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Abstract

An increasing number of people move to cities in search of better opportunities for themselves and their families. This movement makes it difficult for the local government to understand citizens' needs fully, particularly pertaining to public safety matters. Thus, in the city of East London where this issue is prevalent, a smart city project was introduced to help alleviate these concerns. During the first phase of the Public Safety Smart City (PSSC) project, it was identified that there is a need for a feedback loop to facilitate the effective communication of public safety issues between citizens and local government. Part of the problem is that local government is reacting to these public safety issues rather than being proactive. The study followed an interpretivism paradigm and the research methodology employed is the qualitative approach in order to gain a deeper understanding of the issues involved. Semi-structured interviews were conducted with eleven East London citizens and four managers from the Department of Public Safety from the Buffalo City Municipality in order to gain further insights. It was ascertained that the lack of feedback concerning public safety issues between citizens and local government leads to citizens' dissatisfaction. Based on the De Fleur model of communication, the paper concludes that the introduction of an Information and Communication Technology (ICT) enabled feedback loop between citizens and local government can help to reduce these concerns.

Keywords

Smart City, Buffalo City Metropolitan Municipality, Public Safety, Feedback Loop.

1. Introduction and problem statement

Smart city is an initiative aimed at using technologies to improve citizens' quality of life (Christen, Georgkopoulos, Perera & Zaslavsky 2014). It is divided into six core functions and one of them is Smart Living which is divided into healthcare, infrastructure and public safety (Axhausen *et al*. 2012). For purposes of this paper, public safety refers to a way of engaging citizens with public safety matters through the use of a feedback loop. A feedback loop is a systematic method that aims to use emerging ICTs to enhance communication of public safety issues (Jacobs 2010). This will be applied in East London's Buffalo City Municipality. The use

of an ICT enabled feedback loop is about how best to use limited resources available in order to improve the communication process between citizens and local government.

The influx of people to the cities contributes to poor living conditions, lack of employment opportunities and even poverty. An overpopulated city is more likely to experience a number of public safety issues, and if not well managed, it is common for communities to feel less empowered concerning how these matters are addressed (Brodie 2013). 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" (BCMM 2013:72). This implies that it is in the best interest of Buffalo City to serve its people with good quality and reliable public safety services. In light of the challenges mentioned above, this paper seeks to answer the following research questions:

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

The primary objective of the paper is to propose a feedback loop model that will assist in more effective reporting of public safety issues. The remainder of the paper is organised as follows: Section two discusses the background of the BCMM, and the following provides the importance of the understanding of a feedback loop. Thereafter, collection and presentation of data is discussed, the proposed model is explained in detail, and lastly conclusions are presented.

2. Background of the BCMM

BCMM is situated in the Eastern Cape Province and characterised by three main areas: East London (which is the focus of this study), King William's Town and Bhisho. East London (EL) is the second largest city in the Eastern Cape with a population of over 740 000 inhabitants (Tankard 2014). The main languages spoken are Xhosa, English and Afrikaans (Property24 2013). International Business Machine (IBM) and the University of Fort Hare (UFH) are in the process of piloting a smart living project in East London with specific focus on public safety.

The following are the public safety challenges faced in East London in 2014: worst preforming area in the Eastern Cape Province with a high rate of crime including robbery, public violence, carjacking, driving under the influence of alcohol and drugs, murder and drug-related crimes, to name a few (Crime Stats SA 2014).

3. Conceptual background

There are various communication theories that exist in literature such as 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 (Raza 2012; McQuail & Windahl 1993). After careful consideration, these theories were deemed to be less relevant to this study. This was mainly because they either provide linear feedback during

communication; do not include the semantic noise factor during the communication process, and also do not support a wide range of communication messages. The De Fleur communication model was chosen and proved to be the most appropriate model as it best fits the objective 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). With this model, 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. When this model is used, relevant information is transmitted to the targeted audience (Raza 2012). However, the limitation of this model can be that it is more effective for group communications, not for one-on-one communication.

4. Understanding a feedback loop

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, Borisov, Danezis, Dutton, Gurses, Klonowski *et al*. 2009). Public safety means ensuring that people feel safe at home, at school and at work, and enjoys community life free of fear. An effective feedback loop in a city provides users with real-time information about what is happening around the city, encouraging them toward better behaviour (Peha 2013). A feedback loop about public safety issues can be in the form of suggestions, complaints and satisfaction (Asad, Bailur, Custer, Dodds, Gagieva & Gigler 2014). Mishra (2013) adds that there are particularly three benefits of a feedback loop which include leveraging information to make better decisions, anticipating and resolving problems proactively, and coordinating resources to operate more efficiently.

4.1 Factors to be considered when developing a feedback loop

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

- *Purpose* - In understanding the purpose, the feedback loop should be visible between the citizens and local government.
- *People* - There is a need for identifying the roles and responsibilities of all participants within the feedback loop to ensure a continuous process.
- *Process* - This component 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.
- *Tools* - The emphasis in this component is about leveraging existing technologies in order to expand reach while ensuring inclusive participation.
- *Environment* - Creating an enabling environment by engaging citizens to participate while using multiple modalities.

5. Data collection and presentation
This section focuses on the discussion of empirical findings which are presented below.

5.1 Interviews with citizens and managers
One-on-one semi-structured interviews were conducted with four city managers and eleven citizens that live in East London. The interview questions were divided into four sections:

- Section 1 was concerned with the demographics 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 focused on understanding causes that lead to an ineffective feedback loop and how to mitigate these.

5.1.1 Background of the participants
To fulfil the objectives of this study, eleven East London citizens and four public safety officials were interviewed. Among the demographics considered by the researcher was age, gender, level of education, occupation and number of years the participants lived in East London. This was done because the study seeks to obtain in-depth information from citizens of diverse backgrounds on how better to report public safety issues in order to facilitate reaching informed conclusions.

5.1.2 The current state of public safety and ensuring a continuous feedback loop
Both citizens and public safety officials agreed that generally there is a greater concern regarding public safety matters. The most common public safety issues that were mentioned by the interviewees are: carelessness in driving; criminal activities; illegal connections of electricity; poor maintenance of road infrastructure; health hazards, and loitering. These findings correspond broadly with the statistics revealed in 2014 about the state of public safety in Buffalo City (Crime Stats SA 2014). Citizens also highlighted that on ensuring continuous reporting of issues, there are methods they have come up with in order to reduce public safety issues in their residential areas. These include patrols at night; meetings within their wards; reporting to the police; calling the PSSC research project telephone number, and sometimes dealing with the person(s) who caused public safety issues directly themselves. Furthermore, citizens suggested ways of reporting suspicious behaviour or public safety matters and these included call-back or hotlines and awareness campaigns.

5.1.3 Appropriate tools that can be used to present reported data to the citizens
Out of eleven participants, ten pointed out that posters would be most appropriate to present reported data to the citizens. They also had varying opinions on what should be on the posters, namely: pictures, statistical 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 should be made available in platforms such as: local meetings, schools, sport grounds, clinics, post offices, work places and local shops. One participant highlighted that the local radio station would be the right platform to make

public safety information available to citizens, and the remaining participant suggested emails and social media platforms.

When the city managers were asked about the type of tools to be used when reporting data, one participant suggested that the information be presented both in a graph and in words for effortless interpretation. One participant preferred words only, and the other one graphs only. The remaining participant pointed out that because of its significance, it is crucial that the data be presented in a spatial context, such as maps and Global Positioning System.

5.1.4 Cause(s) of ineffective feedback loop
This section centres on understanding reasons for an ineffective feedback loop between citizens and local government. The citizens' reasons include: limited access to public safety information, inappropriate presentation of reported data, and low citizen technology literacy. Additionally, citizens highlighted that all the above mentioned reasons lead to them not knowing what is happening in their areas until it happens to either their neighbours or themselves. Finally, all the citizens who participated felt that being updated about the public safety issues in their areas would be a good idea. The latter statement was in accordance with Dirks and Keeling's (2009) study which pointed out that 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 make city managers more proactive than reactive in decision-making**.**

According to public safety officials, the communication methods used to collect feedback within the functional areas include meetings, the occurrence book or register, 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 in the form of suggestions, complaints and incident reports. Some of the methods used to collect feedback from the citizens include suggestion boxes and incident reports (completing a standard template). With all the methods used, the public safety officials acquire the reports after the incidents have occurred. When the city managers were asked about the current communication process within the Department, they expressed dissatisfaction with their current method.

6. The proposed model
In light of the above mentioned challenges and difficulties, the objective of the paper was to develop a feedback loop model that would ensure continuous communication between citizens and the local government. This model is depicted in Figure 1 and explained in more detail.
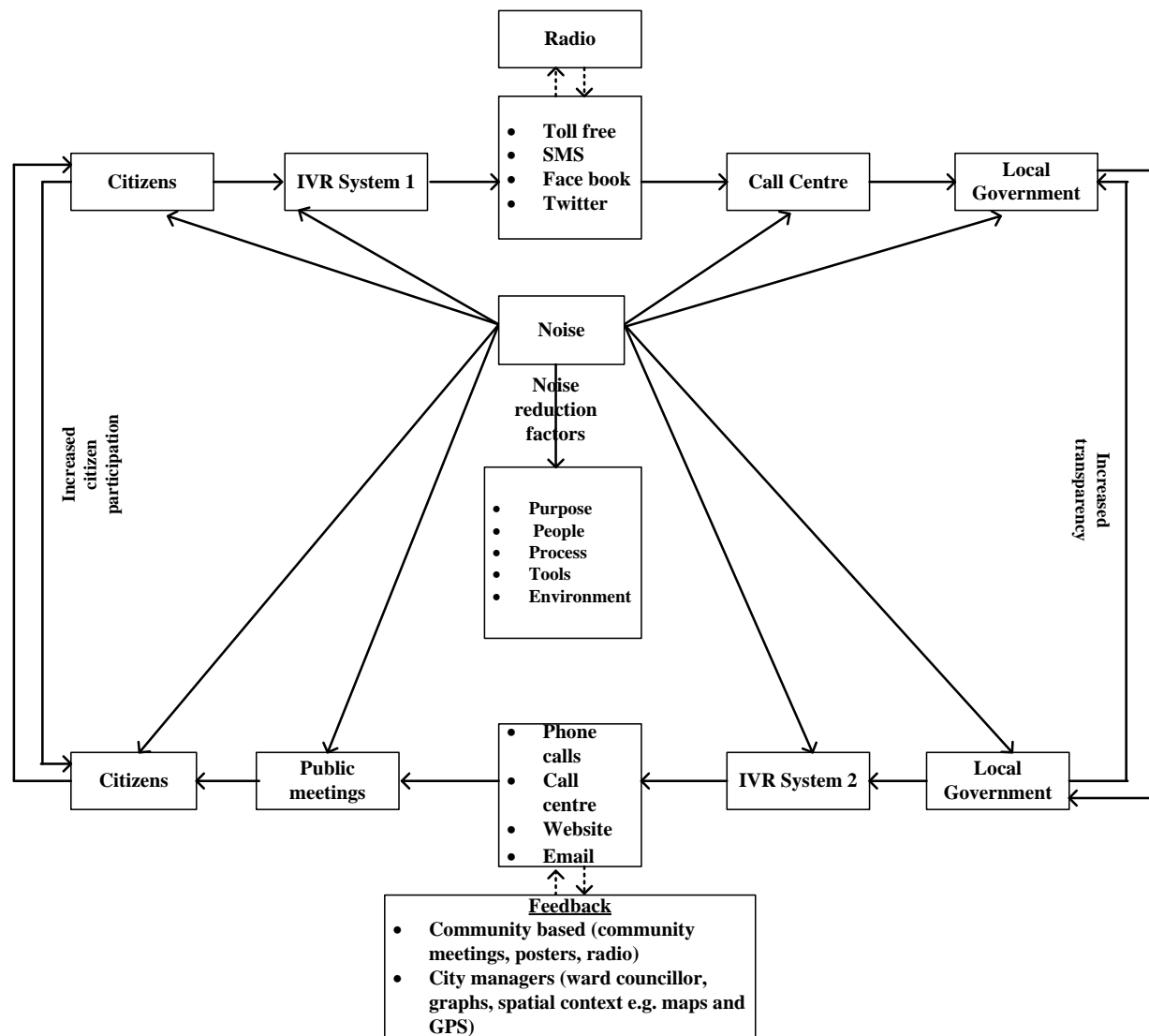
Radio

- **Toll free**
- **SMS**
- **Face book**
- **Twitter**

Citizens

IVR System 1

Call Centre

Local Government

Noise

Noise reduction factors

- **Purpose**
- **People**
- **Process**
- **Tools**
- **Environment**

Increased citizen participation

Increased transparency

Citizens

Public meetings

- **Phone calls**
- **Call centre**
- **Website**
- **Email**

IVR System 2

Local Government

Feedback
- **Community based (community meetings, posters, radio)**
- **City managers (ward councillor, graphs, spatial context e.g. maps and GPS)**

Figure 1: Proposed feedback loop model
Source: (adapted from Folorunso 2013)

6.1 Explanation of the proposed feedback loop model

As stated earlier, the aim of De Fleur's communication model is to encourage the 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. This model was chosen amongst others because it promotes continuous communication synergies between citizens and local government until desired results are met. The model is developed using both primary and secondary data collected from the participants. The intention is to:

- encourage communication of public safety matters between citizens and the local government;

- promote citizen participation in smart city initiatives by increasing capacity and response time of emergency and non-emergency services through information transparency;
- encourage open lines of communication and collaboration to both citizens and local government, and
- 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 as discussed below.

6.1.1 Top Level: Citizens initiating message

Research 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 could lead to the implementation of citizen engagement aspects (Bassler, Brasier, Fogle & Taverno 2008).
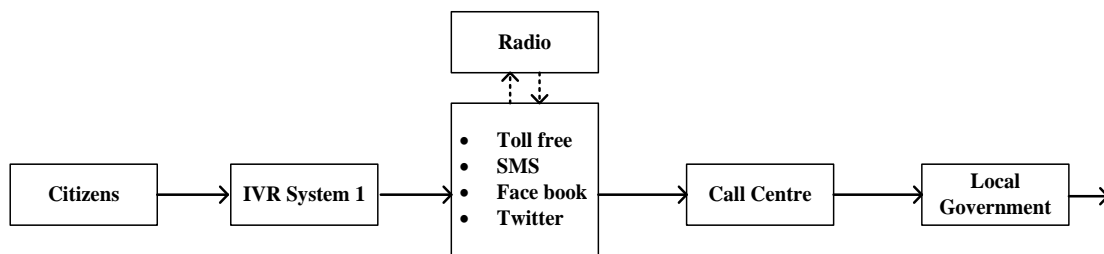

Figure 2: Proposed feedback loop model: Citizens communication with local government

In the model, the citizens are the initiators of the communication process, i.e. this is where the message is originated and is sent via an IVR System 1 using any of the channels (toll free, SMS, Facebook, Twitter). The public safety report is then received in the call centre (receiver's end) and finally reaches the local government (destination).

6.1.2 Noise: During communication process

The next section acknowledges that during the communication process noise can occur at any stage, which can lead to a 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 key factors that can 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, Silver & Kazepov 2010), and also within the local government's side the two-way feedback could lead to *increased transparency* within the functional areas (Bonsón, Flores, Royo & Torres 2012).
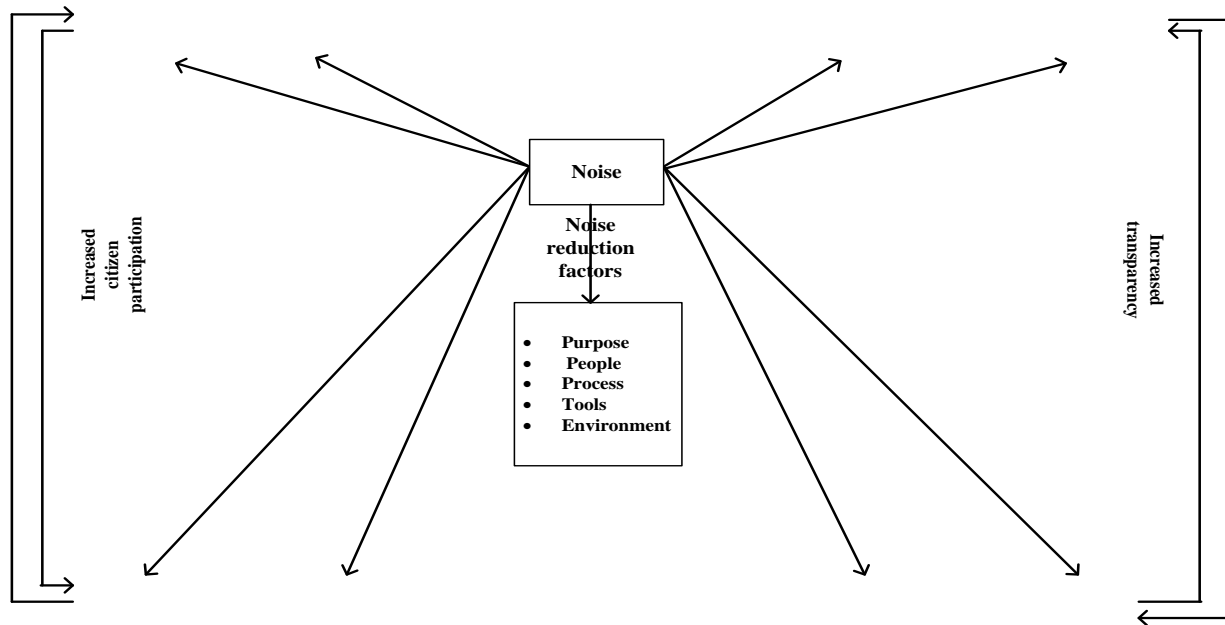
Figure 3: Proposed feedback loop model: The communication process

6.1.3 Bottom Level: Local government providing feedback to the citizens
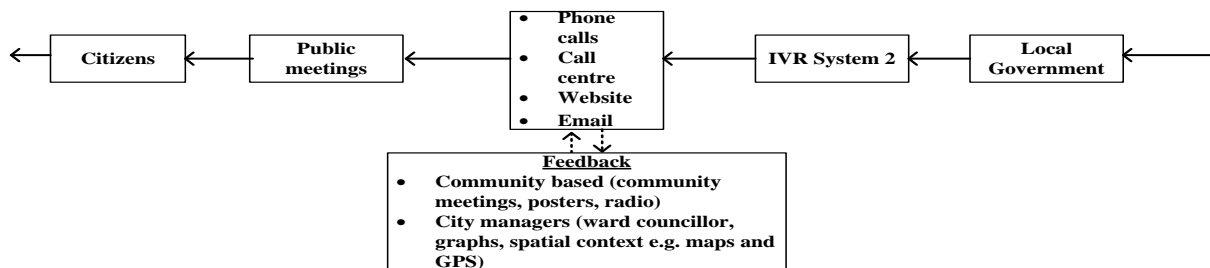

Figure 4: Proposed feedback loop model: local government response to citizens

In addition, the relevant local government official should respond to the public safety reports through the IVR System 2 by means of any of the channels (phone call, website or email). Feedback is then provided to the citizens and within the 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.

According to the information from the interviews, both citizens and the public safety officials prefer that their feedback be provided every time there is something new about public safety matters.

7. Limitation of the study

The major limitation is that the study was focused only in one of the cities that encompasses the BCMM and also in one department under local government. Additionally, more participants could have been involved in the study.

8. Conclusions

The researchers found that the smart city concept is one of the emerging topics in developing countries and it can provide better solutions, thus improving the quality of life of citizens when implemented effectively in line with the city needs. With the existing challenge of limited resources, city managers can find ways to help reduce public safety concerns and improve their communication with the citizens through the adoption of smart city technologies.

Based on the literature reviewed and empirical evidence developing an ICT feedback loop in a smart city has proven to be a positive contributor in encouraging communication between citizens and local government. Thus the benefits that the development of a continuous feedback loop model can offer to the citizens of East London are significant. Additionally, a feedback loop will provide real-time information which will lead to timely actions. These current findings add to a growing body of knowledge concerning the use of a feedback loop during emergencies, and offer opportunities for informing and motivating citizens to feel supported by the public safety officials.

Furthermore, even with the advanced technologies available to enhance communication, without the citizens' partnership the feedback loop is in jeopardy as all projects need to maintain momentum and with continuous feedback. Additionally, the availability and access to information encourages citizens to be aware of public safety issues as a means of improving their quality of life.

In conclusion, it must be emphasised that when developing a feedback loop model certain recommendations including proactive approaches, awareness, frequent training about public safety issues, and improved technology literacy need to be taken into consideration, whilst outlining priorities and sequence of implementation. Since this study is focusing on encouraging communication of public safety matters, similar studies for future research can investigate the privacy of public safety information shared between citizens and local government.

9. Acknowledgements

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