Faculty of Computing and Informatics

Department of Informatics

IMPLEMENTATION OF AN INTEGRATED TRAFFIC FINE INFORMATION SYSTEM FOR

NAMIBIA

By

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ABSTRACT

The Government of the Republic of Namibia as a multi-layered organisation of systems, desires to be effective, efficient and integrated in service delivery. Although it continues to invest significantly in the acquisition and development of information systems, active results and efficiency are not necessarily produced as expected. A concern in public roads traffic control are the various traffic fine information systems involved, which are heterogeneous and decentralised. This has caused challenges, such as fines collection and clearances of traffic related offenses. Systems integration (SI) can be a response to address the issues of decentralised and disparate systems, and the necessity for flexibility and quickness in providing services, and avoiding new systems introduction.

The research provides a framework which guides implementation of an integrated traffic fine information system. A qualitative research method has been applied as the research design, as it enables researchers to study phenomena in their natural settings and seeks an understanding, which was critical in this research, and this helped to avoid assumptions and expectations. A case study strategy was adopted, which involved five cases. Purposive sampling was accepted as the selection method of the study cases and participants. Questionnaires, documentations and interviews were used to collect data about the case studies, and the data collected was analysed and further supported with a theoretical framework as a lens, namely diffusion of innovation (DOI).

The analysis revealed factors of significant influence to the implementation of integrated systems, such as, some systems running on legacy platforms, interoperability encounters, consultants' dependency in decision making, lack of stakeholders' collaboration, and skills development within stakeholders. Based on an understanding of the said factors and with literature findings on integration technologies, an integrated traffic fine information system framework was designed.

DECLARATION

I, **Michael Fikameni Hamatwi** hereby declare that the work contained in this thesis presented for the degree of the **Master of Informatics** at the **Namibian University of Science and Technology**, entitled:

Implementation of an Integrated Traffic Fine Information System For Namibia

is my original work, and that I have not previously, in its entirety or in part, submitted it to any other university or higher education institution for the award of a degree.

Signature: _____ Date: _____

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DEDICATION

This thesis is dedicated to my parents, who taught me that talent alone is not enough but with hard work always pays off something.

Lastly, the thesis is also dedicated to my wife for her unconditional love and support.

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TABLE OF CONTENTS

LIST OF ACRONYMS

AOG:	Admission of Guilty
APIs:	Application Program Interfaces
DOI:	Diffusion of Innovation
EAI:	Enterprise Applications Integration
Ecommerce:	Electronic Commerce
EFT:	Electronic Fund Transfer
ESB:	Enterprise Service Bus
CRAN:	Communications Regulatory Authority of Namibia
CoW:	City of Windhoek
GM:	General Motorists
GRN:	Government of the Republic of Namibia
GSM:	Global System for Mobile Communication
GUI:	Graphic User Interface
HPP:	Harambee Prosperity Plan
ICT:	Information and Communication Technology
IT:	Information Technology
IVR:	Interactive Voice Response
LAN:	Local Area Network
MICT:	Ministry of Information and Communication Technology
M-Payment:	Mobile Payment
M-PESA:	Mobile Payment System name in Kenya
MNO:	Mobile Network Operator
NAMPOL:	Namibian Police
NAMCIS:	Namibia Case Management Information System
NATIS:	Namibia Transport Information and Regulatory Services
NFC:	Near Field Communication
OPM:	Office of the Prime Minister
OS:	Operating System
PDA:	Personal Digital Assistant
RA:	Road Authority

RF:	Radio Frequency
SIM:	Subscriber Identity Module
SMS:	Short Message Service
SOPs:	Standard Operating Procedures
SOAP:	Simple Object Access Protocol
U-commerce:	Ubiquitous-Commerce
USSD:	Unstructured Supplementary Service Data
SI:	Systems Integration
TCS:	Traffic Control System
WACS:	West Africa Cable System
WCPS:	Windhoek City Police Service
WMC:	Windhoek Magistrate's Court
XML:	Extensible Markup Language

TERMINOLOGY

TD-17:	Transcribed data document reference name
	This is a document consisting of the transcribed data
TD-00:	Transcribed data document reference name for year 2014 interviews
RESxx:	Respondents to interviewed questions, XX being the number in sequential of the interview

CHAPTER 1: INTRODUCTION

1.1. INTRODUCTION

This chapter introduces the entire overview of the study. The chapter is divided into ten sections. The first and second sections cover the introduction and background of the research. The problem statement, research questions, and objectives are presented in sections three, four and five, respectively. In the sixth and seventh sections, the benefits and scope of the research are presented. The delimitations of the research are described in section eight. The sections that follow present the outline of the thesis, and finally, a conclusion is drawn.

Namibia's traffic laws and fines were updated in the year 2010 and they came into effect as of the year 2011 (Kashona, 2012). A fee is generally the initial fine demanded to clear any traffic fine offence but due to different circumstances, another aspect is added to the clearance process, which is to open a court case if the offender does not pay the fine within the given time period or after fourteen (14) days after the expiry date of that period (Hamatwi, 2014). A traffic ticket is an official document issued by a traffic officer (also known as "investigation officer or peace officer") to an offender as notice of the violation and the stipulated penalty, which is normally an amount that is payable, with a due date of payment. An offender is a motorist who violates traffic laws or regulations on a public road and is fined for doing so. An offender becomes a defaulter if he or she fails to pay the penalty within a stipulated time.

With the traditional payment of physical transactions, payments continue to be challenging as the mobility of people from one location to another continues to increase and this mobility is highly unpredictable. As a result, payments for services such as traffic fines are increasingly becoming a challenge in Namibia. This has caused severe challenges, such as the fine collection and management for the traffic sector in Namibia.

The aim of the research was to design a framework that can be used to assist in the implementation of integrating these various systems, and with the purpose of having an effective and adoptable centralised system that can be used for traffic fines management and payment in the Namibian context.

1.2. BACKGROUND

A prior research has been conducted by the researcher and a framework for managing traffic fines using a mobile system was developed, guided by the following findings on the current information systems in place, which then motivated this further research.

1.2.1. Lack of centralisation

The existing fines payment system is decentralised; meaning that offenders can avoid their fines should they relocate to a different region.

1.2.2. Lack of real data

Offenders being arrested while they have already settled their fines due to lack of immediate updating of data across the systems involved; meaning, records remain and reflect the same as an offender until they physically visit the offices of the traffic department for clearance.

1.2.3. Manual process

In every process, physical work is required, especially at the administration of the fines, which sometimes contributes to delays in management.

1.2.4. Bureaucracy

A lot of time is lost, particularly from the issuing up to the clearance process. For example, payments can only be made at designated locations, such as the magistrate's court or post office and both venues are known for having long queues.

The honours work of Hamatwi (2014) thus inspired the extension of the research.

1.3. PROBLEM STATEMENT

There are currently four (4) information systems involved in the traffic fines management and clearance process, and all of them are independent and different from each other.

For that reason, traffic fines processing at the moment is observed to be cumbersome and it causes a backlog in their management due to the findings mentioned in the background section, and revenue is increasingly lost due to late or non-payment of fines. The findings add to and makeup the challenges, which have negative impacts on how traffic fines are recorded, managed and cleared. In addition, more resources are employed in the management, and revenue (income) is increasingly lost in the process (Hamatwi, 2014).

ICT provides opportunities for resource consolidation. A well-documented example on systems integration is the Estonian government of their consolidation solution, known as "X-

road", which enable data exchange between different information systems of different organisations, with over 900 organisations and databases connected. Service delivery is significantly improved with over 500 million transactions yearly and above 60% of citizens' usage. Thus, systems integration is fit for consolidation, with cost cutting benefits and value.

1.4. RESEARCH QUESTIONS

The main question of the research is; how can the traffic fines management systems be integrated to have a centralised system for traffic fines management and payment in the Namibian context? The following are the sub-questions for the research:

- How are the existing information systems challenged to manage and issue clearances?
- What methods are available for systems integration?
- How can integration of information systems address the problem(s)?

1.5. OBJECTIVES

The objective of the research is to design a framework for integrated traffic fines payment and management system, for the implementation of an effective and efficient centralised system that can be used in the Namibian context.

Sub-objectives;

- Analyse existing information systems used for traffic fines.
- Evaluate technologies and methods used for Information System Integration.
- Design a framework for integrated traffic fines.

1.6. BENEFITS

- This will assist the law enforcement agencies and managers of traffic fines, to improve efficiency on the management of traffic fines activities.
- The research will significantly contribute to the body of knowledge on systems integration (SI) and information systems (IS).

1.7. RESEARCH SCOPE

The research is specifically on the management of traffic fines process, and this is in the context of the Namibia environment.

1.8. ETHICAL CONSIDERATIONS

Before data collection, permission was sought from the respective stakeholders, with a formal permission request letter (APPENDIX G) from the faculty (NUST) and permission was granted by all stakeholders. The letter served as proof that the research was academic and would abide to the university's research code of ethics. The data collected was only to be used for the purpose of this research and the sharing of all data was only between the researcher and the supervisor.

Regarding the interview process, the interviewees were briefed about the matters to be covered and the researcher requested for permission to record the interview conversations for the purposes of analyses, and the researcher informed the interviewees that participation in the interview is at their free will and no pressure. In addition, it was explained to them and they were guaranteed that their identifications would under no circumstances be revealed to any third party during and after the research without their consent. Permission to conduct and record conversations of the interviews was granted from all stakeholders.

1.9. LIMITATIONS

Data collection was conducted in the City of Windhoek (CoW), as well as Rehoboth and Okahandja towns only. The reason was that there are about 30 stations throughout the country that deal with traffic fines processing and management, and it was not feasible to conduct the research on all of them, mainly in terms of time limitations and budgetary limitations to cover all the stations. A sampling method was adopted, with cases purposively chosen and with considerations that they were close to the CoW.

One challenge was to get permission to explore the involved systems, specifically for a look and feel kind of exploration and to perform basic tasks for the purpose of experimentation and design. Permission was not granted from any of the stakeholders due to apparent security reasons and the unavailability of senior managers at the times of the requests.

1.10. THESIS OUTLINE

This thesis is structured into five chapters as follows:

CHAPTER 1: INTRODUCTION

- The entire research is introduced in this chapter. It includes the introduction part, background, problem statement and questions, aims and objectives, benefits, and research scope.

CHAPTER 2: LITERATURE REVIEW

- This chapter presents the review of the literature that was carried out, relating to the research.

CHAPTER 3: METHODOLOGY

- The strategy, methods, approaches, and practices that were applied in the data collection and analysis are covered in this chapter.

CHAPTER 4: DATA ANALYSIS AND FINDINGS

- This chapter presents the data analysis, including the findings and discussion.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

- In this chapter, the entire research, including the results are summarised. The recommendations and areas for future work are also presented in this chapter.

1.11. CONCLUSION

The present chapter introduced the research, by explaining and discussing the contents of the thesis. It helps the readers to have an understanding of the aim and structure of the research. This includes the problem statement, research questions and objectives.

Within the scope and the objectives of the research, a literature review was carried out. The chapter that follows presents the literature.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

The following literature has been considered to assist in understanding the proposed research. The focus concepts for the preliminary literature review include: traffic fines management, payment systems, systems integration (SI) and technologies, and diffusion of innovation theoretical framework.

2.2 OVERVIEW OF TRAFFIC FINES MANAGEMENT

The road traffic and transportation Act, 1999 (Act 22 of 1999) within the Namibian constitution mandates the traffic units (agencies) in their different capacities with a vital role to play in order to reduce road deaths and injuries resulting from over speeding, as well as reckless and negligent driving. The key focus is to facilitate the free flow of traffic within Namibia and for the enforcement of traffic regulations. Namibia adopted a sort of an integrated system for traffic management and control, that focused more on regulations which comprise of alcohol and other substances abuse, the management of traffic speed, issues with traffic overloading, the management of taxis, training of drivers, wearing of seat belts, education on the Namibian road environment and the possible vulnerability of road users (Kashona, 2012). However, the management of payments and issuing of clearances continue to be a challenge up to date. There are quite a number of different traffic offenses and violations that can cause any law enforcement agent to issue a fine to a motorist. These are highlighted in the issued traffic fines booklet, which is in possession of any traffic officer who can issue fines to offenders. This booklet or related information is found on the website of NAMPOL and in hard copies at any of the traffic agencies' offices (Hamatwi, 2014).

Most road traffic management systems specifically in China in this case, do not meet the essentials of the "huge traffic administration" (Liu & Cheng, 2011). The experience of traffic administration in China and other developed nations recommends that road activities and safety administration should be isolated between the forces of national policy making and execution as far as in power capacity and to set up a consistent and unified system.

Moreover, Liu and Cheng (2011) whispered that nations give careful consideration to the development of road traffic wellbeing administration and build up an extensive road transportation security organisation when the conditions are ready.

Europe has called attention towards the importance to identify the offences and provide immediate support to be executed within a brief period (De Fuentes, Gonzalez-Tablas, Hernandez-Ardieta, & Ribagorda, 2012). In such a manner, they have highlighted the advantages of automating this procedure. In spite of the normal advantages of automated procedures, current implementation practices have three fundamental shortcomings. First, a dependable identification of both driver and vehicle has not been acceptably accomplished so far. Second, an instant feedback of the fine is not given when the offence is spotted by automated devices like sensors. Third, the offense displayed normally depends on a solitary information source (e.g. radar, policemen), which does not guarantee that the offense is completely described. In the meantime, the driver does not have a comparative information source to defend himself from the allegation, prompting an out of line circumstance.

2.3. PAYMENT SYSTEMS

For the purpose of this research, the following definition of 'payment system' from wikipedia (free encycropedia) has been embraced: "A payment system is any system used to settle money related transactions through the exchange of monetary worth, and incorporates the organisations, instruments, people, rules, systems, models, and technologies that make such a trade possible (Wikipedia, n.d.).

2.3.1. Payment methods

There are two categories of payment methods; exchanging (traditional) and provisioning. Exchanging is to change coin, money and or banknote in terms of the value. Provisioning is to exchange money from one account to another. In this way, a third party must be involved. Credit card, debit card, cheque, money transfers, and recurring cash or ACH (Automated Clearing House) payments are all electronic payments methods. Electronic payments technologies comprise of smartcards, magnetic strip cards, contactless cards and mobile payments (Wikipedia, n.d.).

Limpittaya, Warasart and Kungpisdan (2012) define payment as "the collaboration between the customer and the seller in that the customer wishes to buy products or services with the seller" (p. 72). Furthermore, it is "the dealings that the seller sends the payment receipt to the customer consequently and can include a direct or indirect exchange of financial values between parties" (Valcourt, Robert, & Beaulieu, 2005).

As indicated by Sumanjeet (2009), electronic payment systems have been in operation since the 1960s and they have been extending quickly and in addition thereby developing in unpredictability.

> After the improvement of traditional payment system, EFT (Electronic Fund Transfer) based payment system came into existence. It was first electronic based payment system, which does not rely upon a central processing intermediate. An electronic fund transfer is a monetary application of EDI (Electronic Data Interchange), which sends credit card numbers or electronic cheques through secured private systems amongst banks and significant enterprises. To utilise EFT to clear payments and settle accounts, an online payment service will need to add capabilities to process orders, accounts and receipts. Be that as it may, a point of interest came in this bearing with the improvement of digital currency. The way of advanced digital currency or electronic money reflects that of paper money as a method of payment. Accordingly, advanced currency payment systems have the same advantages as paper currency payment, namely privacy and accessibility. As in other electronic payment systems (i.e. EFT based and transitional based) here too security during the transaction and capacity is a worry, although from the different perspective, for digital currency systems double expenditure, counterfeiting, and storage become critical issues, whereas spying and the issue of obligation (when charges are made without authorisations) is significant for the notational funds exchange. Moreover, the gathering can be made on the premise of what data is being exchanged on the web. Consequently, electronic payment system can be extensively partitioned into four general categories: Online Credit Card Payment System, Electronic Cheque System, Electronic Cash System and Smart Card based Electronic Payment System (Sumanjeet, 2009, p. 5).

The traditional payment of physically exchanging transactions and payments continues to be challenging as the mobility of people from one location to another continues to increase in an unpredictable manner. As a result, payments for services such as traffic fines is increasingly challenging in Namibia. Whereas the use of smart phones and mobile devices is rapidly increasing in both urban and rural areas of both the developed and developing countries (Rehman & Abid, 2014). The increase in the utilisation of mobile devices including phones has over the years drawn attention and interest of business communities, as well the government. An example is the use of mobile payment solutions in many businesses including government agencies.

2.3.2. Mobile payment technologies and benefits

Different electronic payment methods have been considered for review with a closer look into mobile payment systems as the innovative and alternative way of payment which the world is adopting rapidly (Rehman & Abid, 2014). "A mobile payment system (MPS) can be defined as any payment system that empowers monetary exchanges to be made safely from one group or individual to another over a mobile system (utilising a mobile device)" (Isaac & Zeadally, 2014). "Payments liberated of time and place made with the assistance of a mobile device are called mobile payments (mPayments)" (Terán, Horst, Valencia, & Rodriguez, 2016). That similarly refers to the business exchanges for a few products or services, using a cell phone, PDA (Personal Digital Assistant), mobile PC (Personal Computer) or other mobile devices (Rui-xia, 2015).

Mobile payments utilise one or more trendy technologies, including SMS (Short Message Service), Near Field Communication (NFC), Interactive Voice Response (IVR), Unstructured Supplementary Service Data (USSD), Drop Call, Software Development Kit (SDK) libraries, WAP protocols, i-mode protocols, Wi-Fi, and JAVA applications (Vizzarri & Vatalaro, 2014).

Isaac and Zeadally (2014) further describe the following technologies for m-payments:

(i). Short message service (SMS). "This service permits mobile systems and other networked devices to exchange short text messages with a maximum length of 160 characters. SMS is accessible on a wide range of networks and is common with both people and organisations.

(ii). Unstructured supplementary services delivery (USSD). This session-based, transaction focused on technology is unique to GSM and refers to the capability built into the GSM standard for supporting the communication of information over the GSM network's signaling channels.

(iii). Wireless application protocol/GPRS. GPRS is a versatile data service accessible to GSM customers, that empowers WAP-empowered gadgets such as mobile phones to support services such as internet browsing, multimedia messaging service, and web based communication services such as email and World Wide Web access.

(iv). Phone-based application. The mobile payment client application (located in the customer's mobile phone) can be developed using the Java 2 Platform, Micro Edition for GSM-based mobile phones and the Binary Runtime Environment for Wireless for mobile phones based on code separation multiple access.

(v). SIM-based application. The Subscriber Identity Module (SIM) utilised as part of GSM cellular telephones is a smart card whose data can be secured using cryptographic procedures and solutions. Smart cards are microcomputers sufficiently little to fit in a wallet or even a cellular telephone. They have their own particular processors and memory for capacity. SIM applications are moderately more secure than customer applications that dwell on the cell telephone.

(vi). RFID. This innovation utilises radio frequency (RF) signals to exchange data between a reader and an electronic device attached to an object, for the purpose of ID and tracking.

(vii). Near-field communication (NFC). This short-range wireless communication standard results from the merging of the contactless smart card (RFID) and the mobile handset.

(viii). Voice-based payment transactions. These can be done by making a phone call to a special number and providing a credit card number.

(ix). Dual chip. Dual-chip phones have two slots: one for a SIM card (telephony) and another for a payment chip card. This solution permits a mobile payment application provider to develop an m-payment application in the payment chip card without cooperating with the telecommunications operator (the owner of the SIM card).

(x). Mobile wallet. This m-payment application software on the mobile phone contains particulars of the client (including bank account details and/or credit card information) that allow the client to make payments using the mobile handset" (p. 38- 39).

Nseir, Hirzallah and Aqel (2013) highlight two kinds of mobile payments established on the technology used. (1). One kind uses contactless technology, whereby the customer and receiver are in the same location and communicate directly with each other using contactless radio technologies for data exchange. (2). The other category is through a mobile internet browser or a smart phone application, whereby the mobile handset is utilised as a device to validate individual information, stored remotely and can be made independently of the payer's location (Nseir, Hirzallah, & Aqel, 2013).

With regards to advantages of mobile payments, Vizzarri and Vatalaro (2014) suspect that the main benefits allowed by the acceptance of a mobile payment system be:

(1) *Speed and efficiency:* m-payment systems permit a more prominent convenience, in addition to shortening the acquisition period. (2) *Reduction of frauds:* mobile payment systems (particularly those in light of a microchip module) can get advantages in terms of security through the use of encryption carried on at several levels, such as the combination of double secret codes. Through such achievements, the control of client authorisations can be joined with other control data provided by the Mobile Network Operator (MNO); (3) *Reduction of costs:* regardless of the fact that the move to the new mobile payment connection by and large comprises start-up expenditures, after some time it might reduce repeating costs, for example those related to the physical understanding of the payment cards, as well as service managing and upkeep (think likewise about the reducing of costs identified with scams); (4) *Flexibility of access to data:* acceptance of security methods, consolidated with the preparing abilities of gadgets and systems, allows customers to enable or disable certain services in real-time; consequently, information insurance can be guaranteed, permitting access just to approved entities and just for the time important to pay out a specific service. (p. 3)

Kauffman, Liu, and Ma (2012) indicate that to succeed with mobile payments, all partners need to take part and participate in a cross industry union to build up an arrangement of basic operational, procedural and technological principles. On the other hand, "with the improvement of information technology, transactions are also developing from the current ecommerce to the u-commerce, in this manner making it feasible to perform exchanges with

11

freedom of device, area, telephone carrier and financial institution" (Roehrs, da Costa, & Barbosa, 2012, p. 169).

Additionally, Kshetri and Acharya (2012) anticipated that "by 2015 in sub-Saharan Africa a larger number of individuals will have cellular telephones than access to power" (p. 10). Kshetri and Acharya (2012) have further raised some security concerns, which the audit reports, indicated that some already implemented mobile payment solutions such as "the M-Pesa offered bank-grade security and controls" (p. 11). Therefore, "More severe effects of mobile malware are expected to be felt later on, as cybercriminals discover approaches to monetise mobile malware and increase the income per infection proportion for such malware" (Kshetri & Acharya, 2012, p. 12).

On an alternate side of the world, the office for the regulation and control of telecommunications of Ecuador reported that their mobile penetration surpassed 100%, with a scope of more than 90% all through its region (Terán, Horst, Valencia, & Rodriguez, 2016). In addition, Ecuador monetary consideration markers have assessed that by 2040 no less than 40% of the population would be unbanked or would have no option method for physical money payment. The previous situations of access to technology and the requirement for monetary considerations have produced the right conditions for carrying out the accomplishment of an electronic payment system (Terán, Horst, Valencia, & Rodriguez, 2016).

2.4. SYSTEMS INTEGRATION

Systems integration (SI) can be defined as "setting all segments of a system(s) together and make sure that each distinctive subsystem works with other subsystems and in a manner that the system in its completeness performs best based on the original requirements", and in a manner that the ultimate end result delivers functionalities beyond or far beyond the possibilities of each distinct segment" (Gutierrez-Alcaraz, de Haan, & Ferreira, 2010).

Silva and Loureiro (2011) define systems integration as "an element of the system engineering process that joins the product elements and the process elements into an entirety. It assures that the hardware, software, and human system modules will collaborate to accomplish the system purpose or fulfil the client's need. "(p. 69).

Furthermore, Javidroozi, Shah, Cole and Amini (2015) comparatively state that integration has a particular meaning, which differs from the concepts such as inter-connection or intercommunication. "The components of a system can be communicating with or linked to each other in order to perform the activities. This system is called "intercommunicated" and "inter-connected", and not necessarily "integrated". The departments/subsystems of the proposed system are connected to each other reciprocally, but without integration; they cannot be considered as a whole because there is no seamless flow of information and processes between them" (Javidroozi, Shah, Cole, & Amini, 2015, p. 313).

Gutierrez-Alcaraz, de Haan and Ferreira (2010) urge the need to do an analysis of the integration and doing so with a formal methodology. In both of their projects, they used a methodology based on the design of the system's interrelations, which consisted of the following steps:

> In the first step the main components of the system and their interrelations to each other are identified. Then, a hierarchy is established among all the interrelations that these components have, which will serve as a tie breaker in case of a deadlock in the design. Next the system is integrated on an interrelation plane by clustering functional units together. In this process simple models are used to test the feasibility of clustering multiple components together, more complex modelling can be used later once the main clusters are defined based on system's requirements and integration hierarchy." (Gutierrez-Alcaraz, de Haan, & Ferreira, 2010, p. 101)

Integration is drawn closer from two points of view of business and innovation. From the business viewpoint, system integration is a comprehensive system of business processes, management processes, organisational relations, organisational alignment and information management. From the technical perspective, system integration is the demonstration of diverse and various technologies, applications, data and communications in the form of an integrated technology architecture and functional operational structure (Setareh & Asosheh, 2014).

Kazman, Schmid, Nielsen and Klein (2013) underline four integration levels that are determined so as to describe how intensely the diverse applications are integrated with each other. According to them, "there is no commonly acknowledged set of classifications for integration, however the following is formulated (Kazman, Schmid, Nielsen, & Klein, 2013, p. 21).

(1) Information Exchange (Data Level): This level makes it possible for one system to provide data that is used in a different system as part of its usual way of processing. The practical challenge here is only the data exchange, correspondingly the shared information access.

(2) Basic Behaviour Interaction (Service Level): in this level one system makes use of the abilities of another. This can be a simple service request, or a request with a response, but other complex collaborations are submitted to the next level. Basic behaviour interaction also needs to address data exchange as crucial information needs to be communicated to all involved systems.

(3) Complex Behaviour Interaction (Logic/Business Process Level): this level describes a complex relation among the different systems. In service-oriented architecture, this is frequently described as choreography and orchestration. The main differences to the basic behaviour interaction are that these will normally extend a number of interactions and order may be important. This level may include the first two levels as sub parts.

(4) User Interface Sharing (UI Level): the different systems might require to share (parts of) the user interface. These could be different ways in a network based interface or different areas in a particular user interface that belong to other systems. In this case the diverse systems might not even be familiar with each other, but need to work together nevertheless" (p. 144).

Huanchun (2010) advises that the ideas of "supporting the organisation and management of system integration, ensuring unity and integration of system functions, improving the distribution of information resources and the improving of the security of system network" (p. 37).

Gutierrez-Alcaraz et al. (2010) conclude that "the integration process depend on the experience of individuals involved in the design and their creativity; as many parameters are unknown beforehand, the outcome of such research is not necessarily the overall best solution" (p. 2).

Relatively, Choi, Lee, Yun, Suh, Hong and Lee (2013), state that "In order to mark complex system integration easy and accelerate expandability, compatibility and reusability of each element, standardization of component is prerequisite" (p. 17). Furthermore, Auer, Kobelbauer, Schranz, Berndt and Langhans (2014) add that "protocol conflicts or misconceptions where the protocol requirement is not fully clear can be a concern of course when integrating such a new technologies with different protocols and resolving the challenge on one or the other side may require quite some determination or at least time" (p. 97).

2.4.1. Benefits of integration

Integration is a necessity to connect all business processes performed by different departments and organisations in order to exchange information amongst them. Overall, the integration of enterprise systems itself is the main benefit and core capability for organisations, and that is all about access to real time information by all sections of an enterprise (Javidroozi et al., 2015).

In general, integration is expected at providing better services, decreasing data redundancy, reducing intersecting of functions, exchanging and sharing information and processes (Setareh & Asosheh, 2014).

There are numerous benefits of integration and the following list adopted by Rau and Seel (2015) and summarised provide significant advantages (Rau & Seel, 2015);

1). Unchanging data pool

System clients work in one and only system. Gaining access to several remote systems is not required to get a present overview and/or to complete tasks. And so the threat of "working parallel" where no division knows what the other is busy with is proportionally low. Aside from that, the information is a great deal more transparent and their credibility can all the more effectively be validated.

2). Centralised data storage

Having all accessible info at only one site saves money on computer storage room (and expenses). Moreover the different upkeep of information, when these are recently made, changed or erased is avoided. This lessens the inclination to mistakes and prompts a higher information consistency.

3). Data in real time

Interfaces continuously lead to a time delay. Thus a state can have altered during the transfer from one system to the other without the client taking note. Working in a constant solution with continuous date lessens this threat.

4). Integrated view to the entire process

Whenever each process member can see which part of the procedure is at present being taken a shot at or which exercises are right now being directed, inter-dependencies are likewise significantly more transparent so that the conceivable results of measures can be better evaluated.

5). Easier analysis

An integrated arrangement permits faster articulations to current numbers and improvements. It is additionally no more important to excessively glue together an analysis through different applications. Critical procedures can along these lines be identified far before and essential counter measures can be taken.

6). Motivated user skills

Users of a uniform software do not need to major on some systems. This eases the introduction and preparation of the system, and allow a more top to bottom know-how of the application utilised.

7). Efficient system management

System administrators just need to oversee one system. This essentially facilitates the support, upkeep and troubleshooting, and decreases the time required.

8). Release ability

On account of a product redesign in a diverse IT division, it should dependably be checked whether it can prompt clashes with different systems being used. Feasible interfaces must be arranged and executed. Likewise overhauls actually happen regularly. This too over and again ties up assets which are then not accessible for the typical operations.

9). Unambiguous contact person

On account of system errors and when inquiries emerge from users, the specific contact is clearly defined. This advances a speedy troubleshooting and issue solution to related aspect.

10). Cost savings

Conditional upon the product being utilised, it may be likely to accomplish a reduction of support and licencing expenses in addition to lessening the work necessary for the upkeep

and management, since these only happen for one system. For the same reason one can expect lesser amendment and improvement expenses for an integrated solution.

2.4.2. Possible reasons for integration

Organisations have established considerably different motivations for systems integration. Some have learned that they should share requests and shipment data in real time amongst legacy systems and existing applications situated in distribution centres or assembling offices. Others have similarly convincing but different scenarios.

According to Javidroozi et al. (2015), "systems integration is a common term in private enterprises. It has been a crucial goal for enterprises since the 1940s, in order to improve their performance by sharing data, accessing real-time information, making decisions on time, and performing their business processes efficiently and effectively" (p. 313).

A fruitfully integrated enterprise can reward an organisation with a significant budget, resources, and time savings. Enterprise Applications Integration (EAI) associates current and new systems to support cooperative processes within the entire organisation (Paramkusham, 2009).

Kazman et al. (2013) express that "recognising the reason for the integration is vital to decide a sufficient example as examples ordinarily just supporting a particular reason" (p. 143). They have distinguished the accompanying decision of conceivable reasons, and expressed that this list is, obviously not complete:

(A). One-Directional Information Exchange (Inform): One system needs to update one or more systems about what is going on, so that the others have the proper understanding of the operational connections.

(B). Bi-Directional Information Exchange (Sync): Two (or more) systems need to trade data to keep each other in a state of sync. There is no clear leader-follower relationship among the systems.

(C). Control: One system controls the other (the course may change after some time or distinctive angles may be controlled in various directions). Unlike data exchange, where the receiver system decides acceptable behaviour in view of the data, here the sending system decides how the accepting system ought to respond.

(D). Negotiation: Various systems need to negotiate to accomplish their specific reason. This normally includes specific examples like auctions and may incorporate the earlier purposes as exceptional cases (e.g., negotiate to figure out which case may apply controlling energy)" (Kazman et al., 2013, p. 143).

2.4.3. Systems integration technologies

The beginning stages in investigating integration technologies and solutions was not easy, especially to categorise technologies, architectures and solutions, as one got lost in an ocean of acronyms, thoughts, and unclear presentations. Although there are numerous numbers of integration technologies available, a number of integration architectures and technologies have been explored and briefly discussed next and with additional vendor centred mixed integration solutions.

Fenner (2003) highlights that in the last decade, "bundled software solutions (such as SAP, Oracle ERP, PeopleSoft, JDEdwards, Siebel etc.) have become very common and they have worked well in isolation, but they create information islands on a greater scale. Long term scalable solutions are required and these solutions are called Enterprise Application Integration (EAI) techniques. As a result, EAI turn out to be an important tool in systems integration (Fenner, 2003). Fenner (2003) further emphasised that EAI needs to cover every part of an enterprise system, including architecture, hardware, software and processes.

The following are the two fundamental types of integration architectures:

i. Point-to-Point

This is the fundamental, more traditional methodology. It is simple and quick, absolutely suitable for circumstances where we have a couple of systems to integrate. However, as further components are added to an organisation, the number of point-to-point links necessary to make a complete integration architecture starts to grow exponentially. On the off chance that we need to keep away from point-to-point, we have to give a middle of the road layer that can segregate the progressions between applications, successfully decreasing the coupling. To do this, we utilise middleware.

ii. Middleware

By utilising middleware, general interfaces are given, which permit applications to pass messages to each other (intervention between applications). Each of these interfaces characterizes a procedure that the application gives. The middleware itself can perform operations, for example, routing, exchanging, aggregating, isolating, and transforming over on the information that is passed. In any case, there is extra complexity as far as setting up the middleware, and changing over the applications to utilise the middleware application program interfaces (APIs). Since the middleware is responsible for all concurrency between the application's information sets and conditions, all communications among applicants need to pass through it, and that can become a single-point of failure for the system. Also, under heavy capacity, the middleware can become a holdup for communications.

Shi, Gao, Xu and Xu (2014) note the mentioned strategies as for the most part, accomplishing interoperability of data through utilising the interface given by the system, and exchanging data through the transitional documents and database (Shi, Gao, Xu, & Xu, 2014). They further highlight the advantages and troubles of both strategies:

> The point-to-point technique has the benefits of straightforward structure and short improvement cycle, yet the workload would increment strikingly when the framework joining engineering is extended or changed because of the point-to-point firmly coupled programming model. The second architecture (middleware) for the most part uses the semi-organized Extensible Markup Language (XML) as the transitional document to exchange the system data. At the point when an integrated system has changed, it just needs to modify its internal code. The coupling between the coordinated systems is decreased. In any case, the framework logic in diversity couldn't be prepared for in light of the fact that XML can't distinguish the relationship between ideas which the integrated systems contain. (Shi, Gao, Xu, & Xu, 2014, p. 4144)

Yun-feng and Li-yun (2011) likewise concluded that the two fundamental strategies are essential answers for the coordination, however with various semantics (Yun-feng & Li-yun, 2011):

(1) *the federal database integration method.* In order to accomplish interoperability between the different databases, and resolve their conflict complications, all the database must be linked one by one and the guidelines of information sort transformation are likewise accommodated every database to different databases. There are n (n-1) areas of the code must be composed to support request access between any two databases. While adding the new database to the system, it must be composed more build up a considerable measure of change guidelines. Along these lines, this current methodology's adaptability and convenience are poor. (2) *The middleware technology integration methods.* Middleware is between unrelated database systems data layer and applications' application layer. It consolidates the database system downwards and make available for a combined data manner for integrated information applications and interfaces for the data access.

Middleware integration strategies can be separated into two ways. (1) Physically. It must build up a data warehouse, which is utilised to store backups for the different information sources. Although, information are regularly old information and the real-time is not solid. (2) The view mode. It must keep up an information source with all the applicable worldwide perspective. At the point when clients need to inquiry information through the global data view, the constant information can be find from every database and input to the client. Nevertheless, these strategies are confronted with how to tackle the integrated semantic heterogeneity issues. Ontology is an express depiction of the idea of a field and the relationship between them. It can answer the diverse information mode structure and semantic heterogeneity issues, to utilization of metaphysics to illustrate the relationship between semantic levels, consolidated with the structure of the XML Schema description. (p. 375)

Integration technologies set up the essential channels through which systems can be integrated. As indicated by Wang, Wang, Xu, Li and Choi (2011):

CEN TC310 WG1 standard has acknowledged three stages of integration: (1) Physical Integration (interconnection of gadgets, NC machines, and so on by means of PC systems); (2) Application Integration (managing interoperability of programming applications and database systems in heterogeneous computing situations); and (3)

Business Integration (coordination of capacities that oversee, control and screen organisation's processes)" (Wang, Xu, Li, Wang, & Choi, 2011, p. 167).

Setareh and Asosheh (2014) did a scenario based evaluation method which shows that adopting cloud computing technology is an effective way for integrating health information systems. "Cloud computing is based on service oriented architecture (SOA). Service oriented architecture permits the association to join into the cloud in light of the sort and level of their requests" (Setareh and Asosheh, 2014, p. 696).

1). Enterprise Service Bus (ESB) Architecture

In an effort to move away from the challenges experienced in the earlier described architectures, a fresh model emerged – the bus architecture. Even though it still used a fundamental routing element to authorise communications from system to system, the bus architecture is pursued to decrease the load of operations engaged on a particular module by distributing some of the integration responsibilities to other parts of the network.

As bus-based EAI advanced, several other essential functionalities were identified, such as safety business processing, fault handling, and more. Instead of requiring hard-coding these elements into the fundamental integration reason, as would have been necessary by other architectures aforementioned, the bus architecture enabled these tasks to be enclosed in different components. This advanced type of the bus-based EAI architecture ultimately came to be recognised as the Enterprise Service Bus (ESB) (MuleSoft, n.d.).

The idea of the ESB architecture is that you integrate diverse systems by putting a correspondence bus amongst them and then enable every system to communicate with the bus. This model unlinks systems from each other, enabling them to communicate without having a reliance or learning of different systems on the bus. The idea of ESB was conceived out of the need to move far from point-to-point integration, which winds up strikingly breakable and difficult to administer after some time.

2). Hub and Spoke architecture (HSA)

Altogether systems integrate from a single place; the hub. Generally, the hub works with application data presentations directly; no established message. Every request to the system or application proceeds to a central hub for further handling. The state is sustained in a joint database. To scale out the design, the hub is bundled. Hub and Spoke architecture is a countless way to get underway with integration, such as the proof of concepts and lesser integration plans or to function as an integration level for an application.

3). Grid Architecture (GA)

This is a great way to execute corresponding processing tasks that can scale out. Scale out refers to the capability to supplement service hardware (nodes) to the architecture for handling more information or proceedings. The handling control must develop right or near right as additional nodes are added. Grids are usually used for extremely computational jobs that can be corresponding such as handling huge volumes of data for trends or data collecting devices (e.g. GPS coordinates) for real-time analysis. This architecture is not as much about integration but more about handling control; however, usually the data comes from numerous data sources and is channelled into the processing grid.

4). API Layer (or Service Layer) Architecture (APILA)

This is used to disconnect users from back-end systems, which is good for reforming legacy applications, stimulating prevailing SOAP APIs, movement of backend systems and merging data sources. The API layer is furthermore used to distribute data such as reference data and lookup data from databases, flat files, and even excel spreadsheets. This architecture provides a set of APIs to access information and/or functionality, and it is normally executed using REST or SOAP services over HTTP.

5). SOAP (Estonia X-road)

SOAP is a message communication protocol that facilitates system requests to be sent in an XML format from one computer to another in a dispersed and networked environment, and permits communication in heterogeneous envoronment (Mwai, 2016). It is a simple, easy to

deploy, extensible and open format. A SOAP message moves between SOAP nodes on a SOAP message route, from an original sender through one or more middle nodes to the final receiver. The message body is processed by the final receiver. X-road is a data exchange platform between independent databases and information systems launched in 2001 by the Estonian governement. Platform freedom is accomplished by using SOAP. X-road is a specialised and authoritative environment that empowers secure web based information exchange between the state's systems. It permits organisations/individuals to safely exchange information too so as to guarantee that the individuals' access to the information is kept up and handled in state databases. Both private and public enterprises can link their information systems with the X-road (e-Estonia Digital Society, n.d.).

One of the key fundamentals of the x-road environment is that its databases are distributed, which means that there is no particular holder or controller; every agency or business can choose the invention that is correct for them and services can be added one at a time as they are prepared.

X-road is the overall-significant link between the different databases, which means that it lets them work together for a determined effect. Altogether the Estonian e-solutions that use various databases use X-road. All outbound information from the X-road is digitally signed and encoded; whilst all inbound information is validated and registered.

Within the X-road environment, the encrypted information is directly transmitted through secured computing from one information system to another. Records do not pass through the X-road hub and they cannot be seen there. The hub only has statistical data about information transfer.

The safety of X-road is assured by its architecture which is organized with monitoring, legislative and practical methods – information relations among service providers and customers happen straight between secure computers and using encryption.

6). SAP XI

SAP XI is part of a German international software corporation (SAP) that creates enterprise software to manage business processes and client relations. SAP Exchange Infrastructure (SAP XI) is SAP's EAI software utilised to enable the exchange of information between the organisation's internal systems and external stakeholders. SAP XI is compatible with software products of other enterprises but it is also considered well suited for linking SAP systems with each other. It provides an integrated workflow instrument that permits defining connectors to non-XML protocols and mappings to convert data content from source to target format (Paramkusham, 2009, p. 2).

7). TIBCO

Tibco (The Information Bus Company) is an American firm that offers integration, analytics and events handling software for organisations to use on-premises or as a component of cloud computing environments (Wikipedia , n.d.). The product manages information, decisions, operations and applications for customers. According to Paramkusham (2009), "Tibco's patented approach is called Information Bus (TIB) and it has been utilised in financial services, communications, e-commerce, transportation, industrial, and energy" (p. 2).

Active Enterprise (AE) is Tibco's integration server platform that supports both dispatch-bus and hub-and-spoke integration server models. The dispatch-bus model links the different applications to a joint backbone using application adapters. The hub-and-spoke model connects all applications to a central server. Tibco's up-to-date addition to AE is business works, which uses web services technology" (Wikipedia , n.d.)

Paramkusham (2009) further highlights the following benefits/weaknesses of TIBCO:

> the simple and dynamic user interface is much more developed than SAP XI. Tibco is capable to publish/subscribe very well. Obtainable messaging kinds include request/reply, publish/subscribe and publish/reply collaborations. Improves overall system performance by reducing repetitive collection requests to bundled application systems. Drops cost-of-ownership through general n-way rather than point-to-point integration. Streamlines management with data transparency provided by subject-

based naming. Boosts networked applications based on component or object development models. (p. 2 - 3)

8). BizTalk

BizTalk is a middleware system created by Microsoft that enables enterprises to automate business processes, through the practice of connectors which are custom-made to interconnect with different software systems used in an enterprise (Microsoft, n.d.). The design provides the access of comprehensive capabilities and tools to connect mission-critical, on-premises applications and with the possibility to extend to the cloud platform through hybrid connectivity between existing systems and cloud applications.

According to Thatte (2005), BizTalk server supports both synchronous (occurring at the same time) and asynchronous (occurring at different intervals) web services. Its adaptation provides dependability and recoverability for long operating processes and also supports concurrent synchronous information recovery, transformation and collection. BizTalk is designed at demanding situations needing high throughput with great consistency. It comprises abilities for multi-message management, disaster recovery, load balancing, and high availability. It offers a crucial point for configurations, managing, tracing and monitoring of integration resolutions, avoiding the "spaghetti" of point-to-point integration links (Thatte, 2005).

9). WebMethods

WebMethods was one of the earliest vendors to recognise the significance of XML communications, getting its initial generation of XML-built B2B integration software to market in 1999. Ever since that time, the vendor has extended its scope to include EAI, electronic data interchange (EDI), and, later, business process management (BPM), giving it the most inclusive and easy-to-use integration collection on the market. WebMethods was acquired by Software AG Company in 2007. It's known to quick connect all applications and systems, regardless of location by using the webMethods Integration Platform, featuring Enterprise Service Bus (ESB). (WebMethods , n.d.)

WebMethods provides robust monitoring features, as well as broad support for legacy applications.

10). IBM MQ/WebSphere

IBM MQ is a messaging middleware that streamlines and speeds up the integration of different applications and organisation's information across various platforms. It make use of message queues to enable the exchange of info between different applications, systems, services and files and make things easier in the creation and maintenance of organisation's applications. It provides collective messaging with a wide set of contributions to meet enterprise-wide messaging requirements, as well as connectivity for the Internet of Things (IoT) and mobile devices. (IBM, n.d.)

According to Paramkusham (2009), WebSphere MQ allows the integration of back-end and external systems. It enables organisations to reliably and consistently integrate applications, letting them to fully control the existing software and hardware resources. WebSphere MQ reduces the need to write difficult codes and suggests a choice of simple APIs (Message Queue Interface (MQI) and JMS) that are reliable across the series of more than 80 supported operating settings, provided both by IBM and partners. WebSphere MQ supports Secure Sockets Layer (SSL) for validation, message integrity inspection, and encryption for data sent across the Internet.

11). eGate Integrator

eGate Integrator is a distributed integration platform that serves as the basis of the Sun Java Composite Application Platform Suite. It provides the core integration function, incorporating comprehensive systems connectivity, guaranteed messaging, and robust transformation capabilities. eGate Integrator also provides a unified, single sign-on environment for integration development, deployment, monitoring and management. (Sun Microsystems, Inc., 2006)

The heart of eGate Integrator is the repository, which is a complete store of information shared to the entire Sun Java Composite. The different components of an eGate Integrator system can be present in the same hardware platform (supposing sufficient system

resources), or be distributed across several different hardware platforms in the enterprise network.

12). Oracle Fusion Middleware

This is a software product owned by Oracle Corporation that delivers software for the development, deployment, and management of service-oriented architecture (SOA). It comprises what Oracle calls "hot-pluggable" architecture, designed to facilitate integration with existing applications and systems from other software vendors such as IBM, Microsoft, and SAP AG. It empowers organisations to build and run agile, intelligent business applications while maximizing IT efficiency through full use of modern hardware and software designs. (Wikipedia, n.d.).

2.5. SUCCESS STORIES
Estonian – X-Road

On the e-Estonian solution x-road, it has been recorded that in 2013 over 287 million queries were done over x-road, as per the Figure 1 statistic diagram, adopted from their website (e-Estonia Digital Society, n.d.).
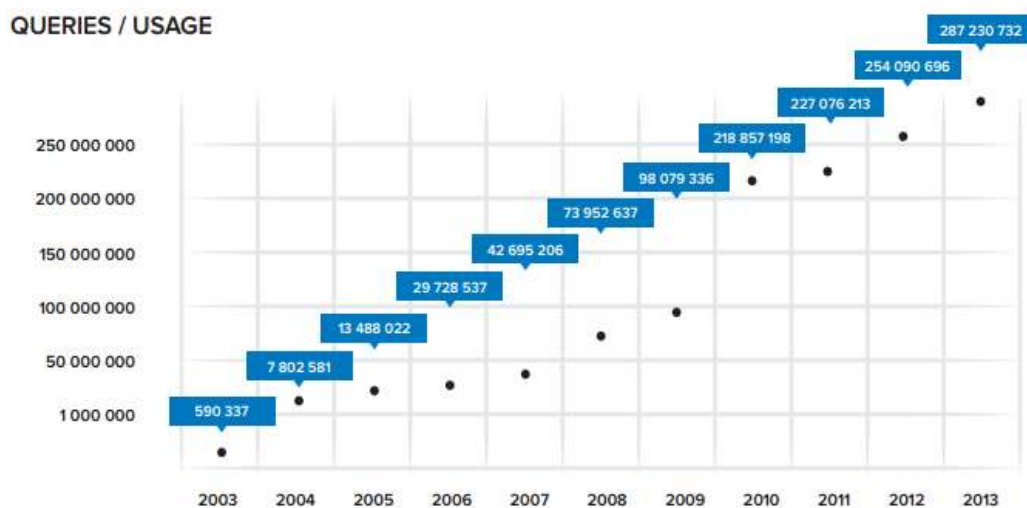

Figure 1. X-Road Success Usage Statistics. Retrieved from X-Road component page. Copyright 2001 by e-Estonia.com.

Additionally,

- Over 170 databases provide their services over X-road in Estonia

- Over 2,000 services are used over X-road in Estonia

- Over 900 organisations use X-road daily in Estonia

- More than 50% of the inhabitants of Estonia use X-Road through the information portal.

According to their current status, x-road supports an extensive variety of generally complex services to be accessed easily, quickly and appropriately. A few of the examples include:

- Residential registration electronically;

- Checking one's personal information (address, exam results, medical information, and so forth) from national databases;

- Taxes assessments electronically;

- Checking the legitimacy of your driving license and vehicles registered on your name;

- A new-born getting medical coverage automatically

In November of 2015, Estonia and Finland launched the first-of-its-kind collaboration via the X-Roads solution.

Kenya - M-PESA

According to Ongoto (2013), Kenya's leading mobile network provider and cellphone company (Safaricom) offered and launched the mobile-money service in 2007 called "M-PESA ("M" stands for mobile and "pesa" means money in Swahili) (Ongoto, 2013). M-PESA allows people to perform regular financial transactions such as deposits, transfers, and withdraw of funds through their mobile phones. Standage (2013) indicates that "M-PESA has been impressively successful in Kenya, reaching about 60% of Kenyan adults. Approximately 25% of Kenya's gross national product (GDP) flows through M-PESA, which is used by over 17 million people - which is more than two-thirds of Kenya's adult population" (Standage, 2013, p. 11).

Mugambi, Njunge and Yang (2014) indicate that M-PESA's original plan of action underlined person to person exchanges, yet it has developed to incorporate individual to business and business to business exchanges.

Person to person: To utilise the facility, an individual registers for an M-PESA account at any M-PESA retail shop (otherwise called an "operator or agent"). The individual gets a subscriber identity module (SIM) card that carries the M-PESA application and this dwells on the

individual's mobile phone. Registering requires a generally accepted type of personal proof, for example, Kenya's national ID card. Registering and depositing are free, however exchanges to other clients and withdrawals are liable to charges (for instance, exchanging US$100 to another M-PESA client brings about a charge of around $0.63). To deposit, clients take their mobile phones and ID to one of the M-PESA retail shops and hand over the deposit money; the shop utilises its mobile phone to electronically transfer the cash to a client's account. Withdrawals switch this approach, with the client electronically sending the withdrawal amount to the retail shop and receiving cash in return. Clients can exchange cash through their mobile phone application by entering their own distinguishing proof number, the beneficiary's mobile number, and the sum and approving the exchange. For each situation, an instant message is sent to all the counterparts required to authorise an exchange.

Individual to Business: Organisations use M-PESA to dispense their employees' wages, and government offices can send costs to and gather dues from individuals. This model of action empowers the appropriate and suitable payment for products, facilities, and salaries. People acquire the same advantages they do in a person-to-person setting, and organisations get more secure and timely expenses. Additionally the same authors indicate that it is more convenient for an organisation to get M-PESA disbursements than to go to a bank. Using your mobile phone to pay for a taxi ride is simpler in Nairobi than in New York. M-PESA and comparably alike systems have advanced from basic cash transfers into a payment stage that gives organisations a chance to send and get payments pretty much as people would. This versatile cash model is utilised for bills, educational costs, and just about whatever else that includes a fee (Mugambi, Njunge, & Yang, 2014).

B2B: Businesses likewise utilise M-PESA to pay for business products and administrations— for instance, to purchase supplies in little amounts. Small and medium enterprises (SMEs) benefit particularly from the time mobile cash administrations and this spares them from the assurance and wellbeing offered by moment, on-request payments. In an investigation of 377 Kenyan SMEs, 95 % of the respondents reported that they were enlisted M-PESA clients and 28 % reported everyday use. Outstandingly, 50 % reported utilising M-PESA to enhance their organisations (Mugambi, Njunge & Yang, 2014, p. 17 – 18).

In their conclusion, Mugambi, Njunge and Yang (2014) alleged that Madagascar, Tanzania and Uganda now have more mobile accounts than bank accounts; in sub-Saharan Africa generally, more people use mobile accounts than facebook accounts.

Tanzania – Mobile Cash Services

According to Seetharam and Johnson (2015):

> Tanzania's mobile cash services now benefit 90 % of users. Of the adults, 44 % have utilised mobile cash services, with at least one relative holding an active mobile cash account in the 35 % of families. In December 2013, clients made 100 million exchanges totalling to US$1.8 billion. The entry of mobile cash affected a critical social effect in the nation where 78 % of the general population has no more bank accounts. Farmers in Tanzania likewise profited most from the mobile cash services. Beforehand they used to make trips to their exporters' workplaces to gather money. A large number of them live more than 150 km from the workplace and they would spend the whole day and $13 on transport costs to reach it. At that point, at the workplace, they lined up for their money. On their way back to the homestead, thieves would at times target them for the substantial measure of money they carry. With the presentation of the mobile payment system, farmers could get credits and payments straight on their mobile phones. Being at home, they would get an SMS notice about the payment. To gather the cash, they could then travel a few kilometres to a mobile cash dealer in their nearby town. A minimal fee is then being charged for the withdrawal of the cash. By utilising this new system, the 300 farmers spared an approximation of $8,000 and 6,000 hours. (Seetharam & Johnson, 2015, p. 30)

Ecuador - Mobile Payment

On the other hand, according to Teran, Horst, Valencia and Rodriguez (2016), Ecuador's ministry of telecommunications and information issued usage statistics on mobile payments which stated that the usage has moved from 63.2% in 2006 to 104.98% in 2015. This means that almost everyone in the country is able to use the automated payment system through USSD.

2.6. THEORETICAL FRAMEWORKS

To support and extend the data analysis, and for the purpose to derive realistic conclusions in applied research, theoretical frameworks can be applied (Rogers, 2003). Theoretical frameworks present and describe theories that explain why the research problem exists and using them opens up the researcher's analysis skills by providing a particular perspective or questions to ask when examining a matter (Gibson, 2016).

Theoretical frameworks serve as guides on which to build and support a study, and they consist of a selected theory (or theories) that binds the thinking of the researcher with regards to how they understand and plan to research a matter, as well as the concepts and definitions from that theory that are relevant to a topic (Grant & Osanloo, 2014).

There are various theories out there and this research paid attention to the diffusion of innovation (DOI) in the literature review. There is no precise or incorrect theory to use when examining a matter, since each matter can be examined from a number of different perspectives (Gibson, 2016). This study purposively explored DOI based on its relevance and its elements that relate widely in innovation and social aspects, including adoption. After the critical analysis of the reviewed literature, DOI theory is adopted for data analysis in this research and presented in Chapters 3 and 4.

2.6.1. Diffusion of innovation (DOI)

In his initial inclusive book on DOI, Everett Rogers defined diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 1995). The theory tries to find an explanation of how, why, and at what degree new ideas and technologies spread. It is also concerned with the way in which a new technological idea, artefact or technique, or a new practice of an old one, migrates from creation to usage (Rogers, 2003).

According to Ee (2015), in order for diffusion to happen, certain conditions must be met. Primarily, there must be an innovation to spread. Furthermore, a communication channel, a social system, and time must also exist for the innovation to diffuse. Mass media and relational communication are two mutual communication channels which adopter first learn about or are exposed to an innovation.

Rogers (2003) indicates that social systems are key elements in the diffusion process. Rogers (2003) defines a social system as "a set of interrelated units engaged in joint problem solving to accomplish a common goal" (p. 23).

Rogers (2003), furthermore highlights that the innovation adoption process ultimately moves from awareness to adoption, and puts emphasis on the role of the critical mass. The critical mass allows the sustainability of an innovation to exist in a social system.

In the process of reaching a critical mass, Rogers (2003) makes a distinction of the following groups: 1) innovators, 2) early adopters, 3) the early majority, 4) the late majority, and 5) laggards (as shown in figure 2). Rogers (2003) recommends that the adoption of a new idea is initiated by human collaboration through interpersonal links, resulting in a distribution that follows a binomial expansion, and follows a bell-shaped curve over time which is based on standard deviations from the mean of the normal curve.

In support of Ee (2015), it is appropriate to consider the innovation-decision process of DOI as a framework to study the process of implementation and adoption. The stage of the decision making process is helpful for comprehensive qualitative exploration as it exposes decision-making as a different process.

An innovation is an idea, practice, or object that is perceived to be new by an individual or other unit of adoption. Communication is a process through which participants create and share information with one another to reach a mutual understanding (Nemutanzhela & Iyamu, 2011).

The adoption period is a decision of "full use of an innovation as the best course of action available" and rejection is a decision "not to adopt an innovation" (Rogers, 1995, p. 3). As stated in the definition; innovation, communication channels, time, and social systems are the four key components of the diffusion of innovations (DOI) and the process is highlighted in figure 2 (adopted from Rogers, 1995).
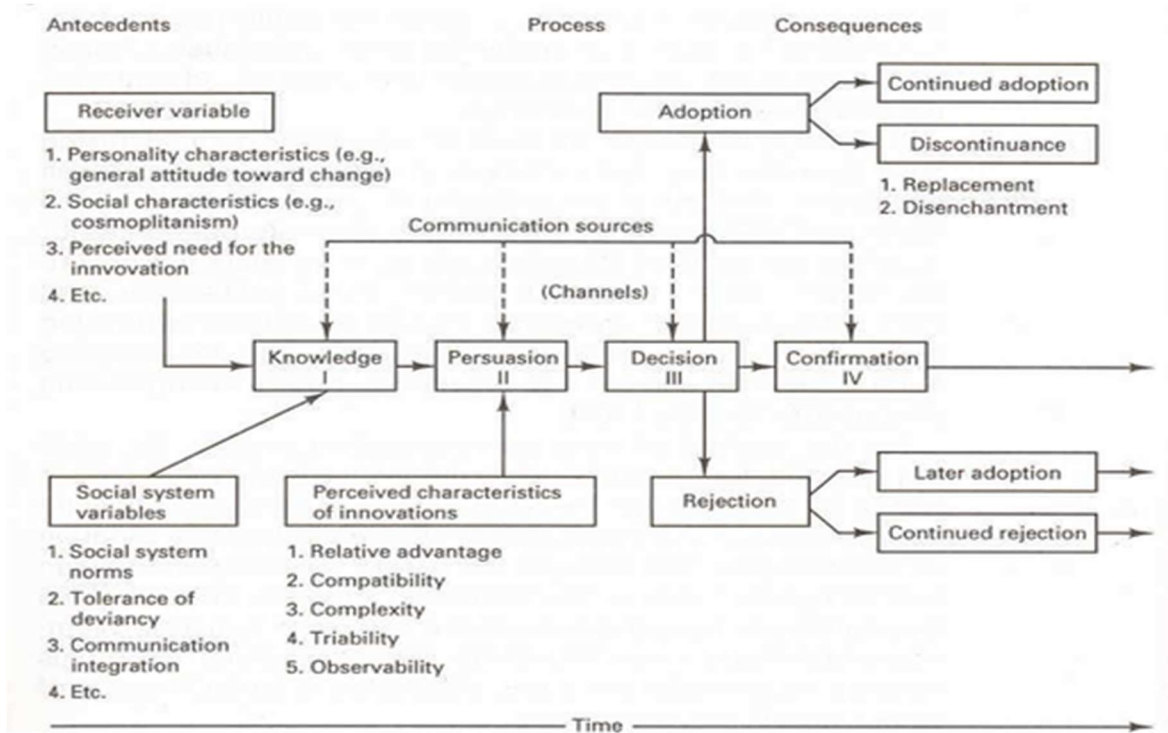
Figure 2: Innovation-decision process (Rogers, 1995)

The ideas of diffusion and adoption are strongly linked. Ee (2015), notes that the complete implementation process consists of individual adoption decisions. In turn, consumer or user awareness and attitude are significant to the DOI. To describe this process, Rogers (2003) expressed 5 phases which reflect the process of adoption behaviour on the individual level and this is labelled as the Innovation-Decision process.

Phase 1 (Knowledge) represents the first introduction to the innovation and corresponds with a lack of information about it. During this phase, the individual tries to find answers to questions such as "what?", "how?", and "why?" As a result, there are three sorts of knowledge obtained during this phase. (a) Awareness knowledge represents the acknowledgment of the existence of the innovation in question. The impression the innovation leaves to an individual as this phase can encourage them to ask additional questions. (b) How-to knowledge is information about how an innovation functions. The more an individual accumulates the how-to knowledge, the higher the chance of adoption to occur (Rogers, 2003). (c) Principles knowledge refers to the "why" of an innovation. Although an adoption may be accepted without this knowledge, the attraction for many adopters lives in the principles behind the existence of the innovation in the first place (Ee, 2015).

Phase 2 (Persuasion) comprises of the individual taking awareness in the innovation and actively seeking related innovation evaluation information. During persuasion, individuals develop a negative or positive attitude towards the innovation. Rogers (2003) argues that this phase is more emotional in nature while the knowledge phase is more rational. As a result, this phase is influenced by social support from others. Seeking confirmation in this way is an attempt to reduce any uncertainties about the use or value of the innovation (Ee, 2015).

Phase 3 (Decision) represents the process of evaluating the advantages and disadvantages of taking on the innovation journey to the outcome of adopting or rejecting it. Trying the innovation has a key role during this phase (Ee, 2015). Rogers (2003) indicates that innovations are accepted most quickly when they have gone through the trial period. Nevertheless, the adoption of the innovation leads to the next phase, though rejection can be active, whereby an individual tries the innovation and rejects it, or passively, whereby no such a review takes place and the innovation is not adopted.

Phase 4 (Implementation) happens when the individual uses the innovation to change points. Ee (2015) however distinguished that although a decision has been made and has resulted from a trial run, implementation can still include a degree of doubt. Rogers (2003) emphasizes that this phase can include a contribution from change agents, those who interpret innovations to or across a community. Often, change representatives offer technical assistance as well (Ee, 2015).

Lastly, Phase 5 (Confirmation) is represented by the continuation of use of the innovation which shows the completion of the decision-making process. This phase contains support-seeking behaviour on behalf of adopters. Rogers (2003) identified that adopters tend to seek confirmation of their decision to adopt an innovation and avoid conflicting messages about it. Individuals may withdraw from the use of the innovation if a better innovation is made available to replace it or if they are unsatisfied with its performance (Ee, 2015).

2.7. CRITICAL ANALYSIS OF REVIEWED LITERATURE

This section describes the purpose, focus, methods, context, gaps and relevance of the reviewed literature. The purpose of the study done by Wang et al. (2011), was to try and evaluate the input of the systems concept to enterprise architecture and integration, and make a summary of the approaches or tools at systems level and an investigation into some fundamental ideas and thinking of systems theory applied in the organisation's integration activities. Enteprise Architecture (EA) has been used as the method and it is defined as "the consolidating judgement for organisation processes and information technonolgy infrastructure reflecting the integration and setting requirements of the firm's functional model" (Wang, Xu, Li, Wang, & Choi, 2011, p. 169).

Reviewed articles established that the current research and practice in organisations' information systems do not give business modellers or system engineers a proper system hypothetical perspective from which business procedures can be broken down in an open, constant and general way. This gap is thoughtful; and for that reason, the authors proffer that a systemic study is important for learning the results of variations in enterprise architecture, enterprise process logic and parameters on business performance measures in order to make better conclusions. They further indicated that the outstanding research challenge in this scope is to overcome systems difficulty, and to meet this, a restructuring is required throughout all levels of organisations, stretching from a design mindset to operational activities in practice. As concluded in this study, systems theory has suggested the need for an awareness of the significance of EA and organisational integration.

Furthermore:

> From systems point of view, technical interoperability shows a fundamental role in integration. It entails well-designed or applied compatibility among practices or interfaces of primary conditions on information and applications. Interoperability can be definitely met if participants operate similar functions. Semantic interoperability manages the "what" of integration and that is diverse with technical interoperability concetrating on the arrangement of "how" to do integration. (Wang et al., 2011, p. 336).

Javidroozi et al. (2015) deliberate Business Process Change (BPC) as the main area of activities in systems integration. They argue that the integration of business processes addresses some issues in other areas of systems integration.

> Thus, they recommend enterprises to shift from functional-oriented integration to process-oriented integration. Organisation process change/restructure is required to transform, advance, and incorporate current business methods, by using some approaches, tools, and practises such as BPMo, BPR, TQM, and Six Sigma. However they alluded that, BPC is a complex project, which is affected by enterprise's capabilities such as change management, project management, and IT, and needs to be managed and planned carefully. (Javidroozi et al., 2015, p. 314)

For the relevance of this reseach, most writers in the reviewed articles on systems integration left the gap of systems analysis wide open and priority will be made towards that aspect in this project. Overcoming system challenges is the goal and analysis should be the starting point towards this goal. Interoperability aspects will be expected to be covered within the analysis.

On SI technologies, most writers highlighted the two options (point to point and middleware) as feasible ways to successfully implement systems integration.

Setareh and Asosheh (2014) challenge the status quo with one of the emerging methods of systems integration, namely web services technologies and including cloud computing. They have used a cloud based model to integrate information systems within the healthcare sector and its adoption showed great effectiveness. The e-Estonia x-road journey is a remarkable story and this research would surely incorporate its successful architectural features.

Literature on mobile payment has also been explored especially on methods and technologies, as well as examples of payment systems. On a study done in Ecuador, Teran et al. (2016) indicated the need for network carriers and operators to collaborate with established banks and other financial institutions for mobile transactions. Considering the growing mobile market in Namibia, this shared experience adds to the notable list of aspects that need consideration upon embarking on a project of this magnitude as it can be a hindrance, specifically on financial security questions from stakeholders. Every author considered in this study on m-payment mentioned the transactions security concerns in

different forms and this is well understood in the study. However, this is marked out of scope for this research and would be considered for future exploration. Further analysis would be detailed and shared in the findings and analysis chapter (Chapter 4).

2.8. CONCLUSION

The majority of the reviewed articles on SI established collective considerations that system integration is a feasible practice but there are realistic challenges in different forms, and proper analysis of design and involvement with stakeholders is vital. Most authors highlighted in their studies that shortcuts should not be compromised; else the process might need to return back to the feasibility phases. However, there is confidence that the benefits and values upon successful implementation outweigh the process.

Similarly with payment systems, concerns pertaining to users' adoption and security of transactions continue to raise questions. A clear understanding of a proposed solution and suitable theories for implementation is commended. Confidently, the rapid evolution of technology tends to provide the possibility for better ways in guarding away concerns. Theoretical frameworks are known as lenses for data analysis. They help choose what questions to ask your participants and what numbers or views to look at during the analysis. The researcher understood that the selection of the theory doesn't really matter and it should be subjective in relation to the desired outputs of the theory, and the various ways of seeing the results of the study.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. INTRODUCTION

This chapter presents the research methodology that was applied in the study. Research methodology is recognised as the collective method to the entire process of the research, which could be put into practice from the predictable basis, to the collecting and examination of data (Wedawatta, Ingirige, & Amaratunga, 2011). The methodology consists of methods, strategies, and practices used. The methodology was selected based on the objectives of the research. The chapter is structured into six sections which consist of the introduction, the design used in the research, the research strategy selected, the data collection process and methods used, the data analysis approach used, and finally, a conclusion is drawn.

3.2. RESEARCH DESIGN

The design applied in this research was the use of the qualitative research method. This was based on the research's objectives and questions, which also anticipated gathering and analysing qualitative data. The design involved interviews and documentation techniques for data collection, which encouraged the understanding of the data at hand and the happenings and examinations during the research. It also promoted and gave the researcher the liberty to view human behaviour as dynamic, as they kept on changing overtime, and different groups created different realities and perspectives, so the researcher could not generalise but create facts based on the acquired information.

The research design shows the inclusive approach that the research study chose to mix the different parts of the study in a logical and practical way, in this way, assuring that the research study has successfully addressed the research problem (Creswell, 2013).

3.3. RESEARCH STRATEGY

A case study strategy was adopted in this research. Through the use of the qualitative design, an understanding of a case was sought and within that context, the case study approach was selected as the research strategy. A case study is employed to obtain an in-depth understanding of the situation and actors involved and it focuses on a phenomenon that has distinct boundaries, a description of how, when, where and why things happen (Henning, Van Rensburg, & Smit, 2004). It expresses what information is required, what methods and

practices are going to be used to collect and analyse the data, and how altogether this is going to answer the research questions, and the way in which these will be organised in the project.

3.3.1. Case studies

Three law enforcement agencies, namely the Namibian Police (NAMPOL), Windhoek City Police Service (WCPS), and Roads Authority (RA) were included in the case studies. Windhoek Magistrate's Court and selected Motorists were also considered as cases in the study. The various information technology departments of all the mentioned organisations were considered as participants to their respective cases. All cases were viewed as one case study. As such, the data collected from all cases were collectively analysed. The boundaries of this case study were limited to the City of Windhoek, Rehoboth and Okahandja towns. The reason for considering three towns only was due to the fact that there are about 30 stations throughout the country that deal with traffic fines processing and management, and it was not feasible to cover all the stations. Therefore a sampling method was adopted.

3.3.2. Selection of the cases

Purposive sampling was adopted. This method was chosen with the judgement of the researcher that only key stakeholders involved in the process of issuing, receiving, management and processing of traffic fines activities were included as cases in this research as they were understood by the researcher to provide correct and tangible information, and as the phenomena being examined is attached to either one of them. The selected cases significantly contributed to the research. "Purposive sampling (also known as judgment, selective or subjective sampling) is a sampling method in which the researcher depends on his or her own judgment when selecting members of the population to participate in the study" (Dudovskiy, 2016, p. 76).

The following section describes the cases chosen and their understood roles and functions;

Namibian Police (NAMPOL) – referred to as Stakeholder 1

The Namibian police, also referred to as NAMPOL, was established in 1990 after the attainment of Namibian independence. The NAMPOL is mandated by Article 115 of the Namibian Constitution to regulate the powers and duties of the force and to prescribe the procedures in order to secure the internal security of Namibia and to maintain law and order (Legal Assistance Centre, 2017).

As per the information on their website (NAMPOL, 2017), their high level statements are as follows;

Vision: "To protect and serve all people in Namibia".

Mission: "To render the necessary quality service, as laid down in the Police Act, with due consideration for the fundamental human rights and freedoms, without compromising in upholding the tenets of law and order, safety and security of all persons."

Values: To deliver quality services.

To uphold the principles of the rule of law, national commitment and unwavering patriotism.

To respect the supreme law of the Republic of Namibia.

To be accountable to the nation and the community we are serving.

Windhoek City Police Service (WCPS) – referred to as Stakeholder 2

As per the information on their website (Windhoek City Police, 2017), "Windhoek City Police Service was established in terms of Section 43.C of the Police Act (Act 19 of 1990), to compliment the Namibian Police in the maintenance of law and order. The powers and functions of the Windhoek City Police are enshrined in the Municipal Police Service Regulations (Reg. 2833 of 2002), formulated in terms of Sec 43.C of the Police Act (Act 19 of 1990), as well as the Declaration of Peace Officers made in terms of Section 334 of the Criminal Procedure Act (Act of 1977)".

"Guided by municipal police service regulations and memorandum of understanding signed between them and NAMPOL., the role of the City Police is to complement the NAMPOL in the following service areas: crime prevention, law enforcement, traffic policing and enforcement of by laws in the city of Windhoek's area of jurisdiction" (Windhoek City Police, 2017).

The Traffic Management Unit is accountable for traffic control related matters in the city, and the maintenance of all city street signs and road markings, in addition to traffic law enforcement activities such as speed and driving under the influence (DUI) enforcement. The Unit also participates in special events (parades, funeral processions, VIP escorts, etc.), and conducts other safety related programmes.

Roads Authority (RA) – referred to as Stakeholder 3

According to the Roads Authority Act (Act 17 of 1999), the statutory objective of the Roads Authority is:

> To manage the national road network so that it is safe and efficient. Notwithstanding its Statutory Objective, Roads Authority has accepted that in pursuance of Namibia's 2030 Vision, the Authority's Strategy has to go beyond its statutory objective. The Roads Authority Strategy document reveals this intent. A sustainable Road Network, road infrastructure and road user support systems ahead of the Namibia's growing demands are pivotal to realising this vision. In support of our national vision, the Roads Authority crafted its core ideology aligned to this vision. Their mission is to manage a safe and efficient national road network to support economic growth. The vision is to be a sustainable road sector which is ahead of national and regional socio-economic needs in pursuit of Namibia's vision 2030 (Roads Authority, 2017, p. 9).

Magistrates Court – referred to as Stakeholder 4

Only applies to Windhoek Magistrate Court, where payments of traffic tickets are processed and warrants of arrest are issued.

Motorists – referred to as Stakeholder 5

These are any licensed drivers purposely selected from the public domain.

Data was collected through semi-structured interviews, documentations, and questionnaires accordingly. Semi-structured interviews and documentations were used with stakeholders 1 to 4, while data from stakeholders 5 were collected through questionnaires and thee were distributed online due to the stakeholders' large number and different geographical settings and budget reasons. The researcher understood that these techniques could provide richness and flexibility in collecting data in the different cases, with the study limitations put into consideration.

Saunders, Lewis and Thornhill (2009) state that a research strategy is the overall plan in which manner the researcher has gone around answering the research questions. Saunders et al. (2009) further point that a suitable strategy has to be carefully chosen focused on the research objectives, the level of understanding on the topic area to be investigated, the time and resources available, and the reasonable ground work of the researcher (Saunders, Lewis,

& Thornhill, 2009). Wedawatta et al. (2011) add that the research strategy provides the direction of the research as well as the procedures by which the research is conducted.

3.4. DATA COLLECTION METHODS

This section presents the methods used to collect data for the study. Questionnaires, interviews and document analysis were used as methods to collect data. Purpose sampling was applied as the selection technique for these methods. This process allowed the gathering of data from all cases mentioned in section 3.3, with the determination of answering the main research question(s) and to expectantly accomplish the objective(s) of the research. The data collection focused on how traffic fines were issued and processed, and the issuing of clearances from stakeholders and relative to the management of traffic fines payments.

In order to draw a comprehensive conclusion on the outcomes, a set of questions derived from the research questions were set up through the following elaborated methods, and with the purpose to avoid bias and remaining relevant to each specific group, the researcher separated the different questions for specific groups in each method used.

The following techniques were used to collect data as discussed as follows.

3.4.1. Interviews

Semi-structured interviews were conducted with stakeholders 1 to 4. Meanwhile, the previous research done by the researcher already conducted a similar exercise in 2014 with a total of 7 interviews which were found in TD-00, 2014. This time around, the researcher only focused on refresher interviewing with key process owners of stakeholders 1 to 4. A total of 8 interviews were conducted this time around. The questions that were used to conduct the interviews are found in APPENDIX B. Interviews were done per individual person and recorded with an android smartphone voice recorder application and then transcribed. The interview technique allowed the researcher for instant probing of answers provided by interviewees and vice versa, and this enabled clarification from both parties.

The respective information technology departments' interviews were initially scheduled to happen in person but due to tight schedules of stakeholders 2 and 3, they opted for phone interviews. Meanwhile, they requested the interview questions to be sent to them due to

their unavailability and they rather completed them as questionnaires and it happened as such and this followed up with a phone call, so there were no recordings which were done.

The following table 1 shows the interviews conducted from the different stakeholders

Interviewee (s) description	STAKEHOLDERS' FULL DESCRIPTION				Stakeholder #
	Namibian Police (NAMPOL)	Windhoek City Police Service (WCPS)	Roads Authority (RA)	Windhoek Magistrate's Court (WMC)	
Chief Inspector	1	-	-	-	1
Traffic Superintendent	-	1			2
Senior Road Transport Inspector	-	-	1	-	3
Chief Legal Clerk	-	-	-	1	4
Analyst Programmer	1	-	-	-	1
System/Network Administrator/Engineer		1	-	1	2 & 4
Head/Manager of IT Department	-	-	1		3
TOTAL INTERVIEWEES	8				

Table 1: Interviews conducted

Different sets of interview questions were set up, which acted as guidelines for the researcher. The set of questions helped to maintain consistency with each case interviewed and some level of uniformity across the interview process. All interviewing processes happened at the Stakeholder's premises and appointments were made prior to the visit, and the interview used the faculty's permission letter to set up the appointment to conduct the research (APPENDIX G). Before the interview process, the interviewees were briefed about the matters to be covered and the researcher requested for permission to record the interview conversations for the purpose of analysis, and permission was granted, except for NAMPOL's IT department as they claimed it was "a security risk" to have them recorded.

The recorded interviews were afterwards transcribed and these can be found in APPENDIX E. The transcribed data, together with the documentations obtained were interpretively analysed.

Semi-structured interviews combined pre-decided set of open questions with the chance for the interviewer to discover specific subjects or reactions more (Thomas, 2010). It allowed for openness and flexibility with participants and helped to bring up new ideas as a result.

Interviews are conversations, commonly one-on-one dialogues between a person guiding the questions (interviewer) and an individual answering them (interviewee), intended to collect information on particular subjects (Harrell & Bradley, 2009). Interviews can be conducted in person or through the phone.

3.4.2. Questionnaires

A questionnaire containing both closed and open ended questions was used. This method has been used within this research for stakeholder 5 only. The reason for selecting stakeholder 5 only is because this case involved a targeted group of people that were scattered between the three locations, namely CoW, Rehoboth and Okahandja towns, and considering the density of information to be collected, the researcher subjectively decided that this was the right method for this case. And the reason for considering three towns only was due to the fact that there are about 30 stations throughout the country that deal with traffic fines processing and management, and it was not feasible to cover all the stations. Therefore a sampling method was adopted.

The questionnaire consisted of 8 closed-ended questions and 2 open-ended questions, giving up a total of ten questions. The format of the questions was done subjectively by the researcher and with approval from the research supervisor, in relation to the objectives of the research, and no specific format / criteria or number of questions was adopted. A copy of the questionnaire can be found in APPENDIX A.

Purposive sampling technique was used in the selection of the recipients of the questionnaire, as there were no proportional samples necessarily required for analysis but as long as they were motorists and had ever received a ticket fine or had experienced challenges in any process related to the case. The dissemination of the questionnaires was through the free online service (namely Survey Monkey). The reason for selecting this service was due to budget and time constraints, and in relative to the total number of people targeted and

different geographical locations where data was expected. Thirty motorists were targeted to participate in the survey and purposive sampling was used as the selection method. Motorists should have been willing to participate and they should have been fined before (issued a ticket) or experienced payment issues before. Prior to dissemination, the researcher requested for their email addresses and the granting of permission to send them the questionnaire.

The following control settings were applied on the online questionnaire (APPENDIX F, screenshot01 diagram 1);

▪ Only allowed the survey to be taken once from the same person or device (computer).

▪ Respondents could not change their answers after completing the survey.

▪ Respondents were considered anonymous (no names or contact details collected).

The purpose of using questionnaires was to find a complete picture and insightful understanding of stakeholder 5 concerning the phenomenon, and have evidence to prove the facts and findings.

3.4.3. Documentation

The documentations technique was also used as supporting data from stakeholders 1 to 4, and it involved data which the interviewees could not completely explain due to time constraints. Documents were requested during the interview process from the interviewees, and they were presented in the form of soft and hard copy formats. The following methods were used for review. First, the documents were studied to understand whether they support the transcribed data from interviews or come contradicting gabs exist. Second, the documentations were studied alongside the research objectives.

Table 2 illustrates the different types of documentations attained. They can be found in APPENDIX C-D.

Documentation attained	STAKEHOLDER'S FULL DESCRIPTION			
	Namibian Police (NAMPOL)	Windhoek City Police Service (WCPS)	Roads Authority (RA)	Windhoek Magistrate's Court (WMC)
1. The 56 ticket (Notice to appear in court)	1	1	1	0
2. The 341 ticket (Parking ticket)	0	1	0	0
3. System login page	0	0	0	1
4. Reports and requests of resolutions	0	0	0	1
TOTAL DOCUMENTATION	**6**			

Table 2: Documentation collected

3.5. ETHICAL CONSIDERATION

Before data collection, the researcher sought permission from the respective stakeholders, and permission was granted accordingly. The data collected was only to be used for the purposes of this research and the sharing of all data was only between the researcher and the supervisor. In addition, identifications of all interviewees and participants were under no circumstances revealed to any third party during and after the research.

3.6. DATA ANALYSIS OVERVIEW

The data collected was analysed interpretively and further supported with the diffusion of innovation (DOI) theoretical framework. DOI theory connected widely and naturally well with this area of topic and with its objectives, and the reviewed literature extensively convinced the researcher to explore it within this research. Interpretive studies emphasise that reality and understanding are social products and hence unable of being understood independently of the social actors that create and make sense of reality (Creswell, 2013). Walsham (2006) adds that the interpretive method starts from the point that our understanding of reality, including the territory of human action, is socially constructed by human actors. Researchers

gather data in the natural settings where they experience the problem or matter under investigation in the study (Walsham, 2006).

Hovorka and Lee (2010) concluded that the interpretive approach is based on the senses and suggestions that the researcher brings in the study (Hovorka & Lee, 2010).

This method has the advantage that the research's overall aim is to examine and understand the subjective view of the participants that are involved in the management of traffic fines activities and to understand how they interact in the management and use of the respective information systems and perceptions towards the systems and expectations for new innovations.

3.6.1. Interpretive analysis method

After the data collection process, the transcribed data from interviews of all cases was put together in one document and arranged according to their respective stakeholders. The overall data was cleaned by correcting wrong spellings, grammar and formatting the whole document to ensure consistency and some level of uniformity across the entire document. At the beginning of each interview, the position title of the interviewee and the date on which the interview was conducted was displayed. Besides each line of the document, line numbers were inserted in the document margin for referencing purposes according to their correspondences in the study. Recorded interviews were replayed back and forth during the transcribing process in order to understand what the interviewees were communicating and making sense of the raw data. That way also, gaps and unclear responses were able to be spotted as a way to enrich the analysis of the data. The transcribed data is saved in the APPENDIX E file and it is referenced with "TD-17" as the author within the document.

The following 5 phases describes how the interpretive method was conducted:

Phase 1). The "TD-17" document together with questionnaires and documentations received were browsed thoroughly by reading and understanding line by line and making notes. This phase has been used to reference in text line by line. For example: (RES*nn*, p. 11, *xx*, 2017). *nn* being the respondent's number in the transcribed document and *xx* the line number in sequential of the interview.

Phase 2). All relevant phrases, sentences, sections, and spots were identified within the data and taken note of carefully.

The following criterion was used as a method to classify something considered as relevant, known as codes:

▪ When the interviewee specifically stated that it is important

▪ New information revelation

▪ Repeating information in several places within the text

▪ Provided information similar or relating to information found in literature

Phase 3). Identified the most important codes, and created groups by bringing several together. This process is iterative and new codes are created by combining two or more codes, also known as themes. The themes were not necessarily of the same type.

Phase 4). Identified categories with most relevance and established an understanding of links between them and with the support of applying the theoretical framework selected. These categories at this phase became the main findings of the research.

Phase 5). Lastly, a hierarchy among categories was created based on importance and finally drawn to summarise the findings, which contributed to the development of the framework presented in Chapter 4.

3.6.2. Theoretical framework method

Due to the nature of the research and its objectives, the "Innovation-decision process" from the perception of diffusion of innovation (DOI) theory was purposively selected. The purpose for using this theory was to try theoretically match the different elements involved, and to find a collective understanding or gaps within the phenomenon. In addition, DOI relates widely in any innovation aspect and covers any others related, including social aspects. The following brief phases describe how the DOI framework was used, however the actual analysis in relation to data is presented in Chapter 4:

Phase 1). Mapped the various codes created in the interpretive method accordingly to the 5 channels within the innovation-decision process of DOI,

Phase 2). Created, and at some point redefined new codes pertaining to the channel condition, and lastly,

Phase 3). Interpreted the different categories based on facts provided for each phase in the channels.

The data analysis was carried in accordance with the research objectives and it is presented in Chapter 4 in more detail.

3.7. CONCLUSION

The chapter presented readers with the sense of how the research was conducted. It shows how all of the main parts of the research work were collected in an attempt to address the research questions. The qualitative method was applied through a case study strategy to study how these information systems and technologies are used, managed, implemented and adopted. Questionnaires, documentations and interviews were used to collect data about the case studies, which are listed and described in the next section. The data collected was interpretively analysed and further supported with a theoretical framework (Diffusion of Innovation) described in section 3.5. All motivation for selections are presented. Chapter 4, which follows, presents the data analysis and findings.

CHAPTER 4: DATA ANALYSIS AND FINDINGS

4.1. INTRODUCTION

This chapter presents the data analysis process, the findings and the discussion of the study. The chapter is divided into five sections. The first section covers the brief introduction of the section. The data analysis process, findings and discussions are presented in sections two, and three, respectively. In the fourth section, the designed framework is presented and finally, the conclusion.

4.2. DATA ANALYSIS INTERPRETATION

This section presents the interpretation of data analysis on information received from all the different data collection methods. The data analysis was carried out in accordance with the research objectives, and interpretation is hereby presented and later on findings are drawn and presented.

4.2.1. Data from interviews

Recorded interviews were replayed back and forth during the transcribing process in order to understand what the interviewees were communicating and making sense of the raw data. That way also, gaps and unclear responses were able to be spotted, to enrich the analysis of the data. The TD-17 and TD-00 documents consisted of the transcribed data and they were browsed thoroughly by reading and understanding line by line. This phase has been used to reference in text, line by line. For example: (RES*nn*, p. 11, *xx*, 2017), *nn* being the respondent's number and *xx* the line number in sequential of the interview response.

The Clerk of the Court (TD-17, 2017) has confirmed that there are three (3) traffic control and law enforcement agencies that issue traffic fines in Namibia, namely; Namibian Police (NAMPOL), Windhoek City Police Service, and Roads Authority (RA) traffic departments (p. 5, 145). These agencies are accountable to the tickets they issue and a fee is generally the initial fine claimed to clear such offences and the revenue belongs to the state. The respective district Magistrates Court is the receiver of all payments (TD-17, RES01, p. 1, 4, 2017). The traffic fines are well described in the new traffic fines booklet which all law enforcement agencies carry all the time. The new updated fees are ranging between N$500 and N$6000 (TD-17, RES02, p. 5, 54, 2017). In order for the traffic officer to issue a fine to an offender, a violation or offense has to happen.

As indicated by Hamatwi (2014) regarding the initial stages of the process, all law enforcement agencies presented that they have two (2) options that they can issue fines to motorists in demarcated areas respectively as mentioned in Chapter 1. There are two options within this process. Option one is the most widely used, whereby the traffic officer in uniform from any of the law enforcement agencies can stop (if spotted) a motorist who has committed any of the offenses and issues him or her with a fine. *"We give all types of fines, from driving related, worthiness of vehicles and transportation"* (TD-17, RES02, p. 4-5, 52, 2017).

A driver's license is normally the initial document asked for by all agencies as part of the introduction, and the traffic officer will have to take down all personal details which are required in completing the document, also known as the ticket. *"We have transportation officers in uniform and they are responsible to enforce the issuing of fines when traffic signs and rules are broken. The process is pretty simple; if you happen to be an offender, you will be asked to provide your driving license to the officer, then they will introduce themselves and what you are charged for and with a notice to appear in court document"* (TD-17, RES02, p. 4-5, 52, 2017).

The fine amount of the offense committed is also stipulated in this document. This option is done either on the individual capacity of an officer or when they conduct road blocks. The name of tickets issued in this option is called "The 56 ticket" (APPENDIX C). The name was derived from Section 56 of Act 51 of 1977 in the Namibian Constitution.

Hamatwi (2014) further states that the second option is through postal addresses, whereby an offender receives the fine through their postal box address in which the motor vehicle is registered. This option is normally done where there is no direct conduct with the offender and an offense is recorded or noticed with the missing of one of the two persons, namely the offender or traffic officer. It is mostly done when an offense is caught through a road camera or a parking offense where there was no direct summon (ticket) given to an offender. The name of tickets usually issued in this option is called "The 341 ticket" (APPENDIX D). The name was derived from Section 341 of Act 51 of 1977 in the Namibian Constitution.

Information systems involvement at this stage is quite minimal. After the issuing, issued tickets need to be captured in each respective system. RA inspector (TD-17, RES02, p. 6, 72, 2017) highlighted that the officers give the original document to the offender, one copy stays

in the book for their records and a copy is sent to the magistrate's court for capturing into their system (NAMCIS) and to prepare the tickets for court proceedings. RA does capture all the issued tickets onto their traffic module information system and Traffman system for NAMPOL, and these systems are only accessible within their LAN (TD-17, RES02, p. 6, 72, 2017). *"The standard procedure is to duplicate the capturing of the fines in the ticket book. One copy is given to the offender and 2 remain with the officer and the officer also makes sure that its captured onto the traffic module information system, which is only accessible in the office. This ticket book is recorded towards the officer and it's his/her responsibility to make sure all issued tickets are accounted for and documented"* (TD-17, RES02, p. 6, 72, 2017).

Likewise, with regards to the Windhoek City Police Service; from the road, the documents go to a specialised department to be captured on their information system, then a manual copy is sent to the magistrate's court (Hamatwi, 2014). If the clerk of the court receives these documents from anyone of the agencies, they are again captured in the court's information system (NAMCIS), which means that there is clearances will be pending from all the systems involved. *"City of Windhoek is linked with us, they normally capture and import the cases and send it to us and the next morning the cases will convert. NAMPOL and RA tickets, we capture ourselves"* (TD-17, RES03, p. 7, 99, 2017).

The second part of the process with regards to information system involvement is whereby only the magistrate court system is involved in this process, whereby they receive and process all payments on behalf of the state (Hamatwi, 2014). *"The traffic department handles all tickets but there is a specific person assigned to receive them and them off with respective agency"* (TD-17, RES03, p. 8, 105, 2017)

Offenders are informed and requested to go and make their payments at the magistrate's office, traffic office department (341 tickets only) or pay through the post office in the form of a telegram, but provided that you make a payment in advance (TD-17, RES03, p. 8, 105, 2017).

According to the Clerk of the Court (TD-17, 2017), the fine ticket has a pay date and a trial date (grace period of fourteen (14) days after pay date). So if you make a payment through the post office before the pay date, then that should be fine for processing at the traffic department at the Magistrate Courts (TD-17, RES01, p. 1, 4, 2017). However, if you are unable

to pay before the pay date, then one is advised to make arrangements and go pay in person, else the court might not take your money afterwards because it can reach the court late after the trial date. The money needs to reach the magistrate court before the trial date. If the offender pays before or on the pay date that is stipulated on the issued ticket or before the end of the fourteen days period, he/she will be issued with a receipt as proof of payment document (TD-17, RES02, p. 5, 56, 2017).

The last stage of the process is the clearance process. With the duplication of capturing that occurred in the first process (TD-17, RES02, p. 6, 72, 2017), offenders are normally advised to keep their receipts with them at all times or to go and present it to the respective agency for their names to be cleared from that information system, and only then is the case closed and no further action is required from either stakeholders (TD-17, RES03, p. 8, 111, 2017). If they do not come and present their proof of payment, their names will still appear in the system until they receive an update from the Clerk of the court with a list of all payments made on their submitted copies of tickets issued and then they can update their records accordingly. However, if they get stopped by a traffic officer before an update is sent to the respective agency, they can be arrested if no proof of payment is presented (TD-17, RES01, p. 3, 36, 2017).

A senior inspector from RA highlighted that offenders are usually informed by officers to go and enquire about their charges at the magistrate's court before the expiry of the court date. By then the clerk of the court will receive payments or complaints (TD-17, RES02, p. 5, 66, 2017). On the circumstance of non-payment, after the grace period of fourteen days of trial date which normally falls on a Tuesday or Thursday of every week, a warrant of arrest will be issued by the magistrate's court and sent (or request for collection) to the respective law enforcement agency for execution, and offenders will be apprehended if found (TD-17, RES03, p. 8, 115 – 117, 2017).

According to the Clerk (TD-00, 2014) of the court, the magistrate's courts will normally have them pay for the full ticket amount as a bail and they then receive another trial date. If they appear in that specific day then that money already paid is forfeited for the ticket. After then, offenders are required to appear in court and explain their reasons why they couldn't pay their fines. The magistrate on duty then makes a decision based on given reasons, which

normally ends up being a fine on top of the initial traffic fine plus an additional fee charged for contempt of court.

The IT departments also highlighted key issues within their respective information systems. The first is from RA which indicated that *"There was no request for integration from 3 parties, the challenge could possibly be outdated technologies"* (TD-17, RES05, p. 12, 174, 2017). This statement shows a lack of direction in systems consolidation between stakeholders. In addition to that, lack of authority to make certain decisions seems to have caused the isolation as the City of Windhoek IT department feels that they can't do much on directing the systems implementation, including systems integration. Another aspect is the platforms on which some of these systems are operating on, especially the NAMCIS system. This aspect has been identified as one the major factors that can be a threat to integration. The system administrator from the Office of the Judiciary stated that *"Compatibility is the main problem since our system is LAN based and developed in a very old programming language"* (TD-17, RES06, p. 12, 188, 2017). More elaboration on this aspect has been listed in the findings section.

The other issue is the lack of or minimal of training received for RA, WCPS and Magistrate Court technical support teams. All of these stakeholders mentioned their challenges accordingly and it has been identified as one of the factors towards integration. *"The support base for NAMCIS application is very limited and challenges to us as a division as there is no proper documentation for both installation and support. We no longer get feedback from the developers when an issue is brought to our attention and there are many challenges that are still pending and no one in the division is currently capable of fixing them"* (TD-17, RES06, p. 13, 192, 2017).

The screenshot (figure 3) is a login page for the Stakeholder 4 system and if closely looked at, the forte runtime environment design (blue & purple icon in corner) can be noticed.

Figure 3: NAMCIS login page

And CoW added the aspect of security: *"No training received . . . because of the police act - for security reasons. We only assist in technical matters, e.g. when there's a network issue or PC problems"* (TD-17, RES07, p. 14, 206, 2017). Direction with clear responsibilities needs be taken.

4.2.2. Data from questionnaires

The request was granted to 30 selected people. However, only 24 completed the survey, of which 67% were male and 33% were female as indicated in APPENDIX F, screenshot02 Figure 1 on page 1, and 2 out of the 24 never got any ticket fine at the time of responding to the questionnaire.

Over 95% of the people that happened to be offenders at some stage indicated that the main cause for none or late payments is the lack of communication between them and the authorities on owed fines as a reminder and they simply forget about the issued ticket as per screenshot03 Figure 1 on page 2 in APPENDIX F. The 95% is out of 23 people that responded to that specific question and only 4% (1 person out of 23) indicated that a bi-weekly communication was done. As a result, the majority indicated that a notification as a reminder

for outstanding fees would be preferred as a means of communication to avoid unnecessary arrests and loss in revenue.

With the preferred contacting mechanism, the SMS was supported by over 79% of the respondents as the preferred mode of communication as indicated in the screenhot04 Figure 1 found in APPENDIX F on page 2.

E-mail was indicated as the second preferred mode with 21% out of 24 people that responded.

The research also indicated that over 80% of motorists would like to settle their outstanding fines through EFT payments or any electronic means as indicated by screenshot05 Response 1-4 in APPENDIX F page 3 - 6. 8% (2 out of 24 people) of those who responded that they prefer cash payments and only 4% (1 out of 24 people) indicated that they had not yet made any payments by the time of their response.

Fifty four percent of the 24 motorists suggested that an electronic payment method should be availed and possibly for 24 hours a day and 7 days a week. Twenty-nine percent highly suggested that a notification reminder for owed traffic fines should be communicated to them as this will reduce a high volume of backlog and unnecessary arrests. Only 17% had other comments and none.

4.2.3. Data from documentation

Copies of different forms (both soft and hard copies) from different stakeholders were gathered as evidence for the provided information in the analysis and for reference purposes as presented in earlier sections. These documents also serve to describe the operations, design, usage and maintenance of the systems.

Three copies in total of the 56 tickets have been acquired from each law enforcement agency (1 each). According to the Clerk of the Court (TD-17, 2017), this piece of document is the one issued to the offender as a notice to appear in court (fine ticket) and a copy is left with each respective agency.

The 341 ticket is the name of the parking tickets, which are issued by WCPS only. However, the Clerk of the Court (TD-17, 2017) pointed out that these are normally settled and no further prosecutions are required.

A screenshot of the system login page of the NAMCIS system was also provided and gathered as evidence and it is presented in the data analysis from the interview section.

APPENDIX H shows records of different challenges of the system and documentation of daily reported cases to the IT helpdesk and which eventually ended up being put in request letters from heads of departments. Some letters were written as back as 2014 and the reported problem never got fixed to date of interviews done.

The rest of the documentation can be found in APPENDIX C-D.

4.2.4. Data from literature

As earlier stated in the literature review Chapter (2) by Fenner (2003), EAI is an important tool in systems integration and long term scalable solutions should always be considered. The explored architectures and solutions highlighted in the literature are further compared in table 3 on different solution expectations and relating to the phenomena at hand and finally a preferred technology is chosen. Table 3 shows the different solutions and their scaling levels towards selected expectations as per the analysis of the reviewed literature, with high, medium and low being regarded as better, moderate and poorly respectively to performance.

Technology (solution)	Legacy system support	Scalability	Availability	Reliability	Manageability
ESB	High	High	Medium	High	High
HSA	Medium	Low	Medium	Low	Medium
GA	Low	Medium	Medium	High	Medium
APILA	Low	Low	Medium	Medium	Medium
X-ROAD	High	High	Low	Medium	Medium
SAP XI	Low	Low	Medium	Medium	Medium
TIBCO	Low	Low	Medium	Medium	Medium
BizTalk	Medium	Low	Low	Medium	Medium
WebMethods	Low	Low	Low	Low	Low
WebSphere	Medium	Low	Low	Medium	Low
eGate	Low	Medium	Low	Low	Medium
OFM	Medium	Low	Medium	Medium	Medium

Table 3: Technology scaling levels comparison

Based on the literature review presented in Chapter 2 and table 3 as the summary, ESB is surely recommendable as the solution to use for integration and it is expected to operate well in this case. The following benefits have been highlighted: It is easy to migrate legacy systems. This implies that one can run different legacy systems in cycle and route messages based on migration needs. A failure in one system does not affect other systems as the bus disconnects

systems (Reliability). It has no state to administer as new members do not increase capacity on a single point in the architecture (Scalability), and this makes it easy to add new systems by simply presenting new members on the bus (Manageability).

In conclusion regarding the process of traffic fines, the flowchart diagram in figure 4 summarises the understanding of which and how each process towards clearance is processed as per data understood. The diagram only illustrates the process flow.
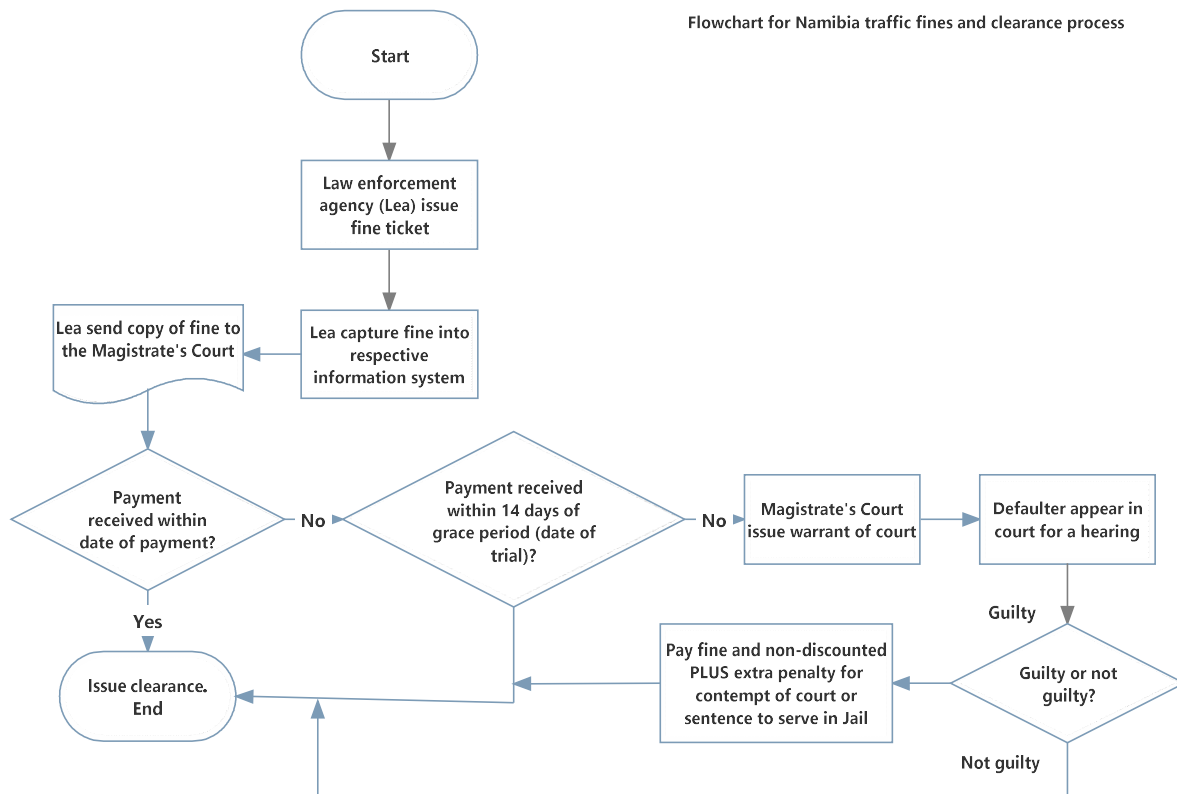
Figure 4: Traffic fines payment and clearance process

4.3. ANALYSIS WITH DOI THEORY

As mentioned earlier in Chapter 3, section 3.6.2, DOI was employed as a lens to the analysis of the qualitative data which were collected in the research. The data from all stakeholders were combined in the analysis. The five communication phases (knowledge, persuasion, decision, implementation and confirmation) of the innovation-decision process from the perception of DOI theory were engaged in the data analysis and presented in this section.

Each phase of the process was applied for determining what is in the data and followed by the presentation of matters that emerged from interviews and the questionnaire's analysed data. The data collection process included some questions directly linked to the 5 phases of the innovation-decision process and the analysis is hereby presented as follows.

1). Innovation-decision process: Knowledge
The knowledge phase is important to any decision-making process. As a matter of fact, an "unfinished" knowledge phase whereby potential acceptance becomes visible to a technology and engages no further is a significant barrier to the diffusion process (Ee, 2015).

Knowledge on the usage of mobile systems and systems integration as a whole have been notable throughout data analysis. Fifty-four percent of the 24 motorists indicated that an electronic payment method, specifically a mobile system, should be availed 24 hours a day, 7 days a week (APPENDIX F, Screenshot06 - Response 2 - 4). Upon briefing the chief inspector at NAMPOL regarding the plan and purpose of systems integration, he restated that *"Absolutely, that would be a solution. It's a necessity and required. We have an e-policing system but it is also not integrated with any of the systems. If you can have all systems integrated, it will be very much helpful"* (TD-17, RES01, p. 3, 28, 2017). It is also factual that many Namibians are already using different types of mobile information systems (e.g. banking services), thus it might turn out to be easy to communicate this knowledge. It was evident that participants were united by their close relations to, or participation in, the technology community. These conclusions were relatable with the views by Rogers (2003) who acknowledged that diffusion can and will occur across a variety of communication channels. Interpersonal communication between groups and with customers represents one channel while mass media represents another (Ee, 2015). Additionally, the three types of knowledge

(awareness, how to, and principle) were present in the data. All participants became aware of mobile systems and systems integration, and they learned about its options and expected operations. The goal of integrated systems is to provide effective services to any motorist in need at any given time, overcoming the restrictions of time, place and character.

2). Innovation-decision process: Persuasion

Persuasion is the next phase in the innovation decision process. This phase is represented by the creation of an attitude towards the innovation (Ee, 2015). Although this attitude may not necessarily be the requirement for the acceptance or rejection of the innovation, Rogers (2003) stated that it has a significant role because it shows a movement from a logical connection with the innovation to a more passionate one. After the introduction of the innovation of systems the integration, all participants showed great enthusiasm but with yet a slight confusion also on the usage aspect.

In fact, NAMPOL through the interviewed Chief Inspector (TD-17, 2017) urged a continuous caution that without broad security precautions to protect motorists' confidentiality, the changeover to the electronic system may be unsuccessful and cause more delays and confusion amongst the public. *"Motorists must trust that using information technology is in their greatest interest and accept the vast effort to change the practice of transactions through digitization"* (TD-17, 2017). So, any confidentiality leaks could erode motorists' trust in the electronic systems, especially if the leaks cause recognisable harm, such as loss of money, loss of work prospects, or damage to reputation. Panic of such consequences may cause offenders not to be favourable with these services.

EAI can help in providing access to information, lowering costs, enabling distant service delivery and increasing efficiency for all motorists to utilise the system anywhere. To make sure that there is a favourable adoption, Rogers (1995) points that the people, in this case motorists, must be involved in the entire innovation-decision process initially. They would have the most knowledge of how GUI works best to ensure an efficient process workflow. These key users will have the capability to consider usability matters that system managers might not be aware of. Also, they would be the valid people to experiment with the system before going live.

Overall, a positive observation of automated systems by all stakeholders was evident despite obvious known challenges in developing countries and Namibia is no exception.

3). Innovation-decision process: Decision

When making a decision whether to adopt this innovation or not, the following key proclamation has been taken into consideration. "The system effectively performs as envisioned in a method in which benefits overshadow ordinary risks" (Kramer, Xu, & Kesselheim, 2012, p. 850). With all the benefits highlighted in Chapter 1, section 1.6, three factors have influenced the decision perception of all participants, and these include this independent research, and the need in demand.

Confidently from all stakeholders, they showed that the innovation will exceedingly perform and deliver services as envisioned. For example, NAMPOL Chief Inspector indicated from the interviews data that *"this innovation will enable them to even integrate speed cameras on the roads and be able to communicate with their radio system for immediate correspondence between the office and officers on the field"* (TD-17, RES01, p. 4, 40, 2017). Another example is from one of the motorists that stated that they would prefer *"all electronic means possible"* *(*APPENDIX *F. Screenshot05 - Response 2)* as the future for traffic fines transactions and that the system can be fully efficient with lots of benefits to be achieved, such as the reduction in data duplication and bureaucracy. However, a training or awareness program should be put in place to educate stakeholders on all the processes involved.

4). Innovation-decision process: Implementation

Rogers (2003), states that the implementation phase of DOI is when the innovation is used rather than simply trialled, whereby after the decision to adopt the innovation, participants share their perceptions of the experience of implementation. However, the scope of the research aimed in seeking out to design a framework based on the collected data during the field work, acquired information and applied knowledge and experience. No prototype or actual system was developed, therefore nor testing with users was put to use, and as a result this element can be acknowledged to be voided within this research.

5). Innovation-decision process: Confirmation

During this phase, Rogers (1995) posited that the decision to adopt has to be made and this decision is further stimulated during confirmation. This phase is also reflected by identifying the supporting evidence for their ongoing acceptance and use of the innovation (Rogers, 2003). In this case, no use of the innovation has however taken place but great encirclement and demand is evident among all stakeholders. Overall, the positive attitudes maintained during all phases drive continued contributions towards the realisation, although new experiences happen every day. Both analysis through interviews and questionnaires suggest that all stakeholders positively reinforced their decision to adopt systems integration. Stakeholders displayed continued expectations regardless of their realities: *"No, the systems are not linked still. That's what we plan in future, to link the court system, NATIS system and Municipality together with us. That is why if you happen to pay at court now, it doesn't show to other systems that you paid. Unless you go there with your receipt and update their system (TD-17, RES01, p. 3, 26, 2017).* The implementation of this innovation would open new ways for technology to improve the management and processing of traffic fines across Namibia.

4.4. FINDINGS FROM DATA ANALYSIS

Based from the data analysis as presented in section 4.2 through 4.3, the findings derived are interpreted into factors which were found to be of significant influence to the implementation of integrated systems within the stakeholders. The key factors comprise of legacy platforms, consultants' dependency, collaboration, and skills development.

4.4.1. Legacy platforms

Based on the analysed data from interviews done with the IT department of Stakeholder4, legacy platforms have been acknowledged to be operating within their system. This system is the key information system responsible for receiving traffic fines payments and issue clearances to offenders.

 "A legacy platform or system, in the context of computing, refers to out-dated computer systems, programming languages or application software that are used instead of available upgraded versions. Additionally, service providers do not always offer support for outdated products, rendering them out-dated" (Techopedia, 2017, p. 1). The Office of the Judiciary (OOJ) is responsible for all magistrates' courts country wide and the research has records of

different challenges of the system and the documentation of daily reported cases to the IT helpdesk. Three following key issues have been highlighted through the responsible stakeholder during the interview (TD-17, 2017). The research has compiled these as key issues as most cases reported are outcomes of these identified issues from which others originate from.

I. Server operating system.

An operating system (sometimes abbreviated as "OS") is the program that after being initially loaded into the computer by a boot program manages all the other programs in a computer (TechTarget, 2017). The other programs are called applications or application programs. The application programs make use of the operating system by making requests for services through a defined application program interface (API). In this instance, according to OOJ's System Administrator (TD-17, RES01, p. 12, 190, 2017), this system can only be installed on Windows Server 2003 operating system. Unfortunately, Microsoft has ended the support for the Windows Server 2003 operating system on July 2014, but this date was eventually extended until July 2015. After this date, this product was no longer receiving security patches that help protect PCs from harmful viruses, spyware, and other malicious software, and users would be no longer receiving technical support from Microsoft on this product and no longer receiving software and content updates (Microsoft, 2017).

This makes it difficult for systems administrators to manage and update these servers. Additionally, the current network domain is on Windows Server 2008 domain level, which unfortunately cannot work well with Windows Server 2003 operating system.

II. Client operating system (for cheques printing, Windows XP OS).

It is understood that the system was designed to function optimally on Windows XP operating system, which unfortunately came to an end of support in April 2014. This challenge has resulted in the staff at different stations to write cheques manually for their customers, as new computers no longer come with Windows XP and GRN no longer issues and support Windows XP due to the end of support (TD-17, RES06, p. 12, 192, 2017).

III. Application and support

*"The NAMCIS application was developed in a proprietary computer language, by Forté Inc.,
under Sun microsystems which has now been acquired by Oracle Corporation in 2010"* (TD-17,
RES06, p. 12, 186, 2017). However, Sun has since declared the product's end-of-life, indicating
no future plans to continue the development of the product. Sun's official support of Forte
was scheduled to cease at the end of April, 2009. The support base for this application is very
limited and challenging to the IT division as there is no proper documentation for both
installation and support purposes. *"No training received. Most stations with NAMCIS are
experiencing functional/technical difficulties and as is the case with other Enterprise systems,
constant maintenance is crucial. The know-how is limited in terms of technical support. The
support base for NAMCIS application is very limited and challenges to us as a division as there
is no proper documentation for both installation and support. we no longer gets feedback from
the developers when an issue is brought to our attention and there are many challenges that
still pending and no one in the division is currently capable of fixing it"* (TD-17, RES06, p. 13,
192, 2017).

The IT division no longer gets feedback from the developers when an issue is brought to their
attention and there are many challenges that are still pending and no one in the division is
currently capable of fixing them.

Similarly with Stakeholder3 through their IT manager, it was found that Trafman of RA was
developed independently some time ago and key skills remained with the developers and
external consultants as per the analysis (TD-17, RES05, p. 12, 178, 2017). Additionally, RA's
internal ICT department is the first line of support. The second line of support of an external
consultant and lastly the third line of support is the independent software vendor or the
developer of the system (TD-17, 2017).

In addition, the legacy paper-founded capturing information systems presently being
employed to process and manage traffic fines has become a hindrance in data processing and
delivering real time data and providing timely clearances to offenders.

4.4.2. Consultant dependency

Since information systems and technology is considered to be a specialised field, in most cases skills transfer does not always take place as expected. This can be due to the systems complexities, and as such there is limited time for the organisations to learn, adopt and acquire the necessary skills about the technologies (Shaanika, 2015).

Shaanika (2015) further highlights that technologies in use in the GRN are either developed internally or they are outsourced. The motivation for outsourcing is due to the lack of technical know-how within the organisations. Outsourcing allows the organisations to acquire technological artefacts from other organisations that have the necessary skills and capabilities. This allows organisations to focus and concentrate on core functions and other projects they are capable of managing.

In this research, there was a little combination of each of the options aforementioned with the information systems in use within the respective studied cases. With Stakeholder1, their system (Trafman) has been acquired from the Republic of South Africa, through a consultant who now resides with them for escalated support and further system needs. *"The support is good and the consultant is working with us responsively. Yes we received training to manage and maintain the system. The source code is with us and there was skills transfer"* (TD-17, RES04, p. 11, 164, 2017). In this case outsourcing has taken a different angle as it also entails skills transfer by the consultants to the organisation's employees. This is usually done during the development and implementation process, whereby employees are involved and trained on how to use and maintain the technologies. However, the consultants do feel that they are the custodians of the application hence they should be the ones responsible for applications and systems maintenance (Shanika, 2015).

With Stakeholder2, their system (TCS system) has been developed internally yet through a consultant but the current IT department has no idea of the system and there is no much collaboration happening with the responsible unit. *"We don't own the system, it belongs to RA and we only have a PC where we only connect when required"* (TD-17, RES07, p. 13, 202, 2017).

What was also fascinating in this case is that the IT department has no idea that the traffic department has an internal system which they use to capture traffic fines related data, and this was different from what the network engineer claimed to know: *"Our system, tcs system,*

the court dates link us to the magistrate's court and we have a certain section only dealing with the court, the data section. The lady in charge of the data section keeps an eye on this. From the road, the documents come to us to be captured and she has to keep an eye on these court dates. Then she prints, for every court date, a certain number of control documents, about 200 per court date. She makes sure the control documents reach the court on time. Usually, they're sent a day before the court date. If people pay at the magistrate's court, they are supposed to tell the people to come clear their names at our offices after paying. Otherwise their names will still appear if they don't come. We also receive the status on payments made on a later stage from the magistrate's court and then we take it off" (TD-00, RES05, p. 19, 657-666, 2014).

Stakeholder3 falls in the same category as Stakeholder1 as they technically use the same system yet each one has its own copy and separate databases. Their manager pointed out that the *"RA internal ICT department is the first line of support. The second line of support is an external consultant, the third line of support is the independent software vendor or the developer of the system"* (TD-17, RES05, p. 12, 178, 2017). Again this gives consultants custodianship status assurance. In addition, Stakeholder3 system is technically hosted in South Africa, as they do not manage their licensing information*: "RA system license is still on leased terms from a South African company"* (TD-17, RES02, p. 7, 90, 2017). Lastly with Stakeholder4 (WMC), the silent responses from the Chief Clerk and System Administrator interviewed, there were serious challenges with this system from the beginning and the consultants that were from South Africa hold the organisation hostage as there was no proper (if any at all) transfer to them: *"The support base for NAMCIS application is very limited and a challenge to us as a division as there is no proper documentation for both installation and support. We no longer get feedback from the developers when an issue is brought to our attention and there are many challenges that are still pending and no one in the division is currently capable of fixing them"* (TD-17, RES06, p. 13, 192, 2017). This has a severe effect on the relationship among the organisation's teams and the consultants. As such, some people do not completely cooperate and this negatively impacts skills and knowledge transfers within the organisation. Therefore, the organisations are continuously influenced by the consultants for support and advice.

4.4.3. Collaboration

Collaboration within and externally is regarded to be one of the significant aspects for ICT success. Shaanika (2015) states that collaboration is important as corporate units are reliant on each other when carrying out decisions and activities.

Interviewees have shown that collaboration matters differently and acknowledged that they are of significant importance and they have a huge influence on implementation. This could be collaboration within organisations and between stakeholders in this case. Of course, not ruling out the nature of some stakeholders such as Stakeholder2: *"Because of the police act - for security reasons, we only assist in technical matters, e.g. when there's a network issue or PC problems"* (TD-17, RES07, p. 14, 206, 2017). Though this is acceptable, this is a huge factor as it can create unrealistic expectations and implementation of information systems: *"So far it has been just talks but nothing has happened due to lack of mandate to control traffic management. Also, the IT department feels like they should take over all systems but unfortunately the executive level feels otherwise and also police setup is uniform, due to security reasons and we're merely civil servants"* (TD-17, RES07, p. 14, 208, 2017). This revealed that lower level and specifically the IT department in this case of the organisational structure feel that the executive level discusses matters of concern about information systems without involving them. Thus, instructions were carried out without proper collaboration.

Likewise, from Stakeholder3, lack of collaboration has been shown: *"It is a fight which we have been fighting for the last 10 years. The two parties couldn't yet agree on the ownership and accountability of expenses to be incurred and information security aspects"* (TD-17, RES02, p. 6, 74, 2017). *"However the last meeting we attended indicated that there are responsibilities, accountability and ownership issues between the two agencies that need to be agreed upon before systems integration can take place"* (TD-17, RES02, p. 7, 90, 2017). Both statements are all collaboration issues between stakeholders. Similarly with Stakeholder1 said that: *"We are not aware of NAMCIS neither Trafman for RA"* (TD-17, RES04, p. 11, 160, 2017). In conclusion regarding this important aspect of integration, none of the IT departments interviewed within the respective stakeholders knows each other's information systems and platforms that are in place. Information systems and technologies' implementation success depends on how they are communicated, interpreted and collaborated between various stakeholders.

4.4.4. Skills development

To effectively manage information systems and technologies, competent skills are mandatory to every staff and department responsible as a whole. The research revealed that there is a low skills development or even skills transfer within some stakeholders as described next. This has been revealed from both the system usage and technical support base perspectives.

Regarding system usage, Stakeholder3 has done very well on their internal policy for new recruits: *"Yes, training is a must and it is part of the employment process and you only get appointed if you pass the test"* (TD-17, RES02, p. 7, 88, 2017). In contrast, Stakeholder4 key users felt that theirs is limited: *"Not really, some of the people didn't get any comprehensive training, but we do provide on the job training"* (TD-17, RES03, p. 10, 2017).

Similarly on support skills, some stakeholders felt that they receive sufficient skills transfer: *"The support is good and the consultant is working with us responsively. Yes we received training to manage and maintain the system. The source code is with us and there was skills transfer"* (TD-17, RES03, p. 11, 164, 2017). During the analysis, it was a struggle to understand the said statement due to the fact that they still remain reliant on consultancy support. The observation includes Stakeholder3 as well: *"The RA internal ICT department is the first line of support. The second line of support is an external consultant; the third line of support is the independent software vendor or the developer of the system"* (TD-17, RES03, p. 12, 178, 2017). In contrast, other stakeholders feel that training (skills development) is not sufficient: *"No training received. Most stations with NAMCIS are experiencing functional/technical difficulties and as is the case with other Enterprise systems, constant maintenance is crucial. The know-how is limited in terms of technical support. The support base for NAMCIS application is very limited and it is a challenge to us as a division as there is no proper documentation for both installation and support. We no longer get feedback from the developers when an issue is brought to our attention and there are many challenges that are still pending and no one in the division is currently capable of fixing them"* (TD-17, RES06, p. 13, 192, 2017). Likewise this is the same for Stakeholder7 where they explicitly stated: *"No training received . . . because of the police act - for security reasons. We only assist in technical matters, e.g. when there's a network issue or PC problems"* (TD-17, RES07, p. 14, 206, 2017). Skills development is a crucial aspect in systems implementation, it ensures that the IT departments are specialised enough to be able to manage respective information systems and technologies effectively.

4.5. DISCUSSIONS

The factors identified in section 4.4 and noted as findings of the research focused and were concerned about information technology aspects (noted as internal), which this research pursued. However, there are others which are outside IT (external) and are non-technical related that have a potential impact in determining the success of systems integration within this case study. Some are derived from the analysed data presented in section 4.2 and some through the literature that was reviewed and explored. These include jurisdiction issues, interoperability status and organisational alignment.

I). Jurisdiction

According to the Road Traffic and Transport Act 22 of 1999 (annotated), only the Roads Authority has the mandate to control and manage public roads, including traffic control in Namibia. This leaves the City Police and NAMPOL to be merely playing the role to assist in apprehending offenders and the administration aspects but with no power to set rules or regulations in management i.e. information processing and sharing or systems change. However, the Roads Authority has not been fully expanding their authority to fully support the traffic control and management process, especially in leading the traffic fines handling with involved stakeholders.

This state of affairs clearly conflicts with the resources available and the ownership of issues towards control i.e. in Windhoek, according to the System Administrator at CoW, the traffic lights (robots) belong to the City and they manage them and yet they do not have the mandate to make rules, e.g. integrate it with the Magistrate's Courts, neither with the Roads Authority. On the other hand, the Roads Authority has a full mandate to rule on all public roads infrastructure and yet they do not own any monitoring resources (in this case, e.g. traffic lights) in any town or city. The magistrates' courts do not manage any road resources or facilities and yet they receive and process payments (revenue) and issue the ultimate clearances of road offenses.

In addition, the Act doesn't allow any permission in the management of or involvement in other districts' matters. Meaning that it is unlawful to manage another town/city's affairs that is in a different region (jurisdiction). This state of affairs gives no room for central information management. Both NAMPOL and Roads Authority officials have confirmed that there have been talks going on for the past 10 years between different stakeholders in recommending

for an amendment of the Act to allow the centralisation of information management, but nothing has happened yet.

Moreover, both the Roads Authority and Magistrates Courts' information technology departments are managed and operated by non-combatants, and for predictable national security reasons, both NAMPOL and the City Police department strongly feel that this state of affairs is a threat to information security and an exposure of their operations. The officials from both NAMPOL and City Police highlighted this concern as the key basis of delay in integrating their information systems with other stakeholders.

And lastly, the research noted that there are concerns from the different stakeholders regarding data ownership upon integration. Who will be the owner of the data? All necessary regulations need to be in place and accepted by all key stakeholders.

II). Interoperability

Hannes (as cited in Astok, 2015), states that interoperability is both a prerequisite for and a facilitator of the efficient delivery of systems integration. Hannes (as cited in Astok, 2015) defines interoperability as the ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals. Interoperability involves the sharing of information and knowledge between the organisations through the business processes they support, and by means of exchanging data between their respective ICT systems. The research identified the assessment criteria to determine the success rating for integration solutions as a possible response for the problem we have in the traffic fines payment and management departments.

According to the Economist Intelligence Unit, in co-operation with IBM Institute for Business Value, E-readiness is an extent of the quality of a country's ICT infrastructure and the capability of its users, businesses and governments to utilise ICT to their benefit (IBM Institute, 2009). As a result, based on the following key layers of interoperability specifically for this case as per the HPP, the research established that Namibia is e-ready and there should be no reasons not to integrate systems.

▪ Technical context

The situational analysis with GRN presently has been well documented. According to the HHP availed by the Office of the President, Namibia has been linked to the West Africa Cable System (WACS) since 2012. This connection is intended to carry increased broadband

capacity, and enhance the acceptance of internet-based services and internet access across the country. The GRN network backbone infrastructure has been redesigned and it is being advanced to be able to transport the bigger bandwidth capacity of 600 Megabits per second (Mbps) from WACS, and enable smooth Government service delivery in all the regions (Office of the President, Republic of Namibia., 2016). Such infrastructure will make it possible for the implementation of integrated systems and facilitate the decentralisation of services. Despite the aforementioned different challenges on the technologies that are available, the overall development of technical issues involved in linking computer systems and services are considerable, and the detailed meaning of semantics seems preserved and understood by all parties.

▪ Political context

This context guarantees that involved partners with compatible visions, aligned priorities and focused objectives are addressed. GRN has shown a clear vision in ICT development and prioritising. The MICT under the leadership of the OPM has established over 25 multi-purpose community centres in all regions nation-wide which are provided with basic ICT equipment to make sure that the digital divide is abridged through the introduction of ICT facilities to rural people. Namibia has progressed in the expansion of established telecommunications, dissemination and postal infrastructures; however there are still challenges that need to be explored and addressed collectively. The vision for installing ICT services in the country is great, yet this involves ground-breaking methods and combined determinations from all stakeholders.

▪ Legislative context

With the purpose to align legislation so that exchanged data is rendered appropriate with some legal weight, the GRN established CRAN to guarantee acceptable regulations of the ICT segment, which in turn encourages the accessibility and openness of communications, mail and ICT facilities at reasonable charges.

Hannes (as cited in Astok, 2015) indicates that the key component of the integrated systems is that data can be exchanged efficiently and safely. For this reason it is suitable to adopt a legal act that sets out the functioning of the data exchange system, which can be done in the

form of a regulation or similar. Also importantly, there needs to be standards for databases so that they can be interoperable and such standards should be supported by the law.

The law in question can be for example the law on public information or similar, i.e. it does not have to be a separate law on databases only. For the actual exchange of data, agreements are needed between the different stakeholders that hold and use data. There can be multilateral agreements and bilateral agreements made on the basis of standard agreements or similar. Currently, any exchange is made based on the established manual process of back to back processing of each offense.

III).Organisational alignment

It is significant that organisational processes are also aligned and those involved share a common understanding to enable systems integration. The following two organisational aspects are found as alignment needs that should take place for the effectiveness of the integration;

▪ Processes alignment

It was found that stakeholders need to regulate procedures to ensure that traffic fines information is documented in a uniform and appropriate method.

▪ Communication and decision-making

This aspect has been alluded to by half of the parties involved, as they indicated that communication flow between the organisations is unnoticed and it does affect the service delivery in traffic fine processing. It is understood that decisions that have a high potential impact are made in isolation from organisations without communicating with all the concerned stakeholders, and conversely, there are developments of hesitancy in leading major decisions and so it delays progress and new improvement opportunities.

The following figure (figure 5) depicts and summarises the factors of significance to the development of systems integration.
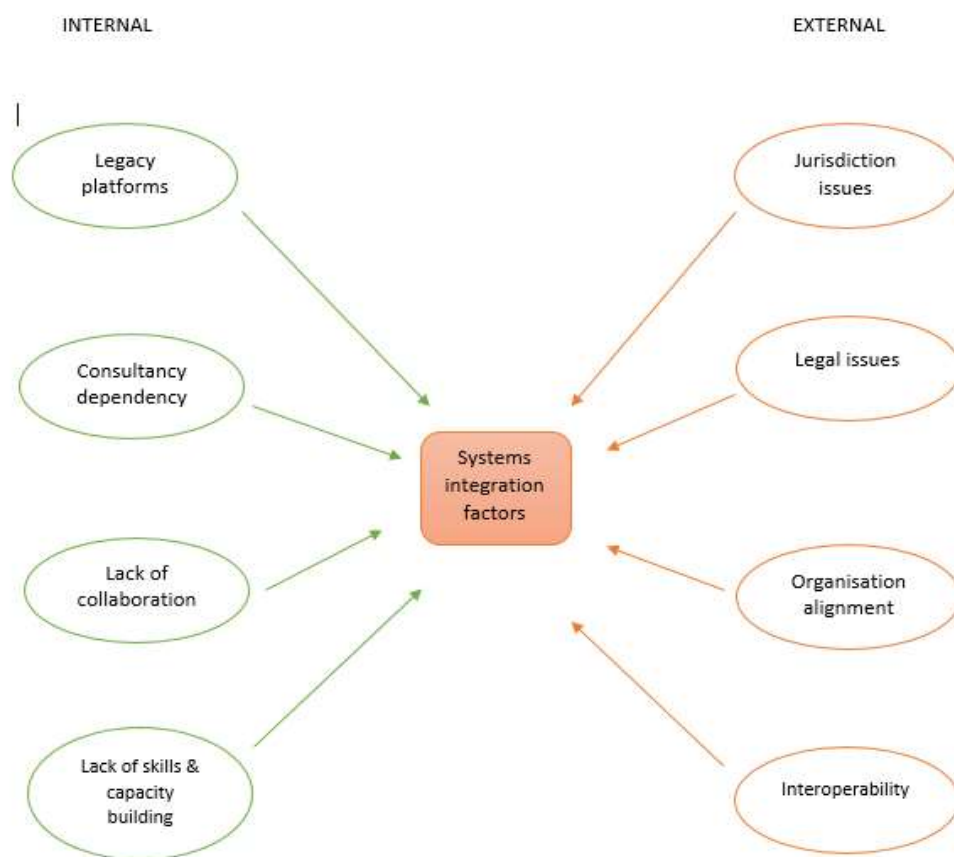
Figure 5: Factors influencing SI implementation in Namibian traffic units

4.6. PROPOSED FRAMEWORK

Based on the understanding of interpreted data in section 4.2, the analysis done and the findings of the research, a framework was designed and it is presented in figure 6. The aim of the framework is to assist with the implementation of integrating the various information systems in the different traffic fines management units, and with the purpose of having an effective and adoptable centralised system that can be used for traffic fines management and payment in the Namibian context.

The elements of the framework presented are derived from the most critical factors which influence integration in organisations as highlighted in the data analysis section.

The factors are considered critical because of their impact and importance in the implementation of systems integration as revealed from the analysis of the case studies. All the elements presented in the framework are interconnected and influenced by each other. They are grouped into competency development, system platform, governance and collaboration and they are unpacked further.

The framework was designed based on the interpreted data and research findings. The following steps was used for the designing;

1). Recorded the various themes of key issues and words classified in figure 5 as per the data analysis done,

2). Generated and redefined themes pertaining to the key aspects in step 1,

3). Depicted the different themes and with facts emphasised for each aspect, and lastly,

4). Created links of influence between the identified themes.

The framework design is depicted in figure 6 and the elements are briefly presented next.
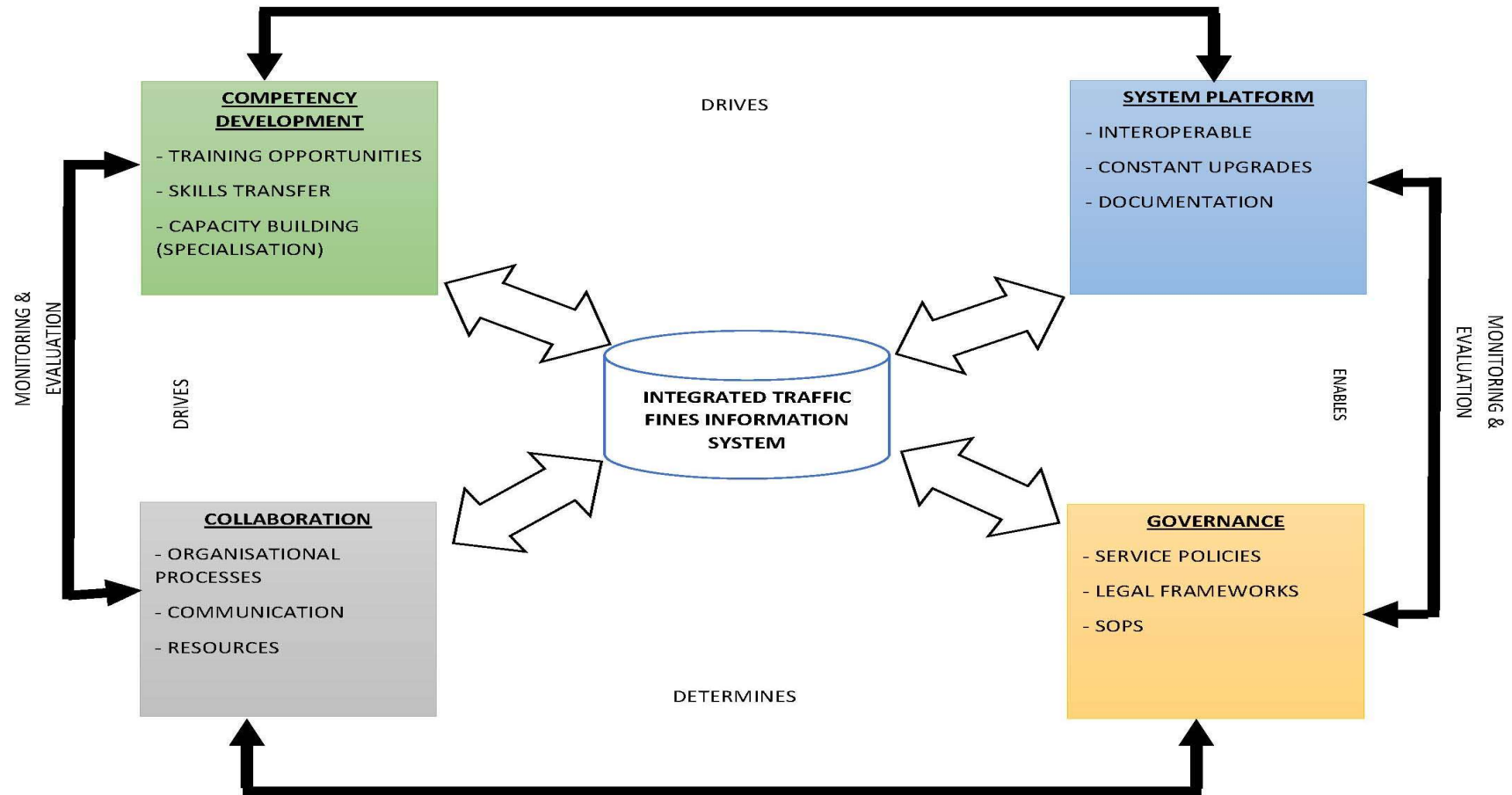
Figure 6: Integrated Traffic Fines System Framework

I). System platform

This element represents the core parts of the integrated system, which may consist of an interoperability framework, system architecture, and constant system enhancements policy documentation.

II). Competency development

This element of the framework characterises the skills opportunities that are required to maintain the systems platform, which is the drive for every system implemented. Shaanika (2015) interpreted Ahlemann et al., (2012) who state that having the right team, with the right skills, in the right roles and responsibilities, and doing the right stuff in a correctly authorised method is crucial for enterprise architecture benefits realisation, which are pillars for systems integration.

IT skills competencies are crucial to the success of systems integration and this may involve training opportunities for specialisations such as systems administrators or engineers, who would be centrally managing the system platforms and all major technicalities, and policy makers who are responsible for the evaluations and monitoring needed following the set standards, procedures and guidelines.

II). Governance

Governance in this case may refer to service policies and agreements between stakeholders or with third parties. This may as well include legal frameworks and standard operations procedures (SOPs) for the system. Additionally, prominent internationally established standards and guidelines that govern the IS industry and ICT as a whole are recognised.

IV). Collaboration.

The collaboration between competency and governance determines and drives the success of integration. This may include clarity on resources availability, communication plans and policies within and between all stakeholders as fundamentals in which members show their satisfaction and frustrations.

4.7. CONCLUSION

The chapter presented the aim of the research, which was to design a framework which could assist in the implementation of integrating these various systems. An understanding of the involved information systems together with key processes in traffic fines management was sought. The following chapter presents the conclusions and recommendations of the research.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1. INTRODUCTION

This chapter presents the final conclusion of the entire research. The chapter is divided into four sections. The first section covers the introduction of the chapter. The summary of the research results and recommendations are presented in the second and third sections, respectively. In the fourth and last section, the conclusion is drawn.

The research has satisfied its primary objective of designing a framework for integrated traffic fines payment and management systems involved, with the purpose of having an effective and efficient centralised system that can be used in Namibia. The findings also provided adequate evidence for the observation that the traffic fines processing at the moment is bulky and that it has a bottleneck which impacts on how activities are recorded, managed and cleared.

5.2. SUMMARY OF THE RESEARCH RESULTS

The findings of the research are driven by the research objectives. The primary objective of the research was to design the framework as mentioned in the introduction and presented in Chapter 4, section 4.4. In this section, the findings are summarised based on the three sub-objectives of the research and concluded by revisiting the research questions.

Research sub-objective 1: The first sub-objective was to analyse existing information systems used for traffic fines. As presented in Chapter 3, there are currently three (3) traffic control and law enforcement agencies that can issue traffic fines in Namibia (NAMPOL, RA and WCPS). Through this objective, the research was motivated and compelled to explore the different information systems of the different stakeholders involved. This objective assisted in determining a starting point in answering the main question of the research on how the traffic fines management systems can be integrated to have a centralised system for traffic fines management and payment in the Namibian context? In an attempt to answer this question, one has to research the state of the systems in their current form and fully understand what is going on with all of them and how they are related to each process in the traffic fines management. Here we learned of the three (3) processes involved in the traffic fines management (issue ticket, pay/appear in court, cleared or apprehended) with the purpose to determine information systems involvement. The first process has little

involvement, while the second process only has one stakeholder (Magistrate's Courts) involved, and altogether they are involved in the last process.

Research sub-objective 2: Evaluate technologies and methods used for Information System Integration. With the guidance of the explored literature, together with experimentation experiences revealed in the literature, the enterprise service bus architecture was the most viable method for this setup, and this is in relation to the analysed data from different groups of elements as described in the data collection section in Chapter 3, section 3.4 and Chapter 4, section 4.2, respectively.

Research sub-objective 3: Design a framework for integrated traffic fines.

The framework has been designed as shown in Chapter 4, section 4.4 and the four major findings (also in Chapter 4, section 4.3) of the research have been the guiding elements; Legacy platforms, consultancy dependency, lack of collaboration and lack of skills and capacity building.

REVISITING RESEARCH QUESTIONS

The main question of the proposed research was: how can the traffic fines management systems be integrated to have a centralised system for traffic fines management and payment in the Namibian context? This was the driving question of the research and the entire Chapter 4 was aimed at answering this question. However, it would be vital to mention that systematic methods were the initial steps in answering this question and together with findings, this question was boldly addressed and also led us to additional questions, and the questions which are highlighted as follow were also explored within this research.

Research question 1: How are the existing information systems challenged to manage and issue clearances? The brief answer to this question would be bureaucracy and the isolated systems involved. As explained in the first chapter, a payment is commonly the initial fine that is demanded to clear any traffic fine offence. However, in case of non-payment, another route can be added to the clearance process, which is to open a criminal case if the offender does not pay the fine within the given time period (pay date) or after fourteen days of the trial date. However, a lot of time is lost, for example, the capturing of tickets on its own has much physical work to be done, with all the data required for the ticket and then sending copies to

the magistrate's court for another capturing process in another isolated system. Clearance from the current system includes many procedures which certainly can cause people to forget or to pay courtesy to their violation or directive.

During the issuing of ticket fines, offenders are informed and requested to go and make their payments at the respective district magistrate's office where the offense occurred, at the traffic office department (Windhoek offenders only) or pay through the post office in the form of a telegram country wide. If the offender pays before the expiry of the stipulated on the issued ticket or before the end of the fourteen days period, he/she will be issued with a receipt as proof of payment document and advised to go and present it to the respective agency for their names to be cleared from that local system and once the clearance is done, then the case is closed and no further action is required from either stakeholders. If they do not go and present their proof of payment, their names will still appear in the system and if they get stopped by a traffic officer, they can still be apprehended if no proof of payment is presented. This research question led the research to draw out a couple of questions regarding the user's expectations and the acceptable technologies leading to fines management and clearance issues. Key in this aspect is that the centralisation of clearance is needed with real time data processing.

Research question 2: What methods are available for systems integration?

This was the driving energy question on exploring and understanding literature on the methods of systems integration available and most importantly, whether these are feasible for the Namibian environment. This question pointed the research to explore two (2) general architectures through which the systems can be integrated, either through point-to-point or using middleware. Middleware was mainly the feasible architecture chosen, and which tipped the research to explore the nine (9) technologies (vendors) available in the market. However, bus architecture was chosen based on its versatility and capabilities in this modern age.

Research question 3: How can integration of information systems address the problem(s)?

With the different methods and technologies explored, the research fully expects the integration of these systems to be a great accomplishment for Namibia as a nation in service delivery optimisation. For example, centralisation would hasten the capturing, processing and

management of information required for every process within the traffic fines departments, while real time data processing would provide immediate requests and transactions done by either stakeholder. The framework presented in Chapter 4, section 4.4 is the central point for this question.

5.3. RECOMMENDATIONS

The research is recommending upcoming researchers to deliberate on all aspects that were not covered in this research for them to be included in forthcoming research. Future research on implementing semantic interoperability between the different information systems should be explored to ensure data standards across the systems. The framework presented in this research should also be further polished. Furthermore, an IS legal framework should be explored and embraced, with the aim to make standards clear, for example making an e-transaction (how do motorists verify payments or how do you know that an electronic signature is a clear expression of will? And issues of obligation and liability must be clear so that it is identified from whom accountability can be asked - who must do what and who is responsible if something goes wrong?

5.4. CONCLUSION

The research has evaluated different technologies of information systems integration and designed a framework to assist the implementation of integrating the four (4) various information systems of traffic fines management, with the purpose of having an effective and acceptable centralised system that can be used in the Namibian context. Within information systems, the significance of addressing interoperability concerns surrounded by existing systems is widely acknowledged in this research. Another fundamental aspect is to permit the four (4) different information systems of traffic fines departments to interchange information in a persistent and reliable manner, though they are technically and geographically dispersed. The research identified the different methods for integrating systems with numerous lists of technologies and ethics for supporting interoperability between the incompatible information systems. The research proposed a framework based on enterprise service bus architecture which has some advantages and is viable for this setup.

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APPENDICES

APPENDIX A

Traffic fine payment system satisfaction questionnaire

Please click where appropriate

Q1. What is your gender?

    a) Male

    b) Female

Q2. In which area were you issued a fine and liable?

    a) Windhoek

    b) Okahandja

    c) Rehoboth

Q3. Overall, how satisfied or dissatisfied are you with the current traffic fines payment system?

    a) Very satisfied

    b) Somewhat satisfied

    c) Neither satisfied nor dissatisfied

    d) Somewhat dissatisfied

    e) Very dissatisfied

Q4. How long did the process take to pay the outstanding fine?

    a) Less than 30 minutes

    b) About 1 hour

    c) Between 1 hour and 2 hours

    d) More than 3 hours

    e) 24 hours

Q5. What type of payment options are available to you? (Select all that apply to you)

    a) EFT

    b) Cell phone/Mobile Payment

    c) Cash Payment

    d) Point of Sale

    e) All of the above

    f) Other (please specify)

Q6. How long does it take to receive full clearance after paying?

a) Immediately after paying

b) Before close of business day

c) After 24 hours

d) After 1 month

e) I do not remember

Q7. How does the traffic fines department communicate with you, when owing a fine?

a) Normally everyday

b) Once a week

c) Bi-weekly

d) At least once a month

e) None

Q8. How would you like the traffic department keep in contact with you?

a) Call

b) SMS

c) E-mail

d) Mass media

e) Other (please specify)

Q9. How would you like to pay your fine in the future?

_____

_____

_____

Q10. What suggestions can you provide for the traffic department to better their customer support?

_____

_____

_____

APPENDIX B

Interview questions

Interviewee: Law enforcement agencies (Nampol, City Police/Traffic Management Department And Roads Authority)

1. What are the processes involved when traffic fines are issued to the offender?

1.1. How is a traffic fine issued?

-Do you give the same fine? is there any conflict between you and other agents?

-Do you use the same system ?

-Who are the law enforcement agents that can issue a fine?

-How are the fines paid?

-Who is involved in the documentation of the fines?

1.2. What are the different types of traffic fines?

1.3. How and where are the fines documented?

-Who is documenting the fines?

1.4. How are the offenders contacted?

Interviewee: Magistrate's ticket/fines departmentt/Law enforcement agencies

2. How are defaulters cleared from the current system?

2.1. How are the fines collected enforced?

-What is the grace period that is given to the offenders?

-Do you give the same grace period to all types of offenders? If yes, why? if no, why not?

-Who is involved in the collection of fines?

-How are the fines collected?

-Who is involved in concluding (close the file) fines cases?

-How is the conclusion of the cases done?

-What does it take to close a case?

-How is the communication (liaising) with the offenders carried out?

-Who is responsible for the communication on behalf of the traffic office?

-Are the communications documented? if yes, how is it done? if no, why not?

Interviewee: *System managers from the stakeholders*

3. How are the existing information systems challenged to manage and issue clearances?

- What can you say is the challenging aspects in the current system?

- Have you received training?

- How is technical support base?

4. What methods are available for systems integration?

- Is there a specific way you wish can be done for these systems to talk to each other?

- Any party currently doing consultations on possible solutions?

5. How can integration of information systems address the problem(s)?

- Do you foresee the proposed solution is the ideal answer to the issue, elaborate more please?

Interviewee: *Information systems administrators from each respective stakeholder*

Your designation title:

6. Please provide the following of your management information system related or use by the traffic department.

   ▪ System name and well known acronyms:
   (If possible, please provide me with even one screenshot of your default page of the system.)

   ▪ Operating system/development platform:

   ▪ Database vendor and version:

7. In your own views, how is your system challenged to integrate with other traffic information management agencies. E.g. **Magistrate's Court, NAMPOL** and **City Police**?

8. What can you say is the biggest challenging aspects in the current system?

9. How is the technical support base on the current system and did you receive training?

10. Any plans for an upgrade or new system in the pipeline?

APPENDIX C
"The 56 Ticket" – NAMPOL

"The 56 Ticket" – WCPS

APPENDIX D
"The 341 ticket"

Front

Back

APPENDIX E

APPENDIX E: Transcribed Data [TD-17]

Interviews were conducted at NAMPOL, Windhoek City Police, Roads Authority traffic management departments, and lastly, the Windhoek magistrate's court traffic tickets payment & management department, and brief interviews with every stakeholder's information technology (IT) department. 8 (-1 not transcribed) interviews in total were conducted as follows:

RES01 - Chief Inspector at NAMPOL Traffic Management Department.

1. Researcher: Thank you very much for your time Chief, the purpose of this interview is to find ways to assist the traffic department in traffic fines management and payment. Could you take me through on the process of issuing a ticket fine and the clearance process?

2. Interviewee: Okay. The issuing of tickets, is all in one process which an offender is informed that there is a date of trial and they are having two (2) options; whether to make a payment if she or he agreed that they at fault, and if they do not agree then there is a court date on the ticket as an option to appear in court to explain why they think the ticket fine was wrongly issued. Then the traffic officer have to complete the fine by capturing the particulars of the
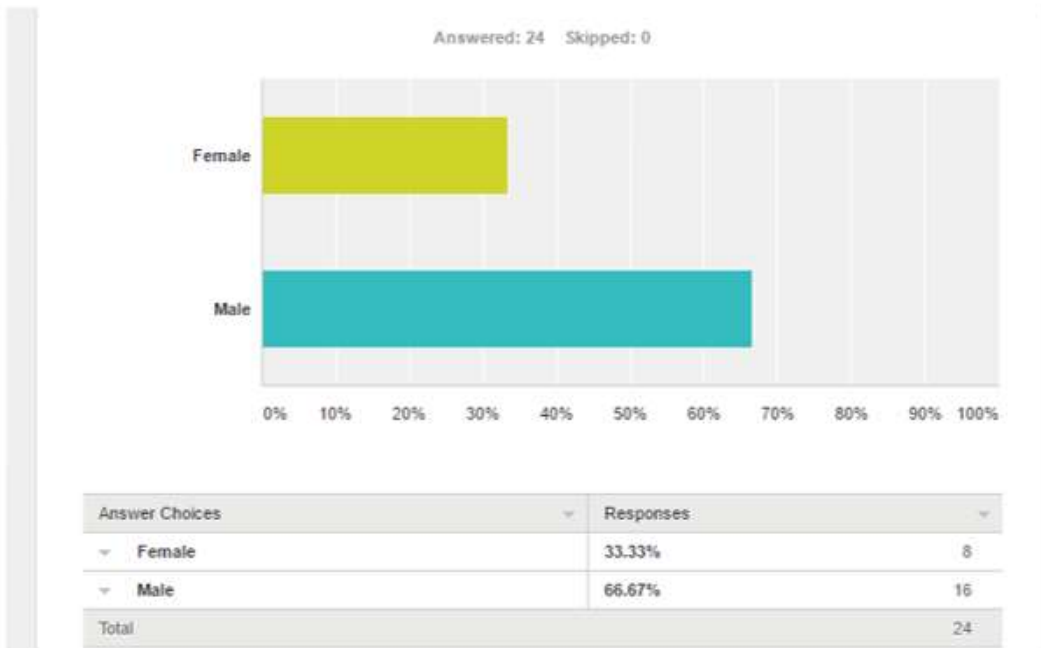
17. Researcher: How does your office make contact?

18. Interviewee: We do phone them or SMS, though people do ignore. The best option is calling them then you make remarks whether you spoke to the person or not. The other option is we go to the person's home or work address and look for the person, and tell them they got a warrant of arrest and ask them when they can come pay.

19. Researcher: But then is the purpose of calling to arrest them or notifying them to come pay?

20. Interviewee: No, that's why I say we have two (2) options. First, if we receive warrant of arrest we let you know. We are not going to arrest you that time, we assume perhaps you forgot. So, we let you know that you have warrant of arrest with this amount, so when can you come make a payment? After that, if you fail now to make a payment then we come and arrest you.

21. Researcher: Okay. The idea is the have effective notification ways and maybe often close to pay date because most people simply forget the payment date on the ticket. How long is the ticket period now?

22. Interviewee: It depends but normally we give two (2) months in between.

23. Researcher: Okay. Do you think something like that (notifications) could assist in preventing this issue and prevent warrants of arrest?

24. Interviewee: Yes. Currently we collaborating with the city of Windhoek police officers,

APPENDIX F. Screenshot01 - Diagram 1.

Answer Choices	Responses	
Female	33.33%	8
Male	66.67%	16
Total		24

APPENDIX F. Screenshot02 - Figure 1.

Page 1 of 10

95

APPENDIX G

namibia university
OF SCIENCE AND TECHNOLOGY

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Department of Informatics

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11 October, 2016

To: Whom it may concern

Re: Permission to carry our research on Management of Traffic fines and an integrated fine system

This serves to confirm that Mr Michael Fikameni Hamatwi – student Number (**200304623**) is a registered Master of Informatics student at Namibia University of Science and Technology within the Informatics Department.

Mr. Hamatwi is carrying out a Master of Informatics research entitled: **Implementation of an integrated traffic fine payment management system: a case of Namibia**. The research problem is based on the following: the inflexible management of traffic fines with existing information systems, the delays and deficits in issuing clearances to offenders. The problem could be initiated by a variety of factors such as: traffic fines can be paid only at designated locations, such as the magistrate's courts, traffic department and post office. Then, the management systems are not centralised. This means that offenders can avoid their fines should they relocate. And finally, when an offender pays his or her fine, their records remain and reflect the same as offender until they physically visit the offices of the traffic department for clearance. The research objective is **to design a system with the integration of information systems for traffic fines management and payment, which could be used to support the effective management of traffic fines and payment in the Namibian** context. The research intends to address the following questions: Examine and understand the information systems involved for each process.

- Explore and define the methods to be used for guiding the integration of information systems.
- Design a system model with the integration of information systems.
- Implement an application prototype for simulation purpose, as proof of concept.

As, the research supervisor and the HoD of the Department where the research is been undertaken, I am kindly asking for your permission to allow Mr Hamatwi permission to carry out his research. He intends to engage stakeholders involve in the traffic payments such as: Windhoek magistrate's court, Namibian police traffic department (NAMPOL), Roads Authority (RA), Windhoek city police traffic department and general motorists from Windhoek city, Rehoboth and Okahandja towns. Selected participants through a random sample will be interviewed and issued a short questionnaire.

The success of his research relies on your support and participation in this research. All the findings and information collected during the research will be used for academic purposes and only for related academic publications. The participation in the research is voluntary and no one is forced to participate. Kindly support Mr Hamatwi for him to achieve his dream as he proposes a solution that will assist in bringing more efficient ICT solution to the Namibian government and citizens.

Feel free to contact me if there is need for any clarification. Thank you.

Dr Nobert Jere

Namibia University of Science and Technology
Senior Lecturer (HOD)
Informatics
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2016 -10- 13

FACULTY OF COMPUTING & INFORMATICS
DEPARTMENT: INFORMATICS

APPENDIX H

12-0/0001

REPUBLIC OF NAMIBIA

MINISTRY OF JUSTICE

Tel.: (061) 280 5111

Fax: (061) 230 868

Enquiries:

Our Ref.: .... Your Ref.: ....

Private Bag 13302
WINDHOEK

TO: THE PERMANENT SECRETARY

FROM: DEPUTY DIRECTOR COURT ADMINISTARTION LOWERCOURTS

DATE: 2 APRIL 2014

NAMCIS PROBLEMS AT THE MAGISTRATE'S OFFICES WALVIS BAY, USAKOS, KARIBIB AND OMARURU

The Permanent Secretary's approval is hereby required to allow ████████ Former NAMCIS Developer and ████████████ Analyst Programmer to travel to the Magistrate's Offices Karibib, Omaruru, Usakos, Omaruru and Walvis Bay in order to attend to NAMCIS problems during April 2014.

It has been reported that NAMCIS does not want to back up the data which were recently entered on the system at some of these offices. The other problem is that whenever cheques are printed, there is always a strange symbol which appears between the figures on the printed cheques which results the cheques to be rejected by the banks. IT have tried on several occasions to solve these problems, but they have not succeeded.

In view of the aforementioned, it would be appreciated if this request could be favourably considered.

Approved/not approved

03 APR 2014

PERMANENT SECERETARY

All official correspondence must be addressed to the Permanent Secretary.

REPUBLIC OF NAMIBIA

MINISTRY OF JUSTICE

Tel: (061) **2921407**
Fax: (061) 238492
Enquiries: _____
E-mail:

The Magistrate
Private Bag 13181
Windhoek
30 June 2014

Ministry of Justice
Independence Ave
Justitia Building
Windhoek

ATT: _____

SUBJECT: PROBLEM WITH NAMCIS

Referring to above-mentioned subject, we are facing serious Namcis problem at our office. The magistrates cannot make orders on some of the cases and at the end of the day we are unable to make bail refunds or a fine payment that is made in court. I did talk to Mr _____ and he was here but the problem is still unsolved.

If possible please give authorisation to Mr _____ to come look in to this matter and for him also to show Mr Idi what to do if something like this happen in future.

I hope that you look in to this matter and come back to me because it is an urgent matter and we are sitting with the cases at this moment.

Thanking you in advance

_____
Supervisor
Criminal Process

MINISTRY OF JUSTICE
CLERK OF THE COURT
LUDERITZ DTR

30 -06- 2014

P_____ BAG 13181
_____