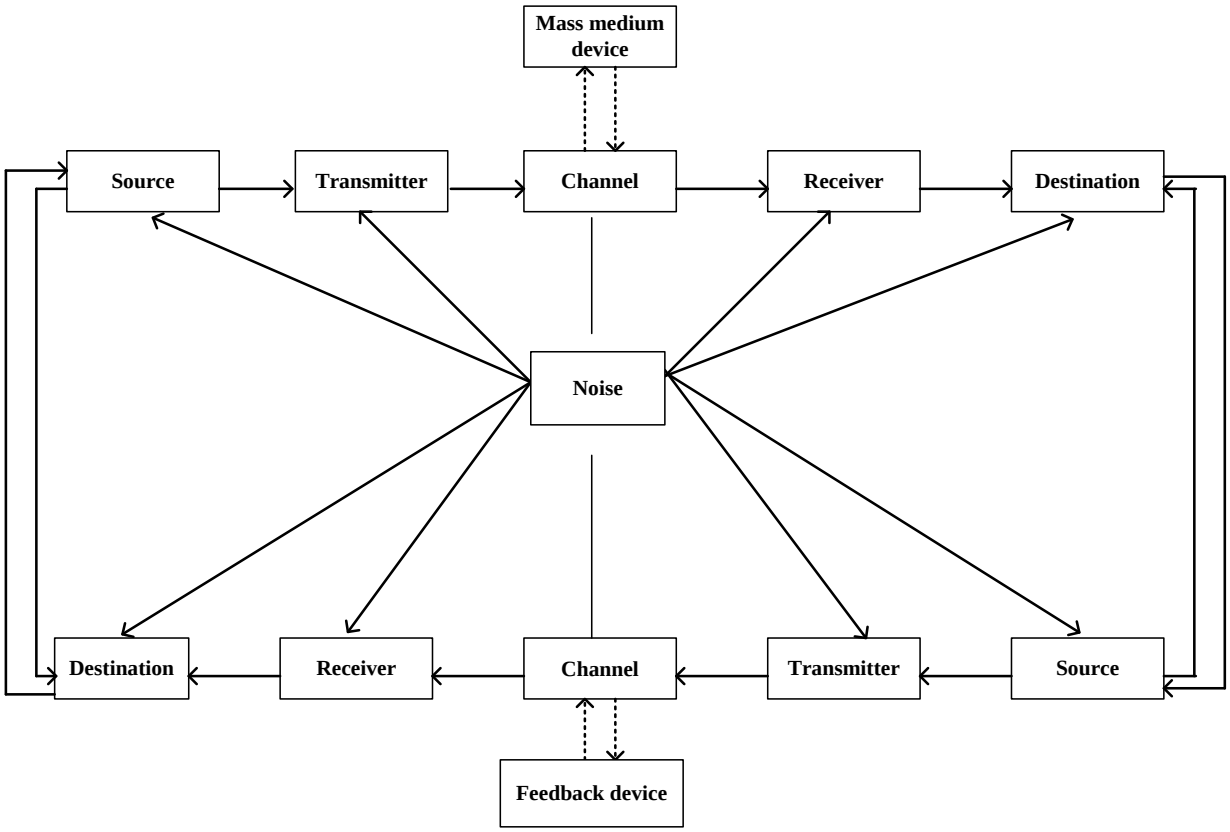


Figure 4: De fleur communication model (Folorunso, 2013)

1.9 Delimitation of the Study

For the successful results of the study, the researcher focused only on local government municipality in the EL area and not on provincial and national government municipalities. Under local municipality in EL, the study focussed solely on Public Safety Department and other departments will not be covered in the study. There are many phenomena that exist in EL area that could have been investigated but for this study only one phenomenon was investigated so as to be able to finish the project in due time. The actual model of a feedback loop that will be provided for this study will be theoretical model not technical. The study will not be concerned with incentives and acceptance when creating the feedback loop.

1.10 Ethical Considerations

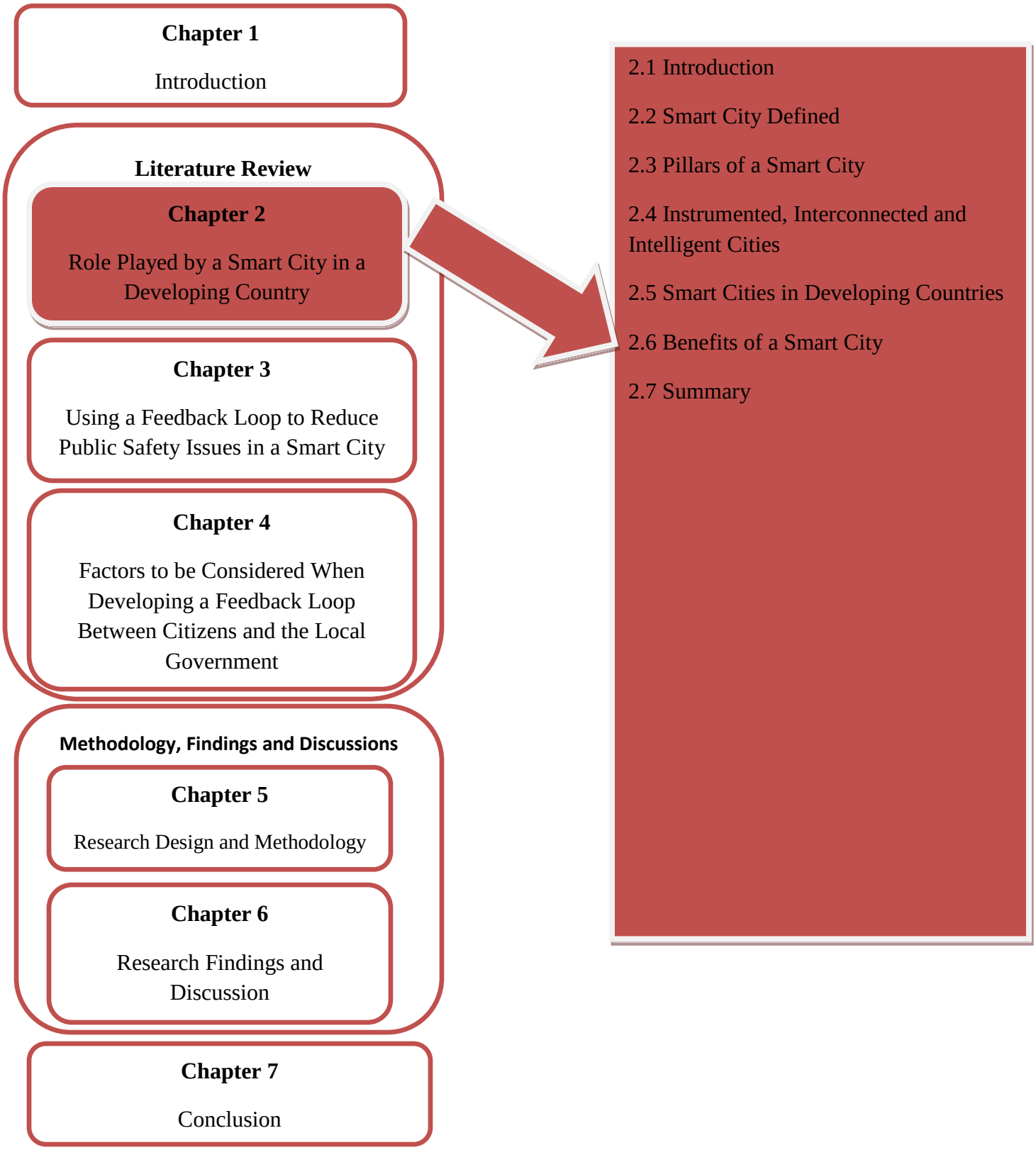
Carlson and Ross (2010); and Resnik (2010) point out that ethics are guidelines that are used in different institutions that govern a person's behaviour in order to meet the institution's aims and goals by distinguishing between what is acceptable and what is not, with authenticity and truthfulness as the cornerstones. Resnik (2010, p. 2) further adds that ethics are important in academia because they "promote the aims of the research, promote values that are essential to collaborative work, ensure the researcher can be held accountable to the public, help build public support for research and promote moral and social values".

For the purpose of this study, before data was collected the researcher applied for the Ethical Clearance from the University of Fort Hare. In addition, the Informed Consent form was provided that must be signed by the research participant(s) before taking part in the study (Govan Mbeki Research & Development Centre, 2011). This was done because the data collection method for this study is semi-structured in-person interviews. Since interview questions may consist of personal and sensitive issues, this means permission; confidentiality and safety were the basis of this study (Allmark et al., 2009).

1.11 Outline of Chapters

Chapter 1 provides the introduction to the study, statement of the problem, research question and sub-questions, objective of the study, significance of the study, literature review, research methodology, delimitations of the study, and ethical considerations. **Chapter 2** discusses the first sub-question which focuses on the role of a smart city in a developing country. In **Chapter 3**, the second sub-question presents the challenges in public safety and discusses ways in which feedback loop can reduce public safety issues in a SC. **Chapter 4**, under the third sub-question, identifies and discusses factors that need consideration when developing a feedback loop between the citizens and local government. Additionally, this chapter presents a brief explanation of the proposed theory for the study that assist as a solution to the problem investigated. **Chapter 5** provides the methodology including research paradigm, data collection, analysis methods and ethics. **Chapter 6** provides the summary of findings and presents the contribution of the study. **Chapter 7** provides conclusions for the entire research study.

CHAPTER 2: ROLE PLAYED BY A SMART CITY IN A DEVELOPING COUNTRY



2.1 Introduction

The smart city concept is becoming popular in developing countries such that governments and public agencies have gladly received the idea to better the quality of life for their citizens and achieve success in their policies (Nam & Pardo, 2011). Smart cities are like knowledgeable systems that source or sense and act on citizens' activities in which real-time information is managed and disseminated across a social group or institutions to optimise operations or to inform local authorities on emerging events and problems (Cagliano et al., 2014).

Smart city is defined as a way of using Information and Communication Technology (ICT) in order to improve the quality of life of citizens and services provided by government through enhanced efficiency under challenging conditions that environmental, economic and social trends may bring (Christen et al., 2014; Mishra, 2013; Axhausen et al., 2012; Guan, 2012). Cagliano, De Marco, Mangano, Neirotti and Scorrano (2014) further state that a smart city does not only involve technological changes but also include investing in human capital so as to improve urban living conditions. Enhancing the quality of life in a smart city would mean that a city must be a content place to live in, with systems of communication being low in cost or free while encouraging human interaction in a technology-led environment that delivers smart services to the citizens (Chen, 2012)**.** A city is smart when it provides new ways of dealing with urban systems, that enable monitoring at a micro-level and creating a friendly and attractive environment for the citizens namely through instant access of public information and interaction of citizens in a city (Donnelly & Harrison, 2011). Bhaveer, Flowerday, and Satt (2013) add that a city is smart when it effectively manages limited resources for its citizens whilst constantly competing with other cities.

Although there are various definitions of this emerging concept, the smartness of a city may differ from one individual to another depending on the citizens' needs. The aim of this chapter is to discuss in detail the role of smart cities in developing countries. This is done by carefully providing an overview of a smart city, examining the pillars of a smart city, and exploring the benefits that can be attained in a smart city, which concludes this chapter.

2.2 Smart City Defined

The smart city concept is aimed at changing how business processes and city services are delivered in order to create an environmental friendly city from a combination of smart technologies and profound public participation (Mginqi, 2011). Technology on its own is not enough that is why citizen participation is in the core of a successful smart city and each city has a different vision of how smart they wish to become. Below is a table showing different definitions of a smart city

Table 2: Definitions of smart city (Adapted from Chourabi et al., 2012)

Authors	Working Definitions of a smart city
Fertner, Giffinger, Kramar, Kalasek, Meijers, and Pichler-Milanović (2007)	A city well performing in a forward-looking way in economy, people, governance, mobility, environment and living, built on the smart combination endowments and activities of self-decisive, independent and aware citizens.
Hall (2000)	A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, subways, airports, seaports, communications, water, power, even major buildings, can better optimise its resources, plan its preventive maintenance activities, and monitor security aspects while maximising services to its citizens.
Eckman, et al. (2010)	A city "connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city"
Natural Resources Defense Council (n.d.)	A city striving to make itself "smarter" (more efficient, sustainable, equitable, and liveable).
Toppeta (2010)	A city "combining ICT and Web 2.0 technology with other organizational, design and planning efforts to dematerialise and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and liveability".

Balaouras, Dines, Hayes, Nelson, Sindhu, and Washburn (2010)	"The use of Smart Computing technologies to make the critical infrastructure components and services of a city – which include city administration, education, healthcare, public safety, real estate, transportation and utilities – more intelligent, interconnected and efficient."

The different definitions of a smart city listed on the table above are evidence that how smart a city is defined depends on the needs of the citizens living in that city. These definitions are similar, meaning that they all focus on improving the quality of life citizens and making cities a better place to live in. This study particularly takes up to the definition by Balaouras, et al. (2010) as the aim of the study is about improving public safety services through intelligent, interconnected and efficient communication between the citizens and the local government.

As shown in the table above, the term *smart city* is a broader concept which consists of six functions. Each function is made of different characteristics underneath it; this is illustrated by Figure 5 below (Axhausen et al., 2012) and discussed further in sections 2.2.1 to 2.2.6

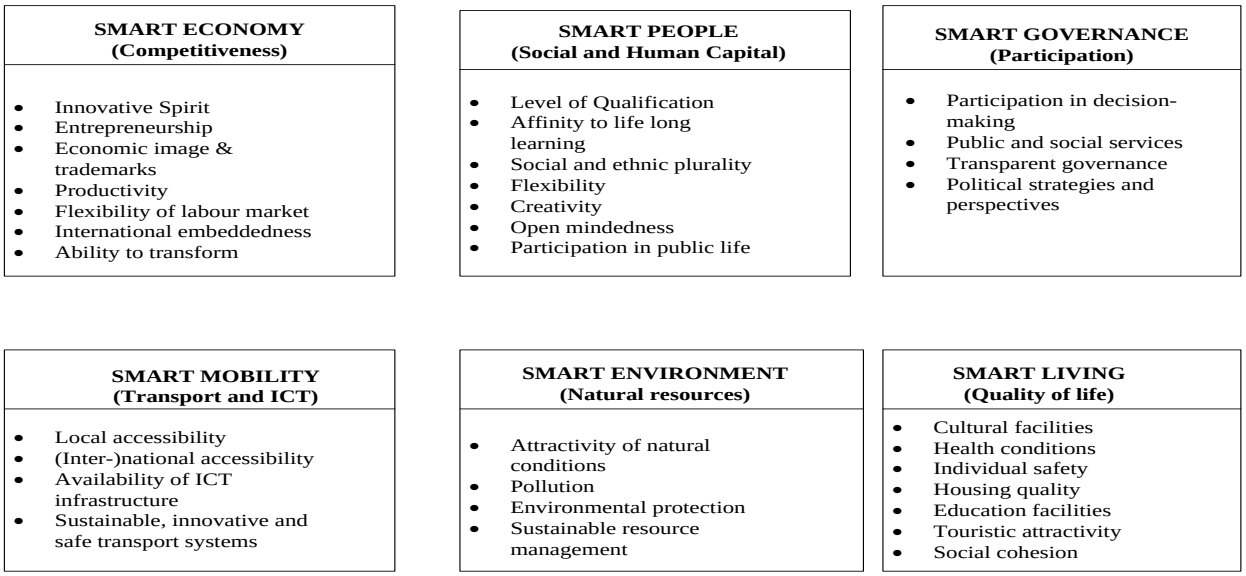


Figure 5: A topology of smart city functions (Axhausen et al., 2012)

2.2.1 Smart Economy

According to United Cities and Local Governments (2012) a city with smart economy is one that involves smart industries in their areas of ICT and in their production processes. These industries reflect the following elements: "penetration of ICT use in businesses, financial promotion, retaining and attracting talent and promoting creativity, support for entrepreneurship, business spaces and internationalisation" (UCLG, 2012, p. 7). This is supported by Osmond (2015) who says smart economy support local businesses to compete worldwide and offer high quality jobs.

2.2.2 Smart People

This segment differentiates smart people as the initiators of a smart city Osmond (2015) and in terms of their human capital development and quality of social interaction (UCLG, 2012) . This aspect includes education and training, and e-Learning to name a few.

2.2.3 Smart Governance

Governance is smart when it promotes active participation, citizenship services and the use of new communication channels, e.g. e-Government (UCLG, 2012), and ensures the maximisation of city resources through effective delivery of services (Osmond, 2015). Smart governance includes transparent governance, promoting ICT and innovation, and online public services.

2.2.4 Smart Mobility

This phase involves flexibility or the ability to move freely and easily around the smart technology services available to the public in everyday urban life and cultivates the connectivity and ICT infrastructure and public Internet access (UCLG, 2012). Smart mobility is the connectedness of the city services to meet the needs of the citizens (Osmond, 2015).

2.2.5 Smart Environment

Smart environment refers to the enabling environment that protects and preserves a city's environment through the use of new technologies. It includes security and trust; and culture and identity (UCLG, 2012).

2.2.6 Smart Living

Smart living is about making citizens' life easier and useful by creating a more liveable, enjoyable and colourful city where citizens will want to live (Eräranta, 2014). On the other hand,

Mginqi (2011) states that smart living is a trend aiming at an efficient lifestyle by allowing citizens to tap into the city's data and providing a high quality of life. Living smart is the pursuit of a lifestyle that significantly improves the quality of life of citizens, such as public safety conditions, access to basic facilities, inclusion, and quality healthcare (UCLG, 2012).

2.3 Pillars of a Smart City

The reshaping of cities to make them better in order to become smart by meeting citizens' needs is the new shift in the 21st century. People change their behaviour as a result of technology, thus cities need to become smarter in advanced technologies and data collection to meet citizens' needs (Pilloni, 2014). This is likely to be possible when a city becomes proactive on the long term development needs such as achieving the pillars of a smart city including competitive advantage, innovation and sustainability and these are discussed in detail below.

2.3.1 Competitive Advantage

Competitiveness needs to be taken into consideration in the making of a smart city, as it is linked to the city's economic well-being. The word *competitiveness* may have different meanings depending where it is applied (Balkyte & Tvaronavičiene, 2010). When improving the competitiveness of a city, directly increases the city's productivity, visibility, attractiveness and quality of life at a national and global level (Bruneckiene, Cincikaite, & Guzavicius, 2010). A city is competitive when it is able to use factors of competitiveness (financial strength, potential of citizens and technology, and shareholder and customer values) to gain competitive advantage and uphold it among other cities (Berger, 2010; Balkyte & Tvaronavičiene 2010).

According to Balkyte and Tvaronavičiene (2010), researchers draw attention to cities that are the drivers of economic growth and boost national competitiveness. This means that city's competitiveness is the "interrelations among its causes (or determinants), the process of competence itself (rivalry among economic units) and its consequences (effects in the macro and micro evolution)" (Bruneckiene et al., 2010, p. 494). Peng and Zhanxin (2011) state that competitiveness of a city is based on the following aspects: strength of economic development, openness of the city, infrastructure, and living environment; these are discussed below.

- **Strength of economic development** – This is a process of making the city prosper in terms of its assets and becoming financially stable while enhancing economic opportunities for its own citizens with the aim to improve the standard of living and diminish poverty (Carley & Lawrence, 2014). Malizia (1994) in Benami, Brown, Carley, Lawrence, and Nourafshan (2010, pp. 83-84) defines economic development as "the ongoing process of creating wealth in which producers deploy scarce human, financial, capital, physical and natural resources to produce goods and services that consumers want and are willing to pay for". Carley and Lawrence (2014, pp. 27-31) further add that economic development is significant in a city mainly because it helps to increase industry growth, income, innovation and entrepreneurship, job creation and reduce poverty."
- **Openness of the city** – Refers to the city that is able to create and maintain relationships of imports and exports with other countries. A city that is able to lead property markets with the principles of sustainability, transparency, citizen engagement and security (Azmizam, Hamzah, & Habibah, 2010).
- **Overall quality of the public** – Refers to the improvement in service delivery and process performance by the government officials. These services may include investing in human capital and control of public safety matters; emergency of health and education systems.
- **Infrastructure** – The bridge between companies and markets, consumers and essential services. It includes transport, energy, communications, educational networks and health services (Segal Rogerscasey, 2012). Hence without it our future cities will struggle to get on with their operations.
- **Living environment** – is referred to as a place where citizens' needs, such as aesthetics and cultural values are taken into consideration. Good living environment incorporates safety, health, contentment and so forth (Korpivaara, 2012). According to Berthon, Collinson, and Massat (2011), competitiveness of a city can be measured within the following forms:

  -Competition for residents and businesses – According to Coetzee and Olivrin (2012) competition for residents is creating an enabling environment where citizens have equal participation and face no barriers. That is, creating appealing

cities that can attract multiplicity of citizens who are well educated, entrepreneurial and thriving to promote innovation and new sources of growth. This means the creation of an environment that can be engaging to the businesses and entrepreneurs to help generate and sustain economic wealth.

-Competition for public and private expenditures – The competition for businesses to invest in cities of their choice in order to create jobs and economic development in those cities (Coetzee & Olivrin, 2012).

-Competition for visitors – The ability of the city to attract both tourists and business travellers (Coetzee & Olivrin, 2012).

2.3.2 Innovation

According to Shearmur (2012) innovation is not something that can be done overnight, it is a process of doing what never existed and lead to a learning opportunity where citizens and government can come closer and share their ideas. De Castro and Santinha (2010) add that innovation is a continuous learning process because the strategic value of information changes in time depending on the needs of citizens. However, Shearmur (2012, p. 11) also states that in order for innovation to be successful certain questions need to be answered including: "Who innovates, what particular processes lead to innovation, how is an innovation recognised and measured and what is the purpose of innovation". Innovation is one of the particular reasons smart city was created, because in order for a city to be smart, innovative ways needs to be put in place to prevent or overcome challenges such as urbanisation (Nam & Pardo, 2011). Hence, in an innovative city, citizens who are better informed of their needs and expectations become the sources of innovation (Capone, Cinti, & Lazzeretti, 2011).

2.3.3 Sustainability

Sustainability of a city according to Wu (2009); and Christodoulou and Mori (2011), means being able to meet the needs of the citizens without putting at risks the needs of the future generation. Ceccato and Lukyte (2010) add that the sustainability of a city depends on the safeness of the citizens from crime activites in that city. This enhances a city's image and also can attract investors in investing in the city. Unlike with an unsustainable city which is distinguished by"poverty, physical deterioration, increasing levels of crime and perceived fear of

crime" (Cozens, 2002, p. 131), Davidson (2010) and Lanoie, Lefebvre, Rajaonson, and Tanguay (2009) define sustainability of a city as a way of making positive change in three elements: environmental protection, economic development and social well being. These elements are further elaborated below in Figure 6, and their overlapping may result in the three dimensions: "equitable (interaction between economic and social elements), livable (this refers to the concept of quality of life) and viable (economic development must abide by the supportive capacity of the ecosystems, and depletions of non-renewable resources must be avoided)" (Lanoie et al., 2009, p. 407).

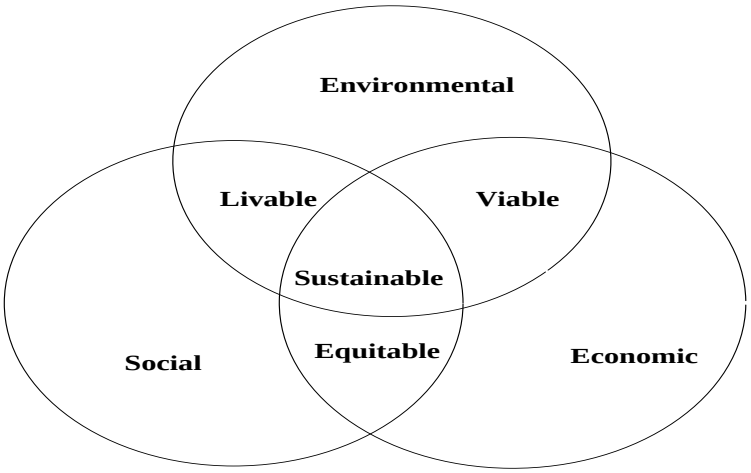


Figure 6: Classic dimensions of sustainable development (Lanoie et al., 2009)

2.4 Instrumented, Interconnected and Intelligent Cities

A smart city fosters instrumentation, interconnection, and intelligence to promote understanding of citizens and informed decision making about systems of systems (Dodgson & Gann, 201). Komninos, Nilsson, Oliveira, Pallot, Schaffers and Trousse (2011) add that with the help of instrumentation and interconnection of systems, real-time urban data can be collected to predict and manage the activities of the citizens and move the city forward through collective intelligence. This means that when you combine instrumented city, interconnected city and intelligence city, this will give you the smart city concept as represented in the figure below.

Figure 7: The concept of smart city (IBM, 2009)

The city is made of a group of systems and these systems need to be instrumented, interconnected and intelligent to enable efficient flow of information thus to make a city smart. According to Reyes (2009), a smart city is more than the smart management of city systems (people, infrastructure, business); its development should be in line with the services that matter the most to citizens. Instrumented, interconnected and intelligent cities are explained in detail below:

2.4.1 Instrumented City

This is the kind of a city that uses ICT to make the city an attractive place to live and also make citizens' lives easier (Bisson, 2013). For example, using public transport systems embedded with sensor networks to check for a parking space in a mall before you even get there or to check which routes whose traffic lights are not working or which roads are mostly used by commuters during the week and so on. Eckman et al. (2010) and Dodgson and Gann (2011) state that instrumented city utilises real-time data that help to provide results sufficiently and quickly that could affect the environment at that time. Instrumented city makes it possible for the integration of data using personal devices, human sensors and social networks (Chourabi et al., 2012). Instrumentation occurs when a city collects information of high quality in a more timely manner than ever before (Dencik, Dirks, & Keeling, 2009). Arbuthnot, Cosgrave, and Tryfonas (2013) add that instrumented city is about optimizing its decision making in the immediate, short and long run to manage better and control the city systems and collating real time data.

2.4.2 Interconnected City

Interconnected city can be seen as a way of sharing public information and services from local government to interconnect business services that are located in the area, with the aim of simplifying citizens' lives and daily activities (Anthopoulos & Fitsilis, 2010). According to Chourabi et al. (2012), interconnectedness of a city refers to the collection of information into an

ICT platform and communicated among various services of the city. The interconnectedness of a city is by means of the Internet of things (IoT) and the need for citizens to actively participate by handing over information to the city managers in order for the smarter infrastructure to be created (Peach, 2013). Dencik et al. (2009) define an interconnected city as a city that is openning up new ways of sharing information by generating bonds among the city data to enable communication. Below is an example of successful cases of interconnected cities compiled by Anthopoulos and Fitsilis (2010):

- Cities in New Songdo and Osaka are able to deliver information anytime, anywhere and to every citizen through their interconnected systems and ubiquitous ICT solutions over the city.
- City of Albuquerque uses business intelligence to share data amongst its employees in more than twenty departments in municipal services. This means that every employee and citizen gains access to the same municipal information ranging from water and public safety to residential and commercial development. This resulted in improvement in efficiency by sharing information across agencies in the city (Dodgson & Gann, 2011).
- New York Police Department (NYPD) undertook sophisticated analytics and provided search capabilities to make connections across multiple database information. This has helped the Department to transmit critical data instantly to officers (Dodgson & Gann, 2011).

Hazapis and Yovanof (2009) emphasize that the goal of an interconnected city is to share information amongst its inhabitants to improve the quality of services. This explains that interconnected city is not like an island; it is an interlinked city whose activities are shared among citizens through development of advanced infrastructures, smart logistic systems and accessible communication systems (Farouh, Giordano, Lombardi, & Yousef, 2012).

2.4.3 Intelligent City

Intelligence of a city refers to the "inclusion of complex analytics, modelling, optimisation and visualisation" in the city between local government and citizens, in order to make informed decisions about the operations of the city (Chourabi et al., 2012). On the other hand, Komninos et al. (2011) propose that intelligent cities are characterised based on five criteria respectively:

broadband infrastructure, knowledge work force, innovation, digital democracy and marketing. The capability to predict future events using new insights to make informed decisions and action, through the utilisation of new computing models and algorithms is known as intelligence (Dencik et al., 2009). For example, the predictive data can be used to estimate weekly electricity usage in the city, in order to come up with ways of saving energy according to the need. Hence intelligent cities can be seen as territories directing towards the existence of environments that can improve citizens' cognitive skills, their ability to forsee and innovate (Komninos & Sefertzi, 2009). Intelligent city help to prepare one's community to meet challenges of a global, knowledge economy (Hazapis & Yovanof, 2009).

However, Nam and Pardo (2011) state that there is a distinction between an intelligent city and a digital city. Intelligent city is characterised as a city where learning, technological developments and innovation procedures are supported, but for the intelligent city to function it needs digital city components. Komninos and Sefertzi (2009) further add that intelligent city is a area where innovation is improved by digital collaboration spaces, interactive tools and embedded systems. On the other hand, Hazapis and Yovanof (2009), defines intelligent city as a city where the behaviour of systems changes because of environment whilst monitoring and responding accordingly to achieve desired goals. Intelligent city can be defined as a city where knowledge and technological innovations are at the centre of the individual citizen and are supported and encouraged by the government to increase competitiveness and sustainability (de Castro & Santinha, 2010).

The intelligent city can offer various smart services including public safety and security of the citizens, large scale environmental monitoring in an urban environment and improved transportation management and logistics (Hazapis & Yovanof, 2009).These services can be accessible anytime, anywhere using a mobile device that is equipped with sensor networks. The figure below is an example of a city that is viewed as a smart ecosystem which delivers better-quality services that are user centric and user co-created to its citizens (Hazapis & Yovanof, 2009).

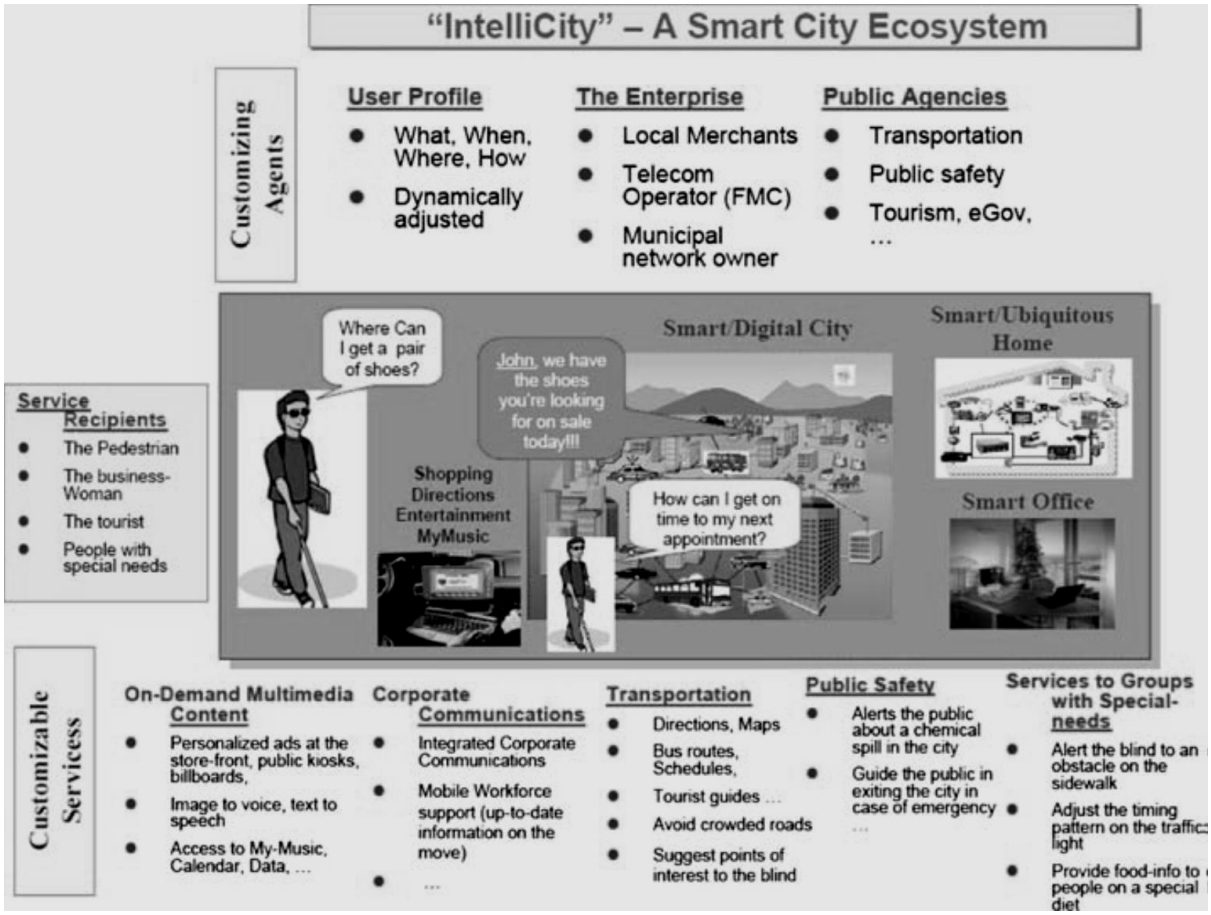


Figure 8: Intelligent city as a smart service provisioning system (Hazapis & Yovanof, 2009)

2.4.3.1 Characteristics of an intelligent city

Intelligent cities can be grouped under different characteristics based on their current level on environmental impact, sustainability initiatives and efforts to promote attractiveness, namely: pioneers, legacy, risk, fast adopters and large cities (Berthon et al., 2011).

- Pioneers – Cities that have already started on the journey of using smart technologies to improve the quality of life (including reduced crime, traffic congestion and greenhouse gas emissions) of citizens.
- Legacy – These cities are on the low to medium range of improving the quality of life of citizens, but have not yet started an all-embracing strategy like the pioneer cities.
- Risk − In these cities the quality of life of citizens is at a risk because of uncontrollable population growth.

- Fast Adopters – Cities with rapid growth, for example urban areas, but aiming to attain the intelligent city model.
- Large Emitters – These are the megacities with the most disadvantaged position based on the quality of life, requiring a disaster recovery plan immediately in order to continue.

One of the most important enablers for an intelligent city is an open, interoperable and scalable platform that provides optimal resource management by means of an intelligent infrastructure functionality (Berthon et al., 2011). This is depicted in Figure 9 by the interconnection of the critical components of an intelligent city, which ensures combination of all services needed in the city in one smart system.

Figure 9: An open platform can integrate and make interoperable the critical components of an intelligent city (Berthon et al., 2011)

Below, the table shows city systems and the outcomes that may be achieved if these systems are instrumented, interconnected and intelligent.

Table 3: Examples of how some core systems can be made smarter with the help of instrumentation, interconnection and intelligence (Dencik et al., 2009)

System	Elements	Instrumentation	Interconnection	Intelligence
Communication	• Broadband, wireless • Phones, computers	Data gathering via mobile phones	Interconnect mobile phones, fixed line, broadband	Information for consumers on city services, on their own time
Citizens	• Public safety • Government services • Health and education	Patient diagnostic and screening devices	Interconnect records for doctors, hospitals and other health providers	Patient-driven pre-emptive care
City services	• Public service management • Local government administration	Creation of local authority management information system	Interconnected service delivery	Immediate and joint-up service provision
Business	• Business environment • Administrative burdens	Data gathering about use of online business services	Interconnect stakeholders across city's business system	Customized service delivery for businesses
Transport	• Cars, roads • Public transport • Airports, seaports	Measuring traffic flows and toll use	Integrated traffic, weather and traveller information services	Road pricing

2.5 Smart Cities in Developing Countries

Smart cities do not only focus their attention on ICT changes but also encourage investments in knowledge and skills of individual or population to make urban living practices and conditions better by supporting and motivating the citizens (Cagliano et al., 2014). IT and Communications Systems team (2010) further elaborate that smart cities can help with overcoming challenges including crime, traffic congestion, urbanisation, scarcity of resources and waste management

even in an environment that faces financial constraints/ hindering situations. These challenges are explained in detail below:

- **Crime** – In South Africa, crime is one the biggest challenges that the country faces. According to the Institute for Security Studies (2013) as recorded by the South African Police (SAPS) interpersonal and violent crimes including robbery, murder, attempted murder and rape are the kinds of crimes that are not easy to reduce or overcome through policing alone. These crimes need citizens' participation and engagement which is one of the aspects encouraged in a smart city. Robbery mainly affects poorer people and usually occurs when people go to and from work, school, shops, visit friends or relatives and so on, often in quiet streets or overpopulated areas (Institute for Security Studies, 2013). Gould (2014) points out that major cause of crime are the increasing levels of poverty and inequality.
- **Traffic congestions** – This is one of the challenges affecting South African urban areas due to the exceeded capacity of citizens. According to Buonocore, Levy, and von Stackelberg (2010), traffic congestion can lead to unpleasant impacts ranging from waste of fuel, time and even excess greenhouse gas emissions which can have a negative impact on public health. de Palma and Lindsey (2011) add that traffic congestion can lead to the increase in urban road tolling, especially in large cities with major highways.
- **Urbanisation** –The movement of people from the rural areas to urban areas seeking better economic opportunities or because of lack of prospects in their rural areas (McGranahan, Satterthwaite, & Tacoli, 2010). Satterthwaite (2011) adds that is also one of the factors causing an increase in the levels of greenhouse gas emissions in most of African countries.
- **Scarcity of resources** – The focus of this study will be on natural resources necessitated to meet the basic needs including land, food and water (Evans, 2010). According to Abdelhak, Mohd, and Sulaiman (2011), scarcity of resources in the continent is the hurdle towards sustainable development and economic growth. Evans (2010) further adds that scarcity of resources, especially for poor people, may increase in the rise of war and conflict, for example, scarcity of food would lead inflated prices of particular staple foods because of the demand.

- **Waste management** – Solid waste is usually more of an issue in urban areas than in rural areas due to the population size, since in rural areas citizens purchase less store items which results in less packaging (Hoornweg & Tata, 2012). These include urbanisation, population growth, poverty, limited capacity and resources of the Waste Department, illegal waste sites, limited enforcement, and public awareness (Future Works, 2014). This is proven to be true in the Buffalo City urban areas where population size is one of the causes of ineffective waste management.

The closure of most general and hazardous waste sites has caused extensive land pollution in the Buffalo City because of illegal dumping and littering, especially in disadvantaged urban areas. Most of the time uncollected waste could be result of flooding, air pollution which impacts the health of citizens. In most cases, a city that cannot manage waste effectively is likely not to do well in complex services such as education, transportation and health (Hoornweg & Tata, 2012). Baccarne, De Marez, Mechant, and Schuurman (2012) also raise that just because a city is instrumented, interconnected and intelligent does not mean it will automatically become smart by itself. The benefits of a smart city are discussed in the next section.

2.6 Benefits of a Smart City

According to Kuszewski (2013), there are several benefits that a smart city can offer to its citizens and business operations, namely:

- **Turn information into insights** – Nowadays data is used everywhere. In a smart city data can be transformed into valuable insights through the use of advanced analytics. This could lead to new opportunities for citizens, government and businesses in terms of rapid informed and confident decisions made. Phelps (2012) adds that turning information into insight helps to use information to a maximum advantage and create value.
- **Drive enterprise operations' effectiveness and efficiency** – smart cities are the enablers of economic development; this means that businesses can do more with less by driving continuous and sustainable operational improvements. According to Hoque (2012),

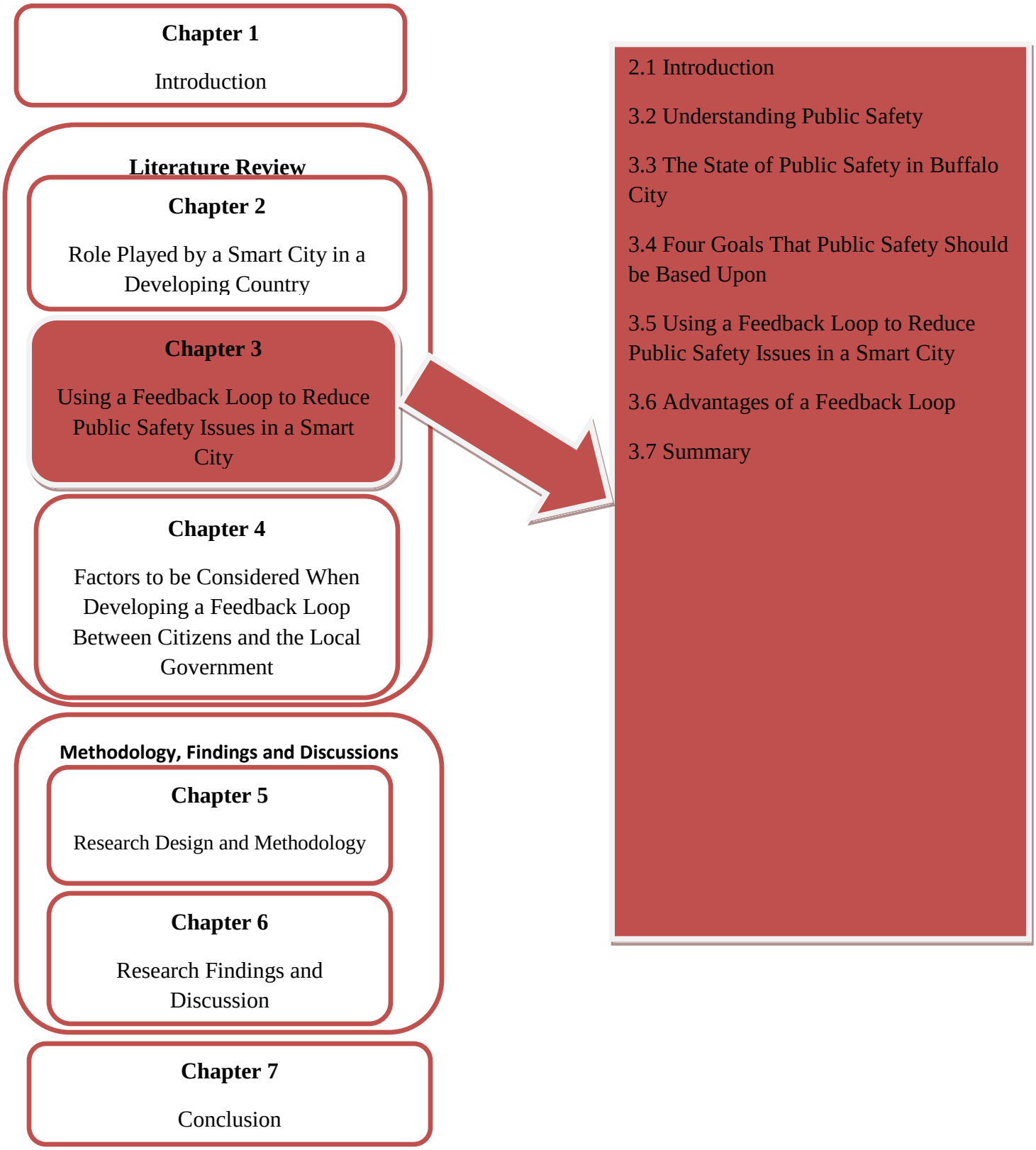
enterprise effectiveness and efficiency is one of the methods that help to allocate limited resources and achieve success in a rapid changing environment.

- **Increase agility** – In a smart city, for example, government needs to be responsive and agile to be able to adapt to the innovative processes in order to lead their cities and do better than their competition. On the other hand, Kirk (2011) proposes that increasing agility in a city will not only transform it, but also results in empowered individuals, creative- participatory decision- making, connectedness, and care for each other.
- **Connect and empower people** – Smart city embraces social technologies, which in turn leads to increased participation with connectivity everywhere from citizens, government and businesses.
- **Enable business service and product innovation** – Due to high product expectations from customers, businesses are faced with the need to create more personalised experiences across the entire product and service life cycle whilst continually improving cost and efficiency (IBM 2009).
- **Manage risk, security and compliance** – The smart city platform provides smarter technologies such as sensor networks which can sense the activities of the city and provide real- time data to the citizens (IBM 2009). This could aid government officials to assess and monitor risks in order to mitigate and prevent them.

2.7 Summary

Smart city concept is defined as a notion of using technologies to make living, people, environment, economy, mobility and governance of a city more efficient. This is in accord with IBM (2009) of combining instrumented; interconnected and intelligent cities whilst enforcing competitive advantage, innovation and sustainability to better the lives of inhabitants. This means when the smart city concept is fully exploited it can provide better solutions to facilitate enabling environments and improving the quality of life of citizens. This study therefore suggests that citizens and city managers must exploit the benefits of a smart city to reduce the challenges of public safety in their communities. Chapter 3 will discuss in detail the ways in which a feedback loop between citizens and local government can help reduce public safety issues.

CHAPTER 3: USING A FEEDBACK LOOP TO REDUCE PUBLIC SAFETY ISSUES IN A SMART CITY



3.1 Introduction

Reducing public safety in EL is one of the major challenges that the Buffalo City currently faces and hopes to overcome in the future. EL is one of the worst areas in the province as of 2014 with high public safety problems including robbery, public violence, carjacking, driving under the influence of alcohol and drugs, murder, and drug related crime (Crime Stats SA, 2014). As stated on page 72 of the BCMM annual report for 2011-2012 financial years, the mission of the Directorate of Health and Public Safety is to "provide a safe, secure, healthy and environmentally friendly environment for the BCMM's residents, citizens and visitors by providing equitable and sustainable health and safety services to all". This implies that it is in the best interest of EL city to serve its people with good quality and reliable public safety services. The introduction of an ICT enabled feedback loop is shows how best to use limited resources in order to improve the communication process between citizens and local government while reducing public safety matters.

According to Baer et al. (2009), ICT is one of the most used tools that have great potential in improving citizens' engagement with local government to public information. Bulu (2013) sees ICT as a way of converting practical aims of human life into applied knowledge. This is also supported by Cagliano et al. (2014) who state that ICT is an integral part of enabling the feed of real- time information between citizens and other public safety departments in order to protect citizens effectively. Technology includes tools and techniques that are more efficient in improving communication by making information available with just a click of a button and building human capital without the need of being in the same place. Technologies create the possibility of influencing different groups significantly to take part in various public safety discussions and make traditional systems faster and more efficient (Baer et al., 2009).

Creation of a feedback loop can mean improvement of public safety operations, community trust and confidence in city managers, increased citizen engagement, and reduced crime activities. The aim of this chapter is to identify challenges surrounding public safety departments that affect their daily operations, discuss the goals that public safety should be based upon, and lastly the advantages that a feedback loop can offer in order to reduce public safety issues. The next setion provides the overview of public safety.

3.2 Understanding Public Safety

Public safety is the face of the nation, hence improvement of it is the cornerstone of every city. The purpose of public safety is to provide a sound public safety system through crime prevention, traffic safety, fire and rescue and disaster management services for all communities in a city. Cagliano et al. (2014) agrees by stating that public safety's aim is to make sure that citizens and their possessions are protected by means of an active involvement of citizens, local government and the police force.

Though the police may have at hand the strategies to achieve public safety objectives, it is also important to interact with the public in order to enforce fair and effective law, and effective responses to public safety issues (Plant & Scott, 2009). Common examples that police could use to deal with public safety issues include "assembling the community as witnesses to patrol the community and for support; requesting that citizens exercise informal social control over one another; using mediation and negotiation skills to resolve disputes and coordinating with other local governments and private services" (Plant & Scott, 2009, pp. 13-14). One of the major challenges facing city managers, mayors or councillors in public safety is to make most of the existing information in order to transform the way metropolises are managed (Dignan, Shah, & Tunvall, 2013). Jordyn (2014) and Dignan et al. (2013) have the same opinion that the challenge of standalone systems is still affecting many local municipalities. This creates friction and leads to duplication of efforts and frustration in different departments and sometimes within the Department of Public Safety. Peha (2013) emphasizes that it is important that today's communication systems be interconnected especially in the case of first responders, where these ineffective communication systems affect the country and put the lives of the people at risk. The latter statement is in contrary with Public Safety Department because it's role to manage emergency services while making a city a liveable and friendly environment. The management of emergency services is made possible by revising four phases and these are discussed below.

3.2.1 Emergency Management

Local government is one of the important stakeholders that play a significant role in emergency management by developing necessary policies and procedures for responding to cities' emergencies efficiently (Henstra, 2010). Emergency management is the process of assisting the

local government to prepare and manage public safety or emergency services in the city and is illustrated with four phases in the figure below.

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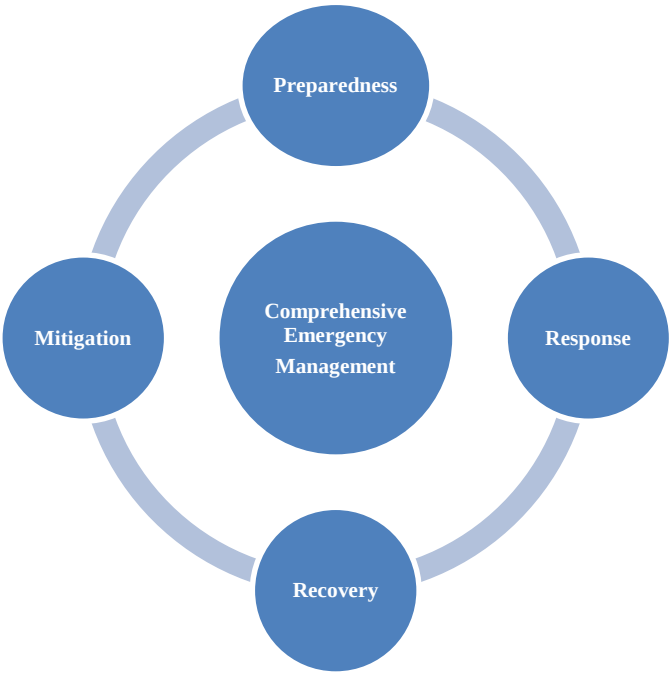


Figure 10: The four phases of emergency management (Jackman & Nestler, 2014)

Preparedness –In this phase refers to activities that are taken by emergency officials in advance of an emergency or disaster, including identifying and collaborating with the personnel, training the employees, and organising equipment necessary to respond to the event (Bumagarner, 2008). The key constituents of this phase are threat assessment, resource assessment and acquisition, intra-jurisdictional cooperation, drills and exercises, and plan documentation (Jackman & Nestler, 2014).

Response –The response phase implements and executes the plans and allocation of resources identified in the preparedness phase (Jackman & Nestler, 2014). The key elements of this phase include activation of emergency protocol, medical assistance and first aid, shelter and evacuation, search and rescue, and secondary damage reduction (Jackman & Nestler, 2014).

Recovery – This phase is made up of short and long- term recovery strategies. The objective of this phase is to continue until all systems return to normal or better (Phillips, Neal, & Webb,

2012). The key elements include damage assessment, clean up after disaster, restoration of critical systems and facilities, provision of temporary basic needs, and basic construction (Jackman & Nestler, 2014).

Mitigation – This phase focuses on reducing impacts in terms of loss of life, injuries, damage to property, infrastructure, economy, and environmental resources and is usually implemented after the disaster. Lastly, activities of this phase can be identified and carried out in each of the above three phases. (Haddow & Haddow, 2014). According to Bassler, Brasier, Fogle, and Taverno (2008), for citizens to participate effectively in reducing public safety matters, it depends on the tools and techniques that the local government deploys and how those tools and techniques are promoted.

In the BCMM report it is stated that poor citizen participation in public safety issues is one of the reasons hindering the city to be managed effectively (BCMM, 2013). Public safety in the BCMM encompasses 154 informal settlements and 230 rural settlements and is divided in the following functional areas: traffic services, law enforcement services, fire and rescue, and disaster management (BCMM, 2013). These functional areas are explained in detail below based on the South African Cities Network (2014) report:

- **Traffic Services** − One of the areas in the Buffalo City that is under the Public Safety Department. It is in charge of enforcing the law under in respect of the National Road Traffic Act and other pertinent laws. It is also responsible for educating citizens about traffic safety, erecting and maintaining road signs and surface markings, issuing learners and drivers' licences, registering vehicles, and keeping records of motor vehicle accidents statistics.
- **Law Enforcement Services** – This section forms part of the Public Safety Department in the Buffalo City area and is responsible for protecting municipal assets, putting into effect municipal by- laws, and preventing crime**.**
- **Fire and Rescue** – One of the divisions that form part of the Public Safety Department within the Buffalo City. This division is structured into three main elements: operations, fire prevention, and training division. These components are responsible for, amongst others, extinguishing fires, rescuing people involved in motor vehicle accidents, emergency evacuations, basic firefighting industries, inspection and registration of

flammable liquid installations, maintaining of fire water supply equipment, and conducting training courses internally and externally about fire and rescue services.

- **Disaster Management –** A division under the Public Safety Department in the BCMM. It is responsible for assisting communities that are affected by catastrophic events, especially when the community resources on its own are not enough. This division also assesses risks and vulnerabilities, prevents and mitigates risks, prepare for risk, responds and recovers risks, and rehabilitates and reconstruct infrastructure. For each functional area there are necessary activities that need to be carried out in managing the city properly; these activities are illustrated in Table 4.

Table 4: Functions under Public Safety Departments (BCMM, 2013; BCMM, 2012)

Traffic Services	Law Enforcement Services	Fire and Rescue	Disaster Management
-Traffic control - Enforcement of traffic laws - Registration and licensing of vehicles - Testing of vehicles for roadworthiness - Testing of applicants for learners and driving licenses - Issuing of business licenses in terms of the Business Act - Maintenance of road traffic signs and markings - Control of dogs - Road safety	-Traffic law enforcement - Enforcement in respect of all offences - Attending to complaints from the public - Processing of applications in terms of the Gatherings Act - Law enforcement operations in conjunction with the SAPS - Visible patrols and crowd control at special events - Safety of municipal installations and plant as and when required - Monitoring of informal street trading - Cash in transit for various municipal cash points	-The suppression of fires - Fire safety inspections - Risk assessments - Fire related training	-To guide the development and implementation of disaster risk management as per the Disaster Management Act - To enable disaster risk management capacity building, training and education, and promote applicable research - To guide the development of the disaster risk management function in the BCMM - To facilitate the inclusion of the private sector, Non-Governmental Organisations (NGOs), traditional leaders, technical experts, volunteers, the community and other relevant role-players in

			disaster risk management in the BCMM - To establish prevention and mitigation as the focus of all disaster risk management initiatives

The listed activities in the table above are confirmation that each functional area depends on the other to reduce or overcome public safety issues, as some of the activities overlap within the functional areas. National Development Plan 2030 highlights that enhancement of public safety could lead to improved quality of life and human development, but when citizens live in fear because they are not safe this could affect and hinder their ability to achieve their potential. This means in cities where public safety is in a crisis few or no one wants to invest; the following section discusses in further detail the functional areas of public safety in EL.

3.3 The State of Public Safety in Buffalo City

According to the Integrated Development Plan Review, the Public Safety Department in Buffalo City is considered underprivileged and fragmented with a lack of communication between the citizens and public safety officials and also within its functional areas (BCMM, 2013). Public safety is comprised of the following functional areas with the challenges listed below.

3.3.1Traffic Services

Buffalo City's Traffic Services in the Department of Public Safety is hindered by various challenges including number of motor vehicle accidents; delays in obtaining an appointment for a driving license test; extension of full services to all areas of BCMM; limited K53 driving license test facilities, and limited office accommodation facilities, equipment and personnel (BCMM, 2013).

3.3.2 Law Enforcement

As stated in the BCMM report, the Law Enforcement section is faced with challenges which include "use of hawker stalls for crime related activities; sale of liquor to minors by liquor outlets; high rate of crime in the central business district (CBD); theft and vandalism of municipal property and lack of adequate facilities, equipment and personnel" (BCMM, 2013, p. 76).

3.3.3 Fire and Rescue

The Fire and Rescue Department is faced by the following challenges: delays when responding to emergencies especially in rural areas; lack of fire hydrants; limited resources including fire engines, equipment and personnel; closeness of informal houses in informal settlements; Fire Protection Association not established by communities, owners of the land, traditional leaders and emerging farmers to manage, control, coordinate and extinguish veld fires (BCMM, 2013).

3.3.4 Disaster Management

The disaster management section is faced with the following setbacks: lack of formal disaster risk management structures; poor planning; insufficient skills and materials; poor aging of infrastructure; inadequate maintenance; householders settling in unsafe areas, and lack of knowledge and understanding (BCMM, 2013). In light of the above mentioned challenges, there are four goals that public safety should be based upon even in resource constrained situations; these are discussed below.

The table below links with the challenges explained above about the state of public safety in BCMM. The BCMM is at the very bottom and with the lowest score which shows the municipality is faced with challenges. This makes it difficult for the local government to clearly understand and meet citizens' basic needs and could lead to increased public safety issues; misallocation of resources; and poor service delivery due to the increase in number of people living in the city (Donnelly & Harrison, 2011).

Table 5: MPI results for South Africa's eight largest cities (Municipal IQ, 2013)

Metro	Rankings	2013 score	Metro average

Cape Town	1	69.1	63.3
Johannesburg	2	67.0	63.3
eThekwini	3	66.0	63.3
Nelson Mandela Bay	4	65.2	63.3
Tshwane	5	64.4	63.3
Ekurhuleni	6	62.3	63.3
Mangaung	7	56.6	63.3
Buffalo City	8	55.6	63.3

The rankings and the scores for each metro are demonstrated in the Municipal Productivity Index (MPI) table, which measure (1) the acceptable conditions that residents live in, (2) how vibrant the local economy is and (3) what role the municipality plays in this (Municipal IQ, 2013).

3.4 Four Goals That Public Safety Should be Based Upon

A safe city means an improved socioeconomic development and equality, which encourages economic growth and transformation, resulting in an environment beneficial to employment creation, improved education, health outcomes and strengthened social cohesion (Baer et al., 2009). Public safety means making sure that people feel safe at home, at school and at work, and enjoy community life free of fear. According to the strategic plan of the Justice and Public Safety Council for 2017, the four goals of public safety are:

3.4.1 Enhance Fairness

This goal is comprised of the following components which are:

- **Accessible** –ensures that public safety services offered are reachable to the citizens proactively, regardless of means or location.
- **Impartial** –encourages that citizens are treated with fairness, integrity and equality.
- **Timely** –includes reducing delays to the public safety services and tries to find early resolutions.

3.4.2 Protect People

- **Preventative** –aims at reducing antisocial behaviour by assisting citizens in rebuilding clean living and productive lives.
- **Protective** –aims at downgrading public safety matters in the city, including protecting victims of crime and preventing ill-treatment of vulnerable citizens.
- **Systemic approach** –intends to support and participate in effective interventions, like working across the levels of local government in order to understand and deal with the root causes of crime.

3.4.3 Sustainability

- **Focused** –ensures resource availability according to evidence based decisions to make sure that public safety service delivery is not interrupted.
- **Managed** –deals with the appropriate allocation of resources based on clear and demonstrated cause and effect.
- **Effective** – deals with measuring and improving the value of public investment spent on public safety services.

3.4.4 Public Confidence

- **Adaptive** –intends to respond to the needs of the citizens, respond to the changes in the community, and also monitor the effectiveness of their programs.
- **Performance focused** –aims at engaging citizens in public safety decision- making by assuming collective and respective responsibility for system performance.
- **Empowering** –encourages citizens who have entered the system's support and learning opportunities and treats the time of every citizen as valuable.

The next section will discuss the use of a feedback loop to reduce public safety matters in a smart city.

3.5 Using a Feedback Loop to Reduce Public Safety Matters in a Smart City

The development of a feedback loop in any organisation provides citizens with real-time information about their actions, encouraging them toward better behaviour (Peha, 2013). Thwink (2012) adds that a feedback loop is a platform whereby the output influences the input and occurs when there is a change in something. Boundless (2014) highlights that a feedback loop is a process that needs to be monitored regularly because of the changes that occur in the process. For example, this means that when decisions are made, they need to be monitored and measured based on the expected results.

According to Goetz (2011) an effective feedback loop consists of four stages, namely: evidence, relevance, consequence, and action. In the evidence stage the data is collected, measured, captured and stored. The relevance stage transmits the data back to the citizens not in the form of raw data, but in the context that is more meaningful. In the third stage, consequence, information is then simplified in order to be clearer to the local government and citizens. In the action stage, it is a moment where decisions are made by the local government and the citizens. The action taken in the fourth stage is then measured and the feedback loop is run until required outcomes are achieved. One of the aims of a feedback loop is to encourage citizens to work hand in hand with the local government to help reduce public safety matters in EL. For example, the feedback loop will allow citizens of EL to report crime activities, accidents, suspicious behaviour and potholes. According to Lee (2014), in the city of Mesa, Arizona there is a mobile application called "MyMesa" that allow citizens to report public safety matters. The results show that ever since its launch in February, 2014, the number of reports increased and the city is providing better public safety services through analysing the data it collects.

A feedback loop system will be the means or the medium to expand public access to information compiled by the local government to citizens and other public bodies about the public safety issues in EL. According to Baer et al. (2009), the local government should address issues such as which content should be made available to the citizens and how that should be done. A feedback loop system is the means of encouraging local government and the citizens to work together in alleviating public safety issues in order to get to the bottom of reducing these issues, and also to lead their efforts to enhanced decision- making.

Several strategies have been tried in previous years to reduce crime in developing countries, including "civil society organizations, community policing forum, criminologists and crime combating strategies", yet the results are not satisfying (National Development Plan 2030, p. 386). The use of a feedback loop with these strategies could lead to remarkable crime control efforts as it is proven to be a method that could collect and disseminate real- time information to the citizens. Therefore, this study needs to determine the different types of feedback loops and determine which best meet the objective of the study.

3.5.1 Feedback loop types

A feedback loop will help to encourage two- way interaction between citizens and local government by allowing citizens the opportunity to participate in decision- making with the intention to better the public safety issues. There are different types of feedback loops, namely: suggestions, complaints and satisfaction (Asad et al., 2014); these are explained in detail below:

- **Suggestion feedback loop** - Encourages citizens to launch their ideas to the local government about the public safety issues and how they can be reduced.
- **Complaints feedback loop** – In this type of a feedback loop, citizens address their grievances or problems with public safety matters to the local government; this could help the local government to know which areas need immediate attention.
- **Satisfaction feedback loop** – Citizens measure their happiness with the reduction levels in the public safety issues and also about their involvement in the decisions made regarding the city.

3.6 Advantages of a Feedback Loop

The opportunities that can be offered by an effective feedback loop in a city are significant, especially in crime activities. According to Newell (2012), remarkable results have been shown by the dropping of crime rates when local government corresponds with its citizens. Mishra (2013) states there are particularly three benefits, among others, of a feedback loop which include: leveraging information to make better decisions, anticipating and resolving problems proactively, and coordinating resources to operate more efficiently.

3.6.1 Leveraging Information to Make Better Decisions

With the use of advanced analytics, the interrelationships between a city's subsystems can be improved by making it easier to understand and to act at every level of public safety. Borning, Ferris, and Watkins (2010) add that the use of real-time data has helped in reducing traffic congestions and carbon emissions in Seattle, Washington by providing citizens with the travellers' information. This idea improved the public transit of bus riders from Seattle in terms of satisfaction in the waiting times, availability of buses per week, and safety. Calabrese, Colonna, Lovisolo, Parata, and Ratti (2011) further propose that the use of intelligent transportation systems can help to obtain and deliver real-time data about traffic incidents, estimated travel times and driving conditions to the travellers. This could aid in directing the traffic if need be to other routes, thereby reducing traffic congestion, and providing a pleasant ride to the travellers.

3.6.2 Anticipating and Resolving Problems Proactively

Feedback loop systems can help the local government to discover patterns and trends with the provision of the real- time data fed into the city's subsystems efficiently and cost effectively. In a rapidly changing society, local government need to be anticipatory; this can allow competitive advantage by gaining sophisticated intelligent techniques, new models of decision- making, and to judge results of public safety matters (Ashely & Morrinson, 2011). Eyre (2014) adds that a proactive approach of managing the city can help the local government and citizens to attain the following goals:

- **Take back control of time** – Firstly, time is essential and cannot be wasted. When the local government plan ahead, this gives space to be able to foresee and be ready for the problems that a city might face. Now, this allows the local government to select essential tasks by determining which responsibilities are critical for the city.
- **Look at processes** –In this stage the local government need to check properly that all processes and citizens' working practices are functional to avoid delays or complexities. Explore possibilities, create a check list to help the citizens adapt, and fill in the local government when there are difficulties in order to anticipate and avoid future problems. Local government need to understand the strategic flow of information from the outside

to the inside in order to avoid receiving analogous information that already exist (Ashely & Morrinson, 2011).

- **Understand and manage risk** – When local government have understood their processes, problems can be addressed, thus permitting the local government and citizens to deal with the challenges faced in the city with confidence. Ashely and Morrinson (2011) add that it is better to identify emerging issues in all sectors including technological, social, economic and environmental before they strike because issues can come from unexpected places.
- **Focus on morale** – The local government need to motivate their citizens by creating learning opportunities and acknowledging the good work that the citizens have done after the completion of a task given. Citizens need to be part of the decision- making process by means of meetings or informal gatherings.
- **Build in continuous improvement** – Local government and citizens continue to improve their working practices and end results. Citizens are given the chance to make the most of their knowledge and experiences by allowing them to suggest changes through discussions or suggestion boxes in order to help them focus on solutions.

3.6.3 Coordinating Resources to Operate More Efficiently

The complexity of a city's subsystems can often cause inefficiencies that result in resources being wasted. With the use of the efficient feedback loop, real- time data will be shared across these subsystems, which allows a city to anticipate and respond to situations whilst optimising city resources.

3.6.4 Promote Citizen Engagement

Because public safety issues facing the cities are vast, empowering citizens to take part in meaningful ways to help their communities, could lead to local government, citizens and businesses working together on the best solutions (Lee, 2014). According to Blakeley (2010), involving citizens in local government projects is the key to citizen engagement and is now a central element in governance. Bassler et al. (2008) support that involving citizens in decision-making, especially in rural communities, helps to boost trust between citizens and local government. According to Scott, Silver, and Kazepov (2010), encouraging citizens to participate in public safety matters has the following benefits:

- Promotes social inclusion, which ensures access and openness about public safety matters to all citizens and allows them to take part in decision- making.
- Citizen participation empowers citizens to engage in public safety matters because simply having a matter on the table is not enough. This benefit allows citizens from different communities to have equal capacities to participate in forums open to the public, encouraging their voices to be influential in decision- making.
- Citizen participation encourages consensus over the public interest, whereby social justice is often achieved.

Bassler et al. (2008) add that the aim behind encouraging citizens to participate in public safety matters is to make better decisions and have a greater positive impact on their communities by increasing frequency, diversity and level of engagement of citizens. On the other hand, Lee (2014) recommends that city managers need to understand that when giving citizens the chance to fix issues or problems associated with public safety matters in their communities, that makes them feel engaged in city matters. As businesses use data to make decisions, cities need to deploy its greatest resources – its people (Lee, 2014). Citizen engagement involves five elements, namely: "increasing citizens' knowledge about a community issue; encouraging citizens to apply that knowledge; using that knowledge to improve the community; creating opportunities for citizens to engage each other and ensuring that these opportunities are regular and on-going" (Bassler et al., 2008, p. 2). However, Anand, Bailur, and Gigler (2014) put forward that citizen engagement has four dimensions which are illustrated in the figure below, moving from bottom to top.

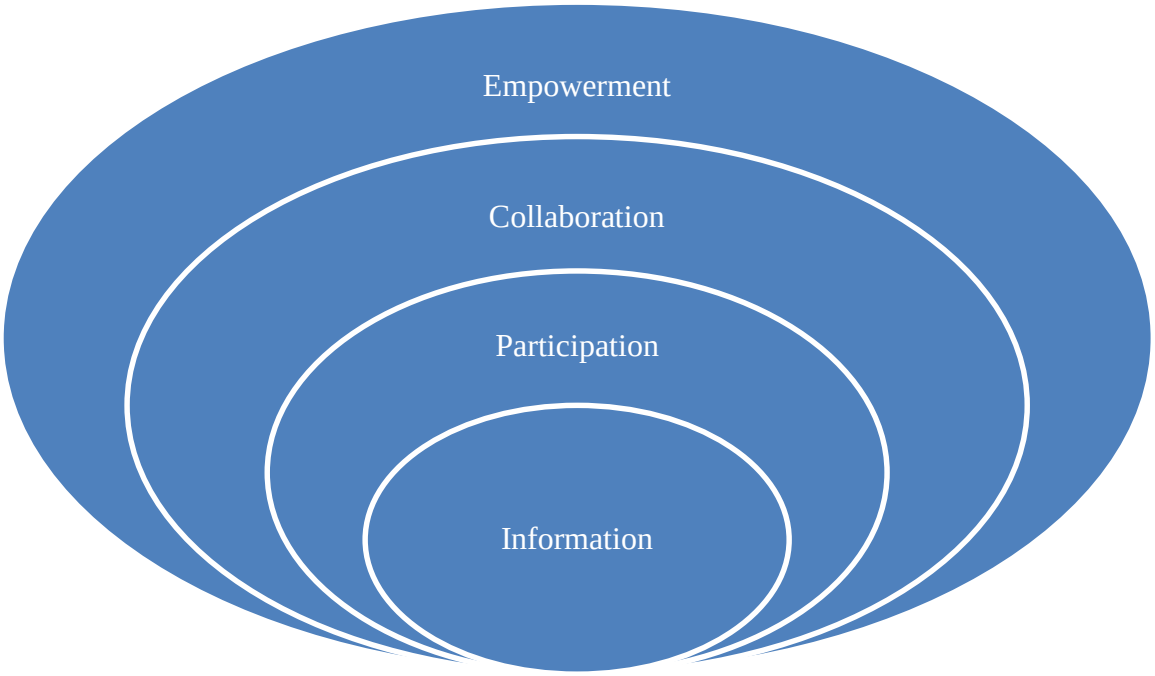


Figure 11: Dimensions of citizen engagement (Anand et al., 2014)

In Table 6 the five aspects of successful citizen engagement are further highlighted and explained in detail.

Table 6: Aspects of citizen engagement (Bassler et al., 2008)

Aspects of citizen engagement	Definitions
Inclusivity	This aspect focuses on recruiting citizens that might seem to be less important because of their past experiences, lack of knowledge and cultural context.
Diversity	Encourages citizens to participate and share their different viewpoints and interests. Viewpoints that seem at first to be unacceptable sometimes turn out to be the seed of the solution.
Equality	Local government need to ensure that everyone participates and all ideas are treated with respect. Open discussions are encouraged to all citizens and participation must be on equal basis.
Transparency	Citizens and local government need to be open to each other about public safety projects and the

	decisions made. Local government must assign roles to help encourage the citizens be involved in public safety projects such as facilitator and collaborator to name a few.
Legitimacy	Local government need to explain to the citizens how important their inputs lead to the final decisions. Decisions made both by local government and citizens need to be justified.
Deliberation	In this aspect the local government need to create an enabling environment that encourages citizens to share and prioritise ideas that lead to consensus.
Substance	Learning opportunities for citizens and local government are created and the knowledge is discussed.
Influence	Local government need to give their continued support early in the public safety projects and as leaders encourage citizen engagement. The results on this aspect aim to influence community decisions and policy making.
On-going	Allows citizens to discuss public safety matters before coming to meetings in order to allow them to think about the solution before making decisions.
Accommodating	This aspect provides opportunities for citizens to meet at times and places convenient for them.

3.6.5 Increased Transparency

One of the reasons transparency is promoted in developing countries is to help change the passive role that citizens have, and to open up a way to build up citizens' trust in local government (Bonsón, Flores, Royo, & Torres, 2012). Since the local government is the first (lowest) level of government spheres where citizens can have direct interaction with their local government officials, this can help citizens to understand government operations and the process of decisio making. According to Armstrong (2010), transparency is about the ease of access to public informtion which needs to be made apparent at the local government level. Androniceanu (2011) adds that transprency is an important prerequisite in the process of decision- making for increased quality of local governance. Armstrong (2010) further states that transparency is a process which occurs in government through promoting visible decision-making, attracting the

input of the public, and allowing the public to cooperate with other organisations who have the common public purpose.

3.6.6 Develop Leaders

When dealing with public safety, police need to adapt leadership skills to enhance the "equity, efficiency, and/or efficacy of police operations" (Schafer, 2010, p. 11). Leadership function is of a strategic manner which ensures effective authority in public safety matters. There are four types of followership, namely: critical observers, alienated followership, sheep, and "yes" people (Jones, Moulton, & Reynolds, 2010). Jones et al. (2010) futher add that followership involves leaders working with citizens in a collective effort in identifying the vision of the people they are leading, and being proactive in contributing and choosing the desired results. The four types of followership are explained in detail below:

- **Critical observers** –People in this category show low participation and are damaging to the mission. These critical observers do not think critically and may not have the thorough vision required to attain solutions, and they observe their leaders as unfair toward them (Jones et al., 2010).
- **Followership** –In this category, people are demonstrated with high levels of critical thinking and participation (Jones et al., 2010). The citizens of this category share ideas with each other with the desire to thrive and achieve the mission with quality outcomes.
- **Sheep** –Citizens in this category do as they are told and follow with little participation and critical thinking (Jones et al., 2010). Citizens share ideas but reserve their own opinions with little self-initiation in the matters discussed due to the lack of knowledge, skills and abilities.
- **"Yes" people** –Citizens in this category tend to follow or go with what the leader suggests. The citizens in this category have more participation than sheep, but low critical thinking in the matters put on the table because they do not have the ability or desire to offer an opinion on the issue at hand (Jones et al., 2010). The authors further add that it is important to identify the significance between leading and managing the city as these two may share common skills but have different outcomes. This is shown in the table below.

Table 7: The commonalities in the supervision tasks (Jones et al., 2010)

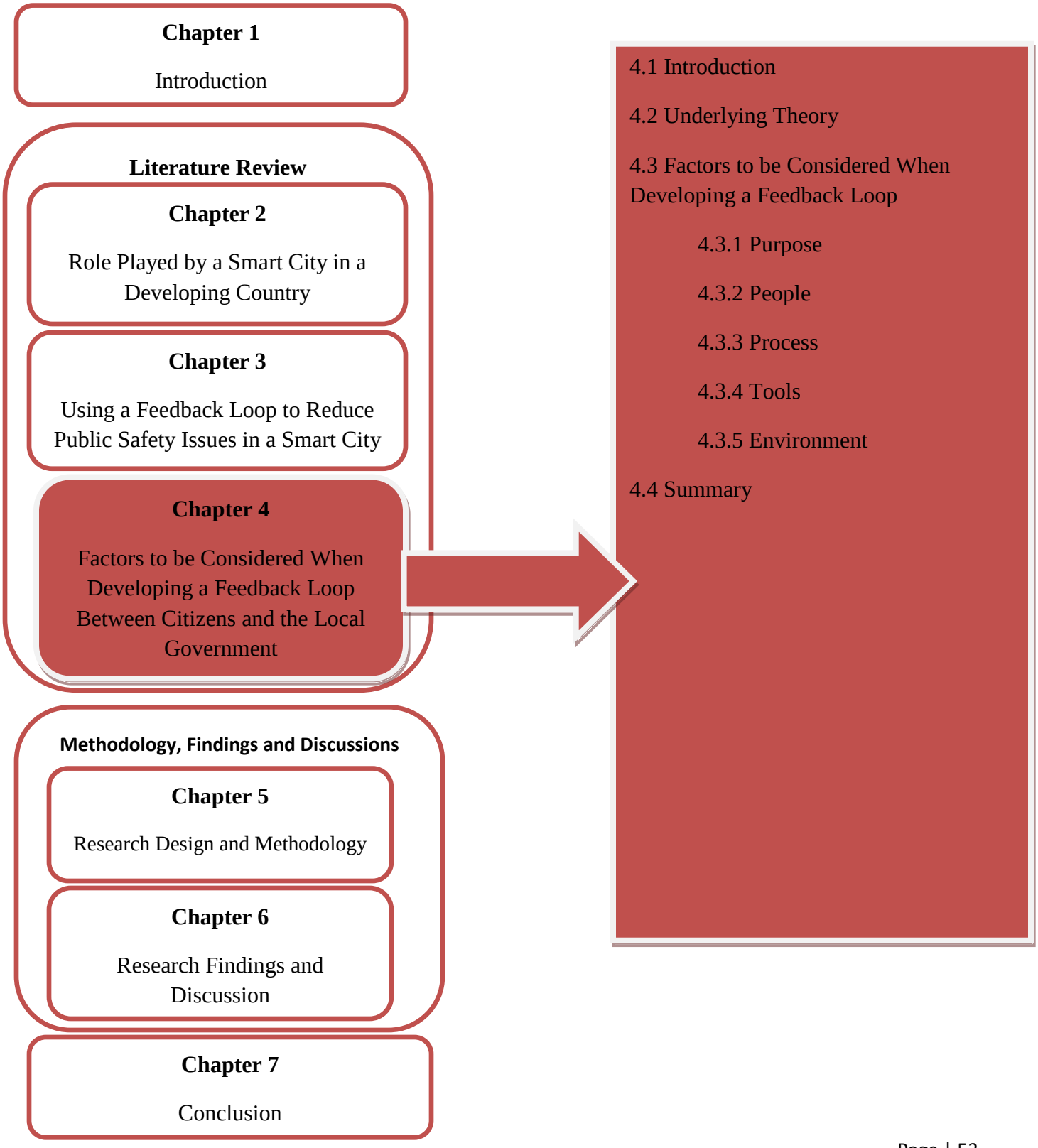
Leadership	Common skills	Management
Global domain orientation	Interpersonal communication	Local domain orientation
Identifies patterns	Social skills	Identifies details
Power based on influence	Situational awareness	Power based on position
Hierarchy not necessary	Organisational knowledge	Usually hierarchical
Mission orientation	Supervisory skills	Process orientation
Developmental focus		Efficiency focus
More than one person		One or more people

3.7 Summary

A feedback loop can come in different types or forms depending on the needs of the citizens. As mentioned in this chapter, feedback loop types are suggestion, complaints and satisfaction; these can be used separately but work best when combined. A feedback loop can offer vast benefits to the citizens and city managers when they all play a part in creating safer communities.

The limitation of resources in the public safety sector makes it more difficult for city managers to reduce public safety issues. This in turn limits the citizens' access to the relevant public safety information so as to make informed decisions to improve the situation. This demonstrates that when partnership between citizens and public safety officials is poor, this could lead to limited information available to the citizens and vice versa, escalation of public safety issues, and ultimately citizens' confidence in law enforcement will decrease. In light of these challenges, Chapter 4 will discuss the factors that need to be considered when developing a feedback loop between citizens and local government.

CHAPTER 4: FACTORS TO BE CONSIDERED WHEN DEVELOPING A FEEDBACK LOOP BETWEEN CITIZENS AND THE LOCAL GOVERNMENT



4.1 Introduction

Due to the vast public safety challenges that our societies face and the growing number of people with mobile phones in the developing countries, mobile technologies serve as tools for collecting data and solving the different challenges including improvement of public safety, health and education (Amarasinghe, Lerer, & Ward, 2010). Barnard et al. (2010) state that, the spreading of mobile phones creates great opportunities for people to access information, which may empower illiterate or semi-literate people living in the developing countries. However, the independent (unconnected) systems utilised in public safety department put the lives of citizens and of the public safety officials at risk (Peha, 2007).

According to Barnard and Grover (2011) access to information is a key element in encouraging citizens to interact socially and economically about entitled services as a means to improve people's livelihoods. Grover, Lubensky and Stewart (2009) state that mobile phone based information access can afford citizens with the opportunity to participate in the information age. This means that benefits may be predicted if information is made available especially in domains such as government services (Barnard et al., 2010). Amodio, Johnston, Peha, and Peters (2010) further add that the use of cellular architecture with Long Term Evolution (LTE) technologies should be put into practise in the Public Safety Department to assist in handling traffic demands and cost efficiencies.

4.2 Underlying Theory

The principles used to explain or predict whether a phenomenon or phenomena is testable, falsifiable and has multiple lines of evidence are known as a theory (Heger, 2012). The role of a theory in research is to underpin the research design, inform understanding of the situation that is in question, and aid as a foundation of knowledge where a study can emerge from (Kelly, 2010). There are various communication theories that exist in literature which include Osgood and Schramm's communication model; The Riley and Riley communication model; Shannon and Weaver's model of communication, and the Westley and Maclean model of communication to name a few. After careful consideration, these theories were deemed to be irrelevant for this study. This was mainly because some provide linear feedback during communication, do not

include the noise factor during the communication process, and also do not support the wide range of communication messages.

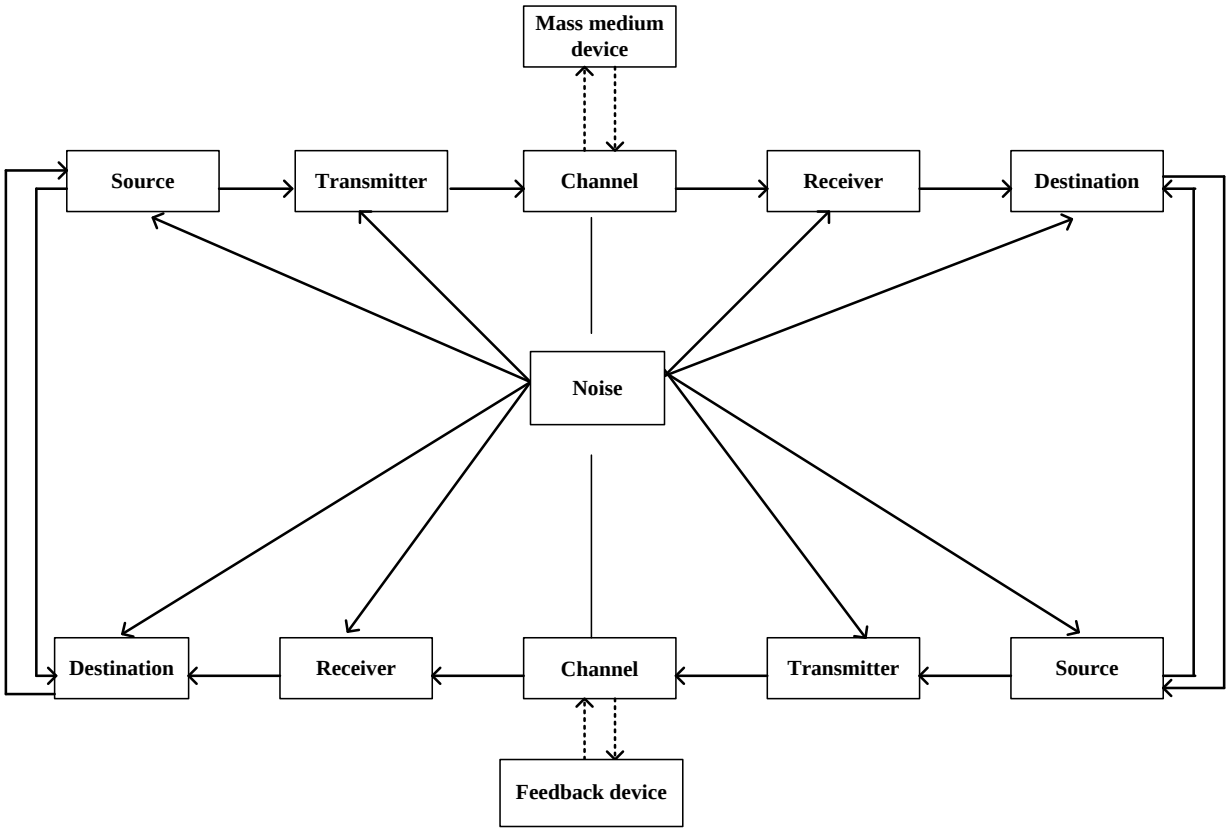


Figure 12: Underlying theory (Folorunso, 2013)

The chosen theory for this study is the De fleur model of communication (Folorunso, 2013) depicted in Figure 12, which aims to improve communication by providing feedback. This model was chosen among other communication models because it best fits the objectives of this study. The De fleur communication model is the combination of Shannon and Weaver's model of communication and the Westley and Maclean model of communication (Dalujose, 2012). In the model source, transmitter, receiver and destination are pictured as a separate phase of mass communication. This means the source and the destination exchange roles during the communication process; furthermore the model introduces two-way feedback during the communication process until results are met and sends the relevant information to the target audience (Raza, 2012). Communication might include discussions about complaints, suggestions or satisfaction about public safety matters, and also give advice or ask questions that relate to public safety matters. Another important aspect about the De fleur model of communication is

that it acknowledges that semantic noise (Dalujose, 2012) may occur at any stage during the communication process and therefore allows for circular communication in order to meet the desired results. As the aim of this study is to construct a continuous feedback loop between citizens and the local government in EL, the De fleur communication model proved to be the appropriate model. The limitation of this model is that it is more effective for group communication, not for one-on-one communication.

4.3 Factors to be Considered When Developing a Feedback Loop

There are five interlinked critical components that a feedback loop should be based upon: purpose, people, process, tools, and environment (Asad et al., 2014). These components will be discussed in detail below.

4.3.1 Purpose

Understanding the purpose of establishing the feedback loop will explain how it responds to citizens' needs. According to Asad et al. (2014), developing a feedback loop can be for the following reason(s): citizen empowerment, demand for good governance, project effectiveness or accountability, depending on the needs of the citizens. In understanding the purpose, it is likely that benefits including reduced stress, increased success, satisfaction and self-esteem (Warren, 2014) are expected to be visible between the citizens and local government when the feedback loop is put into effect.

4.3.2 People

Once the purpose is understood, the following questions should be answered: Who participates? Who provides the feedback? Who monitors, responds to and acts on the feedback? (Asad et al., 2014). This means identifying the roles and responsibilities of all participants within the feedback loop. Another important aspect when dealing with diverse people is language barrier that needs to be pondered upon as this can lead to difficulties when interacting with people.

4.3.2.1 Language barrier

ICTs have the feasibility to increase the reach of citizens participating in local government initiatives as it allows anytime and anywhere capabilities aiming to enhance the delivery of

services especially in public safety (Chittamuru, Dave, Jain, Parikh, & Patel, 2010). English is by far the universal language used and one in which most government messages are disseminated, but 47% of South Africans do not understand English (Barnard & Grover, 2011). According to Property24 (2013), the majority of the EL citizens are not fluent in English. Limitations caused by fluency in English are associated with poor satisfaction with the system in terms of difficulty in accessing local government material, recognition errors, and limited quality of information provided (Alegría & Bauer, 2010). Adler et al. (2010) add that limited English proficient citizens may be particularly at risk due to the challenges posed by inadequate communication as ongoing interaction with the system is needed.

The domination of English may raise communication problems for some citizens when they cannot express their ideas in their mother tongue (Raffournier & Schatt, 2010). For many reasons, language proficiency may have a greater impact on the quality relationship developed between citizens and local government. Effective communication is mainly language dependent and it is the essential factor to building trust and collaboration between the citizens and local government and to achieve effective results (Lo'pez-Duarte & Vidal-Sua'rez, 2010).

4.3.3 Process

This component is focuses on the four main elements: type of feedback that will be solicited; in what frequency; aligning feedback to the existing project cycle, and organisational capacity needed to manage the feedback mechanism (Asad et al., 2014). This is called the process of managing change in an organisation and it deals with prioritising the quality rather than the quantity of feedback; this process is discussed below.

4.3.3.1 Change management

In nowadays, managing change is an unavoidable part of our daily lives, though it may not be embraced by most people involved in it (Lauer, 2012). Change management is a process of taking the city from one position to a desired position whilst dealing with the problems that may arise along with the implementation of change (Mekel & Yonardy, 2014). Looking at the latter statements, change management requires clear communication about the value of change between the persons affected. Preparation for change requires that people involved in it carry out a preparatory analysis that covers the four basic strategies of change management; these

highlight the characteristics of human behavior and are outlined in the table below. According to Faucheux (2009), change is necessary for the improvement of a city, but can bring about bad results if there are no strategies put in place before its implementation.

Table 8: Basic change management strategies (Jansson, 2008)

Strategy	**Description**
Empirical-Rational	People are rational and will follow their self-interest once it is revealed to them. Change is based on the communication of information and the proffering of incentives.
Normative-Reeducative	People are social beings and will adhere to cultural norms and values. Change is based on redefining and reinterpreting existing norms and values, and developing commitments to new ones.
Power-Coercive	People are basically compliant and will generally do what they are told or can be made to do. Change is based on the exercise of authority and the imposition of sanctions.
Environmental-Adaptive	People oppose loss and disruption, but they adapt readily to new circumstances. Change is based on building a new organisation and gradually transferring people from the old one to the new one.

Based on the table above, this means change is an inevitable factor that needs to be managed effectively with the people involved in mind. In summary, implementing change does not only affect the daily activities of the city, but also the behaviors of the people involved in the change process.

Without change the city is likely to fail in meeting the needs of most people and loses its competitive advantage (Richards, 2015). Lauer (2012) states that for change to be managed effectively, the following characteristics need to be visible during the change management process:

- Citizens and government must have a solid understanding of why change is necessary.
- Training must be used in managing change in order to build knowledge and skills about public safety matters between citizen and local government.
- Resistance is identified and dealt with in the early stages.
- Citizens and local government need to engage in both the solution and the change.
- Probability of meeting project objectives is enhanced.
- Most of all, change is supported.

Introducing change in a city and managing it effectively can lead to significant outcomes such as adoption of new technology to improve services, meeting citizens' needs, improving the economy, opportunities for growth, and challenging the status quo (Richards, 2015). According to Lussier (2014), during the process of change there are different stages that need to be dealt with: denial, resistance, exploration, and commitment. These stages are explained in detail below.

Denial –This is a stage whereby an individual does not understand how to accept or deal with change and this is usually where uncertainty and ignorance escalates (Lussier, 2014). According to Sims (2007), sometimes denial is not caused by not wanting to change, but by the lack of information and insufficient knowledge about change.

Resistance –Most people tend to be aware of the change and that there is no way they can avoid and start to actively resist the change (Lussier, 2014; Bruce & Birchall, 2012).

Exploration – People have accepted the change and take action by looking and investigating for ways in which change can have a positive impact in their lives (Bruce & Birchall, 2012).

Commitment – This is the final stage of the change process and people feel more in control of their new roles and responsibilities and finally realize the benefits of change (Bruce & Birchall, 2012).

4.3.4 Tools

The emphasis in this component is on leveraging existing technologies in order to expand reach while ensuring inclusive participation (Asad et al., 2014). Here people first need to understand what tools are in use and what can be done to improve the existing tools in order to provide a medium that could lead to access and sharing of public safety information. These tools are discussed below as people make choices regarding the tools that best fit their needs and context.

4.3.4.1 Technology Literacy

The ability of an individual to use technology tools to access, manage, integrate and understand computers and technology in order to communicate information and improve performance of a service or product is known as technology literacy (Becker, Hodge, & Sepelyak, 2010; Barron, Hohlfeld, & Ritzhaupt, 2010). The latter further add that technology literacy is an essential factor needed when the government inspires to equip its citizens with technology skills required to successfully participate in and contribute to a digital society (Barron et al., 2010). According to Bélanger and Carter (2010), the use of technology to encourage citizens to participate in society matters is increasingly used by governments as a means for citizens to raise their concerns. Given the importance that use of technology is the fundamental driver of societal and economic change, it is important to note that not everyone has access to or is comfortable with the use of technology due to digtal divide (Murray & Pérez, 2010).

This digital divide has an impact on technology use which suggests that among other factors, age and frequency of Internet use can have a negative influence on the means of encouraging citizens to technology utilisation (Bélanger & Carter, 2010). As indicated on the Eastern Cape ICT Strategy of 2009-2014, the Eastern Cape Province has fundamental outstanding challenges that need to be addressed regarding ICT including integration, inadequate ICT connectivity infrastructure, and ICT service delivery. New existing mobile phone technologies can help the local government to improve efforts to communicate proactively with the citizens about society matters, particularly public safety matters. According to Chun, Hovy, Sandoval, and Shulman (2010), shifting from the traditional ways of communicating with local government could enhance direct communication and focus to continuous dialogues with the citizens. The Government Communicators' Handbook 2014-2017 describes effective communication as dependent on (1) the way to respond to the ever changing communication environment regarding

the issue at hand; (2) citizen-centred approaches that uphold changes in people's lives and help citizens to take part in public affairs; and (3) the platform that makes it possible for the government to integrate messaging efforts that can have consistency to its citizens.

4.3.4.2 Usability

As stated by Abran, Desharnais, and Nayebi (2012), usability in ISO 9241 is "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (p. 2). On the other hand, Dubey and Madan (2012) regard usability as an important component of quality software applications, and define it as the ability of a system to allow the user to learn how to operate, prepare inputs, and be able to understand the results provided back by the system. However, Barnum (2011) defines usability as a process that requires a user to be observed when using a service and how he or she achieves a specified goal. For this study, usability will be explained looking at the four elements: ease of access, navigation time, relevance and breadth of information content, and user experience (Asthana, Singh, & Singh, 2013).

i. Ease of access

Ease of access to government information will not only improve the relationship between the government and its citizens, but will also contribute in the speed of response to queries, reduce cost to the citizens and government, and lead to delivery of quality services (AbuAli & Almarabeh, 2010). According to the Government Communicators' Handbook 2014-2017, the government is trying to overcome the lack of knowledge and skills gap within their communication system that can cause complexity in accessing government information. Foley and Helfert (2010) define ease of access as the means of accessing information from the system, the complete amount of information that the user requires, and in a format that is satisfactory in terms of presentation with less effort. Baggesen (2015) further adds that ease of access is a means of attaining quality information with freedom of physical annoyance. Usability could be a benefiting factor if it can be implemented successfully to make it easier for the citizens in developing countries where majority of the non-literate population lives to engage in public affairs. The accessibility to government information, whether on a mobile phone or computer based platform, is an important aspect, but also it is an issue that involves direct elemental access

to information at the user level including restrictions, stability and security (Illinois University, 2001).

Restrictions –This is a tool that is mostly used in ICTs to control the traffic in terms of IP addresses in a website as to whether allow or deny access to the website (Schackow, 2013).

Stability – This tool is more concerned with the amount of traffic the website generates in order to avoid frequent crashes, long load times or failure to load, and availability and speediness to improve performance and satisfy the citizens' needs (Steinmann, 2014).

Security – This tool is an important consideration, especially when in a website where there is an exchange of personal information.

ii. Navigation time

Navigation process plans and executes a direction to a goal path specified in the system (Milford & Wyeth, 2009). The CCSDS Team (2010) states that navigation process is the science of directing a user from one place to another using system commands. Thus, navigation time is how long it will take for a person to understand the directions of the system in order to get to the destination point. According to Dai, Engler, Noack, and Ziebold (2011), a navigation system consists of three steps: plausibility check, validity check and compatibility check, which their primary purpose is to detect errors during the navigation process.

iii. Relevance and breadth of information content

This aspect requires an approach that is proactive in proposing interesting content to the citizens in order to keep up with recently emerging information and better direct citizen's attention. Falls (2011) supports this by adding that there are three reasons why relevant information content matters: Relevant content adds value to the conversation; relevant content increases trust between the stakeholders, and relevant content is reliable but more importantly believable. The University of Alaska Fairbanks (2012) proposes that when dealing with information, certain criterion needs to be maintained to evaluate the information resources; these include accuracy, objectivity and coverage.

iv. User experience

User experience has become popular especially in the ways of understanding and studying an interactive product (Bargas-Avila & Hornbæk, 2011). According to Kuniavsky (2010, p. 14), user experience is defined as the "totality of the end users' perceptions as they interact with the product or service, these perceptions include effectiveness, efficiency, emotional satisfaction and the quality of the relationship with the entity that created the product or service". For the purpose of this study, user experience needs to be enhanced to ensure the communication back and forth between the citizens and the local government.

4.3.4.3 Reliability

Dhillon (2013, p. 4) defines reliability as the "probability that a system will perform its assigned mission satisfactorily for the stated period of time, when used according to the specified conditions". According to Buelow and Hinkle (2008), reliability is the consistency of results processed by the system when the same activity is repeated. This means that reliability is a primary foundation when it comes to technological systems and a number of factors that supports reliability need to be considered, including the quality of hardware and software and how they are made to function most effectively (Reuters, 2011).

For a system to be reliable is an important quality especially in the citizen-government relationship, where one has to keep to his or her promises (Riera, 2010). This means that a reliable system has a track record of doing what it promises and it continually completes the tasks (Kurtus, 2013)**.** This is crucial for reporting public safety issues and for this study because the predicted aims could be used to assist in public safety issues and provide positive ideas for other cities.

4.3.4.4 Interoperability

Interoperability is the ability of individuals from different organisations to communicate and share information with other citizens, and this is often a major problem in public safety (Peha, 2013). This is because of the incompatibility technologies used within functional areas of the Public Safety Department. Tera Medica (2014) defines interoperability not only as the ability of systems to exchange data in various organisations, but also as being able to interpret and display the data in a user friendly manner.

According to Gonzales et al. (2001), interoperability can enable systems from various organisations to effectively operate together in order to achieve a common goal through

standardization, integration, cooperation and synergy. This means interoperability of systems encourage communication, which in turn can ensure effective feedback loop to facilitate in providing up-to-date information to the citizens and the local government. When dealing with information systems, interoperability can reduce costs, risks and complexity (Charalabidis, Gonçalves, & Popplewell, 2010).

On the other hand, Chen, Doumeingts, and Ducq (2012) highlight that an interoperable system should at least have some of the following characteristics: openness (system able to interact with the outside environment), stability (the changing nature of the system) and adaptability (a system able to restructure and adapt according to the other system it's interacting with while keeping to its original objective), and reversibility (system able to go back to its initial state when finished interacting with other systems). Interoperability reduces ambiguity and allows transfer of information among systems and the public to be displayed in a user-friendly manner (Health IT, 2013). HIMSS (2013) refers to interoperability of a system as an important factor as it provides the following:

i. Quality

Managing the quality of a system is a continuous improvement that involves all the stakeholders, particularly local government and citizens, with the focus to reduce public safety matters (Kelchner, 2014). There are a number of benefits that the quality management of a system can bring about; these include better management control of the system; improved communication between citizens and local government, increased citizen satisfaction, and improved delivery of services (Buttle, 1997). This means managing the quality of the system could provide citizens with complete, accurate and timely information in one location.

ii. System efficiency

System efficiency is a way of encouraging citizens and local government to build a long- term relationship through the use of technologies. This means that making use of the inputs given to achieve greater or better level of outputs (Chisholm & Evans, 2010).

iii. Safety systems

The development of safety systems must be in compliance with safety standards and can be an integral part of risk management that can be influenced by human reliability and their performance knowledge (Katta & Stålhane, 2010). Therefore, safety systems are systems that demand information to be transmitted timeously through communication links that are reliable and safe (Boercsoek, Pendli, Schwarz, & Wacker, 2011). This means that public safety information must be available 24 hours a day for informed decision- making.

4.3.4.5 Advanced capabilities

Currently public safety services depend primarily on voice capabilities to communicate with their citizens about public safety issues. However, there are other useful and much better services, for example real-time video geolocation which could assist in tracking the exact location for public safety officials during an emergency (Peha, 2013).

4.3.5 Environment

Creating an enabling environment by engaging citizens to participate whilst using multiple modalities (Internet, mobile phones, community radio, and face-to-face interactions) might ensure inclusivity but may not guarantee it (Asad et al., 2014). Although the citizens' voice may be increased by encouraging inclusiveness, however, exertion of time and money due to facilitating greater citizen participation needs to be considered (Asad et al., 2014). These aspects are discussed below.

4.3.5.1 Awareness to the target audience

In most times the concept of calling a number that is not linked to a person you know sounds strange and especially to those who have never used an Interactive Voice Response application (Barnard et al., 2010). Promoting awareness and basic education of the IVR system in places where the target audience is likely to be found can be a fundamental step to its success. When a new product or service is not effectively communicated to the targeted audience, in this case citizens, citizens may not trust the product and become resistent, which can lower the use of the product (Kelchner, 2014). Mikoluk (2013) defines awareness as an approach that can help to enhance the relationship between the local government and the citizens, benefit the local government to learn the environment, and also discover what is working and what is not in the early stages of the project. According to Farhana (2012), no matter how great a service can be, its potential users need to be aware of it and its meaning.

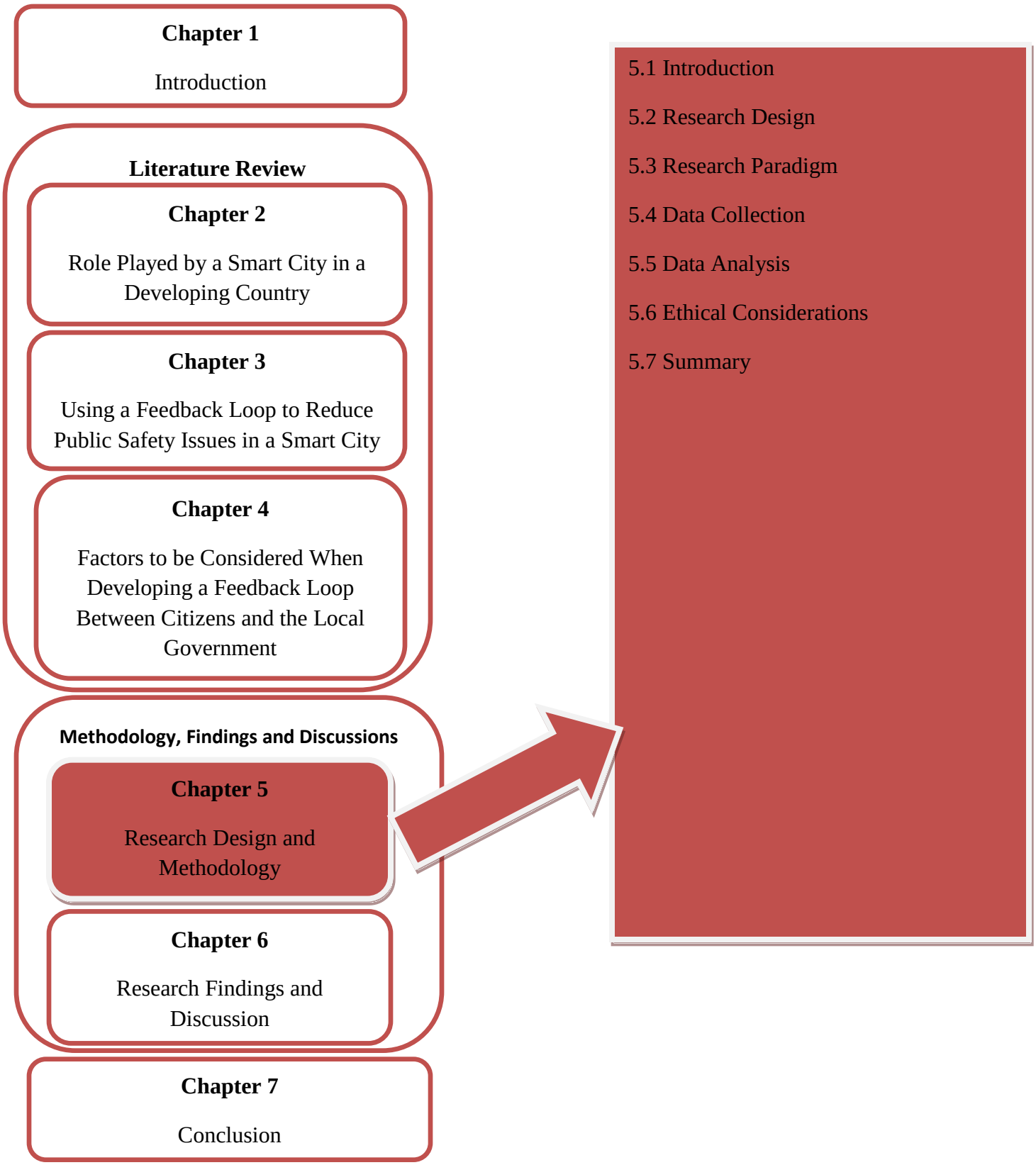
- **Cost, time and distance**

Effective communication is essential between citizens and local government, colleagues in an organisation and so forth, in order to boost the level of service delivery. Introducing an ICT enabled feedback loop will not only strengthen the citizen feedback mechanism, but can also overcome the barriers of cost, time and distance when accessing local government information (Custer, 2012). Access to up-to-date information may be one of the hindering issues in developing countries; this sometimes results in people having to travel long distances to obtain information about critical matters that could significantly improve their quality of life (Barnard et al., 2010). According to Grover et al. (2009), phone based IVR services can cost less and are easy to maintain since the system can be centrally maintained. Removing information silos in local government and implementing an ICT feedback loop can increase information visibility and automated processes to allow government officials to work on other things whilst reports are being generated, and this could lead to doing more work in a shorter amount of time (Peha, 2013). Automated phone based services can play an important role in bridging the information gap and addressing the impediments including infrastructure, cost, distance, and time which citizens face in order to obtain information about the status of public safety (Barnard & Grover, 2011).

4.4 Summary

The lesson learned from the literature reviewed is that when developing a feedback loop to improve communication between the citizens and local government, increasing citizen participation must be at the core of the project cycle. Involving citizens from the inception to the completion of the project probably increases the success of the project as citizens know more about the channels and context that would best fit the needs of the city. Another lesson learned is that there are relating components (purpose, people, process, tools, and environment) that must be considered when developing a two- way feedback loop as these may hinder the success of the project if not properly managed. In conclusion, even with the advanced technologies available to enhance communication, t without the citizens' innovativeness and partnership, the feedback loop is in jeopardy to fail. The next chapter (Chapter 5) will discuss step by step the research methodology employed for this study.

CHAPTER 5: RESEARCH DESIGN AND METHODOLOGY



5.1 Introduction

This chapter outlines the methodological process pursued in conducting the research in order to gain information to answer the research questions and achieve the objective of the study. The sample of the study was made up of two sets of groups consisting of eleven citizens (Group A) selected from participants of the smart city research project and four public safety officials (Group B) from the Department of Public Safety. In total the number of participants who participated in this study was fifteen. The primary objective of this study is to develop a model to ensure a continuous feedback loop between the EL citizens and local government in a public safety environment. The previous chapters (2, 3 and 4) reviewed literature, and this chapter presents the research design and methodology utilised in this study.

The chapter is structured as follows: The first section discusses the research design used for this study, namely research paradigm, research approach, data collection, and data analysis. Ethical considerations were applied for and approved, as data collection process involved humans. Data was collected through semi-structured interviews which were carefully analysed to reach a certain conclusion for a given problem. Details of all research methods used to select a sample and collection of data are clarified in detail below.

5.2 Research Design

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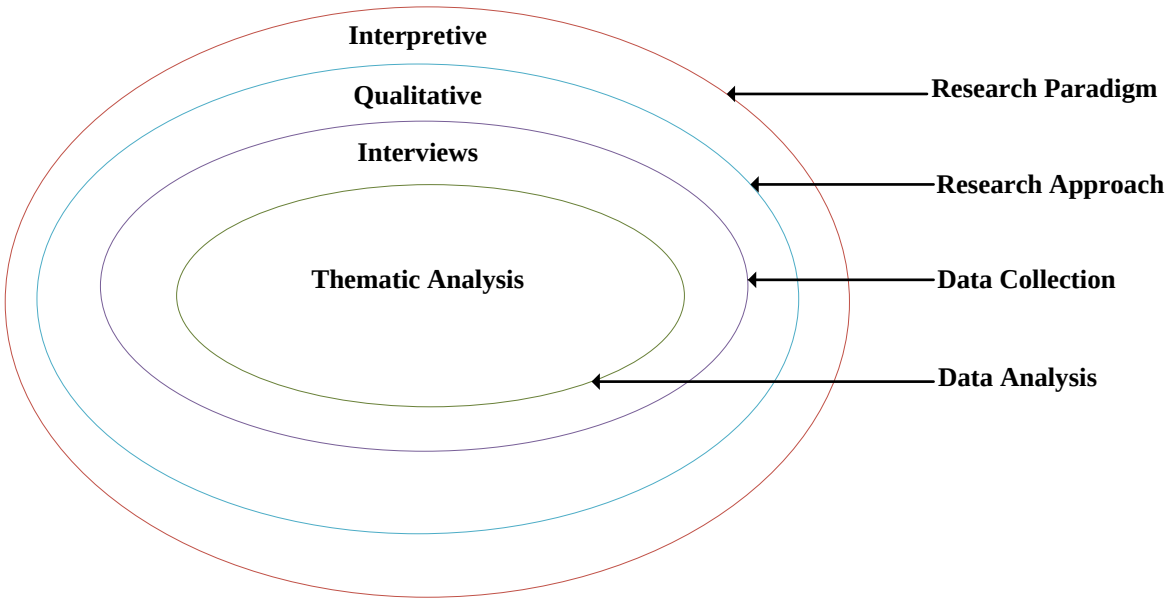


Figure 13: The onion model (Adapted from Lewis et al., 2009)

5.3 Research Paradigm

A research paradigm is a "set of fundamental assumptions and beliefs as to how the world is perceived which then serves as a thinking framework that guides the behaviour of the researcher" (Wahyuni, 2012, p. 69). According to Kuhn (2012), a research paradigm is an approach that is based on thinking and doing the research and is set on shared assumptions, concepts, values and practices. A paradigm consists of three elements: epistemology, ontology and methodology, whereby epistemology involves understanding how and what is possible to know (Chia, 2002), ontology raises questions about the nature of reality, and methodology focuses on how

knowledge is gained about the world (Denzin & Lincoln, 1998). When conducting research, it is important to understand the different types of paradigms and how they align to the research study in order to choose the most appropriate one. These paradigms and their attributes are illustrated in the figure below. The research paradigm followed for this study is the interpretive approach. This paradigm was chosen as it allows the researcher to gain in-depth information about the problem that is being investigated.

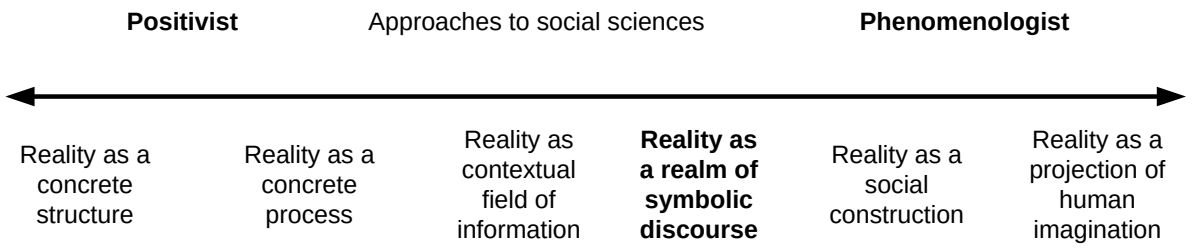


Figure 14: Continuum Ontological Assumptions (Adapted from Collis & Hussey, 2013)

The study will centre its attention on the fourth stage of the continuum model, which states that the "social world is a pattern of symbolic relationships and meanings sustained through a process of human action and interaction" (Collis & Hussey, 2013, p. 49). The following section will discuss interpretive and positivism paradigms in more detail.

5.3.1 Distinguishing Between the Epistemological Traditions

The positivism paradigm is centred on the belief that reality is objective and external, and the positivist approach of gathering information is based on facts measured in order to discover how certain patterns occur. Positivism is an epistemological position where natural sciences methods are used to study social reality (Bell & Bryman, 2011). Guthrie (2010) states that, positivism paradigm has its roots in natural and physical sciences and is founded in experimental and quantitative survey research. Being a positivist means one has to observe the effects and be independent of the subject investigated, while the results of the study are generalised to law-like derivation (Money, Remenyi, Swartz, & Williams, 2002). In contrast, the interpretive paradigm is socially constructed and given meaning by people based on the fact that reality is subjective (Easterby-Smith, Jackson, Lowe, & Thorpe, 2008). In the interpretivist world, knowledge is cultural and has many forms derived from sociology and anthropology (Guthrie, 2010). The essence of these two paradigms is illustrated in the table below.

Table 9: The essence of positivism and interpretive research (Guthrie, 2010)

Positivism	Interpretive
Studies the world and people in it as objective things	Regards knowledge as subjective and value laden
Views data as being independent of the observer	Views data as dependent on the relationship between the knower and the known
Accepts data as scientific evidence only if it is collected by direct observation according to strict rules	Favours naturalistic, non-experimental research where the researcher does not manipulate the research setting or subjects or put data in pre-defined categories
Breaks down data to isolate elements that demonstrate cause and effect, and ultimately, scientific laws	Views knowledge as subjective and holistic
Considers that the scientific method is itself objective	Considers that scientific methods are social constructs

Table 9 exhibits that there are different positions of paradigms which a researcher can choose from. There is no right or wrong paradigm; this just means that if the researcher is in pursuit of scientific research then he/she needs to pursue objective research methods, or use subjective research methods if he/she is in pursuit of social constructs. This means choosing to take up one methodology over the other offer's trade-offs.

The focal point for this study is based on the interpretive paradigm as it is useful for the researcher to be open to new knowledge throughout the study because of the interaction with humans (Edirisingha, 2012). The aim for this study is to gain, understand and interpret the meanings of human behaviour and not generalise and predict causes and effects. The conclusions drawn from the study will be used to identify emerging patterns from the information obtained to help add value in existing knowledge. The next section will discuss the quantitative and qualitative methods.

5.3.2 Quantitative Versus Qualitative Research

The three research approaches used in the social science research are quantitative, qualitative and mixed methods (Bryman, 2012), where the latter is the combination of both quantitative and qualitative research approaches. Quantitative research deploys numerical analysis of data and is usually characterised by an analytical approach to the data generated (Harris & Johnson, 2002). This is the type of approach were it is possible to measure activities of a number of people using

a limited set of questions to give broad, generalised results (Patton, 2002). This means that the quantitative research strategy of solving the problem is to quantify the results by way of generating numerical data that can be converted to statistics (Wyse, 2011). Quantitative research places emphasis on measurement and analysis of numbers through structured data collection methods and follows a deductive method of logical reasoning. Deductive logic is a type of reasoning where results are often generalised based on the premises that are tested to be true and is often known as the top-down approach (Dantzker & Hunter, 2012; Bradford, 2015). Quantitative research tends to follow controlled natural scientific settings that are inappropriate in studying human behaviour and interpreting data (Kruger & Welman, 2001).

However, qualitative research aims to socially construct the nature of reality with emphasis on the relationship between the researcher and what is studied (Denzin & Lincoln, 1998). According to Wyse (2011), qualitative research provides insights about the problem and allows the researcher to get deeper into the problem being investigated through data collection methods varying from unstructured or semi-structured techniques. The qualitative approach is a process of answering questions by highlighting on social experience and meaning creation using the inductive method of logical reasoning.

There are various types of qualitative research including ethnography, phenomenology, grounded theory, participatory action research and case study (Nigatu, 2012), and their criterion is based on trustworthiness (Seville & Perret, 1999). The study will adopt the qualitative approach because with this method, human experience is not seperated from the person experiencing it. This will increase the chances of obtaing accurate information first hand through interaction with the objects of enquiry, rather than observing the participants in a controlled settings. With this approach it is best to start from observations as this will allow detailed understanding of the research problem and then narrow down to a specific area (Gill & Johnson, 2002).

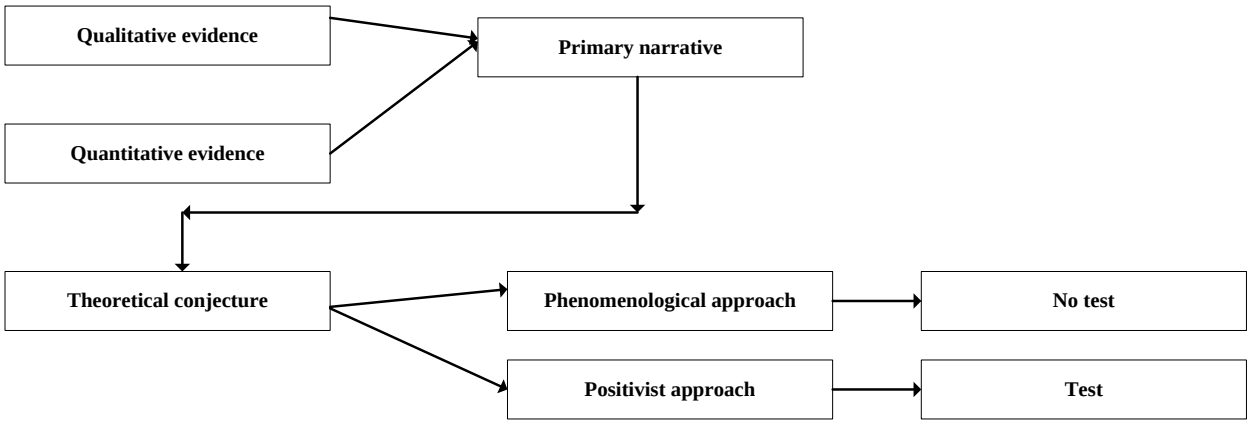


Figure 15: The importance of the primary narrative and theoretical conjecture (Money et al., 2002)

The above figure illustrates that with a qualitative approach, results may or may not lead to a formal test of hypothesis, whereas with a quantitative approach, results lead to the test of hypothesis (Money et al., 2002). The next section will discuss data collection methods in more detail.

5.4 Data Collection

The primary data for this study was collected between two groups: the citizens of EL and the Buffalo City managers in public safety department. This was done to verify and/or add to the knowledge collected from the literature reviewed.

5.4.1 Population and Sample of the Study

The population for this study is represented by the citizens who live in EL and city managers. From the population, a sample was carefully selected from citizens who participated from the smart city Public Safety research project (Group A) and the city managers from the Public Safety Department (Group B). This was done because in reality there will not be enough time, energy and resources to investigate the whole population (Neubauer & Schilling, 2009). Sampling is a method that involves selecting a number of units from a defined population. According to

Phrasisombath (2009), there are two categories of sampling: probability and non-probability, as illustrated in Figure 16. Sampling is a technique that is used to choose from a population a small group (sample) that will represent all the characteristics of a large group (Brynard & Hanekom, 2006; Daniel, 2012). A sample is used in a research study for many reasons including "simplifying the research, saving time, cutting costs and determining specific properties of the whole" (Brynard & Hanekom, 2006, pp. 54-55). When the sample was chosen there were no restrictions with regard to gender, disability, race, education to name a few; however, it was essential for the interviewees to be citizens of EL.

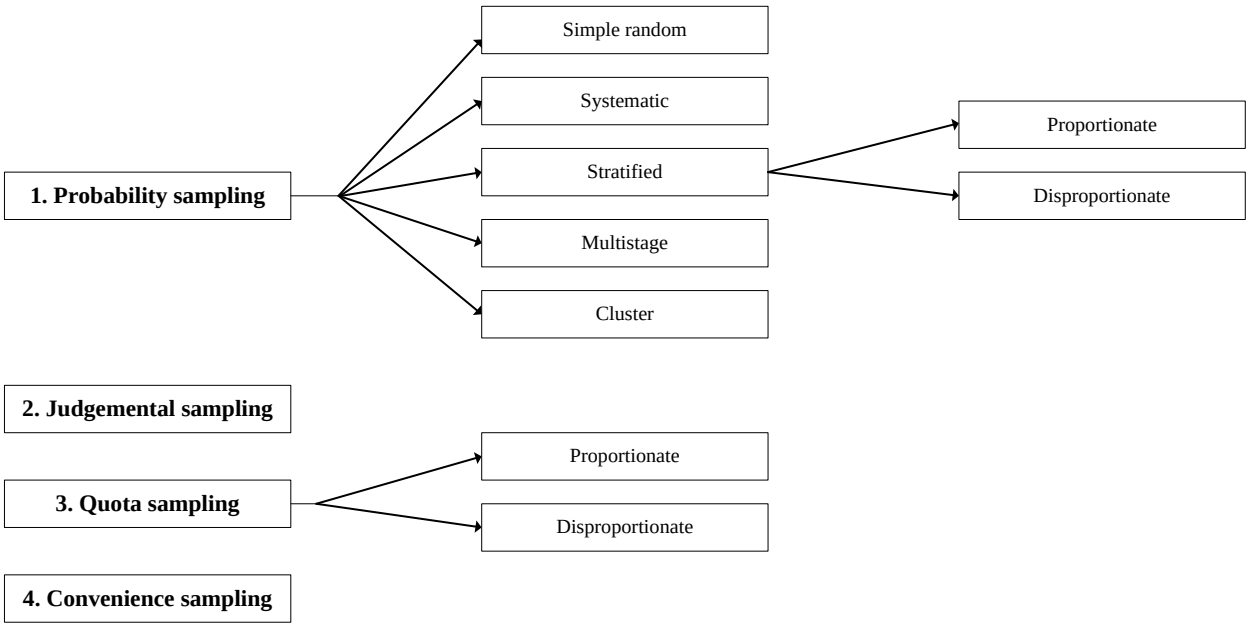


Figure 16: Methods used to select a sample (Royer & Zarlowski, 1999)

One needs to be familiar with the different sampling types involved in the research world before starting to employ the sampling method(s) (American Marketing Association, 2011). In the figure above, the probability samples are simple random, systematic, stratified, multistage and cluster, the non-probability samples are judgemental (purposive), quota and convenience (Royer & Zarlowski, 1999). Purposive sampling was used because the primary aim of the researcher was to gain access to the needed information from the group of individuals willing to share their knowledge or experiences about the research problem (Holloway & Wheeler, 2010). Purposive sampling allows the researcher to dig deeper in the investigation of the phenomenon in question and to gain necessary information by focusing more on the small group (sample size). After all this was done, the researcher collected data from the research participants (sample) using the

semi-structured interviews. The data collection method for this study is discussed in detail below.

I. Interviews

The type of data collection method utilised for this study is semi-structured interviews as it allows the researcher to acquire in-depth evidence about the phenomena being explored. Silverman (2006) highlights that in qualitative research, authenticity is the key rather than reliability because it allows the reseracher to gather genuine people's experiences through semi-structured interviews. In the beginning, a list of interview questions were formulated which were linked to the research questions and the objective of the study, which could help in probing for answers about the research problem. The interviews were conducted with 15 participants, including 11 EL citizens who participated in the PSSC research project competition, and 4 city managers in the Department of Public Safety. The interviews were recorded to capture all the information so that they could be transcribed at a later stage. Recording the interviews ensures the researcher does not summarise the longer responses to questions because of time pressure as this may lead to information being lost (Brenton & Driskill, 2011). Another reason for recording the interviews was that most of the questions were open-ended and the researcher needed to probe some of the answers to discover the participants' understanding of the matter at hand.

The interview process consisted of the interviewer and the interviewee since the study followed the one-on-one approach. Detailed data was collected as the respondents were encouraged to elaborate in great detail especially when it became evident that the interviewee felt strongly about a particular matter being investigated. All the data was collected using an audio tape recorder and was played back to the respondent to make sure no information is left uncollected or missed out. This resulted in rich information to be analysed for the study to ensure success in coming up with answers or solutions to the research phenomena. The interviews were conducted in a suitable site that was chosen by the interviewees in order for the interviewees to be free to talk. The next section will discuss the data analysis methods employed in this study.

5.5 Data Analysis

Once data is collected, it is time to analyse it, but the type of data collected will determine the data analysis method to be used (Hofstee, 2006). According to Money et al. (2002), approaches

to data analysis may differ on the basis that the evidence gathered is either quantitative, qualitative or both (mixed methods). Data collected for this study was qualitative data that was gathered through the use of semi-structured interviews; thus the qualitative analysis method was used. Qualitative analysis was the most suitable as it aims to understand the meaning of what has been said by the respondents, then analyse it and present it in a simplified manner. The data analysis for this study was founded on Gratton and Jones (2004) three stages of analysing qualitative data:

- Data reduction –The data collected through semi-structured interviews was first prepared into transcripts and then reduced and organised to look for patterns and themes. This was done following three stages, namely: open coding, axial coding, and selective coding.
- Data display –After themes were identified, the data was also presented in the form of tables, charts, graphs to make it easier to read and understand.
- Conclusion verification/drawing –The researcher developed conclusions regarding the study based on the analysed data. This was done by verifying the existing data and critically referencing discussions.

To achieve the above mentioned dimensions, this will be made possible by the use of thematic analysis when the data is scrutinized in detail. The process is further elaborated below.

I. Thematic analysis process

Thematic analysis is a type of inductive analysis and an approach that is normally used in analysing qualitative data. According to King (2013) and Coviello, Jones, and Tang (2011), thematic analysis is a process that focuses on identifying themes and patterns in the textual data that describe the subject matter of the research study. Thematic analysis is simple to use compared to other qualitative analysis methods as it allows flexibility and can be used with any theory that the researcher chooses, while allowing "rich and detailed, yet complex account of data" (Braun & Clarke, 2006, p. 81). However, this process can be labour intensive. Thematic analysis is based on six stages, namely: familiarizing yourself with your data; generating initial codes; searching for themes; reviewing themes; defining and naming themes, and producing the report (Braun & Clarke, 2006).

In keeping in accordance with the above steps, the researcher became immersed in the data, going through over it as many times as possible in order to code and categorise the data. This was done by breaking the data into small units for analysis and categorising it into themes. Thereafter the data was sorted according to the similarities and differences based on the participant responses to the interview questions. Therefore, in this study, the qualitative data was treated thematically to present important issues in relation to the research objectives. Thus ethical considerations for this study are outlined in the next section.

5.6 Ethical Considerations

Research ethics refer to what is acceptable or unacceptable when conducting research so that the researcher conforms to the norms and values that are generally accepted by the institutions funding the study (Brynard & Hanekom, 2006). Social researchers should be ethical when conducting a research study as this will help to ensure that the rights and dignity of the participants are protected. The researcher applied for Ethical Clearance from the University of Fort Hare's Research Ethics Committee and it was approved. This was done because the data collection method for this study is semi-structured in-person interviews which may sometimes include sensitive questions. For the purpose of this study, the following ethical guidelines were looked at: informed consent form, confidentiality, anonymity, privacy and honesty.

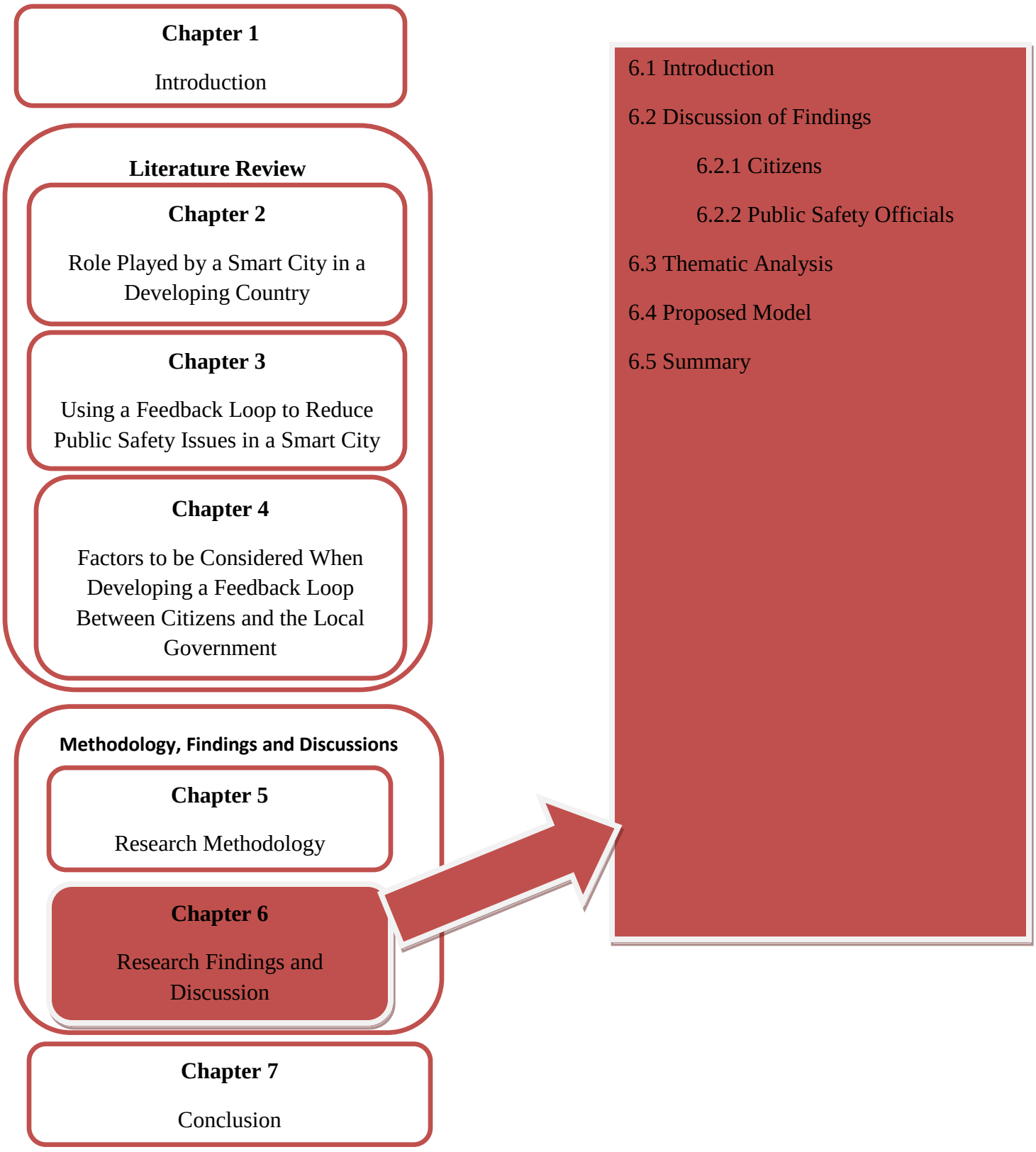
This was done as follows: Permission to conduct the interviews was sought from the citizens and the BCCM officials in the Public Safety Department and permission was granted. The consent form of every participant was obtained to make sure that the participants understood the purpose of the study. This was done by outlining the objectives of the study through presentations and meetings with the participants; the participants read and signed the consent forms that were sent to them before the commencement of the interviews. The interviews for the city managers were conducted in a board room to guarantee privacy and confidentiality. The researcher explained to the participants that the data collected for this study will only be used for the purposes of the study. The participants involved in the study will be known to the researcher only. To attain anonymity, the researcher made it a point that the subjects remain nameless and anything that can identify the subjects will be removed. The researcher confirms that the subjects' responses

are protected and will remain the property of the researcher for two years after the publication of this study, thereafter they will be deleted. Misrepresentation of the responses that were provided by the participants was avoided to make sure the data is complete, accurate and without deceit; this was made possible by playing back and forth the recordings. All the participants involved in the study participated voluntarily and knowing that they will not be compensated for their participation in the study.

5.7 Summary

This chapter has provided knowledge on the planning of this study and described in detail the research paradigm, design and methodology. The onion model shown in Figure 13 was used to summarise the research methodology of this study. For the purpose of this study, the two methods (qualitative vs. quantitative) were compared against each in order to choose the most suitable research method. The research method chosen for this study was the qualitative research approach which is more suitable for exploratory research rather than experimental research. Inductive reasoning also allowed for the phenomenon in question to be understood by the researcher as it provides a platform of reviewing information from the secondary sources first. The targeted population for this study was the citizens of EL and also local government officials, and the sample used was the non-probability purposive sampling. This sampling method allowed the researcher to select appropriate participants for interviews in order to meet the objectives of the study. The data collection instrument used was the semi-structured interviews and was conducted with citizens of EL who took part in the PSSC research project and public safety officials. The approach taken for data analysis was thematic analysis which allows the researcher to look for patterns that emerge from the empirical data and group the similar responses into themes. Delimitations and the ethical clearance received from the University and from all participants that guided the study are also described. The research findings and discussion will be presented in the following chapter.

CHAPTER 6: RESEARCH FINDINGS AND DISCUSSION



6.1 Introduction

The preceding chapter discussed the systematic methods applied in this study in order to find results to the phenomenon investigated. Chapter 5 described in details the methodology that was followed for the research study and the empirical data collection process and analysis used. This chapter discusses the empirical findings obtained from the research participants during the interviews as explained in the previous chapter. The results obtained and illustrated in this chapter will be used towards the objective of the study. The primary objective of the study is to develop a feedback loop model to help improve communication between citizens and local government in Buffalo City and is discussed in the final section of this chapter.

The researcher began by reviewing relevant secondary data based on the existing literature in order to be familiar with the investigated topic. This was done because the study follows an inductive reasoning, which is the process of beginning with information from secondary sources and then determining what general conclusions can be derived from that data (Bailey et al., 2011). Another data collection technique for this study was semi-structured interviews conducted with EL citizens and public safety officials. During this time the researcher explored experiences of citizens and city managers with the intention to understand how they manage or deal with public safety matters in the city of EL. The primary data collected from the participants was described, summarised and organised using Microsoft Excel spreadsheet for effortless comprehension. Thereafter, the data was analysed following the six stages of thematic analysis, namely: familiarizing yourself with your data; generating initial codes; searching for themes; reviewing themes; defining and naming themes, and producing the report (Braun & Clarke, 2006). The aim of this chapter is to present the collected data and discuss the primary findings.

This chapter is divided into two parts. The first part presents data collected from the citizens and the second part presents data collected from the city managers in Buffalo City. Firstly, the next section will highlight the findings of both citizens and city managers, followed by analysis employed in the research study and will discuss the emerged themes. Finally, the underlying theory and proposed model are explained.

6.2 Discussion of Findings

According to Bryman (2012), discussion of findings allows the researcher to identify, present and discuss important and interesting issues emerged from data analysis that relate to the research questions. In the beginning, secondary data for this study was reviewed, thereafter primary data was collected and analysed using thematic analysis in order to draw meaning from it. Both data were compared to meet the research objective which is to develop a feedback loop model to enhance communication between citizens and local government. This section discusses the empirical findings and is divided into subsections: 6.2.1 (citizens) and 6.2.2 (managers) respectively.

6.2.1 Citizens

The one-on-one semi-structured interviews were conducted with 11 citizens who live in EL. The questions were divided into four sections, namely: general questions, continuous feedback loop, appropriate tools that can be used to present reported data, and reasons that can cause an ineffective feedback loop. These questions were split as follows:

- Section 1 asked questions related to the background of the participants.
- Section 2 concentrated on understanding the current state of public safety and ensuring a continuous feedback loop.
- Section 3 focused on the appropriate tools that can be used to present reported data to the citizens.
- Section 4 aimed at finding out reasons that cause ineffective feedback loops and how these can be reduced.

6.2.1.1 Background of the participants –Citizens

Within the scope of this research study, 11 EL citizens were interviewed. Some of the demographics that the researcher considered were age, gender, level of education, occupation and the number of years that the participants have been staying in EL. This is illustrated by the participants' characteristics in the table below. This section (Section 1) concentrated on the above demographics because the study's focus is on finding better ways of reporting public safety issues in EL from people who have lived here for some time. Furthermore, the researcher

aimed at obtaining in-depth information from citizens with diverse backgrounds to facilitate reaching informed conclusions towards achieving the research objective.

Table 10: Characteristics of citizens

Code	Age	Gender	Level of education	Occupation	No of years in EL
C1	22 years old	Male	Grade 12	Student	4
C2	21 years old	Female	Degree	Student	4
C3	22 years old	Male	Grade 12	Student	22
C4	26 years old	Male	Grade 12	Student	3
C5	23 years old	Female	Degree	Student	4
C6	22 years old	Male	Grade 12	Student	4
C7	41 years old	Female	Grade 11	Employed	10
C8	52 years old	Female	Grade 11	Self-employed	52
C9	57 years old	Female	Grade 8	Self-employed	57
C10	85 years old	Female	Grade10	Pensioner	52
C11	36 years old	Male	Grade 12	Employed	30

6.2.1.2 The state of public safety

Section 2 was aimed at understanding the public safety issues encountered in EL; whether there is an increase or decrease in these issues; what is it that citizens have done to deal with the issues, and also citizens' views on how suspicious activities can be reported. The participants' responses were grouped into three sub-groups: *public safety problems; current status of public safety issues,* and *ensuring continuous feedback loop; these* came out from the responses and are discussed below. All the participants responded to these questions by making examples from their own experiences.

6.2.1.2.1 Public safety problems

The most common public safety issues that were mentioned by the participants included carelessness in driving; crime activities; poor maintenance of road infrastructure; health hazards, and loitering. These issues are discussed and illustrated in the figure below. Out of eleven participants, three of them agreed that the issue of speeding cars on public roads hinders or put citizens' lives in danger. One of the participants pointed out that passengers need to tell the drivers when they are speeding as this will not only affect the driver, but everyone who is in the

vehicle. Another participant mentioned that even though in his vicinity the road has been maintained and upgraded, the drivers seem to have been given a licence to speed.

Out of the eleven participants, eight of them declared that different crime activities take place in their areas each day; and the issues discussed below are the ones that were raised repeatedly by almost every participant. These issues include robbery (mugging, housebreaking, theft, pick pocketing, stabbing) and Izinyoka. One of the participants reported, *"We are faced with problems of being mugged usually items such as cell phones and money in our community, when we walk in the streets we are not safe anymore".* Apparently, they live in fear of their lives and of their children.

Out of the ten participants who pointed out that crime related issues are the biggest concern in their areas, eight of them mentioned the issue of uncontrollable robbery in the streets whether it's during the day or night. One participant brought to light that she was recently mugged and lost a very expensive phone in the process. Most of the participants emphasised mugging as being the most common factor to crime activities that they are facing in their communities. One participant said, *"We are faced with many problems such as mugging and we as citizens are not happy".* Another participant added that *"We can't even go to town to collect our pension money, we get robbed".*

Three other participants highlighted the issue of Izinyoka as the big problem in informal settlement areas, especially when it is raining. One of the participants said: *"Izinyoka are becoming worse such that the lives of the children are at danger they can be electrocuted".* The previous statement was in accordance with what was published in the Daily Dispatch newspaper (almost four months after the interviews were conducted) that a child was electrocuted by Izinyoka and died in Duncan Village, an area in EL (Fuzile, 2015). Since 2012, it is alleged that twenty-six people have died in the Buffalo City due to Izinyoka (Fuzile, 2015).

Out of the eleven participants, three of them declared some of the public road issues including fallen road signs and potholes that are usually overlooked but which can lead to road accidents. Two participants reported that there are problems of potholes in their areas that affect their daily living and put their lives in danger. One participant shared: *"Problem is the deep potholes that are at the main rod close to my house, sometimes the drivers can be reckless. I always worry that*

one day a car would bump into the house and I will not have money to fix it because I'm old". Another issue mentioned by one participant was that of citizens' health being exposed to health problems due to the unhygienic conditions they live under. Furthermore, the issue of liquor stores that do not comply with the Liquor Board Act concerning trading hours which lead to the citizens not sleeping at night was also mentioned by two participants. One participant remarked that when taverns do not close at night, children do not sleep and this affects parents because *"no parent can sleep when the child is not in the house".*

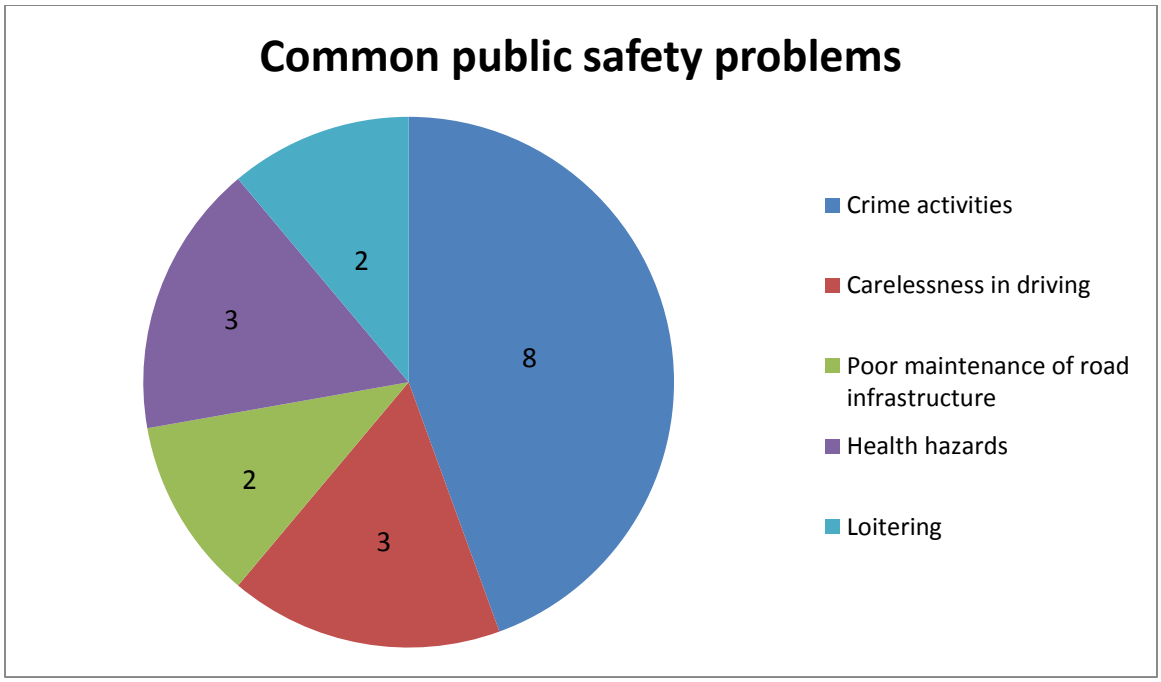


Figure 17: Public safety problems

6.2.1.2.2 Current status of public safety issues

Of all eleven participants that were interviewed about the current status of public safety issues, nine reported that there is a rise in public safety issues every day. The remaining two participants stated that there is a little bit of improvement because in some of the issues there is a decrease, although there is an increase in issues like crime activities, careless driving and poor maintenance of road infrastructure. One participant mentioned that this is mainly caused by the fact that there is no follow-up to their reports.

6.2.1.2.3 Ensuring a continuous feedback loop

This section was aimed at reporting responses about a continuous feedback loop in order to facilitate an enabling environment between the citizens and local government. Two sub-groups were developed based from the similar responses provided by the citizens.

A. Citizens' attempts at reducing public safety issues

All the participants reported that there are methods they have come up with in order to reduce the public safety issues in their areas. These include patrols at night; meetings within their wards; reporting to the police; calling the PSSC research project number to report, and sometimes just dealing with the person (s) who causes public safety issues. Out of the eleven participants, six participants declared that they deal with public safety issues through community engagements where they discuss how to reduce these issues; however, two of the six participants highlighted that after these meetings nothing happens. One participant said, "*Usually meetings are called to try and come up with ways of reducing or overcoming these problems. Sometimes we would suggest things like patrol whereby people would volunteer at night but to no progress*". Another participant added: "*We normally call meetings as the citizens to try and solve these problems, but this does not become successful because we are not united and sometimes the ward committees that we report to do not care*".

Three participants said that they either call the police, speak to the person causing the public safety issues, or report to the PSSC research project number. The remaining two participants said that they just do nothing. One of them highlighted this matter by saying: "*Honestly you just have to deal with it; like you can't do anything because it happens every day it's like the norm and of course you can report it, but which don't really get much answered, it's the trauma that'd be done*". These participants also suggested that working together as the citizens can help to reduce public safety issues.

B. Reporting suspicious behaviour or public safety matters

Participants gave different opinions on how suspicious behaviour can be reported. It was evident in the reports made by the participants that citizens do not know of other ways of reporting suspicious behaviour other than reporting to the police. Five participants stated that reporting suspicious behaviour to the relevant public safety officials is the only option they know of.

However, one participant suggested a “call me back” system or hotlines that are free of charge as a useful way of reporting suspicious behaviour. On other hand, two participants proposed that if the perpetrator is caught in the act by the community members, then they must blow a whistle to alert others. Two other participants suggested that there should be awareness or campaigns about reporting suspicious behaviour, and the remaining participant did not know how suspicious behaviour can be reported. Citizens took their time when answering this question, trying to think carefully of the method that could best fit the people living in their area; these methods are shown in Figure 18.

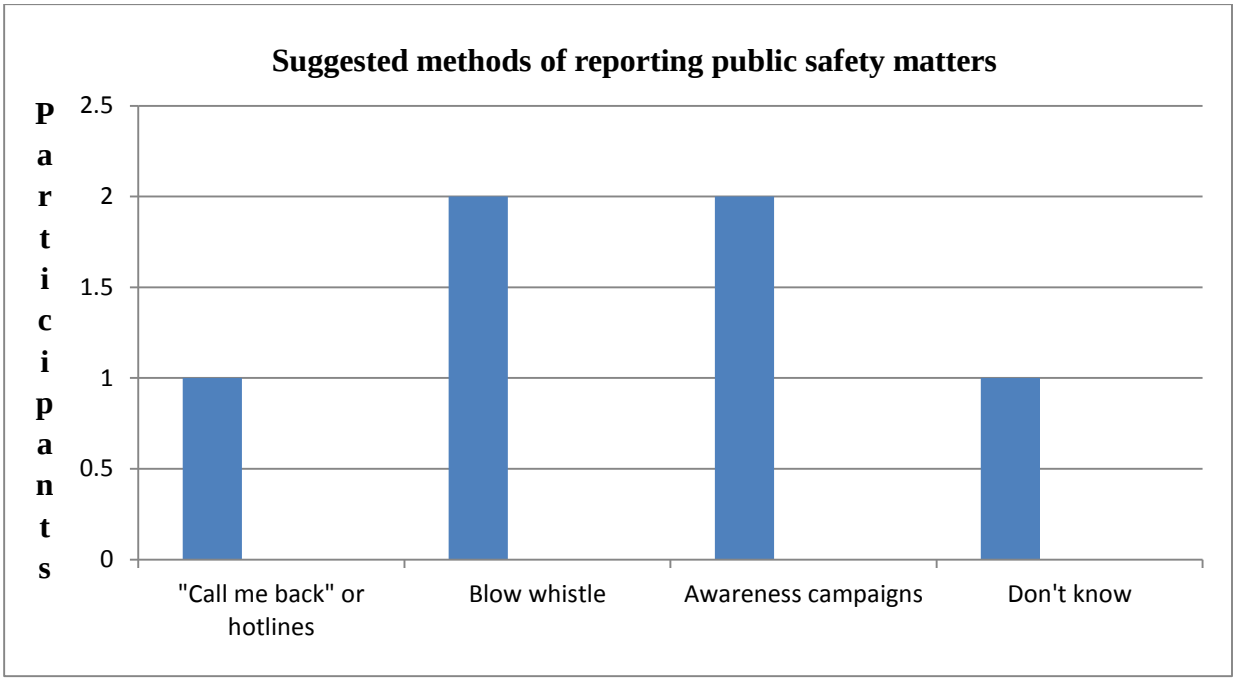


Figure 18: Suggested methods of reporting public safety

When citizens were asked about how they currently report a public safety matter, six out of eleven pointed out that they either call or go to the police station. Three participants stated that they call community meetings to report the public safety matter to other community members and the ward committee, and the remaining two participants said they report to the office of the councillor. This is shown in Figure 19.

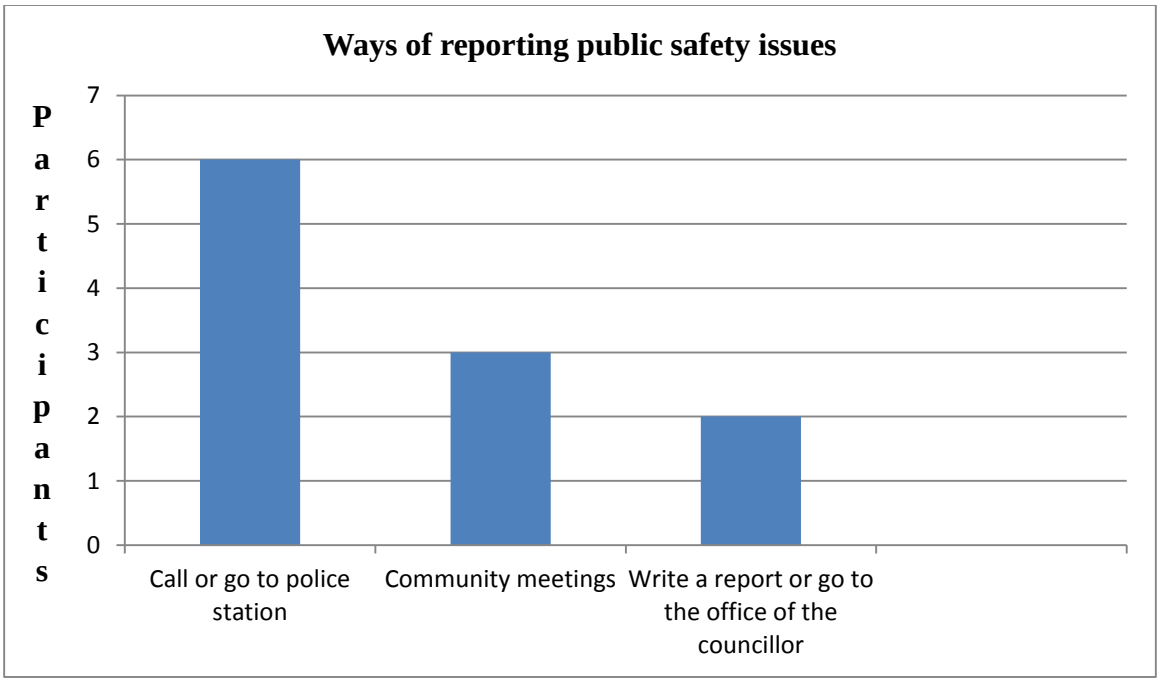


Figure 19: Current methods of reporting public safety

In terms of being updated about public safety issues, both citizens and public safety officials declared that the most common method used to collect and convey feedback was through ward councillors. Three out of four city managers declared that they work through ward councillors to convey the information to the citizens and then back to them. This indicates that citizens are still utilising traditional methods of reporting and this depicted by the figure below.

6.2.1.4 Appropriate tools that can be used to present reported data to the citizens

Section 3 concentrated on understanding appropriate tools that can be used to present reported data to the citizens. Out of eleven participants, ten pointed out that posters would be appropriate. They also had varying opinions on what should be on the posters, namely pictures, statistics information and emergency hotlines. The remaining participant said that the public safety data should be presented by ward councillors to their areas. Out of eleven participants, eight suggested that the public safety data be made available in platforms such as public places namely meetings, roads, schools, sport grounds, clinics, post offices, work places and shops. One participant highlighted that radios would be the right platform to make public safety information available to the citizens, and the remaining participant suggested emails and social media platforms.

6.2.1.5 Cause (s) of ineffective feedback loops

Section 4 was centred at understanding reasons that can cause ineffective feedback loops between the citizens and local government. These reasons are detailed below.

6.2.1.5.1 Limited access to public safety information and inappropriate presentation of reported data

When participants were asked about their knowledge in terms of public safety issues, nine out of eleven participants declared that they get to know about public safety issues when they happen. The other two participants stated that they know about public safety issues through word of mouth such as community meetings or gatherings. From these responses it can be seen that citizens have limited access to public safety information unless a person keeps on checking with the relevant public safety officials. Anand et al. (2014), also highlights in Figure 11 that encouraging access of public safety information to citizens can result in the four dimensions of citizen engagement. All participants felt that being updated about the public safety issues in their areas would be a good idea; four out of eleven suggested that updates can be made every time there is something new. From the remaining participants, two of them said once a month, two said quarterly, another two participants suggested twice a year, and the last participant declared that at least once a week.

6.2.1.5.2 Low technology literacy

With the use of Internet cafés, seven participants responded that they do not use Internet cafés often as they have access to Internet at school. The other three participants said they do not use Internet cafés at all because they do not know what they will do in Internet cafés as they do not have any knowledge about computers. One respondent added that he does use Internet café, but he must have a taxi fare as the Internet cafés are only available in town. Seven out of eleven participants stated that they would use the Internet to report public safety issues because it is quick and easy, costs less, and allows for anonymity. The other three participants declared that they do not know how to use the Internet. One participant added that he is not sure about reporting public safety issues with the Internet as most of the systems used in public safety departments are manual.

6.2.1.5.3 Lack of communication about public safety issues

Out of eleven participants interviewed, eight thought that the improvement of communication will help reduce public safety issues because this will make the citizens feel supported by the public safety officials. In turn, the city managers will get to know about the public safety issues straight from the horse's mouth (citizens). The remaining three participants said improving communication between the citizens and local government will not reduce public safety issues because this is beyond that, and also public safety officials are not directly affected by these problems. Based on the responses it can be seen that most participants believe that improvement of communication can help reduce public safety issues and citizens can assist the public safety officials when there is continuous communication.

Eight participants cited that there is no feedback received about the reported public safety issues, but they sometimes just see the problem they had reported being solved. The other three participants said that they only receive feedback if they keep on checking with the public safety officials about the reported matter; if not there is no feedback at all. This means that the public safety officials do not value communicating to the citizens about public safety problems, as was indicated by ten out of eleven participants that the communication between the citizens and local government is poor. One participant declared that even when ward councillors are invited to community meetings it is difficult to meet up with them.

Different reasons were put forward as to why city managers do not value communicating with citizens and also for taking long to attend to emergencies. These included shortage of resources, lack of knowledge and skills, and no humanity.

6.2.2 Public Safety Officials

The Public Safety Department in EL is divided into four functional areas: Traffic Services, Law Enforcement, Fire and Rescue, and Disaster Management. The interviews were conducted with each public safety official from the different functional areas. The questions of the semi-structured interviews were divided into four sections, namely: general questions, public safety office, appropriate tools that can be used to present reported data and reasons that can cause an ineffective feedback loop. These questions were split as follows:

- Section 1 asked questions related to the background of the public safety officials.

- Section 2 concentrated on understanding the current state of the public safety office.
- Section 3 dealt about the appropriate tools that can be used to present reported data to the public safety officials.
- Section 4 aimed at finding out the reasons that cause ineffective feedback loops and how these can be addressed.

6.2.2.1 Details of participants

All the interviewees from the Department of Public Safety were at managerial level and reported to have qualifications relevant to the particular job that they are doing. All the participants who participated in this interview were males because there are no female managers in the Department. When asked about this, the participants explained that their job is one of the tough jobs that require manpower. When asked about the number of years that they have been living in EL, out of four participants, one said that he was born and bred in King Williams Town, one participant has spent twenty years of his life in EL, another participant declared to have been in EL for five years, and the remaining participant was born and raised in EL. This is depicted in the table below.

Table 11: Characteristics of managers

Code	Age	Gender	Level of education	Occupation	No of years in EL
M1	54 years old	Male	Diploma in Traffic Science	Manager in Traffic Services	0
M2	45 years old	Male	Degree in LLB	Manager in Law Enforcement Services	20
M3	53 years old	Male	Higher Diploma in Fire Technology	Manager in Fire and Rescue	5
M4	57 years old	Male	Several Diplomas	Manager in Disaster Management	57

6.2.2.2 About the public safety office

When city managers were asked to outline their role in their respective functional area, different responses were recorded. These are in detail below.

- Traffic Services –The manager declared that the role of this functional area is to ensure safety on the roads by reducing accidents, concentrating in high accident zones, rendering efficient service to the members of the public in terms of application of drivers licenses, motor vehicle registration licenses, renewal of motor vehicle licenses, application for learners or drivers licenses; road markings to ensure lines are visible, and maintaining traffic signs.
- Law Enforcement Services – The manager highlighted that enforcing municipal by- laws; crime prevention activities in the city, and having joint activities with other stakeholders (SAPS, Home Affairs, Eastern Cape Liquor Board; Traffic Services, etc.) that deal with law enforcement and approval of marches and pickets in terms of the Gatherings Act are part of this functional area.
- Fire and Rescue –The role of this functional area is to ensure that there are sufficient resources so that the Department can cope with any eventuality.
- Disaster Management – The manager declared that this functional area's role is to manage disasters.

These different responses show that even though the Public Safety Department in EL is a single unit, it is made of various and divided functional areas.

When the participants were asked about the most important factor about managing the city effectively and how they have done this in the past, different opinions were raised. Two out of the four participants stated that managing a city on its own is a challenge, let alone when the functional area is hindered by the shortage of resources, manpower and the geographical area. One participant declared that managing the city effectively is about working jointly with other relevant stakeholders. The remaining participant gave emphasis to the management and eradication of poverty (access to a range of services, goods, quality of life, employment, etc.) as the means of managing the city effectively. Of all the participants, only one stated that they have successfully done this in the past by planning joint meetings and on agreed time frames embarking on activities.

The approach used to solving public safety issues in a smart city is important as it distinguishes whether the city is winning or not (Donnelly & Harrison, 2011). When asked about their approaches to dealing with public safety issues, one participant stated that they identify high

accident zones by using a measuring tool to capture statistics in order to do comparisons with the previous year's months. Another participant declared that they consult with the Communications Department to make people aware of the planned activities. One participant said that his approach to solving public safety issues is to have sustainable funding, and the remaining participant said that they solve the public safety issue when it occurs. Only one participant mentioned that their approach has been effective. Although the approaches are different, it seems that all the functional areas are still employing the reactive approaches rather than the proactive approaches to solving public safety issues.

The participants highlighted the different public safety issues based on their functional area and this information is depicted in the table below.

Table 12: Public safety issues

Traffic Services	Law Enforcement	Fire and Rescue	Disaster Manager
-Speed -Road traffic signs -Parking in driveways	-Pick pocketing -Illegal hawking -Protests	-Burning of land fill sites -Illegal dumping -Illegal electrical connections	-Recurring exposure to the same risk

Participants highlighted the different types of skills that a public safety official must have which included the following: general understanding of policies and legislation; professionalism; assertiveness; managing activities; good communication command; good writing skills; fairness; leadership, and a risk specialist. In all the functional areas, communication and management skills were seem to be common. Based on the skills mentioned above, the functional areas undergo training through the Human Resources Department and South African Emergency Service Institute (SAESI). The evaluation of the trainings differs as two participants declared that their trainings are evaluated constantly, one participant stated the evaluation is done every six months, and the remaining participant said annually. This indicates that there are no agreed time frames of evaluating the trainings within the Department.

6.2.2.2.1 Tools and feedback mechanisms currently utilised in Public Safety Department

In the context of this study, a tool is defined as a method or approach used to carry out a particular task. Public safety officials were asked about the type of tools they use to collect public safety data and how they receive feedback from the citizens and within functional areas. The subsections below present tools that are used by public safety officials to collect information on public safety issues from citizens and also feedback mechanisms to report back to citizens and within the functional areas.

1. Traffic Services

- Identify high accident zone areas by having more visibility and enforcement in those areas, and on a monthly basis the functional area capture statistics in order to compare months with previous years' same months. It is a measuring tool that identifies whether the Department is winning or not, but at the moment it is effective.
- Train officers in terms of legislation used, especially when there are amendments so as to keep our officers up to date with the latest amendments.
- Engage with communities on road safety issues, like looking after stray animals, and also educate schools, mainly primary schools, about road safety, i.e. how to cross on the road and also the dangers of freeway crossing.
- Files and suggestion boxes are some of the tools for citizens to write their complaints, suggestions or express satisfaction.
- Security communication radios.
- Traffic officials submit performance reports to national showing overall results of the province not in terms of the performance of the metros.

1a) Feedback to the citizens and within departments

- Feedback is conveyed to the public by a ward councillor or ward committee; sometimes a public safety official verbally conveys feedback to the public.
- Awareness campaigns.

- Citizens physically go to traffic offices or phone the call centre or traffic office to make a report.

2. Law Enforcement

- Liaise with the Communications Department to make the public aware when there is going to be, for example, general crime prevention in the city, raids or joint operation with other stakeholders.
- Officials communicate with citizens by telephone.
- The functional area uses occurrence books and registers to record everything.
- Exception reports that are collated on a monthly basis form part of feedback within the functional areas.

2a) Feedback report to the citizens and within the departments

- People raise their concerns to the ward councillors who form part of the Portfolio for Public Safety. The committee is made of various political structures that engage with the communities, and then the information collected is filtered to the functional area.

3. Fire and Rescue

- Officials communicate with citizens by telephone; there is no formal communication method used.

3a) Feedback report to the citizens and within the departments

- Board of committees interact with citizens, then report to the officials.
- Feedback is conveyed to the citizens through ward councillors.

4. Disaster Management

- Debriefing sessions are one of the tools used to determine what went wrong and what can be improved.
- Written media statements are sent to the Communications Department in order to be published in the newspaper or broadcasted on the radio.

4a) Feedback report to the citizens and within the departments

- Incident reports are the means of collecting feedback from the citizens and also within the functional areas, whereby citizens are asked to fill in a standard template with details of the nature of the incident that they had at risk.
- Ward councillors and ward committees are the intermediary between citizens and officials.

The table below shows the differences and similarities of the tools and feedback mechanisms used within the functional areas of public safety. It is evident that the most common tools and feedback mechanisms used in the functional areas are security communication radios (walkie-talkie), telephone, and ward councillors; this shows that there is no integrated method of collecting public safety information from the citizens. This could result in public safety officials taking long to respond to citizens' issues and also make it difficult to understanding which areas need more attention. It is apparent that Public Safety Department uses traditional systems to interact with its citizens and some of these tools provide one-way feedback about public safety matters.

Table 13: Summary of tools and feedback mechanisms currently utilised in Public Safety Department

	Traffic Services	**Law Enforcement**	**Fire and Rescue**	**Disaster Management**
Tools	-Identify high accident zones by **capturing statistics** and compare it with previous -**Train** traffic officers in terms of legislation -**Engage** with communities on road safety issues -**Files** and **suggestion boxes** to collect complaints, suggestion or satisfaction from the citizens -Security **communication radios** -**Submit performance reports to national as a province not as a metro**	-**Liaise** with Communications Department to inform citizens abut public safety related matters -Officials communicate with citizens by **telephone** - Use **occurrence book** and **register** to record information -Use **exception reports** -Security **communication radios**	-Communicate with citizens by **telephone** -Security **communication radios**	-**Debrief sessions** -**Media statements** -Security **communication radios**
Feedback	-Conveyed by **ward councillors** or **committees** -Awareness **campaigns** -Citizens need to **go** or **phone** traffic offices or call centre	-Conveyed by **ward councillors**	-**Board of committees** interact with citizens and report to the officials -Conveyed by **ward councillors** to citizens	-**Incident reports** -**Ward councillors**

6.2.2.2.2Views of public safety officials about the current tools used in public safety

Out of four participants, one declared that they are currently sitting with the problem of communication with their security communication radios popularly known as "walkie-talkie". The other three participants pointed out that they would like to change some of their communication methods as other methods are working quite well. However, all four participants declared that they had no problem when it comes to communicating with the citizens via ward councillors, though they would like more effective ways of communication. All participants declared that with the current communication methods used in Public Safety Department citizens do value communicating with their city managers.

Furthermore, when considering the design of a feedback loop, the four participants pointed out that metros should be looked after so that they can be more effective in reaching their objectives. This means providing various trainings to the public safety officials and citizens. All participants declared that the development of a feedback loop will definitely improve their communication with the citizens because the communities will be updated about all the developments in place. All four participants declared that the current system that they are using is working quite well, unless there is another that is more efficient that they are not aware of. In terms of improving the current system, one participant pointed out that when they send information to national government, the province combine all the metros and this becomes a problem when they get funds. For example, Buffalo City is one of the worst performing metros when it comes to public safety (refer to Table 5), so now national government allocates the resources based on the performance of the province and not of the metros. Another participant highlighted that they would like a computerised system as the current system is a paper trail that takes long to sift through when they search for previous years' information.

Additionally, the main challenges that affect the operations of the department include the following: communication via radios; shortage of resources (vehicles, personnel, equipment, etc.); transformation of law enforcement into becoming metro police; lack of compliance; update of the by-laws, and limited human capacity. This is in accord with the discussion in sections 3.31 to 3.3.4. All the participants mentioned that these challenges are dealt with at management level and also by the politicians, so they do not know how they are being addressed. However, two participants declared that they think citizens are satisfied with their services. The other two

participants highlighted that satisfying citizens is a challenge because 1) there is an overlapping of functions within the departments which causes delays in response time, and 2) the department is not up to the standards specified by the metro.

6.2.2.3 Appropriate tools that can be used to present reported data to the officials

When the officials were asked about the type of tools to be used when reported data is presented, one participant suggested that the information be presented both in a graph and in words for effortless interpretation. Another participant preferred words only and the other preferred graphs only. The remaining participant pointed out that it is crucial that their functional area data be presented in a spatial context, namely maps and Global Positioning System (GPS), because of its significance.

6.2.2.4 Cause (s) of ineffective feedback loops and how these can be addressed

According to the public safety officials, the communication methods used to collect feedback within the functional areas include meetings, occurrence books, registers, by phone, and debriefing sessions. The collection of the feedback within the functional areas and from the citizens is usually done daily or on a monthly basis and is usually in the form of suggestions, complaints and incident reports (where citizens complete a standard template). With all the methods used, the public safety officials get the reports after the incidents have occurred. When participants were asked about the current communication process within the Department, they seem not completely satisfied with their current method of communication as it has its advantages and disadvantages. These communication methods are further discussed in the section below.

The table below lists some of the advantages and disadvantages of the communication methods used within the functional areas of public safety.

Table 14: Advantages and disadvantages of communication methods

Tool	Advantages	Disadvantages	Reference
Community meetings	- Give individuals a chance to voice out their ideas, give feedback etc. on what went well or what can be	- May raise citizens' expectations but can lead to frustrations if expectations are not met	(Environmental Protection Agency , 2015)

	improved		
File (occurrence book/ register/ exception report)	- No training required for people to access and manipulate data	- High chances of data duplication and limited data sharing	(Hamel, 2011)
Telephone	- Immediate response or feedback to things asked about	- There must be someone stationed to pick up the phone	(Nestor-Harper, 2015)

6.3 Thematic Analysis

The researcher employed semi-structured interviews for collecting empirical data from the participants. The commonality about the participants was that they all reside in EL, meaning that their responses were not too disparate. These responses were then grouped into themes built up from descriptive codes which revealed meaning or pattern to the data. It was because of this pattern that the researcher was able to group themes for coherent analysis. These themes are discussed in detail below.

Theme 1: Accentuate proactive approach

According Ashely and Morrinson (2011), in a rapidly changing society, local government needs to be anticipatory which can allow competitive advantage by gaining sophisticated intelligent techniques, new models of decision- making, and to judge results of public safety matters. This theme seeks to understand the way of reporting public safety issues to the public safety officials and also how the reports are collected by the Department of Public Safety. Empirical data shows that citizens do not know of other ways of reporting other than to call the relevant public safety official or go to their workplaces when something has happened. This was also an issue that was raised by the public safety officials, as well pointing out that their approach to dealing with public safety issues is after an incident has occurred. Public safety officials mentioned that they collect reports from the citizens by making use of a suggestion box, completing a standard

template, and by phone. Both the citizens and public safety officials still make use of traditional systems when communicating about public safety issues.

Theme 2: Increase local government support

Both citizens and public safety officials highlighted two important aspects to be considered when encouraging city management support: working jointly with other stakeholders, and also encourage citizen participation. A response emerging from the empirical data shows that a person can report a public safety matter and not receive an answer because 1) public safety functional areas overlap with other departments, e.g. Traffic with Engineering, and to get response may take longer as the report must be escalated to the relevant department; 2) sometimes the ward committees or councillors do not care, and 3) citizens are not united. This theme is about the support that citizens get from local government in attempt to reduce public safety issues in their areas. However, empirical evidence revealed that citizens do not feel supported by the public safety officials since they are not involved in public safety decisions taken, so the decisions public safety officials with their management make are not communicated with them first. The literature also agrees that involving citizens in decision- making, especially in rural communities, helps to boost trust between citizens and local government (Bassler et al., 2008).

Theme 3: Awareness of public safety issues

Communication methods used by both citizens and public safety officials in order to understand whether citizens receive feedback about reported public safety matters are dealt with in this theme. It emerging from the data gathered that the communication methods used to collect feedback within the functional areas are occurrence books, debriefing sessions, or conveying message to the citizens through the ward councillors. This shows that citizens do not have access or knowledge of the public safety information. According to Mikoluk (2013), awareness is an approach that can help to enhance the relationship between the local government and the citizens, benefit the local government to learn the environment, and also discover what is working and what is not for the community in the early stages of the project.

Because of the mentioned challenges, citizens do not receive feedback; they just see the public safety problem reported being solved. Sometimes it is only the affected people who will receive

feedback about the reported public safety issue if they keep checking with the public safety officials.

Theme 4: Improved technology literacy

This theme deals with the current ways of reporting used and the knowledge of technology citizens possess. Empirical data revealed that most citizens do not have a problem reporting using the Internet on their mobile phones; however, some citizens pointed out that they do not have knowledge of or access to computers. Both the citizens and public safety officials raised the need of computerised systems; one of the officials highlighted that having a computerised system would make things quick and easy than the paper trail or manual system currently used. Barron et al. (2010) add that technology literacy is an essential factor needed when the government inspires to equip its citizens with technology skills required to successfully participate in and contribute to a digital society.

Theme 5: Change management

The aim of this theme was to find out whether citizens have access to public safety information and what appropriate tools can be used to present the reported data to the citizens and public safety officials. Based from the empirical data, participants suggested that the public safety information can be presented using visual aids including Global Positioning System (GPS), graphs, or posters with text and pictures. This information may be available in public places every time there are new developments. Richards (2015) acknowledges that when introducing change in an organisation and managing it effectively can lead to significant outcomes such as adoption of new technology to improve services, meeting customer needs, improving the economy, opportunities for growth, and challenging the status quo.

Theme 6: Frequent trainings

This theme seeks to understand the reasons that cause public safety officials to take long to respond to emergencies. This was done by understanding the nature of the public safety office, and also the types of trainings provided in making sure that there is direct interaction between the citizens and public safety officials. According to the empirical data, external and internal trainings are provided to the public safety officials to ensure the smooth running of the daily

operations in the Department. One of the respondents mentioned that external trainings are more focused on educating the citizens about road safety issues, and all the respondents highlighted the internal trainings being provided. Although the evaluation of trainings differs from each functional area, three out of four respondents indicated that training is evaluated annually. Lauer (2012) states that, for change to be managed effectively, trainings must be used to manage that change to build knowledge and skills about public safety matters between citizen and the local government.

The study makes use of the De fleur model of communication to identify factors that need to be considered during the communication process in order to create an effective feedback loop. The De fleur model of communication is a combination of Shannon and Weaver's model and Westley and Maclean's model of communication. According to the De fleur model of communication, it consists of the following constructs – source, transmitter, receiver and destination – on both sides of the communication process, with noise bound to occur at any stage. Some of the constructs were renamed to fit the objectives of the study, which is to enhance communication between citizens and local government. The next section will discuss the proposed model and explain how it fits the objective of the study.

6.4 Proposed Model

The proposed model was developed from the components of the underlying theory introduced in Chapter 4 and briefly highlighted above. The study does not dispute the theory, but expands on it. In the model, twelve constructs were replaced at the top and bottom levels by means of the findings from the primary data. Furthermore, the information from the secondary sources assisted to refine the model to suit citizens and local government needs in EL. The original constructs on the underlying theory on the top level are: source, transmitter, channel, mass media device, receiver and destination, and on the bottom are decoder, transmitter, channel, feedback device, receiver and destination. These constructs on the top level of the theory are renamed as follows: *citizens*; *IVR System 1*; *citizens' channels* (*toll-free, SMS, Face book, twitter)*; *radio; call centre,* and *local government.* The constructs on the bottom level are renamed as follows: *local government*; *IVR System 2*; *local government channels* (*phone calls, website, and emails)*; *citizen and city managers feedback; public meetings,* and *citizens*.

The channels for sending and receiving information about public safety matters were highlighted by the participants (citizens and local government) during the interviews to be suitable to use. Furthermore, five additional factors from the literature were added as a means of reducing noise during the communication process; these are: *purpose*, *people*, *process*, *tools*, and *environment* (Asad et al., 2014). Lastly, from the literature two outcomes of internal feedback, which is *increased citizen participation* (feedback between citizens) and *increased transparency* (feedback between local government officials), were also added. All the text written in italics shows the constructs that are renamed and also those that are added into the underlying theory in order to come up with the proposed model. The goal of this study was not to test the model but to provide suggestions through communication feedback loop model on how to manage or reduce public safety issues in Buffalo City. However, the proposed model was evaluated by the panel of experts in the field of ICT through various seminar presentations. The proposed model is depicted in Figure 20 below and is explained in detail in the next section.

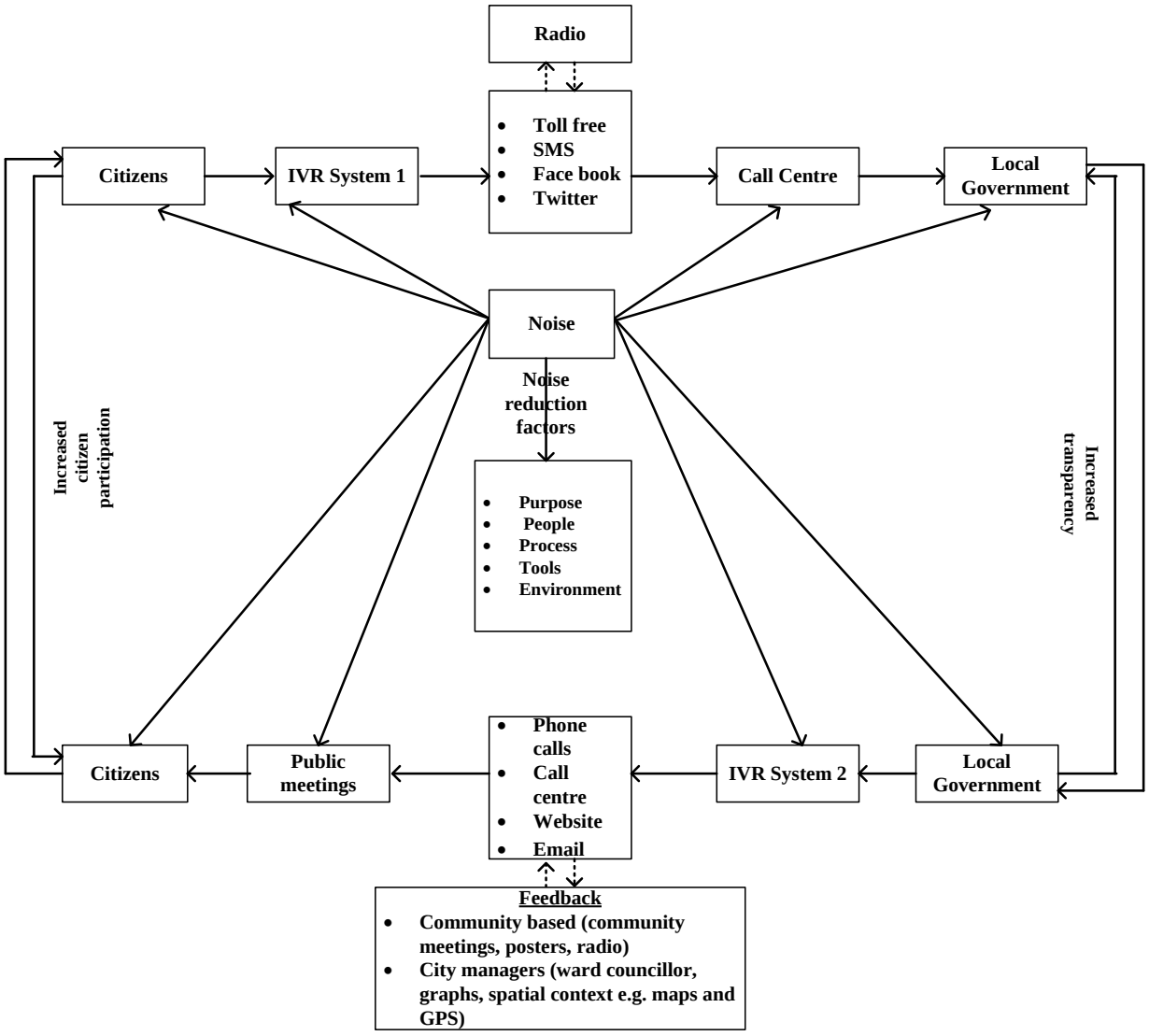


Figure 20: Proposed Feedback loop Model

6.4.1 Explanation of the Proposed Feedback loop Model

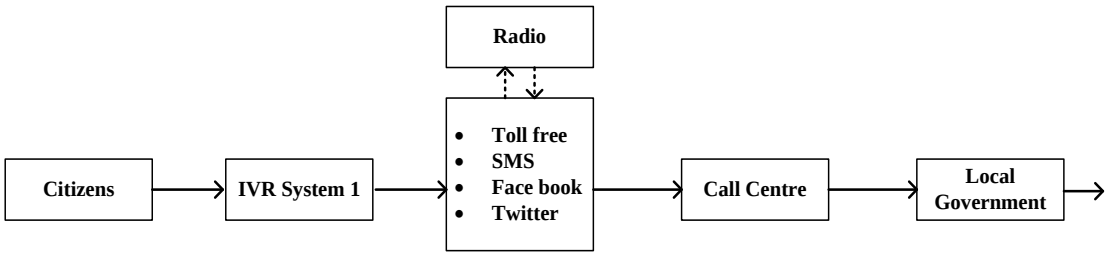
The aim of De fleur's communication model is to encourage communication process by providing two-way communication and two-way feedback to the target audience, while acknowledging that noise can occur at any stage of the communication process. The model is developed using both secondary data and primary data collected from the participants. The intention of the study by developing the proposed model is to:

- Encourage communication of public safety matters between citizens and the local government.
- To promote citizen participation in smart city initiatives by increasing capacity and response time of emergency and non-emergency services through information transparency.
- To encourage open lines of communication and collaboration to both citizens and local government.
- To provide visualisation of information (e.g. graphical presentation of public safety data) to both citizens and public safety officials.

The proposed model is split into three segments below to allow better understanding.

6.4.1.1 Top Level: Citizens Initiating Message

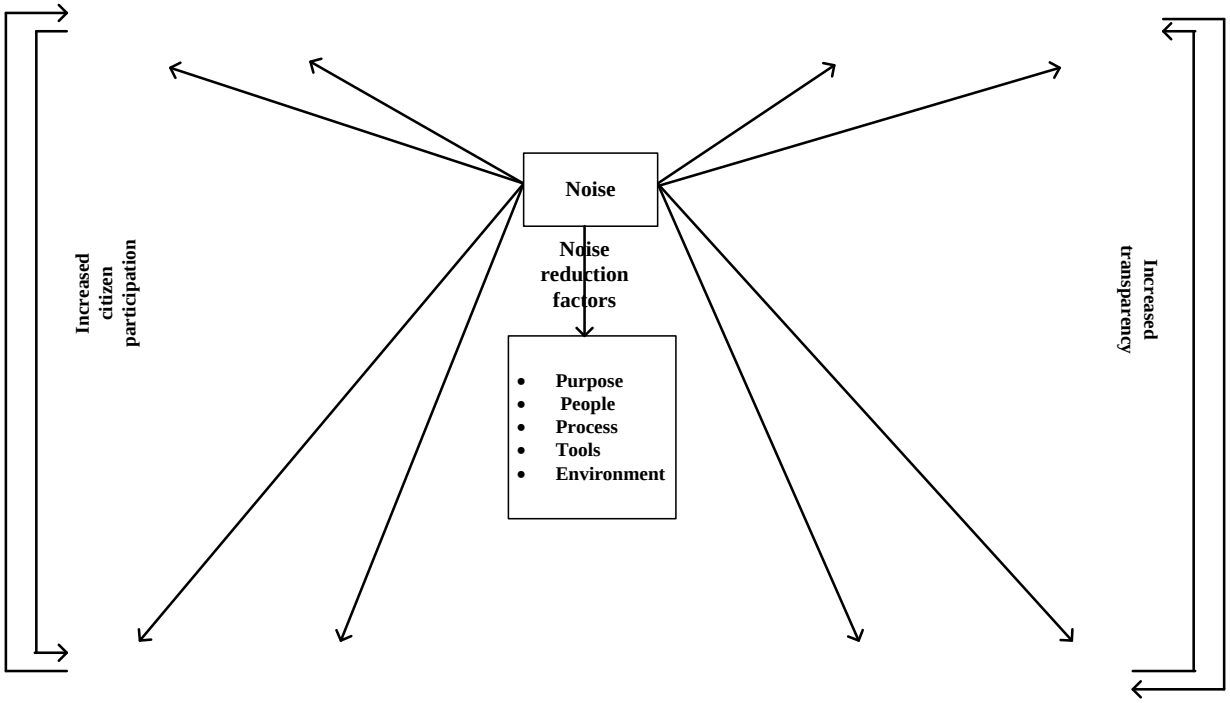
Empirical evidence shows that citizens play an important role in the communication process as they are the ones who are directly affected by public safety issues. This is could lead to the implementation of citizen engagement aspects (Bassler et al., 2008), see Table 6.



In the model, the citizens are the initiators of the communication process, i.e. this is where the message is originated and sent via IVR system 1 using any of the channels – (toll free, SMS, Facebook, Twitter) and through a mass medium device such as the radio. Then the public safety report is received in the call centre (receiver's end) and finally reaches the local government (destination).

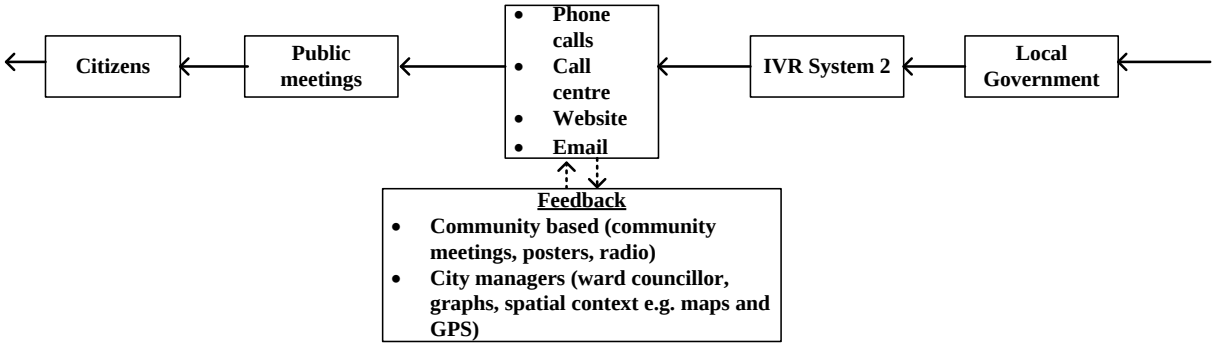
6.4.1.2 Noise: During Communication Process

The next section acknowledges that during the communication process noise can occur at any stage which can lead to communication breakdown if there is no effective feedback loop. According to the literature reviewed there are five interlinked components that a feedback loop should be based upon: purpose, people, process, tools, and environment (Asad et al., 2014). These components are added in the proposed model as the factors that could reduce noise during the communication process.



During the communication process, internal and external feedback loops emerge. In the citizens side the two-way feedback could lead to *increased citizen participation* (Scott et al., 2010) and also within the local government's side the two-way feedback could lead *increased transparency* within functional areas (Bonsón et al., 2012).

6.4.1.3 Bottom Level: Local Government Providing Feedback to the Citizens



In addition, the relevant local government official responds to the public safety report through IVR system 2 by means of any of the channels – (phone call, website or email). Feedback is then provided to the citizens and within functional areas by means of community meetings, posters, radios, ward councillors or with visual presentations. The communication process is circular, meaning the process continues until the desired results are met while the roles of source (citizen) and receiver (local government) are interchanged.

Empirical evidence revealed that both citizens and the public safety officials prefer that their feedback be provided every time there is something new about public safety matters.

6.5 Summary

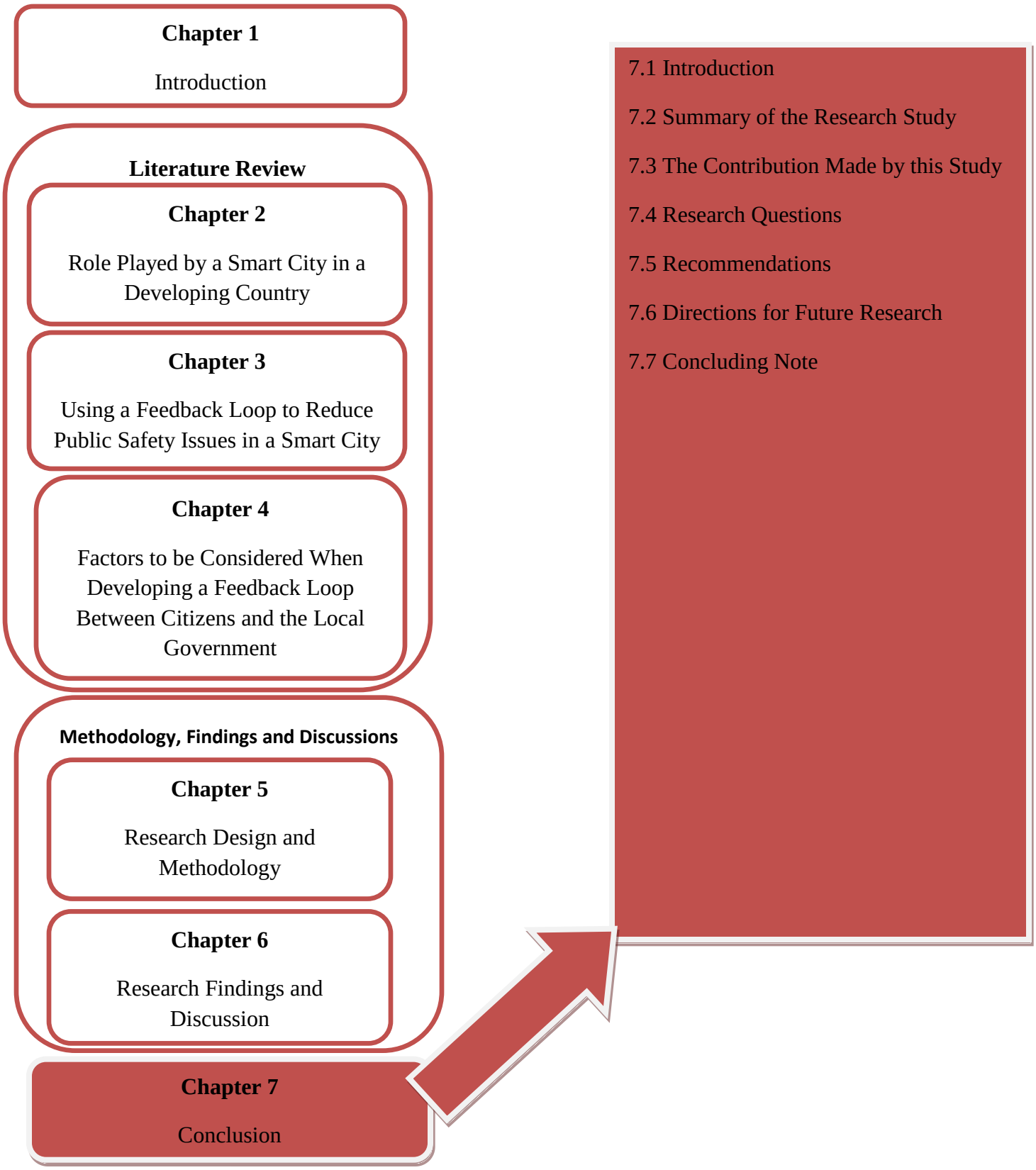
This chapter focused on analysis of the primary data collected through semi-structured interviews with EL citizens and public safety officials. Open- ended question interviews were carried out one by one to allow better understanding of the knowledge and practises in public safety. The audio responses from the interviews were sorted into transcripts, which were later analysed and categorised into themes that were based on the similarities of the responses in order to enable management of the data.

The sample was divided into two groups in order to compare and contrast the results. The findings revealed that respondents share similar perceptions about poor communication

processes of public safety matters. These findings add to a growing body of knowledge concerning communication processes used in Buffalo City, particularly in EL. The findings revealed that the problem of communication about public safety issues does exist between citizens and local government and within departments.

Additionally, the empirical evidence provided understanding of the public safety state, i.e. challenges faced and ways to reduce them. Furthermore, the findings contributed to refining the proposed model. In the model, various components were pointed out by the participants, which showed that there is still a need for public safety officials to adhere to strategies that are likely to be used by the citizens, especially in stressful circumstances. The overall conclusions of the study are outlined in the next chapter.

CHAPTER 7: CONCLUSION



7.1 Introduction

The previous chapter presented the empirical evidence of the research study, and this chapter provides a summative conclusion of the entire study. This chapter presents the conclusions of the study that was undertaken to investigate the role of a feedback loop between citizens and local government in Buffalo City.

The conclusions of this study are drawn from the objective of the study, literature reviewed, underlying theory, and from the results of the empirical findings. The findings from the model also revealed that both citizens and public safety officials acknowledge that there is a lack of communication about public safety issues and also inappropriate tools are used to present public safety information which lead to limited access to public safety information. Hence there is a need for a continuous feedback loop model. The study consists of seven chapters.

This chapter is structured as follows: It will begin by providing a brief summary (the reviewed literature, the proposed model, research methodology, empirical findings and discussion) of the study and recommendations; thereafter the limitations, suggestions for future research will be discussed, and finally the concluding remarks are conversed. The next section presents a brief summary of the previous chapters in this study.

Therefore, the focus of this chapter is to present conclusions drawn from the findings and to suggest recommendations.

7.2 Summary of the Research Study

Chapter 1 is the introduction of this whole study and it presented the background to the identified research problem and also the main objective of this study. In trying to address the research problem, main research questions and three sub-questions were developed. The significance of the study, methodology and the underlying theory were also discussed briefly.

Chapter 2 examines the role of a smart city in developing countries. This was done by giving a thorough, general definition of a smart city. Thereafter, the pillars and the constructs of a smart city and how each construct fit to a city depending on the needs of a city were discussed. Finally, the last section reviewed the potential benefits that can be offered by a smart city when successfully deployed among cities in developing countries.

In **Chapter 3** the importance of a feedback loop between citizens and local government is discussed. Thus was done by understanding the general concept of public safety and the current state of public safety in EL. Additionally, goals that public safety should be based upon were discussed and how a feedback loop can reduce the public safety issues. Lastly, the chapter discussed in detail the advantages that a feedback loop between citizens and local government can offer to help reduce public safety issues in a smart city. This was in accord with the reviewed literature and also the underlying theory that pointed out that effective communication can provide numerous benefits between the citizens and local government in a smart city. These benefits were identified in section 3.6 including *Leveraging information to make better decisions; Anticipating and resolving problems proactively; Coordinating resources to operate more efficiently; Promote citizen engagement; Increased transparency,* and *Develop leaders.*

Chapter 4 is the final chapter of the reviewed literature section. In this chapter a brief discussion about the underlying theory was explored, which is the research solution to the research problem that was introduced in Chapter 1. This chapter proposes that the underlying theory is the most appropriate to the research problem and provides a platform to build the solution to the problem area. Furthermore, this chapter argues that when developing a feedback loop between citizens and local government, certain components or factors (*purpose*, *people*, *process*, *tools*, and *environment*) need to be considered first. These interlinked factors were discussed in detail in order to provide understanding as these may impede the success of the project if not properly managed.

Therefore, strategies that citizens and local government may follow to sustain the communication process in order to exploit the benefits that a continuous feedback loop can offer over time are discussed in this chapter.

Chapter 5 focuses on research methodology that was followed in this study, that is, the procedures carried out in collecting data and the nature of analysis the study made use of. The research method was established and it supported the interpretive paradigm. Primary data was gathered by means of semi-structured interviews as an ideal research instrument to provide in-depth knowledge about the research problem. The qualitative method was deployed in order to put the researcher in the perspectives and experiences of the participants to acquire more insight about how citizens and local government's relationship can be improved, and mostly because

this philosophy is concerned with quality. Data collected was transcribed and sorted into a more manageable format for analysis by using Microsoft Excel spread sheet.

Chapter 6 presented the empirical findings obtained from the primary data supported by the reviewed literature. Emerging patterns were identified from the collected data and grouped into themes for thorough analysis in accord to the similarities and differences found. Analysis of data was applied using inductive reasoning, and the findings were analysed by using thematic analysis. The results of the study revealed that both citizens and local government acknowledge that there is a lack of communication about public safety issues.

This chapter (**Chapter 7**) concludes the entire research study. The chapter begins by clearly discussing the research questions and what was done to meet each sub-question. Thereafter the contribution made by this study is discussed, followed by recommendations, limitations and directions for future research. Finally, a summary of this chapter is presented.

7.3 The Contribution Made by this Study

Smart city is an initiative aimed at using information technology to improve the quality of life of citizens (Christen et al., 2014). Although smart city is divided into six constructs –Smart Economy, Smart Living, Smart Environment, Smart Mobility, Smart Governance, and Smart Utility – for this research project the focus was on one of the Smart Living constructs, which is public safety. This was driven by an idea that IBM and the University of Fort Hare had to making cities smarter in the BCMM. BCMM consists of three towns that it looks after, namely: EL, King William's Town and Bhisho. EL was then chosen as a test bed to introduce the concept of a smart city in the local government by mainly focusing on reducing public safety issues in the area.

This section will highlight the contribution of the research project to the existing body of knowledge. Based from the literature reviewed it has been highlighted that lack of effective communication, whether oral or written, often leads to conflicts and creates a number of problems, particularly in the local government sector, including poor team work, employee morale, decreased innovation and lack of efficiency (Joseph, 2015; Writing, 2015). A significant problem that requires attention in EL is that there is currently no effective method available for

the citizens to communicate with the local government about public safety related issues. This means that EL citizens do not have a better channel in place to address their public safety issues to the local government. This is a problem because it is making local government reactive rather than pro-active. This could lead to the developments or decisions made by the local government in public safety not fully communicated back to the citizens.

From this research project a model was developed and discussed in Chapter 6. The model aims to ensure a continuous feedback loop between the EL citizens and local government in a public safety environment, and was verified using literature reviewed, objectives of the study, underlying theory, and primary data. The model provides factors that need to be considered before developing a feedback loop. The highlighted themes from the participants' responses can be used as recommendations during the communication process. This can help local government as a starting point as they do not have an effective method in place. The important aspect about this model is that it will encourage cyclical feedback between citizens and local government about public safety issues EL. This is worth doing because if there is no feedback loop, the research project will fail and there could be unresolved public safety issues. The next section will discuss the research questions that address the problem statement in this study.

7.4 Research Questions

The primary objective of this research project was to develop a model to ensure a continuous feedback loop between citizens and local government. To meet the primary objective of this study, research questions were developed as noted in Chapter 1 and relevant information aiming to answer these questions were provided. Furthermore, different qualitative methods were used to gather data to ensure in- depth understanding of communication practises in use in public safety through the use of literature review and primary data collected. The proposed model is expected to enhance the communication process between citizens and the Department of Public Safety. The main research question investigated for this study was:

What feedback loop mechanisms can be applied in a smart city to support effective communication of public safety issues between the citizens and the government?

The main research question was broken down into three sub-questions which were discussed from Chapters 2 to 4 and are indicated below:

a) What is the role of a smart city in a developing country?

The aim of this sub-question is to provide a better understanding about the role played by a smart city in a developing country. The secondary data revealed that government sectors are enthused about the smart city concept and are interested in making their cities smart. Chapter 2 reviewed real- world cases to understanding the function of a smart city; these cases are specific to cities in South Africa. Furthermore, the benefits associated with the transformation of a city into a smart city are identified and discussed in this sub-question. These include turning information into insights, driving enterprise operations' efficiently, increasing agility, connecting and empowering people, enabling business service and product innovation, and managing risk, security and compliance.

The findings on the literature reviewed provide evidence that smart cities do not only focus their attention on ICT changes, but also encourage investments in knowledge and skills of individuals or populations to make urban living practices and conditions better by supporting and motivating the citizens (Cagliano et al., 2014). Additionally, challenges that cities face, namely crime, traffic congestion, urbanisation, scarcity of resources, and waste management, can be reduced by the practice of a smart city, even in an environment that faces financial constraints. The second secondary question will now be evaluated.

b) How can a feedback loop reduce public safety issues in a smart city?

This sub-question seeks to provide thorough discussion about public safety, with particular focus on Buffalo City. To understand public safety it was necessary to explain in detail the different goals that public safety should be based upon. Thereafter, feedback loop types that citizens can use to report and also the advantages of a feedback loop to help local government to identify areas that need more attention are discussed.

Findings on the literature reviewed in Chapter 3 of this sub-question revealed that a feedback loop will help to encourage the two- way interaction between citizens and local government by

allowing citizens the opportunity to participate in decision- making with the intention to better the public safety issues (Heirman et al., 2012). A feedback loop system will be the means or the medium to expand public access to information compiled by the local government to citizens and other relevant public bodies about the public safety issues in EL. Asad et al. (2014) add that a feedback loop can be divided into three categories namely suggestions, complaints and satisfaction to try and meet the different needs of citizens and to disseminate information easily to the local government based on the categories. Literature also revealed in the National Development Plan 2030 that several strategies with the same intention, which is to improve quality of life of citizens, include civil society organisations, community policing forum and so forth; however, their results are not satisfying.

From the empirical findings it was also revealed that public safety matters are the main serious issue in Buffalo City. This means that the implementation of a feedback loop could help to identify and reduce public safety issues before they actually cost the local government a lot of money. In the interviews conducted, citizens attested that creation of a feedback loop will not only help with the conveying of reports, but it will also raise citizens' voices and make them feel cared for.

c) What factors should be considered when developing a feedback loop between citizens and the local government?

Chapter 4 addressed the third sub-question of this research project. The chapter began by providing a brief discussion about the underlying model that assisted in formulating the proposed feedback loop model. The theory explains the communication process between two or more individuals. Different communication models were compared, and it was established that the De fleur Communication Model was deemed to be the most appropriate to the communication process. Although a feedback loop can offer vast advantages, namely leveraging information to make better decisions, anticipating and resolving problems proactively, coordinating resources to operate more efficiently, promote citizen engagement, increased transparency and develop leaders, based on the literature reviewed these benefits cannot be fully exploited if factors influencing the development of a feedback loop are not considered. According to Asad et al. (2014), the five interlinked critical factors that a feedback loop should be based upon are:

- Purpose

- People
- Process
- Tools
- Environment

The different research questions presented at the beginning in Chapter 1 of this research project have therefore been addressed and the sections in which the different outputs were provided; this is shown in the table below. The recommendations of the study are presented in the next section.

Table 15: Research questions

Question number	**Research question**	**Chapter (s) addressed in**
Main research question	***What feedback loop mechanisms can be applied in a smart city to support effective and efficient communication of public safety issues between the citizens and the local government?***	2, 3, 4, 6
Sub-question 1	***What is the role of a smart city in a developing country?***	2
Sub-question 2	***How can a feedback loop reduce public safety issues in a smart city?***	3

Sub-question 3	***What factors should be considered when developing a feedback loop between citizens and the local government?***	4

7.5 Recommendations

The use of an ICT feedback loop in a smart city has proven to be a positive contributor in encouraging communication between people, particularly citizens and local government. The benefits that the development of a continuous feedback loop can offer to the citizens of EL are significant. These include updating citizens about public safety matters; increased citizen participation; increased response time of emergency and non-emergency services; increased transparency between the Public Safety Department, to name a few. However, the city of EL currently does not enjoy the benefits provided by an ICT enabled feedback loop in a smart city environment. The study aimed to develop a feedback loop model that will encourage communication of public safety matters in an enabling environment. Furthermore, given the fact that the introduction of a smart city initiative is still new in EL, the following recommendations need to be considered before and during the implementation of a feedback loop and are based from the literature reviewed and empirical evidence:

- Local government need to **accentuate proactive approaches** about public safety issues, which in turn can allow competitive advantage.
- Secondly, there is a need for **increased local government support**. For example, public safety officials to work jointly with other related or relevant stakeholders in reducing public safety issues.
- Additionally, citizens need to be updated about the state of public safety issues in their areas, i.e. the local government needs to encourage effective **awareness of public safety issues** in communities.

- Furthermore, the benefits of having computerised systems rather than paper trails are very important in public safety to ensure swift response of citizens' reports. This means the government needs to equip its citizens with **improved technology literacy skills** that are a prerequisite to participate in and contribute to a digital society.
- It should be acknowledged that for the above points to be plausible, **change management** of public safety matters must be put into effect. This will, for example, allow citizens to have access to public safety information and also understand which tools are appropriate to present reported data to both citizens and local government.
- Finally, **frequent trainings** need to be provided between citizens and local government and also between public safety officials in order to keep advanced about the changing causes of public safety issues. This will help in improving the response time of emergency and non-emergency services.

7.6 Directions for Future Research

Based from the literature reviewed, the smart city concept is becoming apparent in the field of ICT, but the concept is still quite new in EL. This section aims to provide suggestions for future research in this field, and these are listed below:

- The problem of effective communication between citizens and government generally is quite a broad topic, and a great deal of research can be done to come up with effective solutions to this problem. Since the focus of this study was on encouraging communication of public safety between citizens and local government, similar studies in future can investigate and improve communication in other government departments.
- The privacy of public safety information shared between citizens and local government needs to be explored.
- Further studies could also investigate the appropriateness of the feedback loop model within other local government departments.
- The same study can be carried out in other cities or provinces in South Africa to compare the results.

All these were left for further research possibilities in order to manage the research study. The next section provides the overall conclusions of the research study.

7.7 Concluding Note

This chapter focused on the overall conclusions of the study. Various literatures have been reviewed in the beginning and during the research study. The aim of this study was to develop a feedback loop model that would assist in enhancing communication of public safety issues between citizens and local government and also within the Public Safety Department. The data was collected from eleven citizens and four public safety managers. The primary data was then analysed following thematic analysis and the empirical findings were used to inform the proposed model.

Since the empirical findings revealed that communication of public safety issues between citizens and local government is very poor in Buffalo City, the development of a continuous feedback loop model would play a significant role in facilitating communication of public safety issues. This can be successfully done by incorporating the five interlinked critical factors namely purpose, people, process, tools, and environment Asad et al. (2014), social media technologies and some of the traditional methods that were used before in to the smart city concept. Though the model was developed focusing only on the Public Safety Department in Buffalo City, it can be used for other departments and cities generally.

Furthermore, the thesis has described the communication process between citizens and local government and also within public safety functional areas in Buffalo City. Above all, the study gave a summary of the state of public safety and how challenges related to public safety can be reduced. Finally, empirical evidence revealed that to facilitate communication of public safety issues, it should begin with creating awareness by local government and the relevant stakeholders.

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ACRONYMS

BCMM : Buffalo City Metropolitan Municipality

EL : East London

SC : Smart City

PSSC : Public Safety Smart City

ICT : Information and Communication Technology

IBM : International Business Machines

CBD : Central Business District

CCSDS : Consultative Committee for Space Data Systems

NDP : National Development Plan

APPENDICES

Appendix A
Interview Questions for Citizens

General questions

1. What is your gender?
2. How old are you?
3. What is your highest level of education?
4. How long have you been staying in East London?

Continuous feedback loop

6. What public safety problems encountered in your area?

7. In the past years has there been an increase or a decrease in these problems?

8. What have you done to deal with the public safety problems encountered in your area?

9. In your opinion, how should something suspicious be reported?

Appropriate tools that can be used to present reported data

10. In your view, how do citizens know about public safety matters?

11. In your knowledge, how do citizens report an emergency or public safety matter(s)?

12. How will you want the public safety information to be presented?

13. In which platforms will you want public safety information to be available?

14. How often do you think that citizens need to get updated information about public safety matters?

15. Do you think that the improvement of communication about public safety matters between citizens and local government will help reduce the problems of public safety? Why?

16. In your view, how do citizens receive feedback about reported public safety matters?

17. How often do use Internet cafés? Why?

18. Would you use the internet to report the public safety issues in your area?

Reasons that can cause ineffective feedback loop

19. How can you describe the communication between the citizens and the public safety officials?

20. From your perspective, do the city managers value communicating with citizens about public safety matters?

21. What could be the reasons to that?

22. What do you think makes the public safety officials take long to respond to emergencies?

Closing Questions

23. What additional information do you think I should know about you?

24. Is there anything you would like to add on public safety issues or public services?

25. Do you have any questions before we end?

Appendix B

Interview Questions for Public Safety Officials

General Questions

About public safety office

1. Could you please outline your role at your functional area?

2. What are the objective(s) of the public safety department?

3. What do you think is the most important factor in managing the city effectively and efficiently? Explain how you have done this in the past

4. What is your approach to solving public safety issues? Give an example of where your approach has been effective.

5. In your experience, which public safety issue(s) bother citizens the most?

6. Describe top skills which a public safety official must have?

7. Based on the skills, who develops your training?

8. How often do you evaluate your training?

Appropriate tools that can be used to present reported data

9. In your opinion, how satisfied are people with the public safety services available?

10. What collection mechanisms do you currently use to collect feedback within the functional areas?

11. What collection mechanisms do you currently use to collect feedback from the citizens?

12. How frequently do you collect feedback? Functional areas / Citizens

13. What type of feedback do you currently collect from the functional areas / citizens?

14. In which format would you like the reported information to be received e.g. in graphs etc.

15. What do you feel is working well about your current feedback collection practice?

16. What do you feel could be improved in your current feedback collection practice?

17. What further considerations or mechanisms do you feel should be thought of in designing and implementing feedback loop to support your objectives?

18. Do you think that the development of a feedback loop will help improve communication between citizens and public safety officials? Why?

Reasons that can cause ineffective feedback loop

19. How does the local government update its emergency response plan?

20. How can you describe the communication process within the functional areas of public safety?

21. Can you explain any public safety challenge(s) that affect the operations of the department?

22. How are these challenges addressed?

23. How can you describe the communication process between you and the citizens?

24. From your perspective, do the citizens' value the communication processes?

25. What sort of support is available for the citizens in communicating about public safety matters?

Closing Questions

26. What additional information do you think I should know about you?

27. Is there anything you would like to add on public safety issues or public services?

28. Do you have any questions before we end?