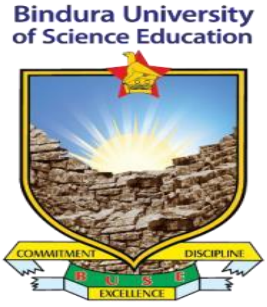

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE
GRADUATE SCHOOL OF BUSINESS (GSB)
'Where Great Minds Meet'

MASTER OF LEADERSHIP AND CORPORATE GOVERNANCE (MLC)

DEVELOPING AN INTELLIGENT SYSTEM FOR INVESTIGATING CARD CLONING FRAUD IN ZIMBABWE.

BY

BLESSING MUDZINGADUTU

[B1542847]

SUPERVISED: DR MAZHAMBE

A DISSERTATION SUBMITTED TO BINDURA UNIVERSITY OF SCIENCE EDUCATION (BUSE) IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR A MASTER OF LEADERSHIP AND CORPORATE GOVERNANCE (MLC) DEGREE QUALIFICATION.

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APPROVAL FORM

The undersigned certify that they have read and recommended to Bindura University of Science Education (BUSE) for acceptance a Dissertation entitled **"**DEVELOPING AN INTELLIGENT SYSTEM FOR INVESTIGATING CARD CLONING FRAUD IN ZIMBABWE**"** by **B1542847 BLESSING MUDZINGADUTU** in partial fulfilment of the requirements for the degree of Master of Leadership and corporate Governance (MLC).

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DECLARATION

I, BLESSING MUDZINGADUTU Registration Number B1542847, do hereby declare that this dissertation, "Developing an intelligent system for investigating card cloning fraud in Zimbabwe," is a result of my own investigation and research, except to the extent indicated in the acknowledgements, references, and comments included in the body of the report, and that it has not been submitted in part or in full for any other degree to any other university.

03/12/24

STUDENT SIGNATURE **DATE**

DEDICATION

This dissertation is dedicated to my wife and my kids Gladys N Mudzingadutu, Anotida, Nokutenda and Atipaishe Mudzingadutu who has been my source of strength and inspiration. their steadfast support brought success of this study to completion. They suffered economically due to the money that was redirected to paying school fees.

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ABSTRACT

The study aims to Develop an intelligent system that can be used by investigators in the investigation of Card cloning Fraud. Business community and individuals continue to lose their valuable property through criminals who specialise in cloning debit card. The Bankers Association of Zimbabwe and the Zimbabwe Republic Police continue to look for effective ways of fighting Card cloning fraud. Criminals are taking advantage of technological advancement and manipulate the payment systems available in the country. They are skimming the debit cards to steal information which they will then use for criminal purposes. In an effort to fight Card cloning Fraud, the ZRP adopted several crime prevention initiatives such as use of informers and contacts, target hardening, profiling of known criminals and linkage analysis but the detection rate is very low. Linkage analysis is one of the pillars of intelligence led policing which can be used to develop an intelligent system for investigating card cloning fraud. It emphasis on a pro-active approach in fighting crime through gathering, recording and examination of different crime scenes in order to identify crimes scenes with identical modus operandi. Linkage analysis can be used on different crimes like murder, unlawful entry and theft among others. In this study linkage analysis was examined to determine its impact on Card cloning fraud. Card Cloning is a crime that is known in other countries as a type of credit card fraud where a criminal copies a legitimate card in order to steal it and is also known as Card skimming. In Zimbabwe it is defined under section 167 of the criminal law codification and reform act Chapter 9:23. Linkage analysis has been used to link crimes of card cloning for quite some time by the Zimbabwe Republic police but no known recorded success in its use is in place unlike other crime like murder and robbery. It is against this background that the researcher sought to develop an intelligent system for investigating card cloning fraud. A mixed positivist philosophy has been used in this study. A descriptive survey was used as an appropriate research design. A stratified random and judgmental sampling methods were used in this study. The sample comprised of 80 participants extracted from a research population of 200 detectives stationed at Commercial Crime Division (CCD) headquarters in Harare. Questionnaires and interviews were used to collect primary data from the selected sample. Secondary data was collected from crime registers of the Commercial Crime Division. Collected data was analysed using statistical package for social science research (SPSS) software Version 27. It was presented in the form of pie charts, graphs and tables. The study highlighted that linkage analysis assist investigators with possible suspects linked through behaviour patterns, location of suspect, modus operandi, targeted victims and property. Geographical, intelligence and victim profiling are moderately used in the investigation of card cloning cases. The use of linkage analysis as a tool in the investigation of Card cloning cases in the ZRP is not very effective due to constraints such as lack of resources, lack of knowledge, incompetence on part of the detectives to conduct the analysis. In order to realize maximum fruits on linkage analysis, it is recommended that the ZRP be equipped with resources such as computers for storing, processing, analysis criminal information, internet infrastructure to enable detectives to do research on how other countries are doing it and invest in training.

KEY WORDS

Linkage, Analysis, detection, Card, Cloning

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ABBREVIATIONS AND ACRONYMS

AFIS- Automated Fingerprint Identification System

ATM- Automated Teller Machine

BAZ- Bankers Association of Zimbabwe

CCTV- Close Circuit Television

CCD-Commercial Crime Division (CCD) is a Section under Criminal Investigation Department (CID)

CIU- Criminal Intelligence Unit

CNP- Card Not Present

CVV-Card Verification Valve (A security feature used to prevent unauthorized transaction on a debit card.

VUCA- Volatility, Unceternity, Complexity and Ambiguity

ViCAP- Violent Criminal Apprehension Program.

ZICT-Zimbabwe Information and Communication Technology

ZRP –Zimabwe Republic Police

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.0. INTRODUCTION

This study is essentially aimed at developing an intelligent system for investigating card cloning fraud in the Zimbabwean context using linkage analysis. There are various techniques that can be used to detect and investigate card cloning fraud which include data analytics, data mining, machine learning among others. This study is focusing on Linkage analysis as an add to be used in the investigation of card cloning. The literature available about the subject is mainly based on the empirical researches done in the European and American studies. A few studies can be noted in some parts of Africa with South Africa dominating on the subject of linkage analysis. Zimbabwe is among the nations that employ linkage analysis in Africa in the detection and investigation of various serial crimes such as robbery, murder, rape and theft among others. This study is going to bring out knowledge on Card Cloning, linkage analysis, what it is? and how it is done? The concept of linkage analysis is going to be applied in detection and investigation of Card cloning fraud as the underpinning effort of optimizing its use to achieve at least above 80% detection rate and secure more conviction at court. This will act as deterrent measure to would be criminals intending to venture into felonious behaviour. The study views linkage analysis as an intelligent system that can be developed and used in the detection of Card cloning fraud.

In view of the available information about the subject, the research aims at developing an intelligent system for detecting and investigating card cloning fraud. The assessment gives a measure of the success stories and constraints faced by the law enforcement agencies, bankers and other investigators in detecting Card cloning fraud.

The research gap on this study is on the usage of linkage analysis as a technique in investigating card cloning fraud. Previous studies were concentrating mainly about detection of card cloning fraud using techniques like Data analytics, Data Mining and Machine learning by banks.

Literature on linkage analysis and card cloning was obtained from the journals, Crime linkage and books authored by renown criminologist.

1.1. BACKGROUND OF THE STUDY

The keeping of money in a bank and using a bank card to withdraw it was viewed as good safety net in the yesteryears. That is not the case now in this world of contact-less technology, where the cyberspace is being manipulated to benefit criminals. Card cloning madness has hit the world. A person is a millionaire today and wakes up with nothing the following day. Card cloning has become a big problem world over. The continuous rise in Card cloning fraud cases in both private and public sectors is the most feared threat world over, whether real or perceived and often causes discomfort in public and private enterprises due to loss of huge sums of money to fraudsters. According to the Federal Trade commission, a total of 271 000 plus reports were filed in 2019. The Zimbabwe Information and Communication Technology (ZICT) report on 18 October 2018 indicate that there were 154 cases of card cloning cases recorded in Zimbabwe. According to the herald of 29 January 2022, the Zimbabwe Republic Police (ZRP) had to issue an alert, warning the public about the alarming increase in card cloning.

Card cloning fraud is a crime that is defined under section 167 of the Criminal law codification and reform act chapter 9:23. The section provides that, anyone who, without authority, manufactures, copies or uses; or without reasonable excuse, possesses, any credit or debit card belonging to another person shall be guilty of unauthorized use or possession of a credit or debit card. It is one of the most prevalent crimes being committed in Zimbabwe. It is a form of money laundering because ill-gotten money through card cloning is then cleaned by spending in supermarkets, food outlets and hardware shops to look legitimate. Sometime in March 2021, Police in Bulawayo arrested a card cloner and recovered from him 78 active Zim-switch cards. According to the Zimbabwe independent of 24 November 2023, Bankers association of Zimbabwe (BAZ) reported an increase in bank fraud across the country as financial institution increasingly turn to digital platforms to do transaction. This shows how prevalent the crime is in Zimbabwe.

There are various techniques that can be used to detect card cloning fraud which include data analytics, data mining, machine learning among others. Law enforcement agency uses informers and contacts, electrical surveillance system (CCTV), forensic evidence, profiling, crime linkage, identifications parades, tip-offs and hot lines to gather information. The researcher's focal point is on developing an intelligent system for detecting card cloning fraud by incorporating linkage analysis technique to effectively combat the cases, disrupt criminal networks and protect the public.

Linkage analysis or Crime linkage analysis is an investigative tool that is designed to assist investigators in identifying whether a set of crimes has been committed by the same offender (Egger 1984). It helps in detecting patterns and trends through analysis of linked cases which enables investigators to anticipate and prevent future crime (Canter 2004). Linked cases can foster inter-agency cooperation as investigators share intelligence and best practices (Chainey and Radcliffe 2005).

Crime linkage is traced back to the development of the Federal Bureau of Investigations (FBI)'s Violent Criminal Apprehension Program (ViCAP) in 1985 (Egger, supra). Woodhams and Bennel (2014), allude that crime linkage is practiced across several countries which include United Kingdom, United States of America, Belgium, France, Germany, Ireland, Netherlands, New Zealand and Switzerland, where it was used to link crimes according to crime locations. In New Zealand, crime linkage is done through forensic evidence gathered from the crime scene, fingerprints uplifted from crime scenes, classified and identified through the Automated Fingerprint Identification System(AFIS), DNA profiling techniques, Modus operandi, targeted property, method of exiting the crime scene and time of operation, (Gavin 2014).

Zimbabwe is among countries that is practising crime linkage analysis in Africa. Labuschagne (2006) opines that linkage analysis is employed in cases of murder, rape, bank robberies and burglaries or unlawful entry using forensic sciences, fingerprints, DNA, fibre -comparison, closed-circuit televisions, tool marks, ballistics, soil, shoe and tyre imprints, modus operandi, geographical location and signature.

The Zimbabwe Republic Police in an effort to reduce blue collar crimes and other crimes, formed the Criminal Intelligence Unit (CIU) in 2000 under the Zimbabwe Republic Police Central Planning Committee minute number 38/2000. The CIU’s core business as cited in the CIU Manual, among other duties, are integrated crime management (a combination of prevention and investigation methods), profiling of criminals and conduct crime linkage analysis. CIU is structured in a way that it avails its services at stations, districts, provinces and National levels where it has to provide crime linkage analysis among other duties through fingerprints uplifted from crime scenes during scene attendance and compiles a report. The linkage analysis should be in a report format that informs relevant sections about the possible linkages of certain crimes to assist the investigating officers.

Despite these various strategies put in place by Zimbabwe Republic Police in an endeavour to detect and reduce the crime, Card cloning fraud cases are increasing and a few accused persons are being found guilty and convicted. Table 1 below shows yearly statistics of Card cloning

Table 1: Card cloning cases reported, detected and cases finalised at Commercial Crime Division Harare.

Year	Reported	Detected	Undetected	Finalised at Court
2018	45	15	30	8
2019	43	10	33	5
2020	55	9	46	3
2021	58	22	36	7
2022	61	19	42	5

Source: Commercial Crime Division Crime register.

The above statistics indicate the total number of cases of card cloning reported to police, number detected each year and cases which were referred to court for prosecution and cases which successfully prosecuted. The detection rate is very law and finalization of these cases is taking long and quite a number of cases are being dismissed due to lack of evidence. It is against this backdrop that the study looked at optimizing the use of crime linkage analysis in detecting card cloning cases within the CID Commercial Crime Division.

1.2. STATEMENT OF THE RESEARCH PROBLEM

Crime has been in existence in this world for as long as human beings have inhabited it and is raising daily. Card cloning/Skimming cases has caused untold loses to individuals and financial institution in Zimbabwe. According to the Zimbabwe Information and Communication Technology report on 18 October 2018. A total of about 154 cases of card cloning cases were recorded in Zimbabwe. The herald of 29 January 2022, shows that the Zimbabwe Republic Police had to issue an alert, warning to the public about the alarming increase in card cloning. Tom Muhleya in his article ‘Watch out, card cloning on the rise in the herald dated 11 December 2021, indicated that on 01 January 2021, Nyaradzo lost **ZW$200 000** in suspected card cloning, on 18 March 2021, A man was arrested for stealing **ZW$500 000-00** in bank fraud, on 14 June 2021, A

man cloned bank cards and stole over **ZW$3 million** and on 18 August 2021, a company lost over **ZW$436 000** through card cloning. According to the Zimbabwe independent of 24 November 2023, Bankers association of Zimbabwe (BAZ) reported an increase in bank fraud across the country as financial institution increasingly turn to digital platforms to do transaction. This shows how prevalent the crime is in Zimbabwe. Its frequency in occurrence means that perpetrators don't necessarily meet the end they deserve. Individuals like farmers, civil servants and many more continue to lose their hard-earned cash through card cloning. Financial institutions are forced to fight Card cloning all the time and it continue to threaten the reputation and stability of financial institution world over. The expansion and continuous evolvement of technology affords supplementary conduct to criminals to commit Card cloning cases.

The biggest dilemma is that, perpetrators are escaping conviction after being found not guilty during court proceedings and send back to the community and continue to engage in their illegal conduct. The unsuccessful convictions are being caused by lack of sufficient evidence to prove and link the accused to the Crime. Investigators do not have in depth knowledge on Card cloning Fraud. This prompted the researcher to do this investigation. The researcher argues that if linkage analysis is used as an aid to detect card cloning fraud, it will be a game changer in increasing detection rate.

The problem of Card cloning impact negatively on the community. Monetary losses owing to Card cloning affect both individuals and banks. To a large extend it affects the bank image because if a customer falls a victim with a certain bank, he/she might not be loyal to that bank and choose another bank. Intelligence led- policing is the way to go in this Volatile, Uncertainty, Complexity and Ambiguity (VUCA) environment where criminals are taking advantage of the cyber space to commit cyber related crimes.

The importance of this study is that it is projected to the body of knowledge in improving the practice of Crime linkage in detecting card cloning. The outcome of this research make rational recommendations to solve the problem through best practices.

1.3. RESEARCH OBJECTIVES

The main research objective was:

To develop a system of investigation through the use of Linkage analysis as a tool in investigating Card cloning fraud in Zimbabwe.

Specific Objective were:

To establish what linkage analysis entails and its origin.

To establish the impact of linkage analysis in investigating Card cloning fraud.

To find out different types of linkages that can be used in Card cloning investigation.

To find out factors that influence the use of linkage analysis in Card cloning detection.

1.4. RESEARCH QUESTIONS

The major research question was:

What system can be developed and be used by investigators to fight Card cloning Fraud in Zimbabwe?

Other research questions were:

What does linkage analysis entails and its origin?

What is the impact of linkage analysis in investigating Card cloning fraud?

What are different types of linkages that can be used in Card cloning investigation?

What are the factors that influence the use of linkage in investigating Card cloning fraud?

1.5. HYPOTHESIS

H0: Linkage does not help in investigating Card cloning fraud in (Zimbabwe).

H1: Linkage do help in investigating Card cloning cases in (Zimbabwe)

1.6. ASSUMPTIONS

The researcher carried out the research basing on the following assumptions:

Respondents will answer the questionnaires truthfully.

Respondents will be accessible for and the administering of questionnaires.

Secondary data from crime records will be accurate.

1.7. PURPOSE OF THE STUDY

The purpose of the research is to develop an intelligent system for investigating Card cloning fraud in Zimbabwe.

1.8. SIGNIFICANCE OF THE STUDY

Denscombe, (2002) underscores the importance of relevance of a research in terms of contributing to existing knowledge, solving practical needs and being of relevance to current issues. This study aims at educating, advising and enriching the Zimbabwe Republic Police, the society, institution and the researcher on the problem of Card Cloning phenomena as follows;

1.8.1. To the Researcher:

The researcher benefited much through the acquisition of requisite knowledge on Card Cloning detection strategies. Academically, the researcher increased knowledge base and learn new trends in the field of criminology.

1.8.2. To the Institution and the academic fraternity:

It is anticipated that this study will form part of future literature for students undertaking their studies in field such as Contemporary Policing, Forensic investigation, Criminology, Principles of Investigation, among other disciplines. The research will assist to cement the relationship between the Police service and the Institution. The Institution will be in a position to give informed recommendations on this subject.

1.8.3. To the Society

When the society is exposed to this literature pertaining to effects of Card Cloning and how it is committed, it will employ target hardening skills and ensure their debit cards do not fall into wrong hands. The community may also embrace the concept as its own and partner law enforcement agency in fighting this vice. The importance of the society in addressing the research gap id that, it will act as a watch dog and whistle-blower for public and private enterprises. Apprehension of criminals will increase as well as detection rate thereby reducing cases of card cloning fraud.

1.9. JUSTIFICATION OF THE RESEARCH

The importance of this study is that it is projected to the body of knowledge in developing an intelligent system for detecting Card cloning Fraud. Card Cloning fraud is prevalent in Zimbabwe causing untold loses and suffering to the general populace.

Ability to quickly detect, arrest culprits and prosecution will deter the increase of these cases in our beloved nation. The outcome of this research make rational recommendations to solve the problem through best practices.

1.10. DELIMITATION OF THE STUDY

The study was carried out in Zimbabwe and was confined to ZRP Investigators. The study looked at Developing an intelligent system for detecting Card cloning fraud in Zimbabwe.

1.11. LIMITATIONS OF THE STUDY

The researcher faced the following hindrances:

1.11.1. Time

The research was conducted whilst the researcher is on full time employment, which denied him enough time to work on the study. He was involved in a lot of work during week days fulfilling his duties as required by the employer.

However, the researcher was periodically making use of time offs and weekends to visit the library, sample subjects and consult other consultants. The researcher has a family to take care of, with children who needed his attention but, the researcher sacrificed their happiness to complete this study so that they celebrate together at the end.

1.11.2 Information

Information on Card cloning is treated as sensitive because if it falls in wrong hands, it can be used by criminals to commit crime hence obtaining data from banks and Security service was difficult.

1.12. DISSERTATION STRUCTURE.

This dissertation is divided into five (5) Chapters. Chapter one (1) provided the introduction, background of the study, statement of the problem, research objectives, research questions, hypothesis, assumption of the study, purpose of the study, justification of the study, significance of the study, delimitation and limitations of the research and definition of key terms. In Chapter two (2) the researcher reviews literature relevant to the employee retention strategies. In Chapter three (3), the researcher discussed the research methodology and further described the issues

relating to the study design, the philosophy, the research strategy, sampling and research procedures, as well as data collection methods. Chapter four (4) focuses on the discussion of the research results, including a thorough analysis of findings. Chapter five (5) concludes the dissertation providing recommendations including areas for further study. Some attachments are provided as Appendices to this dissertation.

1.13. SUMMARY.

This chapter discussed on background of the study, statement of the problem, research objectives, research questions, hypothesis, assumption of the study, purpose of the study, justification of the study, significance of the study, delimitations and limitations of the study, definitions of key terms and dissertation layout. These are the necessary basic elements to set up the platform for the research to take place. Chapter 2 will focus on literature review.

CHAPTER TWO

LITERATURE REVIEW

2.0. INTRODUCTION

The previous chapter discussed about the research problem and concerns surrounding it. The current chapter unveiled the view of other writers on Card Cloning fraud, linkage analysis, the history of crime linkage analysis and its meaning and the purpose of crime linkage analysis. The chapter looked at related theories to the study and also the empirical evidence on linkage analysis in order to address the problem of Card Cloning. The study unearthed the gap that exist between the past researchers and current study. Literature review is the study and examination of research studies done by other researchers, company data, or industry reports that act as a basis for the proposed field or area of study (Cooper and Schindler 2003). According to McCombes 2023, A literature review is like a survey of scholarly sources on a specific topic. According to Gill and Johnson (2002), a detailed literature review is of paramount importance at this stage as it helps the researcher to elaborate the various possible relationships that might exist and the phenomena whose empirical variation is of prime concern. As a researcher, I am going to summarize arguments and existing knowledge obtained from sources related to my research. This review of literature is going to give me direction and foundation of my success in this research.

2.1. CARD CLONING

Card cloning refers to making of an unauthorized copy of a credit card. This practice is sometimes termed skimming. According to the Federal Trade Commission (2020), Card cloning is a type of Fraud where a criminal creates a duplicate of a victim's debit card without their knowledge or consent. According to Livewell.com (2023), What happens is that criminals stole sensitive financial data, including the cardholder's name, card number, expiration date and CVV code. This information is then coded onto a blank card essentially creating a clone of the original card.

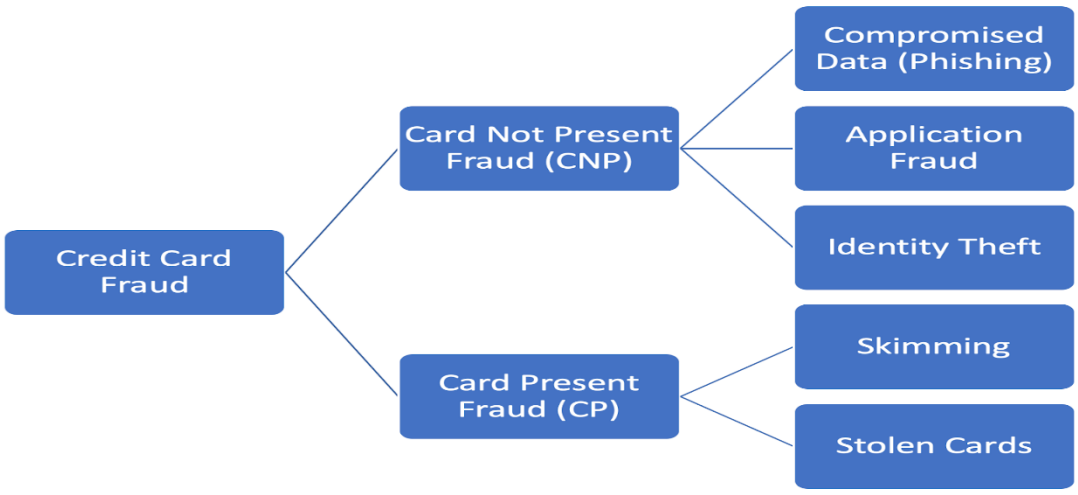
Card cloning is no longer limited to physical cards only but with the rise of online shopping and the use of digital payment methods, Criminals have also established methods to clone debit cards

virtually. They can either hack into online payment platforms or infect computers with malware to capture credit card details during online transactions (Livewell.com).

This type of fraud occurs when one lost his or her card through theft or just dropped it and someone pick it or someone steals the card for fraudulent purposes. This is regarded as the simplest method to obtain cardholder details without having to invest in new technology because it does not require the physical credit card to be stolen. Instead, they simply use an electronic device to covertly scan the card's information and copy it into the device's memory. The thieves can then access that information digitally, or else download the information onto a separate credit card that is already in their possession. The compromise can take place on many common routes and can be made without at least tipping off the cardholder, the dealer or the bank until the account is actually bankrupt.

2.1.1. Credit card frauds flowchart.

Figure 2.1 Types of credit card frauds flowchart



Source: Sharma 2019

2.1.2. Stolen cards

According to Junger and Thelander (2013), Stolen cards are usually used for fraudulent transactions until the issuer notifies the issuing bank to deactivate the account. Culprits will spot their victim in a supermarket or at an ATM and observe the OTP as the owner uses his card.

He will then steal the card and went on to use it to purchase goods. This is one of the best method opted by fraudsters. A thief can go on to purchase items worth thousands of dollars before the cardholder or card issuer knows that the card was compromised.

2.1.3. Compromised accounts

A thief can lure his victim to a fake website where one's card number divulged. This information will then be used by the thief for fraudulent purchases (Junger and Thelander 2013).

2.1.4 Card Not Present transaction (CNP)

Phua & Lee (2013) posits that fraudsters favour routes of Mail and the Internet to commit fraud against retailers selling and delivering goods. The credit/debit card holder can be tracked by mail or phone. The information of the card can be compromised without the holder's fault but through data breach of a store where you occasionally use the card. Once the culprits are in possession of the debit or credit card data, they use this information to rack up online charges. It is difficult for a merchant to verify that the owner is the one authorizing the purchase.

2.1.5 Identity theft

This type of fraud is also known as identity fraud and it is crime where an individual's personal information, such as their name, social security number or credit card details is stolen and used without their consent (Pontell 2009). It occurs when a person uses stolen documents to open an account. Fraudsters can steal personal documents such as bank statements and utility bills to create useful personal information. They will then gain control of an account and then perform unauthorized transactions.

2.1.6 Skimming

Fraudsters can acquire a victim's card number or information by photocopying receipts or by sophisticated methods like using a skimmer. Skimming commonly take place in restaurants, fuel service station and bars where the skimmer will have possession of the victim's payment card out of their immediate view. Skimming can also occur when a third party card-reading system is mounted outside or inside a fuel dispenser.

Figure 2.2 Skimming Process

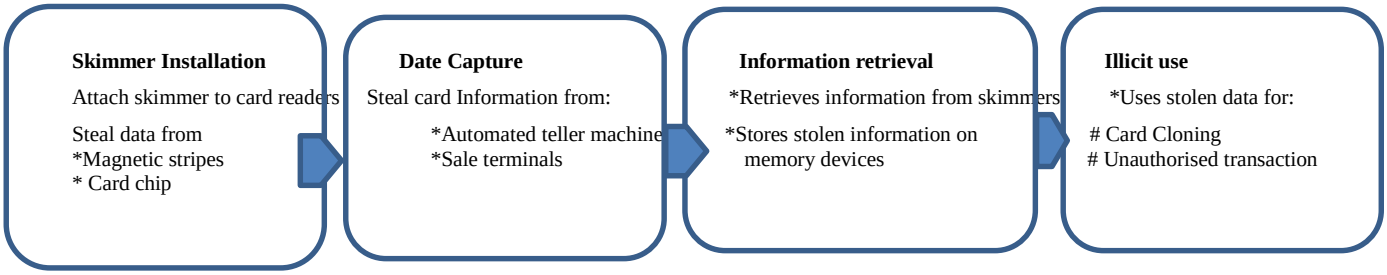
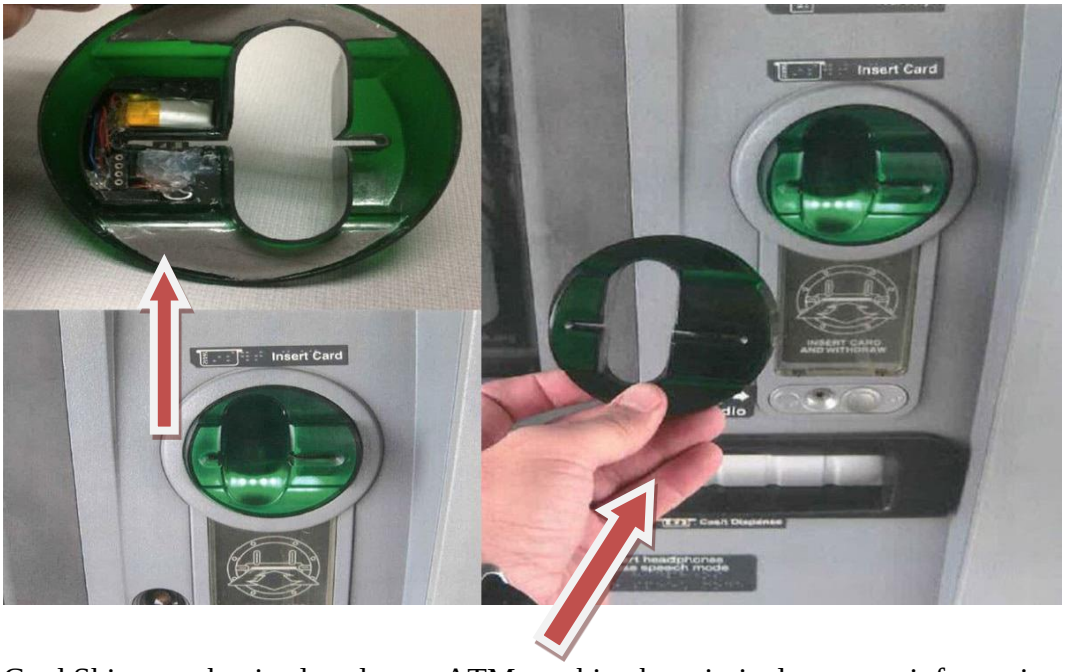


Figure 2.3 Credit Card Cloning device

Credit card Skimming device

Figure 2.4 Example of a Card Skimmer planted on an ATM machine



Card Skimmer that is placed at an ATM machine by criminals to copy information

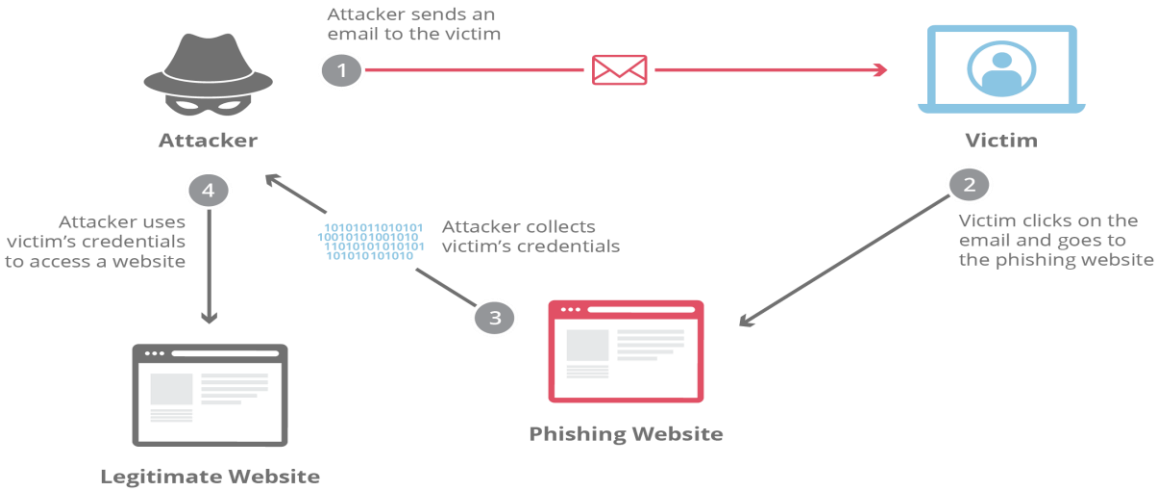
Figure 2.5 Example of a Card Skimmer

Credit or Debit card skimmer

2.1.7 Phishing

This is when fraudsters use a number of schemes to lure their victims to provide them with their debit or credit card information through websites that pretend to be a bank or payment system. A telephone set up call can be used in phishing as it is made to appear to be affiliated with a banking organization and cause the victim to divulge information about his account.

Figure 2.6 Example of Phishing process



Source: Cyberhoot.com

2.1.8 How card cloning works

Card cloning is also known as credit card skimming and it is a financial fraud where a criminal creates a duplicate of a debit card without the owner's knowledge or consent (Delahunty 2015). Once the criminals are in possession of the information, the information can be transferred onto the magnetic strip of a new card or can be used to overwrite data on an already stolen credit card (Pontell 2009). For cards that use a personal identification number (PIN) number in addition to a magnetic strip, such as debit cards, the PIN would need to be observed and recorded.

Cloning has been made difficult due to modern security enhancement such as the use of modern chip cards which have embedded microchips that contain sensitive information. These are hard to compromise because they contain encrypted data within the chip itself. This means that even if the thieves successfully access the chip card, they would not be able to use the information they stole. However, criminals have figured out how to target the chip recently through a practice called shimming. They insert a paper thin device known as a shim into a card reader slot that copies the information on a chip card (Hopper & Blum 2016).

One of the common modus operandi being used by criminal to obtain credit card information is the use of hidden scanners that can be installed onto a legitimate card reader device such as Automated teller machines (ATMs) and the Point of sale (POS). What is more deceptive is that criminals do not require the cooperation of the personnel working at those stores. Instead, those orchestrating the attack can simply collect data on an ongoing basis from the hidden scanners, without the customers, employees, or business owners being aware of the source of the breach (Delahunty 2015).

Transaction involving debit cards can either be physically by the card holder or remotely by a criminal. In a physical card-based transaction, the cardholder(s) physically shows his card to the dealer to make a payment. A criminal must steal the credit card in this form of transaction to conduct fraudulent transactions. According to Delahunty (2015), Criminals are interested in knowing the card number, the time, and the fact that the legitimate cardholder is unaware that his or her card information has been seen or stolen to commit fraud in these types of transactions. To detect this form of fraud, examine the users' or customers' spending profiles on each card and look for any discrepancies with their normal spending patterns (International Journal of Computer Science and Network (IJCSN) Volume 1, Issue 4, August 2012).

The identification of credit or debit card fraud often has two unusual characteristics. The short time frame in which the credit card approval or rejection decision must be made and secondly, the massive volume of credit card transactions that must be processed in a short period of time.

The best evidence of cloning is where two separate transaction take place within a short time of each other at different locations far apart, making it impossible for the same card to have been used. For example, a transaction took place in Mutare and Bindura within a few minutes of each other.

2.2. LINKAGE ANALYSIS

Linkage analysis according to **Cambridge intelligence.com**, it is sometimes called graph visualization or network visualization. It is the process of visually presenting networks of connected entities as nodes and links. The nodes will be representing specific data points and the links represent the connections between them. This is then used to uncover hidden relationships and identify patterns, like dependences or irregularities that are not visible in amassed analysis. Linkage analysis reveals intelligence insights such as how and when suspect communicate with one another, how money and information flows within and between networks, the structure of organizations, gangs or terror groups and movement of people or equipment.

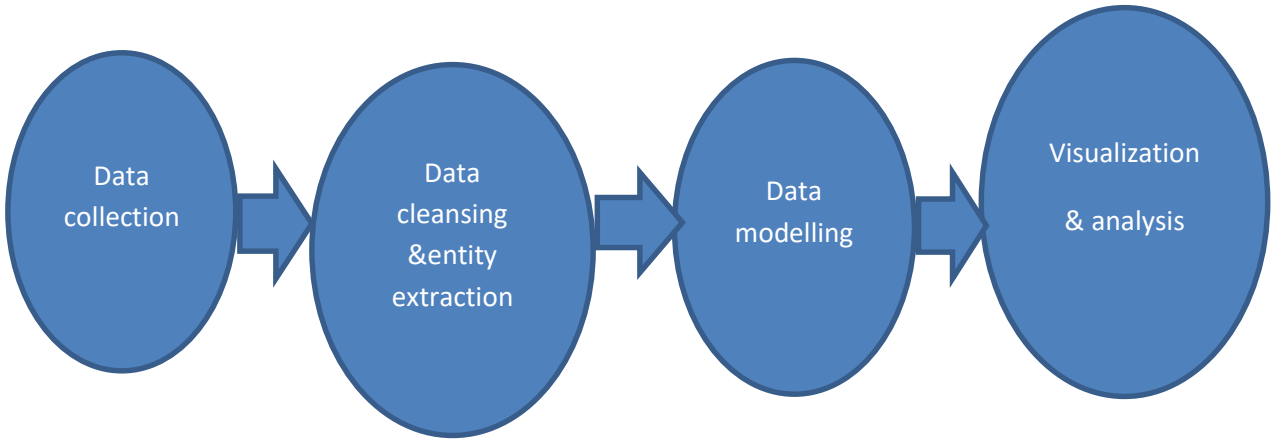
In criminology, Linkage analysis system is a concept which can be traced back to the development of the Federal Bureau of Investigation's (FBI) Violent Criminal Apprehension Programmes in 1985 which was used to support Crime linkage analysis (VICAP) (Burgess et al 2013). The system was devised in Canada where it was used as an aid to investigate crime of serious nature especially in the investigation of suspects who commit multiple but same crime. The concept assumes that offenders behave in a similar way across their crime and that offenders are sufficiently heterogeneous from each other for series of crime committed hence can be differentiated from one another. Crime linkage system is a form of behavioural analysis that is used to determine the possibility of a series of crime as having been committed by one perpetrator (Hazelwood and Warren 2003).

The **Cambridge intelligence.com** argued that Crime linkage is an investigative tool used to identify and categorises certain scenes of crime as having been committed by the same person. A number of behavioural characteristics are used to carry out a linkage analysis and they include; Modus Operandi, Signature, time, property targeted and class of victims among others (Hazelwood

and Warren 2003). Modus operandi refers to action taken by the offender during the perpetration of a crime in order to perpetuate the crime. It is a learned set of behaviours that the offender develops and sticks with it because it works for him. The Signature aspect refers to the element of criminal behaviour exhibited by the offender at the crime scene. This conduct goes beyond the action necessary to perpetrate the crime and it points to the unique personality of the offender. In other words, signature is a way of the offender to satisfy him emotionally in the process of committing the crime.

2.2.1 The Process of Crime Linkage

Figure. 2.7 The Process of Crime Linkage model



Source: Cambridge Intelligence.com

According to **Cambridge intelligence.com**, Data collection entails gathering data from various structured and unstructured sources. The data will then be tabulated, normalized, de-duplicated and ensuring that nodes and links have the right attributes and identifiers for analysis. The third stage is the translation of a conceptual model based on information one wants to cover, into a logical model, based on the available information. The fourth stage is when you develop and interact with nodes and links in a link analysis chart. The visual analysis can be enhanced by various techniques and algorithms which include centrality analysis, time line visualization, automated layouts and many more.

According to Woodhams et al (2008), the process is where the analysts bring together all relevant data about the crime from sources such as reports received book and information from the crime scene. The analysts will then categories the behaviours of the accused through modus operandi or

signature. After creating the lists of crimes with similar behaviours, the analysts then collate and evaluate the information basing on the accused's behaviours and then consider similarities and differences in modus operandi of each crime. The Crime analysts then produce a linkage in the form of an analysis report.

The role of crime linkage analysis is to avoid linkage blindness which means the absence of communication about potentially related cases across the investigation of crimes of serious nature. Crime linkage helps in identifying crime that showed distinct patterns of similarity that could reflect linkage. Egger (1984), also explains the role of crime linkage analysis as to identify crimes that shows distinct patterns of similarity that might reflect linkage. Grublin et al (2001) also posit that crime linkage analysis determines whether a set of crimes has been committed by the same offender. Bosco et al (1998) posit that crime linkage is being practiced across several countries which include United Kingdom, United States, Belgium, France, Germany, Ireland, New Zealand, Switzerland and Zimbabwe.

In Zimbabwe, crime linkage analysis is used to link crimes that are similar in terms of Modus Operandi, time of operation, area of operation, targeted property and or victims. Crime linkage analysis does not only provide offences that are alike but also provide with possible suspects and reasons for suspicion.

There are various tools used in carrying out a linkage analysis and they include data analytics, Machine learning algorithms such as decision trees, Data Visualization, Network analysis, Forensic analysis among others. In this study, the researcher will discuss matrixes as source documents used by investigators they include registers and Frequency charts.

2.2.2 Crime Matrics linkage model

Table 2.1 below shows the model of a basic crime linkage matrix used in Zimbabwe

Ref	Date & Time	Offence	Bank	Victim	Places card used by owner	Value stolen and places card used by culprits
4/08/06	02/08/24 1500 hrs	Card cloning (Fraud)	CABS	Catherine Shoko, **Res**: Chegutu **Sex**. F **Occup**. (Farmer)	BM service station (Kwekwe) Toll gates Bulawayo to Harare	cash, USD2 000. OK Chinhoyi TV sales Karoi
9/08/06	03/8/24 0900 hrs	Card Cloning (Fraud)	CABS	Trish Hove **Res**: Harare **Sex**: F **Occup**: Teacher	BM service station (marimba, Harare)	Cash. USD900 Chicken inn (Epworth)
10/08/06	07/8/24 1800 hrs	Card Cloning (Fraud)	ZB bank	James Shuro **Res:** Harare Sex: M **Occup:** Doctor	BM service station (Kuwadzana 2)	USD 2 400 TV sales Ted Hotel

Source: Author

An example in the table above is that of a correlation process that enables one to link Card cloning cases. All the above entries indicate that BM service station is appearing in all cases as places visited by all victims. It therefore shows a possibility where card skimming is taking place. It will then indicate to investigators areas to target their investigations.

2.2.3 Cloning frequency chart by bank

Table 2.2: Cloning Frequency chart by bank

KEY

BLUE CABS

GREEN ZB BANK

YELLOW CBZ

PINK BANK ABC

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
CITY/ TOWN																															
CABS																															
ZB																															
CBZ																															
BK ABC																															
Total																															
	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W

Source: Author

This Frequency Chart is used to record card cloning cases daily as they occur according to the bank that fall victim. Drawing pins with different colours are then used to denote a case and bank that could have been committed on a particular day and in a particular city or town.

2.2.4 Crime Register

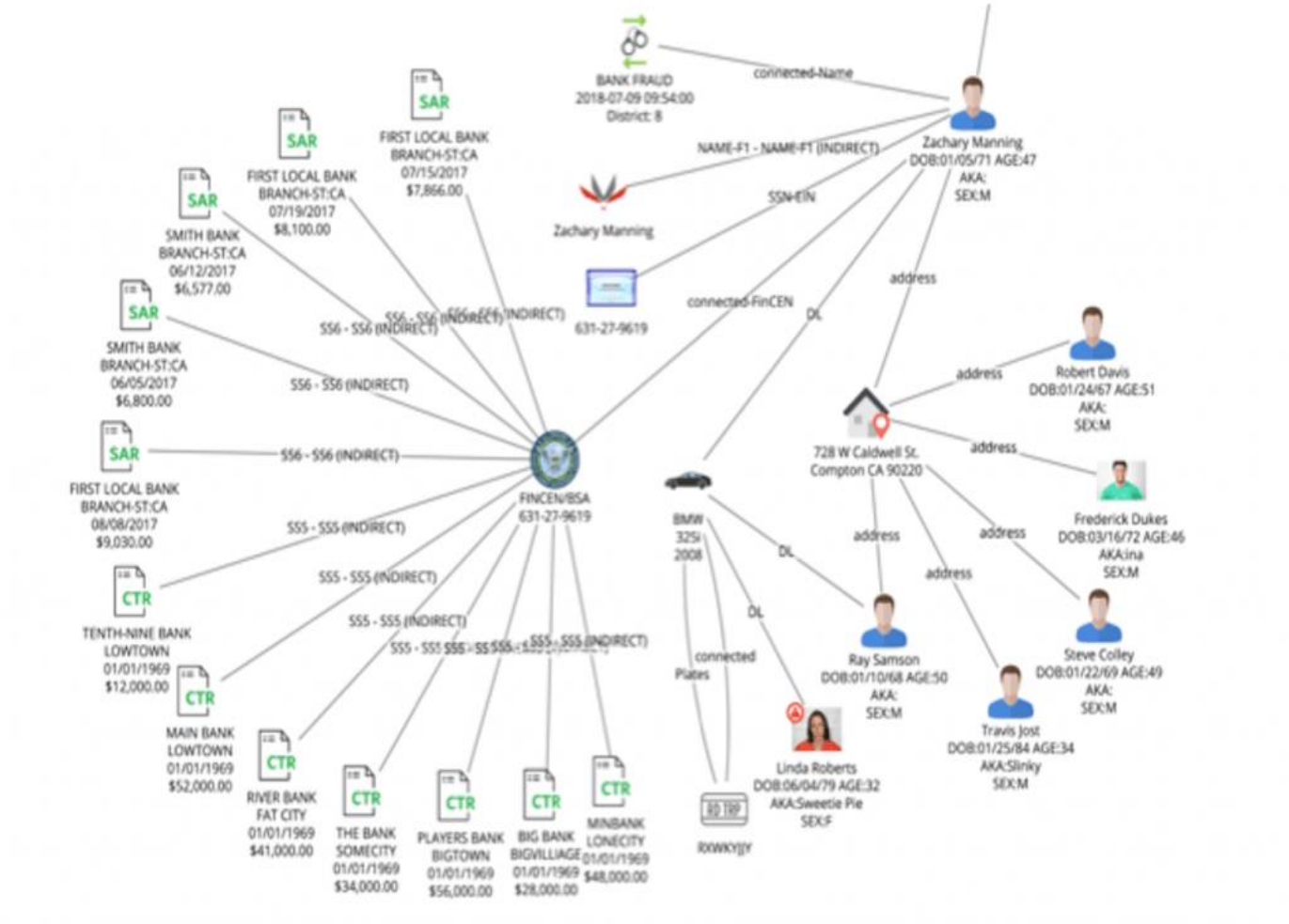
Table 2.3: Crime Register

CR	OFFENCE	ACCUSED DETAILS	BRIEF CIRCUMSTANCES	I.O	POSITION OF DOCKET	RESULTS
112/03/23	Fraud	Amos mbaura Age: 24 NR.05-134563 C 75 Res: 66 Epworth Harare Bus: Unemployed	The accused person was arrested at Market Square bus terminus, Harare on 15/03/23 after he misrepresented to Fungai Jachi that he was a VID officer and can facilited that she can obtain a driver's lisence.. he was then given 300USD which he converted into his own use and went away unnoticed.	Detective Sergeant HOVE	Court on 16/03/23	Convicted

Information that is recorded in the above matrices and registers will then be used to develop a linkage that is then analyzed for relationships and possibly leading to detection and arrest of culprits.

2.2.5 Intelligence Links system

Figure 2.8 intelligence links system



Source: Datawalk.com

2.3.THEORETICAL FRAMEWORK

Linkage analysis is related to a number of theories, but for the purpose of this study will dwell much on the least effort Principle, Routine activities theory and the crime pattern theory.

2.3.1 The least effort Principle

The principle as stated by Rossmo (2000: 87-88) suggest that when a rational person is given two alternatives course of action, people will choose the one that requires least effort meaning that people always want to adopt the easiest course of action. The same principle applies to everyone including criminals who commit fraud related cases.

They sometimes choose targets where they apply least effort like those without proper knowledge of using ATM and lacks the requisite security of their swipe cards.

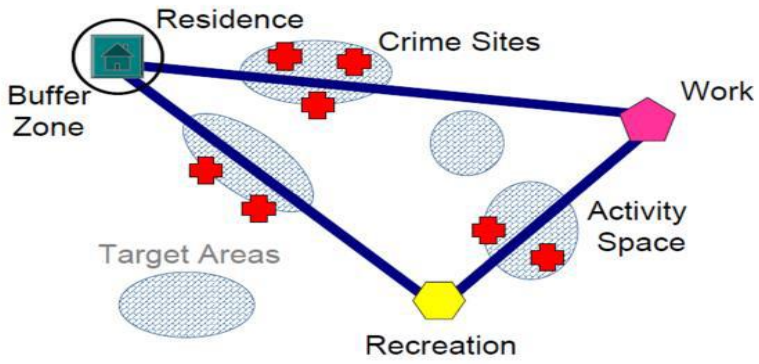
The least effort Principle entails that the effort and time one put into planning the crime varies greatly, depending on whether the offender is a first time operating as amateur or as a professional. Amateurs usually do not have enough resources and do not want to travel far to commit the crime, hence they choose easy and close targets where they put least effort. Therefore, they normally spend little time planning and do not do thorough research on their targets. On the other hand, professional criminals consider planning the crime as a vital stage before they pounce on their target. They carefully consider in detail the security measures available, where possible, consider ways to overcome them. They also spend substantial time and effort organizing disguises and escape plans. After considering a number of targets' security measures, they will then choose to pounce on a target with weak security measures where least effort to overcome resistance is required.

The least effort principle helps investigators or crime analysts to understand card cloning trends, characteristics of the criminals, whether amateurs or professionals basing on the modus operandi used, geographical location and targeted victims. This will enable the crime analysts to predict the next target and put measures to prevent the crime by alerting possible victims.

2.3.2 Distance Decay Principle

It is based on the assumption that the frequency of an offender committing crime decreases as they travel further from home. The same applies to crime where the offender will choose between two different targets and rationally the offenders will choose the target that is close to them but outside their buffer zone. The buffer zone is the area in which criminals are less likely or do not commit offences as they will pause a risk of being identified (Rossmo, 2000).

Figure 2.9 Distance decay principle



Brantingham's Crime Site

Figure 2.5 above illustrate the concept of distance decay principle.

Criminals try as much as possible to portray good behavior in and around their community of residence which is the buffer zone. So in an effort to blind fold their neighbours, they will commit crimes a bit away from their buffer zone. These findings were also supported by (Kopper and De-keijser, 1997), when they opined that offenders rarely commit offences on their doorstep, presumably because the chances of being recognized by people who know them are higher.

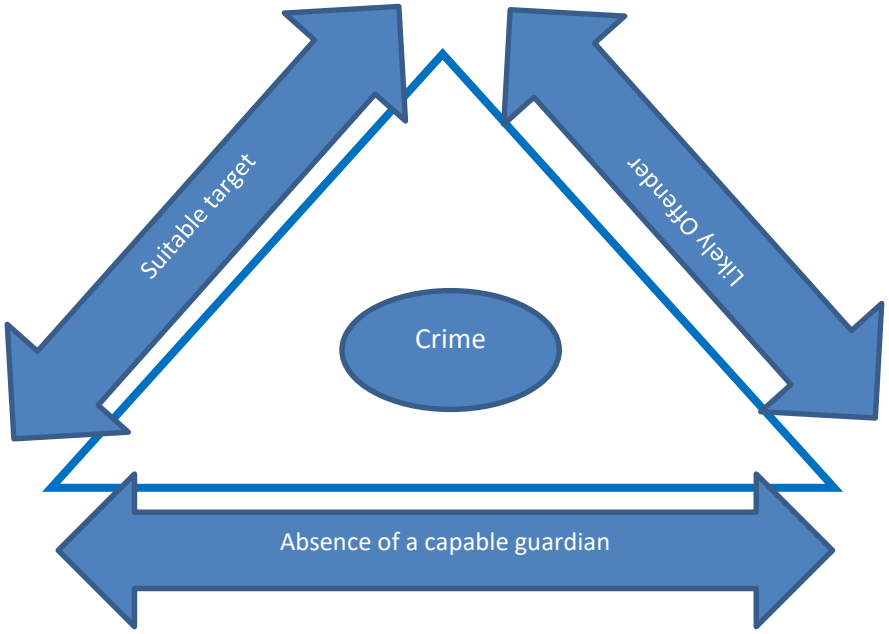
Card Cloning criminals tend to also refrain from operating around heavily policed public places because they fear being arrested. Instead they travel away from their place of residence so that they decrease the likelihood of being recognized and look for targets in areas with low police visibility.

The distance decay principle assists the crime analyst to geographically predict the likely residence of offenders of robbery cases from the scene of crime area. This will help in directing focus of investigation and well as limiting the number of possible suspects to be picked up for interviews.

2.3.3 The Routine Activities theory

It is another relevant theory to linkage analysis . This theory is found within the classical school of criminology and focuses on rational choice. The routine activities theory founded by (Cohen and Felson 1979), opine that a crime is likely to occur only if there is an interaction of three components namely; the presents of someone who intends to commit a crime (likely offender), someone or something to be victimised (a suitable target) and absence of capable guardian. This can be presented diagrammatically as shown by figure 2.1 below.

Figure 2.10: The model of the routine activity approach



Source: Cohen and Felson 1979

According to Cohen and Felson this theory does not explore factors that influence the offender to commit crime. Instead, it focuses on the daily routine activities of people such as going to work, running errands, going to church, and going for a holiday and many more. It is through these routine activities that offender come into contact with their targets.

According to the theory, crimes such as Card cloning Fraud occur in relation to convergence of time and space of the presence of motivated offenders, the availability of suitable targets for law-breaking, and the absence of capable guardians for those targets.

The routine activities theory contends that instead of acting impassively, fraudsters act rationally when committing crimes as they calculate the reward/punishment equation.

These theories assist crime analysts in understanding how fraudsters come across their targets, time of operation, area of operation, M.O and recommend target hardening methods. It also helps crime analysts to gather necessary data which will then be used to compile a matrix for analysis.

2.3.4 The Crime Pattern Theory

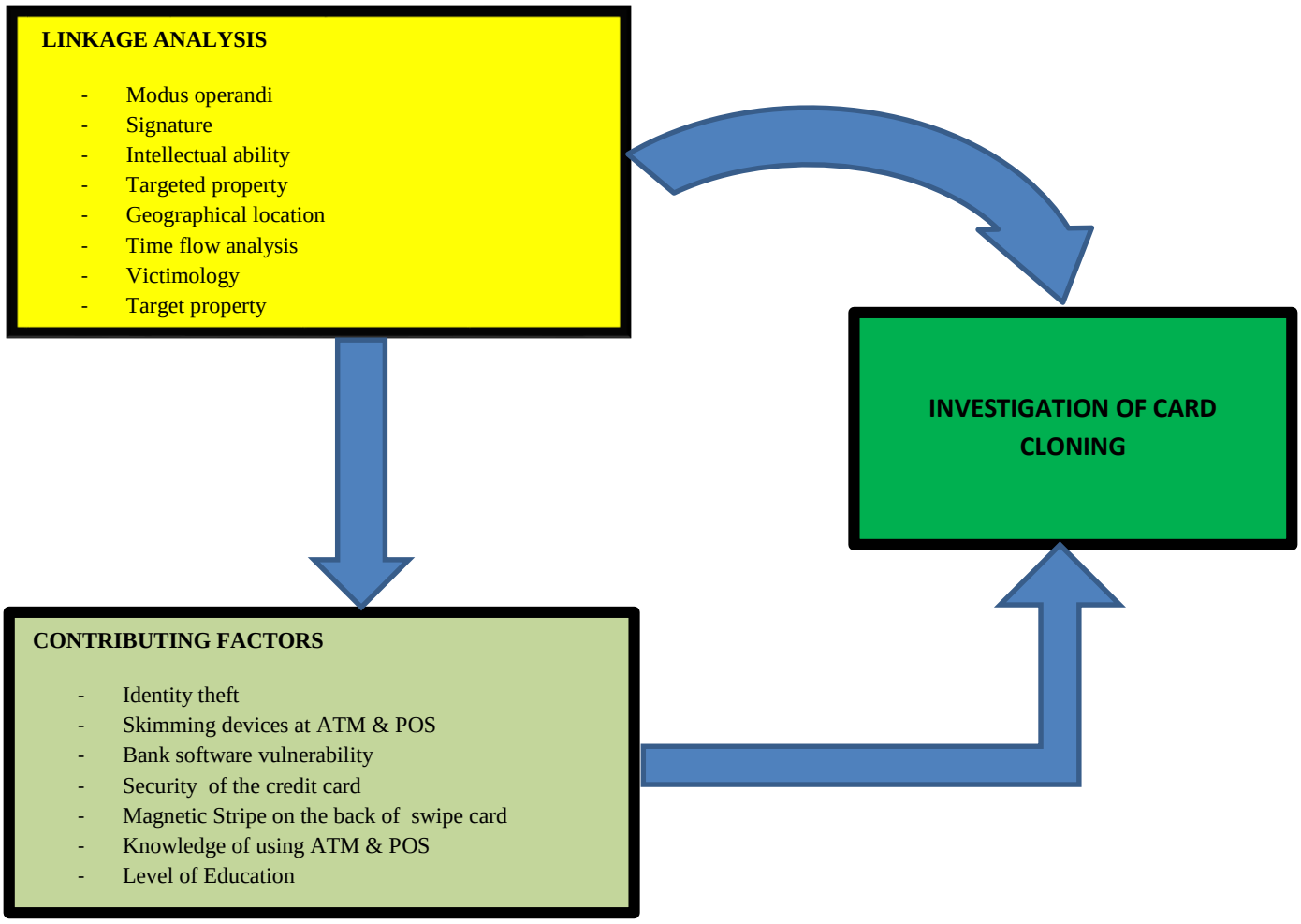
This theory was formulated by Travis Hirschi as explained by Brantingham and Brantingham (1995), as cited by Johnson (2014). It explains why crime is committed in certain areas. It is based on the notion that crime is not random; it is either planned or opportunistic. Hirschi went on to say that crime happen when the activity space (location in everyday life, like home, work, school and restaurants) of a victim or target intersects with the activity space of an offender. The route a person takes to and from work; school or restaurants are called personal paths. So, when the activity spaces of both the offender and the victim cross paths, crime occurs. In other words, the crime pattern theory, emphasis that the offender is more likely to commit a crime when they are familiar with the surroundings and these crimes are more likely to happen in clusters where opportunity is available to evade identification. Card cloning cases tend to happen more in highly density populated areas where there are a number of businesses clustered together. Most card cloning cases in Zimbabwe tend to happen when farmers are selling their produce especially tobacco farmers.

2.4. CONCEPTUAL FRAME WORK

Crime linkage system is a concept which can be traced back to the development of the Federal Bureau of Investigation's (FBI) Violent Criminal Apprehension Programmes in 1985 which was used to support Crime linkage analysis (VICAP). The system was devised in Canada where it was used as an aid to investigate crime of serious nature especially in the investigation of suspects who commit multiple crimes. The concept assumes that offenders behave in a similar way across their crime and that offenders are sufficiently heterogeneous from each other for series of crime committed hence can be differentiated from one another. Crime linkage system is a form of

behavioural analysis that is used to determine the possibility of a series of crime as having been committed by one perpetrator (Hazelwood and Warren 2003).

Figure 2.11 Conceptual framework



Source: Author

Crime linkage analysis is an investigative tool used to identify and categorises certain scenes of crime as having been committed by the same person. A number of behavioural characteristics are used to carry out a linkage analysis and they include; Modus Operandi, Signature, time, property targeted and class of victims among others. Modus operandi refers to action taken by the offender during the perpetration of a crime in order to perpetuate that crime. It is a learned set of behaviours that the offender develops and sticks with it because it works for him. The Signature aspect refers to the element of criminal behaviour exhibited by the offender at the crime scene. This conduct goes beyond the action necessary to perpetrate the crime and it points to the unique personality of the offender.

In other words, signature is a way of the offender to satisfy him emotionally in the process of committing the crime.

2.5. EMPIRICAL STUDY

Papers have been published pertaining to crime linkage analysis in the academic world. A study on behavioural case linkage was conducted by Martin Joseph Weeks in 2017 on linking residential burglary offences while he was a student at the University of Massey, Albany, New Zealand. The researcher used eighty-two (82) cases of unlawful entry into residential premises that were committed in New Zealand by forty-seven (47) serial house breakers in Napier as his sample and the data was extracted from the New Zealand Police National Intelligence Application (NIA) database. In addition, the researcher used behavioural case linkage, that is, the three behavioural domains for unlawful entry crimes which include: the use of crime scene behaviours (MO), inter-crime distance and temporal proximity in his study so as to accurately predict whether the crimes were committed by the same accused persons. In determining the ability of crime scene behaviours (M.O.), inter-crime distance and temporal proximity of cases used the receiver operating curve so as to predict or generalise the findings.

In his study, Weeks found that of the eighty-two (82) solved cases, forty- one (41) cases were linked (that is, two or more crimes were committed by the same accused persons) whilst the other forty-one (41) cases were not linked (that is, they were committed by different accused persons). His findings were that inter crime distance was the least accurate predictor in determining the linked crimes as compared to the crime scene behaviour and temporal proximity. However, the combination of temporal proximity and crime scene behaviour proved to be more accurate in determining whether the crimes were committed by the same accused persons.

It was also suggested that, caution has to be exercised when using inter crime distance alone in linking crimes within small areas of studies.

Another study was conducted by Labuschagne in 2006 whereby he examined the use of linkage analysis report as evidence during the trial of a New Castle serial murderer in the Republic of South Africa which was presented as evidence in Pietermaritzburg High Court in KwaZulu Natal province, whereby the accused Themba Anton Sukude was being tried for a series of murder cases.

Four cases were linked to the accused basing on the circumstances of the crimes, the modus operandi or crime scene behaviours and the signature behaviours which were critically analysed

before reaching a conclusion that the four crimes of murder were committed by the same accused persons. Out of the four cases, the accused person was convicted to two crimes after the evidence was admitted in court despite the lack of forensic evidence.

In addition, Kraemer, Lord and Heilbrun (2004) carried another study on homicide offenders in a bid to differentiate between serial and one-off or single offenders on homicide offenders whereby they used a sample of homicide offenders and data gathered from the Federal Bureau Investigations (FBI) database. In their study, the researchers used a sample that consisted of 195 single offenders who accounted for 133 victims of which they compared to 147 serial offenders who also accounted for 133 victims. From their study, they found that the number of offenders was greater than the number of the victims due to several offenders having worked together. Their analysis also looked at the victim and offender characteristics, the intentions of the offenders, the relationships between the victims and the offenders, the approaches by the victims, locations, body disposal and different evidence types. Their findings were that serial offenders were more often strangers to their victims, that is, they were not related, of which most of them used the modus operandi of strangling their victims and in most cases, the offenders left their victim's bodies in remote locations. In addition, they also found that the single homicide cases were 72,2% and serial homicides were 76% of the total cases. Also, 78,6% of the victims were females (Slatter 2014). This study therefore shows that crime linkage can be done through the modus operandi (in this case the M.O used was of strangling the victim), through the geographical locations, offender signature, that is, in this case, the offenders left their victim's bodies in remote locations and forensic evidence.

2.6. GAP ANALYSIS

Since the introduction of crime linkage analysis, most police officers around the world adopted crime linkage analysis as an important or key investigative aid in their policing initiatives so as to fight different crimes in their communities. Previous researches have been carried out in most developed countries, such as the United States of America, of which the methodologies used and the environments were however different from those of the current study. The researchers were much concerned on crime linkage and its application to crimes such as homicides, robberies, murder, rape, unlawful entry- both residential & commercial and arson.

In Zimbabwe, crime linkage analysis is practiced on crimes such as murder, unlawful entry- both on residential and business premises, theft from car, robbery and rape. However, there are very

little or no researches carried out to investigate or assess the effectiveness of crime linkage analysis in the detection of Card cloning. This study will be carried out so as to fulfil the research gap.

2.7. CHAPTER SUMMARY

This chapter introduced the definition of literature review and its purpose. On theoretical framework the study discussed Criminological theories like the Least Effort Principle, Distance decay principle, Routine activity theory and Crime pattern theory. These theories are centered on criminals and their bahaviour. Conceptual framework covered the concept of linkage analysis, contributing factors to the commission of card cloning and its investigation process. Empirical studies were also reviewed looking at the past researches that were carried out by different researchers on linkage analysis' effectiveness. The next chapter, that is, chapter 3, is going to focus on the research methodology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. INTRODUCTION

Research methodology entails the procedures or techniques used to identify, select, process, and analyse information about a topic. In research, the methodology section allows the reader to critically evaluate a study's overall validity and reliability. The methodology section answers the questions of how the data was collected? And how it was analysed? This chapter focused on the research methodology that was used in this study. It also looked at the research philosophy, population of the study, research design and justification, sampling procedures and research methods used in data collection in this research project. It further exposed the relevance of testing data gathering tools, reliability and validity to this project.

3.1 RESEARCH PHILOSOPHY

A research philosophy is an outline that guides how research should be conducted based on ideas about reality and the nature of knowledge (Collis and Hussey, 2014). According to (Creswell 2014), There are four (4) possible research philosophies which are positivism, realism, interpretivism and pragmatism (Creswell, 2013). Positivist philosophy view nature as scientific based and that reality is independent of us hence researchers observe reality objectively. The positivist philosophy proponents on one hand argue that in evaluating a study phenomenon, the facts are static and can be scientifically analysed. They also argue that the factual basis of the phenomenon cannot change in the short time especially over the period data is collected. In Interpretivism, reality is seen as highly subjective because it is shaped by people's perceptions (Collis and Hussey, 2014). On the other hand, interpretive philosophy proponents argue that Interpretivism emerged as a result of the perceived inadequacy of positivism to meet the needs of social scientists (Collis and Hussey, 2014) Interpretivism is concerned with exploring the complexities of social phenomena through achieving an empathic understanding of how the research subjects view the world (Bryman and Bell, 2011).In Saunders, Lewis and Thornhill (2015), the impacts of different social construct should be factored in and considered when developing a study analysis.

In this study the research applied a mixed positivist philosophy, the study sought to develop an intelligent system using linkage analysis to be employed in the investigation of Card Cloning fraud in Zimbabwe. Based on the scenario at hand the researcher will interview Investigators and

ascertain whether they are aware and understand Linkage analysis and how it can be applied in investigating Card cloning fraud. The respondents will be asked to explain Card cloning Fraud, Linkage analysis, their experiences and methods they used in investigating card cloning Fraud.

The idea in on addressing research questions on the impact of linkage analysis in the investigation of Card cloning Fraud. The information will be scientifically obtained basing on figures and can be easily analysed through the use of graphs. The information can be static during the period of the study as statics can be obtained from a source which is updated over a period of time. All these variables indicate that the research will be evaluated scientifically as positivism.

3.2 RESEARCH APPROACH

The research was conducted using both qualitative and quantitative research methods. It can be termed as a mixed approach as both methods were used to collect data.

In quantitative method data will be collected through the use of questionnaires which provide quantitative data whilst some data will be obtained through interviews, which is qualitative data. According to Kothari (2004:22), "Qualitative research is concerned with subjective assessment to attitudes, opinions and behaviour." Techniques such as focus group discussions and in-depth interviews are used to gather qualitative data. In this research an in-depth approach will be used to collect data from Fraud investigators.

Quantitative research approach is more structured and controlled. The researcher will be using structured questionnaires and is more in control of the interviews. Information obtained is pre-determined by the researcher. In this case a sample questionnaire will be drafted and sent to relevant people from the target population. The method will help in having control of the interviews and collect only data which is relevant for the research. The aim will be to offer questions which can assist in answering the research questions. The focus will be on the research objectives and the desire to control the research and save time on unnecessary issues. The target population will be readily available, hence the idea of choosing questionnaires ahead of surveys which may take a lot of time and is cost intensive. Data will be readily available since all the stakeholders in the fight against Card Cloning Fraud are accessible around zimbabwe.

The quantitative approach uses the positivist approach which believes that human behaviour can be studied scientifically through objectivity. This can be used and attained if the researcher is able to get to where respondents are and seek for their opinion.

The triangular approach was attributed to the fact that quantitative data and qualitative data is obtained during interviews. The interviews will be done through the use of questionnaires and face to face interviews. The variables can however, be static data whereas reactions from face to face interviews conducted will reveal how knowledgeable the investigators are on Card Cloning Fraud and the attributes that they must possess in order to combat this type of crime. Face to face interviews can also reveal the nature and extent of co-operation that the local system has gone as far as regional cooperation is concerned.

3.3 RESEARCH DESIGN

A research design is viewed as a blueprint that is used when one is carrying out a study with maximum control over factors that may interfere with the validity of the findings (Zikmund, 2010). In addition, Cohen, (2006) is of the opinion that a research design generally is a plan that acts as a guide to the researcher and it outline what is to be researched, where and how the data is going to be collected, processed and analysed. Kothari (2004) claims that research designs include exploration design, diagnosis design experimentation design and description design.

For the purpose of this study, a descriptive survey was be used because it is a method which concerns itself with the present phenomena in terms of conditions, practices, beliefs, processes, relationships or trends invariably (Cooper and Schindler, 2003). It was the best for this study as it presents to the researcher the opportunity to employ quantitative approach. Quantitative approach is concerned with the numerical data collected in the research meaning the number of times an aspect repeated itself when counted in the data collected (Cohen, Marion and Morrison, 2011).

3.4 RESEARCH STRATEGIES

These are tools which are used by researchers to collect data in order to answer research questions. Quantitative technology is associated with numerical data, for example crime statistics and in this case the number of cases reported and investigated. When deciding which technique to use, researchers remember that techniques or methods are not an end in themselves but a means to an end, namely the development of knowledge (Ladikos, 2014).

It would have been ideal to conduct the research including all police detectives and private investigators around Zimbabwe. Practically it was not possible due to time, financial and geographical constraints. The study will be centered on investigators at CID Commercial Crime Division Harare who had a population of around 200. However, a sample of 80 investigators was

interviewed and the target population represents the entire population. The other issue considered was the busy schedule that the respondents have at their work stations. Linkage analysis is performed by the police particularly the CID detectives as well as other private investigators hence the reason why the research was centered on them.

3.5 METHODOLOGY AND DATA COLLECTION METHODS

The researcher collected a supporting letter from the University's Graduate School of Business (GSB. This the letter that he used to get information from participants. Chilisa and Preece (2005), say research instruments are tools that are used to gather data. They add that there is need to decide on what sort of data to be collected and the purpose for which the collected data will be used. There are many instruments that can be used to collect data. In this study the researcher chose Interviews and a questionnaire as data gathering instrument. Questionnaires were hand delivered to participants.

3.5.1 Interviews

An interview is a conversation between a researcher and a respondent aimed at gathering evidence or data. Investigators both from Criminal Investigation Department and private investigators will be the main focus area of the study.

3.5.2 Face to face Interviews

This technique will be used to gather both qualitative and quantitative data. Preliminary investigators on the field indicated that police have the CID Asset Forfeiture (AFU) and CID Commercial Crimes Division which are departments mandated to investigate commercial crimes which include serious fraud cases. The idea will be to interview all the heads of these departments to hear their take on linkage analysis. The aim will be to obtain statistics and challenges faced when employing linkage analysis as an aid to investigation of card cloning fraud. Since the area is quite new the idea is also to use questionnaires which are open ended especially on these target groups.

3.5.3 Structured Interviews

These will be in the form of questionnaires which the researcher design and will be asking pre arranged questions and complete on his own. The interviews will be researcher administered. The

target population will be mainly Fraud investigators and members of the Zimbabwe republic Police CID department who normally practice linkage analysis. The target population will be about 200 investigators.

3.5.4 Questionnaire

According to Morris and Wood (1991), regarded questionnaire as the most widely used technique for collecting data. To be effective, each question must be simple and clear, so that respondents will understand it. This is a technique widely used to gather quantitative data. Questionnaires can be open ended or closed ended depending on the type of questions being asked. Mostly in explorative researches open ended questionnaires are widely used in order to get much information about the subject being researched on. A questionnaire should not be ambiguous and should also answer the research questions and address the research objective.

When formulating questionnaires, the research need to ensure that the questionnaire is structured in a way that it answers research. In other words, it seeks to address the problem at hand. The questionnaire also must ensure that it relates to the research objective and research questions. It should suggest what could be deduced from the answer. Check whether the research contains sensitive information that the respondents may not be comfortable to answer. This relates to ethics in research. The key is that questions must be clear, relevant, simple and unambiguous.

Newman (2000), outlines that the advantages of a questionnaire are that, it can be used on a relatively large population, it is cheaper to administer especially on a small area, can be administered through mail hence helps in responding to sensitive areas, data collected is easy to quantify or evaluate and respondents are given more time to think thereby coming up with considerable answers. The disadvantages of a questionnaire are that, there may be no time to clear ambiguities once administered, there is failure to gather data from verbal clues like in interviews, there is no follow-up on omissions and in adequate answers and this brings bias on responses.

The target population is mainly investigators and questions were structured that the research answers questions relating to investigation process. The target population will be drawn from investigators from Commercial Crime Division in Harare. A random sampling technique will be used to select participants. A total of 80 questionnaires will be distributed among the investigators.

3.5.5 Open ended questionnaires

These are questionnaires where the respondents are allowed to air out their opinions not restricted to pre- structured questions. The respondent can explain in his own words and may give a response based on personal opinion. An open ended questionnaire is also known as unstructured questionnaire, no response options are provided and space is left out for the respondents to formulate their own opinion.

Open ended questions were included in the questionnaire and respondents will be able to give their opinions. It was interesting that different opinions were obtained and respondents were free to express themselves. The idea was to yield maximum results from the research. The research aim was to get an overview of the problem at hand.

3.5.6 Questionnaires closed ended

On the closed ended questions, a dichotomous scale was used to reduce the time respondents take on the questionnaire and also to get quick responses. The other questions were made to be short and precise where the respondents were only made to tick in the box. The information will be presented on a bar graph depicting the level or understanding of the respondents. Questions which were deemed to be crucial were presented in the form of closed ended questions.

3.5.7 Secondary Data Collection

Secondary data is data which has been collected by individuals, (Chilisa and Preece, 2005). Previous similar studies can also be used as secondary data sources. The advantages of secondary data are that it saves administrative time and money, can be used for comparison with the collected data, are less biased and are of high quality. The disadvantages are that access may be difficult and the data could have been collected for a different purpose. Obtaining records usually requires permission from senior management within an organisation, (Leedy, 2000). Some of the secondary sources used by the researcher include books, articles, journals, newspapers and websites.

3.5.8 Primary Data Collection

Primary data is a type of data that is collected by researchers directly from main sources through interviews, surveys, experiments, (Kothari, 2004). Primary data is usually collected from the source where the data initially originates from and is regarded as the best kind of data in research.

The sources of primary data are usually chosen and tailored specifically to meet the demands or requirements of a particular research. Before choosing a data collection source, things like the aim of the research and target population need to be identified. The researcher used questionnaires to gather data from the respondents.

3.5.9 Pilot Testing

The questionnaire was designed with the assistance of the supervisor. It was crafted for a pilot programme, tested by actual field work in order to ensure that the research instrument is reliable and consistent. The researcher tested the questionnaire items with a small group of 10 investigators. Items were properly stated and easily understood by the respondents. The primary aim of that piloting was to improve the quality of the questionnaire by improving its clarity. The pretesting of piloting of the questionnaire increased its validity and reliability, (Leedy, 2000).

3.6 POPULATION AND SAMPLING TECHNIQUES

3.6.1 Population

The researcher studied 200 Fraud investigators from the Commercial Crime Division in Harare. According to Silverman (2005), a population consist of all the individual things or elements that fit in a certain specification. A population is therefore a larger pool from which a sample can be withdrawn. In this context the population refers to the target group of investigators from Commercial Crime Division Harare responsible for the investigation of serious commercial crime that include Card cloning Fraud.

3.6.2 Sample Size

The researcher used stratified random sampling technique to select a sample of 40% from the population of 200 detectives. According to Wegner (1993), the larger the sample taken, the more likely it is to resemble the main population. The sample comprising of 80 Investigators, both males and females from the total population was chosen through a fishbowl random sampling technique. Wegner (1993), defines a sample as data set which is a subset of the population data. The sample has properties that make it a representative of the whole population. It therefore follows, that the size of the sample must be carefully selected so that it is representative of the larger population.

It is a part of the population which is carefully observed and selected in such a way that avoids a biased view of the population.

3.6.3 Sampling Methods

The researcher used stratified random and judgmental sampling techniques which permitted him to ensure that each and every unit in the population has its own representative. He then put investigators in homogenous strata based on their ranks. This means putting investigators with similar characteristics and same job descriptions in the same group. The respondents were grouped according to their ranks to represent each stratum, see table 3.1 below. The sampling technique helped the researcher to have a full representation of each section.

Table 3.1 Number of Investigators according to Rank/Stratum at CCD Harare

Rank/Stratum	**Population**
Detective Inspectors and above	25
Detective Assistant Inspectors	50
Detective Sergeant/ Majors	75
Detective Constables	50
Total	**200**

3.7 QUESTIONNAIRE ADMINISTRATION

A total of 80 questionnaires were distributed to respondents at commercial Crime Division Harare (CCD). All the questionnaires were hand delivered by the researcher then collected them after all the respondents had completed them.

3.8 METHOD OF DATA ANALYSIS

The researcher ordered structured information obtained in the course of the study so as to develop a better picture of what he achieved by the study. In this chapter the researcher adopted the use of tables, charts, graphs and figures. Tables were used owing to the fact that they are easy to read and comprehend. Quantitative data presentation was used. The SPSS data analysis method was used to analyse data. Conclusions were drawn from the data that was collected and recommendations were established from them.

3.9 VALIDITY AND RELIABILITY

3.9.1 Validity

Validity entails the extent to which a measurement instrument accurately measures what it is supposed to measure (Alkharusi 2020).

The questionnaire and interview guide are valid instruments because they successfully collected information from the participants through inputting data in answering the questions. In this study, the questionnaire comprised of close ended questions, which were clear and simple. Corrections were carried out on the questionnaire on errors that were noted during the pilot test of it.

3.9.2 Reliability

Reliability entails the degree to which measures are free from error and therefore yield consistent results, (Leedy, 2000). It is the extent to which administration of the same instruments yield the same results under comparable conditions. All the information that was gathered from respondents was very, reliable and free from errors because it was obtained from source documents and experienced investigators who had vast experience in as far as investigations of fraud related cases in concerned.

3.10 ETHICAL CONSIDERATIONS

According to Leedy (2000), whenever human beings are the focus of investigation, the researcher must look closely at the ethical implications of what the person wishes to do. It is prudent that one always carries out ethical considerations when conducting a research. Ethical issues refer to values and guidelines that explain the conditions under which the research will be directed (Oates *et al*, (2010). Respondents were treated with due care and respect. Those who did not wish to participate were appreciated.

The researcher safeguarded confidentiality, consent, and privacy of respondents at all costs by not mentioning names of respondents. Permission was sought in examining documents produced for other purposes and all issues of anonymity and confidentiality were considered. The researcher first sought for informed consent from the respondents as an ethical principle in research. The information obtained was confidentially treated to avoid fear and victimization of the respondents and the respondents were informed of that.

3.11 CHAPTER SUMMARY

This chapter focuses on methodology and it discussed the research philosophy which is the mixed positivism and mixed approach where both qualitative and quantitative were discussed. An outline of the research methodology that was used in carrying out the research study which is descriptive survey was discussed citing the advantages and disadvantages of each method. Questionnaires and interview guide were used to collect data for the research. The design of the methodology was described and examined with particular attention to the population, the sample, data collection instrument, validity and reliability and ethical considerations.

CHAPTER IV

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 INTRODUCTION

The previous chapter unfolded research methodology for the study. This chapter deals with the description, analysis and interpretation of the data collected from 40% of the 200 police detectives deployed at CID Commercial Crime Division Harare. This translates to a sample size of 80 police detectives used to conduct the research. The SPSS Version 27 was used to analyse and present data. The results obtained are represented using Microsoft Excel in the form of tables, pie charts and graphs for better visual presentation.

4.1 RESEARCH OBJECTIVES REVISITED

The main research objective was:

To develop a system of investigation through the use of Linkage analysis as a tool in investigating Card cloning fraud in Zimbabwe.

Specific Objective were:

To establish what linkage analysis entails and its origin.

To establish the impact of linkage analysis in investigating Card cloning fraud.

To find out different types of linkages that can be used in Card cloning investigation.

To find out factors that influence the use of linkage analysis in Card cloning detection.

4.2 QUESTIONNAIRE RESPONSE RATE

Eighty questionnaires were administered to 80 Investigators at CID Commercial Crime Division who were selected for the sample.

Table 4.1 below shows the questionnaire response rate of all Investigators at CCD against their sample.

Table 4.1: Response rate of questionnaires

Station	Questionnaires distributed	Questionnaires returned	Questionnaires response rate
CID Commercial Crime Division (CCD)	80	80	100%

Source: Primary data

Table 4.1 shows a 100% response rate and all the distributed questionnaires were fully completed as expected. As a result, this enhanced the credibility and validity of the research findings. The researcher is an ex-member of the force and once worked with the respondents and was maintaining a good rapport with them. This has attributed to a high response rate of 100%.

4.3 INTERVIEW RESPONSE RATE

Five interviews were scheduled and conducted with the, Officer Commanding CCD, Officer in Charge Crime CCD, Officer in Charge team one, and Officer in Charge team two, Officer in Charge team three and Officer in Charge team four. The five respondents are the commanders within the department responsible for overseeing and supervising all investigations of serious cases. A total of 100% response rate was achieved and this facilitated meaningful generalisation of results. The high response rate was attributed to a request made by the researcher to the interviewees suggesting the date of the interview prior to the session to avoid inconvenience.

4.4 RESPONDENTS' DEMOGRAPHIC PROFILE

This shows an analysis and interpretation of demographic information concerning personal qualities of the respondents in respect of their gender, age, rank, length of service and educational qualification collected from the respondents.

4.4.1 Gender

The gender aspect was crucial in this study to ascertain how both men and women detectives tend to respond to the issue of profiling of criminals. Figure 4.1 shows distribution of respondents according to gender.

Table 4.2 Gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	60	75.0	75.0	75.0
	Female	20	25.0	25.0	100.0
	Total	80	100.0	100.0	

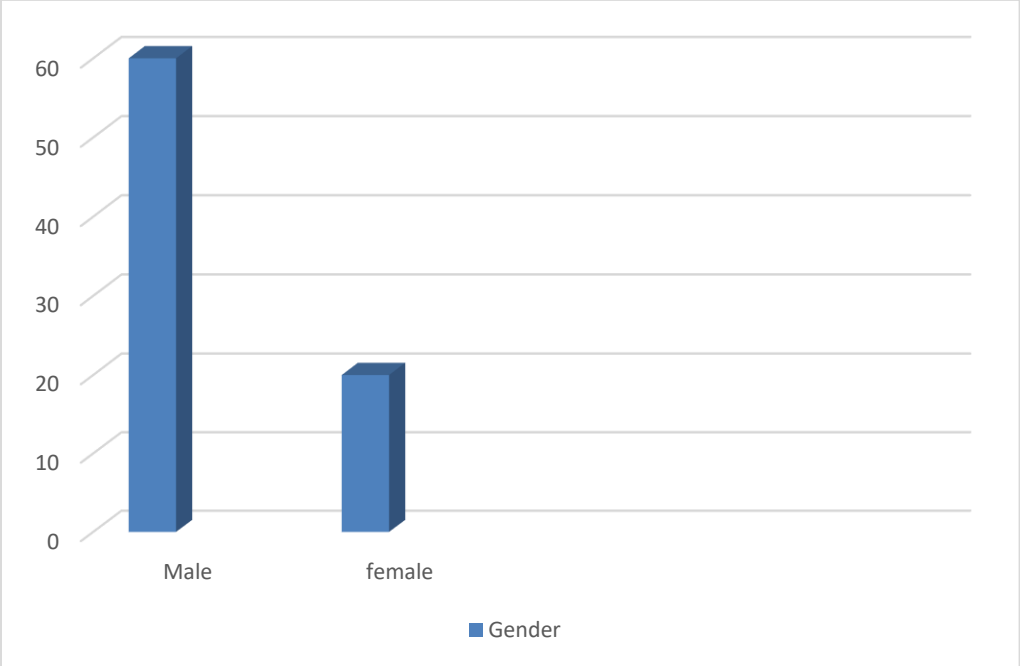


Figure: 4.1: Distribution of respondents according to gender

Source: primary data

Figure 4.1 above mirrors the fact that 60% of the staff in the CID CCD are males and 20% are females. This indicates that the majority of the respondents were men.

4.4.2 Age

The age of respondents was vital as it helped in determining maturity of the respondents.

Table 4.3. Age

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29 years	6	7.5	7.5	7.5
	30-39 years	44	55.0	55.0	62.5
	40 years and above	30	37.5	37.5	100.0
	Total	80	100.0	100.0	

Figure 4.2 Age distribution

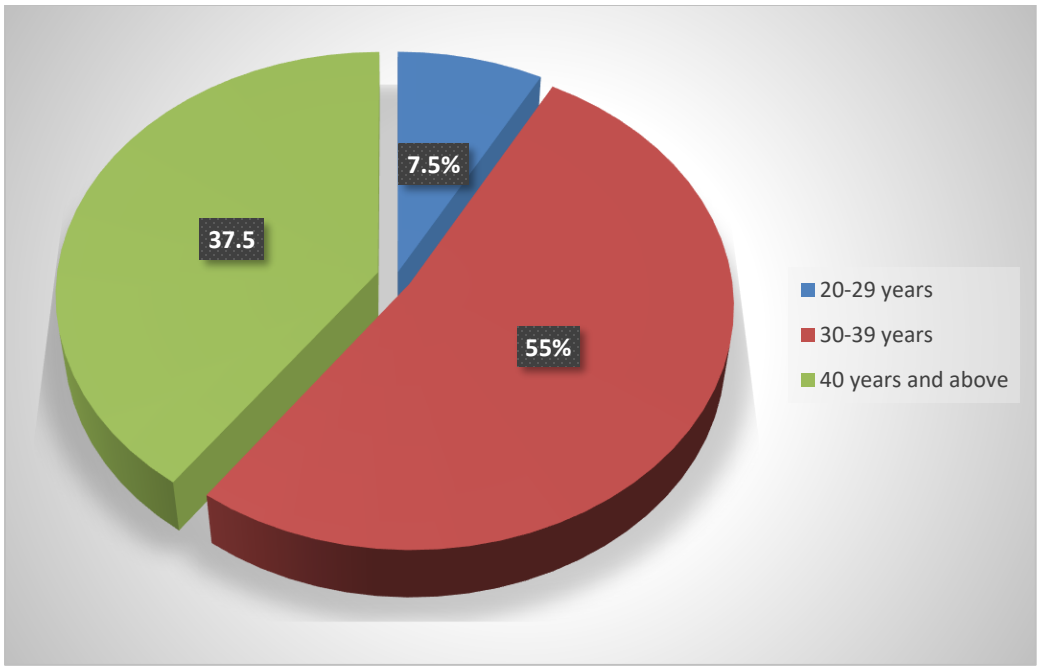


Figure 4.2: Age distribution of respondents

Source: primary data

Figure 4.2 shows a dominant age group of 30-39 years with a frequency of 55% followed by an age group of 40 years and above with a frequency of 37.5%. This is an indication that almost three quarters of the respondents were matured Police detectives. The issue of maturity was vital in this study as it guaranteed the researcher that he obtains positive and relevant input from the respondents as they had greater ability to grasp the aims and objectives of the study.

4.4.3 Education

Table 4.4 shows the level of education acquired by the respondents. This information is vital as it indicate the ability of the respondents to understand the concepts being asked and answer questionnaires objectively.

Table 4.4: Distribution of respondents according to level of education

Educational Qualification					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ordinary Level	35	43.8	43.8	43.8
	Advanced Level	20	25.0	25.0	68.8
	Certificate/Diploma	15	18.8	18.8	87.5
	Degree	10	12.5	12.5	100.0
	Total	80	100.0	100.0	

Source: Primary data

Table 4.4 above shows that, the majority of the respondents (43.8%) were found to have attained ordinary level followed by 25% who had attained Advanced level qualification. The remaining 31.2% of the respondents had attained a diploma or degree. The minimum entry qualification for a police officer is five ordinary levels with mathematics and English compulsory. This indicates that the participants had high literacy level.

This illustrates that police detectives were capable of grasping the meaning of the questionnaires and interview hence reasonable responses were obtained from respondents.

4.4.4 Rank

Table 4.5: Distribution of respondents according to ranks

Rank					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Detective Constable	20	25.0	25.0	25.0
	Detective Sergeant/ Major	30	37.5	37.5	62.5
	Detective Assistant Inspector	20	25.0	25.0	87.5
	Detective Inspector and above	10	12.5	12.5	100.0
	Total	80	100.0	100.0	

Source: primary data

The data shown on Figure 4.5 above was very vital to this study because it reflects the distribution of manpower within CID CCD as well as their ranks. Detective sergeant is the rank that represents a large number of respondents with 30% followed by Detective Assistant Inspector and Detective Constable all at 20% respectively. Detectives with the above-mentioned ranks are referred to as operatives and they perform most of the investigations involving serious cases and conducting Crime linkage analysis activities. In this study ranks of or above the rank of Detective Inspector to be discussed about include Superintendent and Chief Superintendent. A detective inspector is a person who will be in charge of station, section, team or a specialized team. CID Commercial Crime division is headed by Chief Superintendent and Superintendent as his or her deputy. They oversee and give directions to all investigations of serious cases in the section. In this study they are all represented by 10%.

4.5. LENGTH OF SERVICE

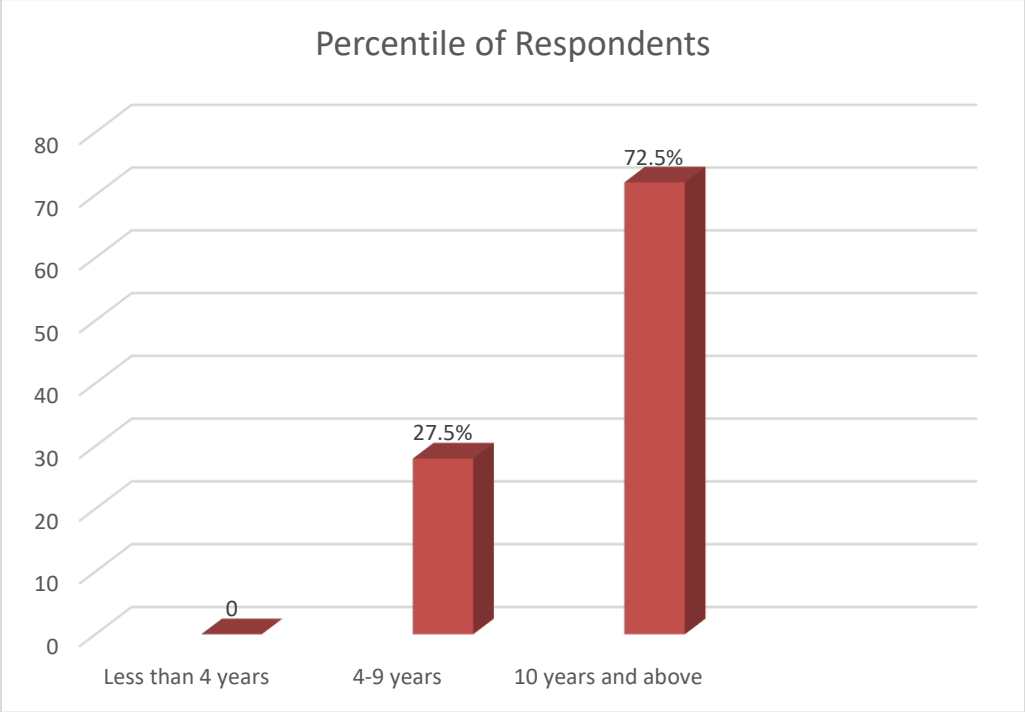


Figure 4.3: Length of service of respondents

Source: Primary data

Figure 4.3 shows that the majority of the respondents (72.5%) had served for more than 10 years and 27.5 % had served above 4 years but less than 9 years.

This can be interpreted to say they have vast experience as investigators hence greater contribution can be achieved in assessing the value of linkage analysis in investigating card cloning Fraud. It is rare to find a police officer who has less than 4 years of service in the police being recruited in the Commercial Crime Division. This is due to the fact that they are said to have little or no experience as far as Investigation is concerned hence they need to acquire more experience in other departments the like Duty Uniform branch and then became eligible to apply to join CID department.

4.6. ROLE OF LINKAGE ANALYSIS IN THE INVESTIGATION OF CRIME.

This theme arose from a qualitative question which sought to establish the role of linkage analysis in the investigation of Crime. All the respondents showed that they are indeed convinced that linkage analysis plays a pivotal role in the investigation of serious crime. A number of roles were raised by the respondents and about 92% highlighted that the major role of linkage analysis is to assist investigators with possible suspects, who then may be linked with similar crime scenes through same behaviour patterns. One of the respondent mentioned that "Crime linkage helps to predict the likely residential area of the possible suspect hence the investigating officer will focus his investigations in that area".

Some of the roles found out from the study include that, linkage analysis also helps in identifying the modus operandi used by different criminals and that it helps to know the most targeted victims or property. This means that through crime linkage analysis, pro-active measures will be put in place to counter the shenanigans plans of criminals. The roles of linkage analysis found in this study are the same with those found in the study conducted to establish the utility and validity of linkage analysis by the Canadian police as recorded by (Snook et al 2007). It was found out that approximately 94% of the officers in that study agreed that linkage analysis is a valuable investigative tool which provides further investigative understanding of a case under investigation.

4.6.1. Period of using linkage analysis as an investigation tool.

After finding out the role of linkage analysis in this study, it is prudent to look at the period spent by the respondents using linkage analysis in the investigation of serious cases. This gives a better understanding on whether the respondents have experience in conducting linkage analysis.

Table 4.6 below shows the data concerning the respondents 'distribution of period spent conducting Crime Linkage analysis.

Variables		Frequency	Percent
	Below 5 years	10	12.5
	6-8 years	14	17.5
	9 years and above	56	70.0
	Total	80	100.0

Source: Primary data

Data displayed on figure 4.6 above, shows that 17.5% of the respondents have been using crime linkage in investigation for between 6 and 8 years. A total of 12.5% confirmed to have used crime linkage analysis between 2 to 5 years while those who have been using it for more than 9 years were 56 which translate to 70%. This data aided the credibility of the findings because the respondents have some years of experience using crime linkage as an aid in the investigation of serious cases.

4.6.2 Respondents' views on linkage analysis.

It was important in this study to hear the opinions of the respondents regarding the usefulness of crime linkage in investigation after they had identified the roles of crime linkage analysis. Four statements were inserted in the questionnaire and respondents were required to indicate their opinion towards each statement. Tables 4.7 below shows the respondents' view on crime linkage analysis regarding its usage and roles in the investigation of crime cases.

Table 4.7: Respondents 'views on linkage analysis.

Variables	Strongly agree		Agree		Neutral		Disagree		Strongly disagree	
	freq	%	freq	%	freq	%	freq	%	Freq	%
Linkage analysis is useful as a tool in detecting card cloning fraud by investigators	68	85	12	15	0	0	0	0	0	0
Linkage analysis helps in detecting card cloning cases	66	82.5	14	17.5	0	0	0	0	0	0
Linkage analysis helps to predict characteristics of card cloning offenders	15	18.8	15	18.7	30	37.5	20	25	0	0
Linkage analysis helps investigators to identify patterns and targets for card cloning offenders.	55	68.8	15	18.7	10	12.5	0	0	0	0

Source: Primary data

A total of 85% of the respondents strongly agree that linkage analysis is widely used in the investigation of crime while 15% agree with the same notion. One can therefore conclude that all the respondents admit that linkage is widely used. Crime linkage analysis is used as an investigative tool in countries like Canada, Australia, Finland, Germany, Ireland, Malaysia, New Zealand, Russia, South Africa and Sweden (Snook et al 2007).

It was also found out in the study that 82.5% of the respondents strongly agree that crime linkage helps to solve card cloning cases while 17.5% agreed with statement. This is in agreement with a study that was recorded by Pinizzotto (1984) where the FBI profiler John Douglass confirmed that crime linkage has solved 46% of the 192 cases reported. In his study 77,2% of his respondents indicated that crime linkage helps in the investigation of serious cases.

A total of 18.5% of the respondents strongly agree that linkage helps to predict characteristics of card cloning offenders. 18.7% also agrees with the statement while 37.5% were neutral and 25% disagree with the statement.

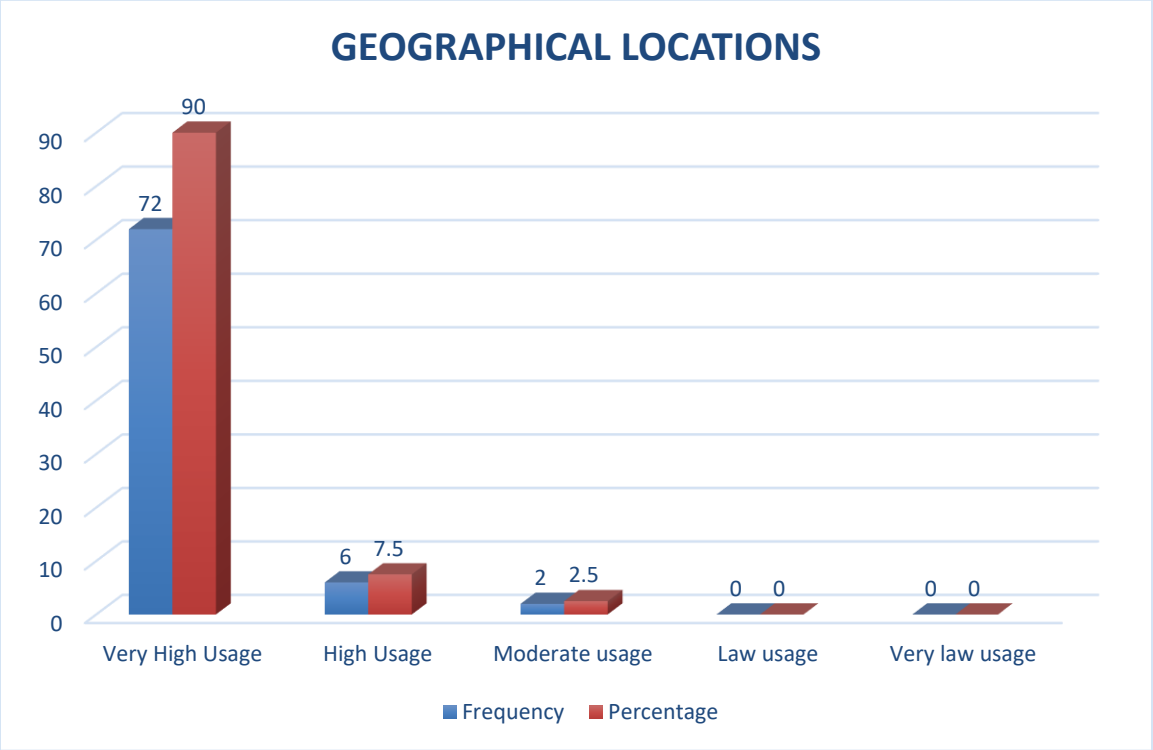
The type of linkage analysis that is assumed to be used to predict offender characteristics is termed Profiling of offender characteristics. This type of profiling includes the demographic information about the suspect. This view of the respondents who agree with the statement can be supported by the findings of (Bull et al, 2006), when he suggested that the assumption of this approach is that the way an offence is committed is also related to the characteristics of the offender basing on the behaviour of the suspect during the commission of the crime.

A total of 68.8% strongly agree with the notion that linkage helps the police detectives to identify card cloning offenders while 18.7% also agree. An analysis of the data indicate that all the respondents agree with the statement and they only differ in their standard of agreement. The issue of identifying offenders using crime analysis lacks empirical evidence. This was supported in the findings of Shanaham (2008) where the author posits that most of the profiled cases yielded negative results as no arrests were made.

4.7 FACTORS TO BE CONSIDERED WHEN CONDUCTING LINKAGE ANALYSIS.

This theme seeks data concerning the various methods to be used in carrying out a Linkage analysis so as to formulate an intelligent system of investigating card cloning fraud. The factors include Geographical location, Modus Operandi, Crime Scene Evidence, Name of bank, Victim Profile, Card type Signature behaviour and fraudulent transactions.

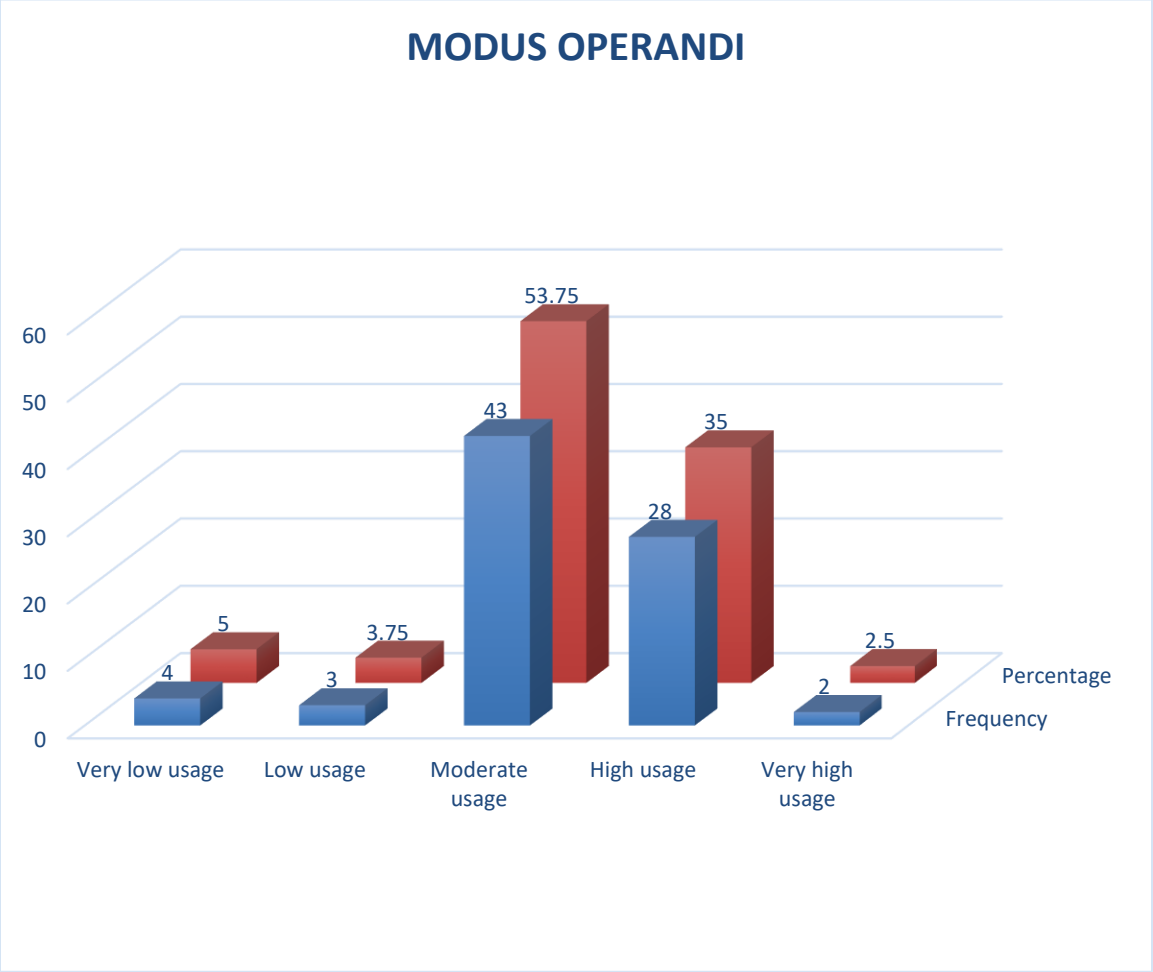
Figure 4.4 Respondents 'views on Geographical Location



4.7.1 Geographical locations

The findings of this study show that 90% of the respondents agree that there is very high usage of this method to conduct a linkage analysis while 7.5% agree that there is high usage. About 2.5% also confirmed that there is moderate usage of it. None among the respondents confirmed low usage and very low usage. The usefulness of this factor to conduct linkage analysis can be linked to the findings of Bennell and Jones (2005) where they suggested that the distance between burglary locations (that is inter-crime distance is the single most reliable indicator of whether or not unlawful entry cases are committed by the same offender, with shorter distances indicating a greater likelihood that offences are linked.

Figure 4.5 Respondents 'views on Modus Operandi

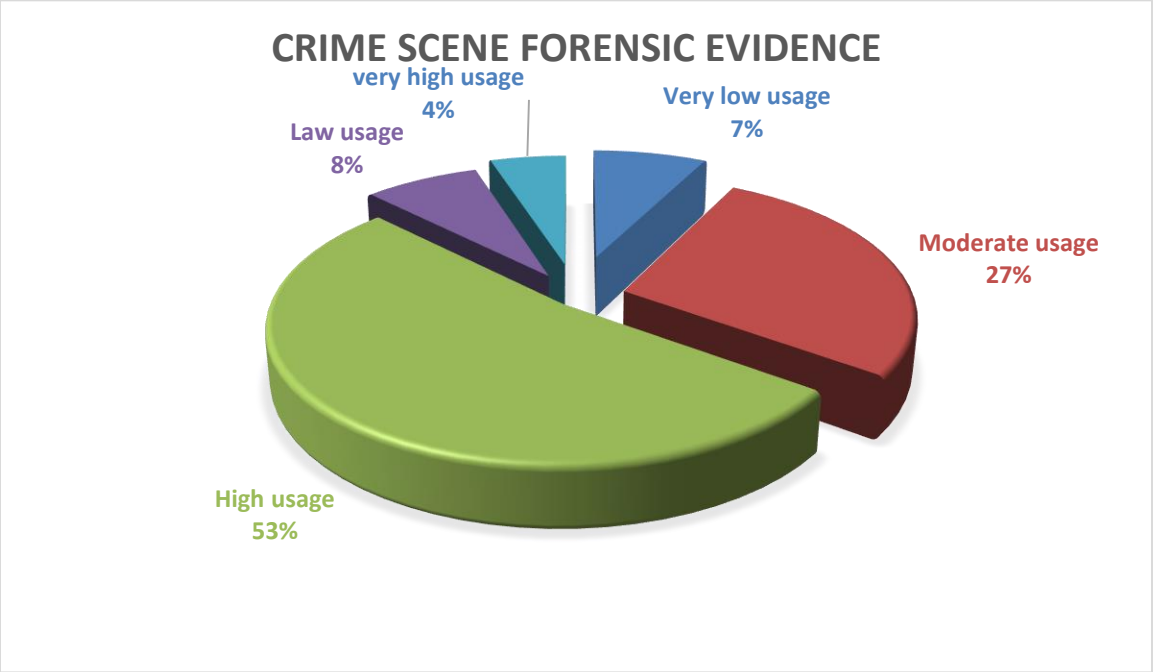


Source: Primary data

4.7.2 Modus Operandi

Modus operandi refers to the behaviour of the offender in carrying out the offence. For example, breaking window by latch or cutting burglar bars with a bolt cutter. In card cloning we will be looking at Identity Theft, Theft of physical debit card, cloning of the card by skimming software, Phishing for Debit card information by hackers, bank employee insider threats and methods of operation. A total of 35% of the respondents confirm that there is high usage of this factor in linking card cloning while 53.75% moderately agree that Modus operandi is useful in the investigation of crime. Those who affirm to the notion that there is very low or low usage are represented by 5% and 3.75% respectively.

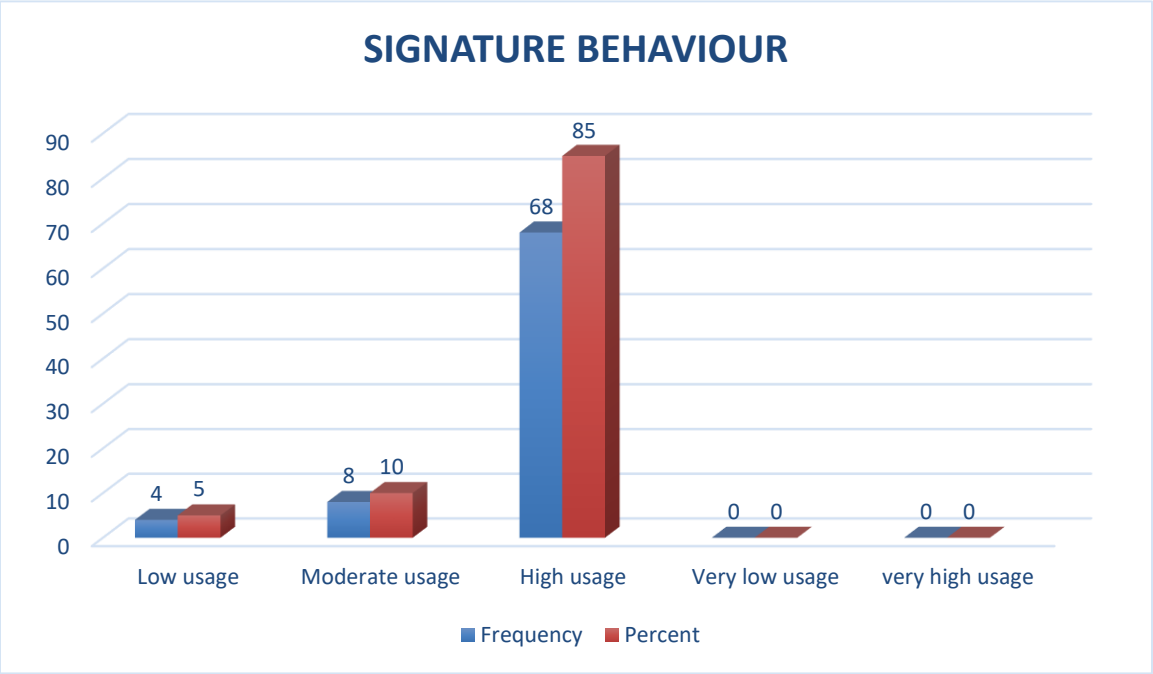
Figure 4.6: Respondents' views on Crime Scene Evidence.



4.7.3 Crime Scene Forensic Evidence

A total of 27% moderately agree that crime scene forensic evidence is used to conduct linkage analysis in the investigation of card cloning fraud while, 53% have indicated high usage of this factor in conducting linkage process. It was found out that crime scene evidence is used mainly to link known and unknown suspects who are involved in criminal activities. Examples of such evidence can be obtained from Close Circuit Television (CCTV) footage where facial identification can be done. Latent or chance prints that are uplifted from smooth surfaces such as glass materials and physical evidence found at the scene such as, fingerprints, shoe prints and tyre print that are found and photographed at crime scenes. In addition, there are other types of forensic evidence such as digital footprints and gadgets that could have been used in the commission of the crime. This type of evidence is more effective if the same type of evidence is found from different crime scenes This can thus show the usage of this factor in linking a number of people involved in the criminal racket.

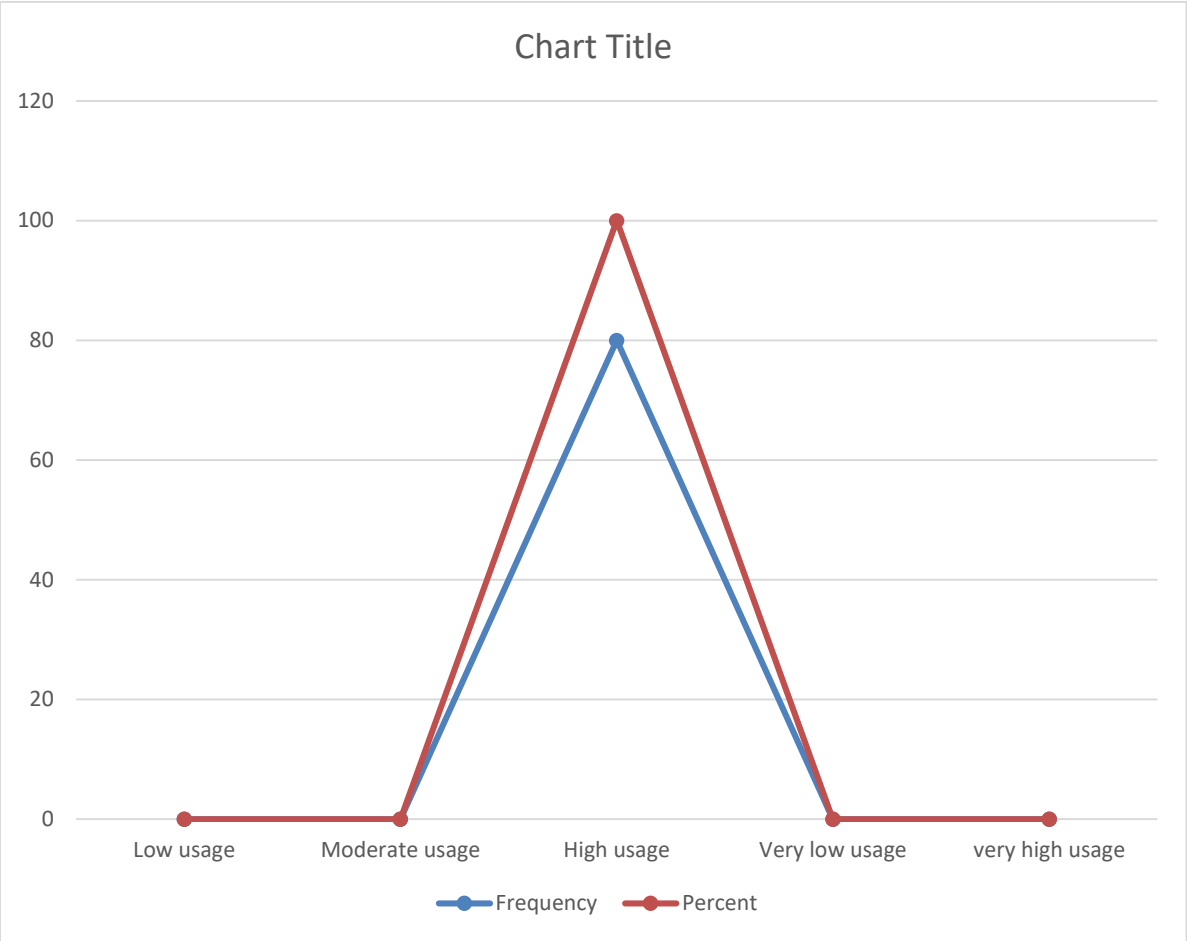
Figure 4.7 Respondents' views on Signature Behaviour



4.7.4 Signature Behaviour

There is high usage of Signature behaviour in linking different crime as confirmed by the 85% of the respondents. A total of 10% agree that there is moderate usage of Signature behaviour while 5% indicate low usage. Signature behaviour refers to a noticeably different behaviour that is displayed by an accused person across his crimes so as to meet some psychological needs, such as the positioning of a victim's body in a degrading manner after committing murder, Douglas and Mumm (1992). In other words, signature behaviour refers to a certain behaviour or action exhibited by the accused soon after the commission of a crime that is totally different from other accused's behaviour such as relieving himself at the door step after commission of unlawful entry crimes thereby leaving his stool at the door step. According to Hazelwood and Warren (1990), signature behaviour are similar to ritualistic behaviours and can psychologically change due to crime situations. In relation to card Cloning Fraud, signatures refers to patterns such as unusual login or access patterns, multiple failed login attempts, sudden increase in transactions.

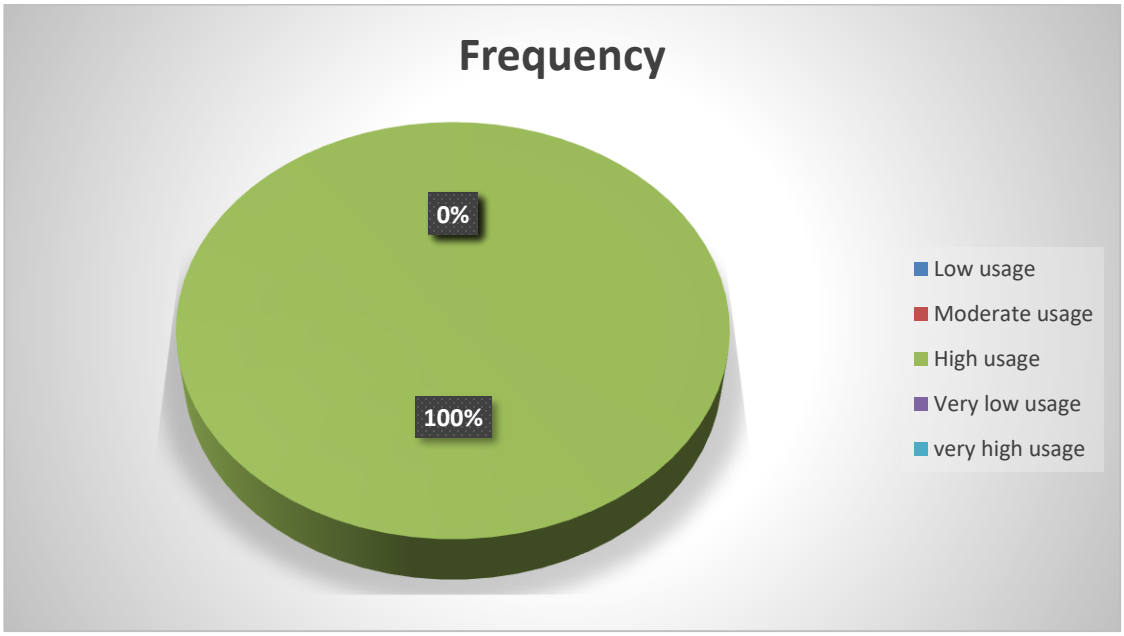
Figure 4.8 Respondents' views on Name of Bank



4.7.5. Name of Bank and Card type

Name of Bank plays a crucial role as a factor in linkage analysis process. It helps investigators to identify card issuer and verification of the card's authenticity. Certain banks are more vulnerable to card cloning than others depending on the security of the bank and card type. Basically the following are the types of debit cards namely Chip- enabled, Contactless, Virtual only to mention but a few. Respondents believe that this factor is importance hence 93.75% confirmed high usage while 5% confirmed moderate usage and 1,25% representing one person confirmed low usage.

Figure 4.9 Respondents' views on Fraudulent transactions



4.7.6 Fraudulent transactions

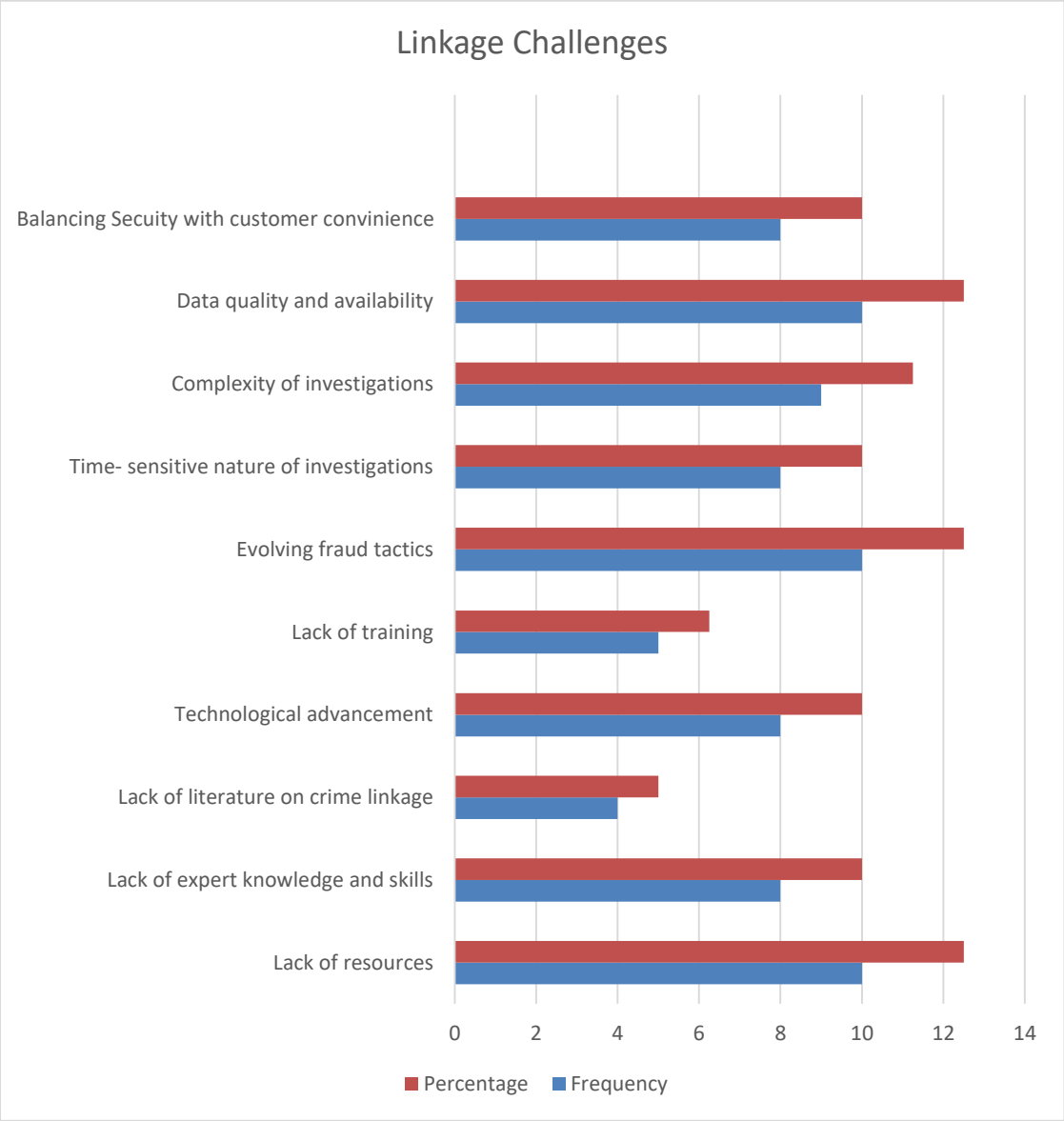
Fraudulent transactions play a crucial role in the investigation of card cloning fraud. It helps ti identify unusual transactions in different geographic locations, Multiple transactions in short time frame and transactions with similar amounts or patterns. This will provide leads to investigators and narrow their investigations towards a number of suspects. All respondents confirmed the usefulness of this factor in conducting linkage analysis which translate to 100%.

4.8. CHALLENGES TO EFFECTIVE LINKAGE ANALYSIS

This theme focuses on obtaining what the respondents regard as major obstacles affecting the effectiveness of linkage analysis in the investigation of Card cloning fraud.

Figure 4.7 below shows the views of respondents on what challenges that affect the effectiveness of linkage in the investigation of Card cloning fraud.

Figure 4.10: Challenges of linkage analysis N=80



Source: primary data

It was established in this study that Lack of resource and evolving fraud tactics are the major obstacles with 12.5%, followed by Complexity of investigations 11.25%, lack of expert knowledge, Technological advancement and Time sensitive nature of investigations all with 10%. The respondents pointed out that the investigators are not adequately resourced, trained in Card cloning investigations and is lagging behind in terms of technological advancement.

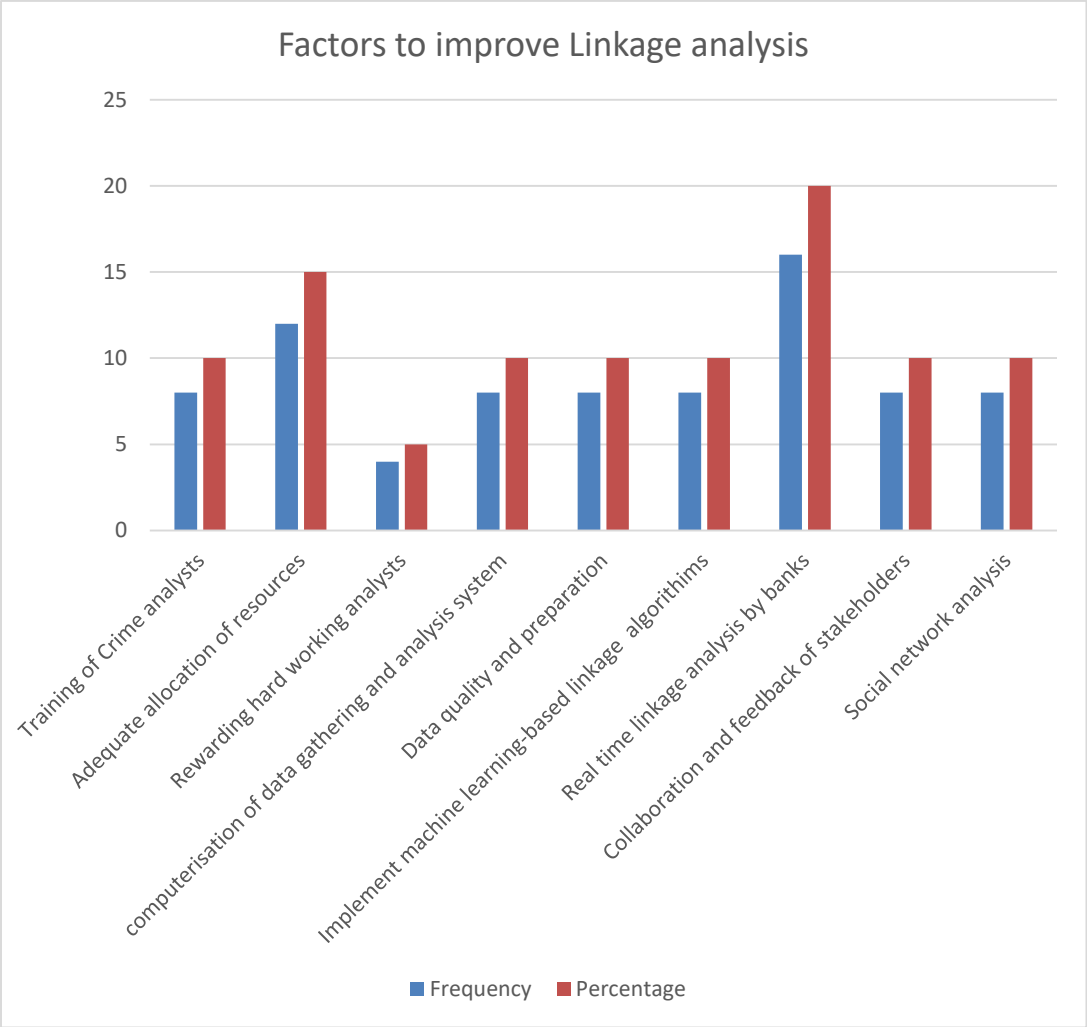
It was found out from the interviewees that shortage of computers to store, process, analyse data and vehicle to increase mobility in gathering criminal intelligence for profiling from complainants, victims and at scenes of crime have been militating against the effectiveness of linkage analysis especially in the investigation of card cloning Fraud.

Furthermore, it was established through interviews that organizational culture seems to have constrained the effective implementation of crime linkage analysis. The reason sighted was that the culture of the organisation seems not to facilitate the tenets of the philosophy due to organizational sluggishness as the majority of the interviewees agree that there is resistance to change.

A Superintendent among the interviewees pointed out that the other obstacles which is affecting linkage analysis process in the investigation of card cloning cases is that, the process is done manually. The ZRP uses forms 293, 125, 14, 14A and 170 to profile suspects and their modus operandi and then use the data for linkage analysis. This was said to be contrary to the South African Police Service (SAPS) way of profiling where they use computerized system called the Case Administration system (CAS). All data bases that might contain a suspect's information is sourced and analysed with the aid of computer software packages designed for that purpose.

4.9. FACTORS TO IMPROVE EFFECTIVENESS OF LINKAGE ANALYSIS

Figure 4.11: Factors to improve effectiveness of linkage analysis in card cloning investigation



Above stature shows that real time linkage analysis by banks plays a pivotal role in linkage analysis process and is represented by 20%. Adequate allocation of resources to conduct the linkage process in the second highest followed by training of analysts, data quality preparation, Social Network analysis , Implementation of machine learning –based linkage algorithms, Rewarding hard working analysts and computerization of data gathering and analysis system.

4.10. CHAPTER SUMMARY

The chapter presented the findings of the study. The findings were presented and analyzed using descriptive statistics. The findings showed that linkage analysis is a valuable tool that can be used by investigators in Card cloning fraud investigations. Development of an effective intelligent system in the investigation of card cloning hinges on consideration of various methods to be used in carrying out a Linkage analysis. The factors include Geographical location, Modus Operandi, Crime Scene Evidence, Name of bank, Victim Profile, Card type Signature behaviour and fraudulent transactions. However, there are identified challenges that militate against the success of linkage analysis which include balancing security with customer convenience, evolving fraud tactics, data quality and availability, resources and training of investigators. The study found out that effectiveness of linkage analysis is based on real time linkage analysis by banks, Adequate allocation of resources to conduct the linkage process, training of analysts, data quality preparation, Social Network analysis, Implementation of machine learning –based linkage algorithms, Rewarding hard working analysts and computerization of data gathering and analysis system. The next chapter presents conclusions and recommendations of the study.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 INTRODUCTION

Chapter one presented on the basic elements to set up the platform for the research which include background of the study, statement of the problem, research objectives and questions, significant of the study, assumptions, limitations and delimitations. Chapter two focused on literature review, theoretical review and empirical studies while chapter three highlighted the methodology used in the study as well as the research design. The previous Chapter dealt presented and analysed data through the use of the statistical package for social science research (SPSS). This chapter dwells on the summary and conclusions of the findings of the research study. This chapter will also focus on making recommendations that are aimed at improving and developing an intelligent system through the effective use of linkage analysis in the investigation of card cloning fraud. The chapter also guides areas for further study to direct future studies related to this study.

5.1 SUMMARY OF FINDINGS

5.1.1 ACHIEVEMENT OF RESEARCH AIM AND OBJECTIVES

The aim of the research was to develop an intelligent system that can be used in investigating Card cloning fraud in Zimbabwe. The study was inspired by financial losses that are being incurred by organizations, banks and ordinary citizens through card cloning fraud. The main research objective was to develop a system of investigation through the use of Linkage analysis as a tool in investigating Card cloning fraud in Zimbabwe. The study sought to develop a system that promote quick detection of card cloning fraud and the immediate identification and arrest of culprits by investigators. This will go a long way in reducing the rate at which card cloning fraud is being perpetrated in Zimbabwe.

The study was guided by criminological theories namely the Least effort principle, Distance decay principle, Routine activity theory and Crime pattern theory. Quantitative research was used and the data was collected using questionnaires and interview guide. The study used a sample size of 80 respondents and descriptive statistics were used in the analysis of findings.

5.1.2 FINDINGS

The study found out that linkage analysis is practiced in Zimbabwe by the Zimbabwe Republic Police. It is used to link suspects who has the propensity to commit serious crimes which include robbery, murder, unlawful entry into premises and theft. Its major role was its usefulness as an investigative tool to identify possible suspects, and crime scenes linkage using same behavior patterns analysis.

It was also established that the use of crime linkage analysis in the investigation of Card cloning fraud is not frequent as compared to its use in the investigation of cases like murder, serial rapists, Robbery and Unlawful entry and Theft cases. The major obstacles hindering the effectiveness of linkage analysis in the investigation of card cloning fraud include lack of resources such as computers to store, process and analyse criminal data, lack of expert knowledge in the investigation of Card cloning fraud and inadequate training on the subject of linkage analysis.

The study revealed that linkage analysis is one of the best tools that can be used in the investigation of card cloning fraud. There is need for a holistic approach in fighting this crime between investigators and Bankers Association of Zimbabwe. Banks. The study revealed that computerization of data gathering and analysis system, Real-time linkage analysis by banks, implementing machine learning-based linkage algorithms and Collaboration and feedback of stakeholders is key in developing an intelligent system to fight card cloning. The investigators who conduct the case investigation and presentation of the docket with findings to the court is affected by lack of resources and training on how to use linkage software packages like the machine learning-based linkage algorithms.

Factors to be considered when conducting linkage analysis were identified as modus operandi, Crime scene forensic evidence, signature behaviour, Name of bank and Card type, Fraudulent transactions and geographical location. Geographical location is a profiling technique used to predict the likely residential location of the suspect which will then help the investigating officer to focus his investigations in that particular location.

The respondents pointed out that the organization like Zimbabwe Republic Police who has the mandate to investigate and present the docket for prosecution at the courts is not adequately resourced and is lagging behind in terms of technological advancement. Profiling and linkage analysis is done manually in the ZRP using special forms designed for that purpose. This is an

outdated way of practicing profiling and linkage analysis in this 21st century when compared to other countries reported to practice profiling like South Africa which uses computerized system. This was found to affect and derail the effective investigation process of card cloning fraud through the use of linkage analysis. The study also revealed the need for the Bankers Association of Zimbabwe and the Zimbabwe Republic Police's Commercial Crime Division to conduct a combined training to equip them with requisite knowledge and best practices on the investigation of Card cloning fraud.

Highlighted also by the interviewees was the change of organizational culture by the ZRP which need to be considered. Culture that support proactive way of fighting crime such as criminal profiling and crime linkage analysis needs to be supported by strategic planners in the organisation.

5.2 CONCLUSION

In response to objective 1, which sought to establish what Linkage analysis entails and its origin. the study finds out that Linkage analysis or Crime linkage analysis is an investigative tool that is designed to assist investigators in identifying whether a set of crimes has been committed by the same offender. Crime linkage is traced back to the development of the Federal Bureau of Investigations (FBI)'s Violent Criminal Apprehension Program (ViCAP) in 1985 It is practiced across several countries which include United Kingdom, United States of America, Belgium, France, Germany, Ireland, Netherlands, New Zealand and Switzerland, where it was used to link crimes according to crime locations. In New Zealand, crime linkage is done through forensic evidence gathered from the crime scene, fingerprints uplifted from crime scenes, classified and identified through the automated fingerprint identification system(AFIS), DNA profiling techniques, Modus operandi, targeted property, method of exiting the crime scene and time of operation.

In response to objective 2, which sought to establish the impact of linkage analysis in investigating card cloning fraud. It was established that the use of crime linkage analysis in the investigation of Card cloning fraud is not frequent as compared to its use in the investigation of cases like murder, serial rapists, Robbery and Unlawful entry and Theft cases. It was revealed that linkage analysis is one of the best tools that can be used in the investigation of card cloning fraud. There is need for a holistic approach in fighting this crime between investigators and Bankers Association of Zimbabwe. Banks. The study revealed that computerization of data gathering and analysis system,

Real-time linkage analysis by banks, implementing machine learning-based linkage algorithms and Collaboration and feedback of stakeholders is key in developing an intelligent system to fight card cloning.

Objective number 3 sought to find out different types of linkages that can be used in Card cloning investigation. The study found out that modus operandi, signature, geographical location, Name of bank and card type and fraudulent transactions are some of the factors that can be used to establish a relationship in card cloning Investigation.

In response to objective 4, factors such as Data availability, analytical tools. Collaboration between stakeholders, effective communication, experienced investigators, complexity of the fraud, prevalent of the fraud and continuous training were identified to positively influencing the use of linkage analysis in card cloning investigation.

The need for developing an intelligent system for the investigation of card cloning fraud using linkage analysis is evidenced by the continuous rise in cases of card cloning despite the fact that suspects are being arrested yet those who are being apprehended and successfully convicted are very few. Huge amounts are being stolen through card cloning while the recovery rate is very low.

The study found out that linkage analysis is practiced by the Zimbabwe Republic Police in the investigation of serial crime like murder, robbery Unlawful entry in premises, Theft and Rape. The results are not the same when the same concept is applied on Card cloning fraud. Detectives are aware of major role of linkage analysis as a valuable investigative tool used to identify suspects characteristics, modus operandi, predict locations of suspects and establish linkage and pattern of crime. Developing an intelligent system to enhance and promote linkage analysis as a better way of investigating card cloning fraud requires a holistic approach from all players namely Bankers Association of Zimbabwe, investigators and the courts. The study revealed that computerization of data gathering and analysis system, Real-time linkage analysis by banks, implementing machine learning-based linkage algorithms, Collaboration and feedback of stakeholders is key in developing an intelligent system to fight card cloning. The investigators who conduct the case investigation and presentation of the docket with findings to the court is affected by lack of resources and training on how to use linkage software packages like the machine learning-based linkage algorithms.

The investigation system should consider the following factors when conducting linkage analysis namely modus operandi, Crime scene forensic evidence, signature behaviour, Name of bank and Card type, Fraudulent transactions and geographical location. An examination of the above mentioned factors by well-trained and knowledgeable crime analysts who knows the acceptable legal way of gathering evidence and conducting the investigation will provide leads towards the detection of the case and prosecution of offenders.

5.3. RECOMMENDATIONS

5.3.1 Training

In order to realize maximum fruits on linkage analysis, it is recommended that banks and investigators combine efforts and resources to adequately train investigators on modern way of investigating Fraud using the linkage analysis model. Courses like that of certified Fraud examiners and Forensic accounting will enhance investigators' skills. It is also recommended that organisation like ZRP second members from the Commercial crime Division to attend training sessions offered by regional organisations like SAPCCO and other security services like FBI who started with criminal profiling and cases linkage analysis and effectively practice it. This will enable the organisation to see where it is lagging behind as far as linkage analysis is concerned thereby putting in place remedial action to effectively address the problem.

5.3.2 Awareness campaigns

Bakers and Investigators need to conduct awareness campaigns against Card cloning Fraud to members of the public on ways to protect themselves from skimming and shimming. The public must look out for skimmers and shimmers before one insert his card into an ATM or card reader. One has to keep his/her eyes peeled for visible damaged, loose equipment or other possible signs that a skimmer or shimmer may have been installed.

5.3.3 Use of EMV comply debit cards

The use of a chip-enabled card also known as Europay, Mastercard and Visa (EMV) is a game changer in fighting Card cloning fraud. The chip is a small, metallic square on the front of the card and it stores the same basic data as the magnetic strip on the back of the card. Each time a

chip card is used, the chip generates a one of a kind transaction code that can be used only one time. This enhances security of the card from being cloned.

5.3.4. Use of mobile payment applications

Encouraging people to purchase with mobile payment applications like the Ecocash and Netone wallet is better secured than using the physical card. Mobile payment applications are safer because data transmitted in a digital transaction is encrypted and less prone to fraud.

People should be urged to monitor their card activity all the time. This can be done on line or on paper after requesting for a bank statement. Check for any suspicious transactions and quickly notify the bank to deactivate the account.

5.3.5 Resources

The ZRP may acquire more resources such as computers, surveillance cameras, vehicles and adequately equip its forensic science laboratories with. Acquiring more computers, for instance, can help the organisation to improve capturing profiling data for suspects, retrieval, analysis and case linkage and processing of criminal intelligence. In order to be more effective in apprehending moving criminals, the ZRP might acquire more powerful vehicles since such offenders are always mobile.

5.4 AREAS OF FURTHER STUDY

Since the study of crime linkage is wide, the researcher suggested that the future study should consider effects of training on the effectiveness of linkage analysis in fighting crime, Development of a linkage analysis framework for investigating cyber-enabled fraud and the role of Social Network in uncovering Fraudulent relationships.

5.5 ANSWERS TO RESEARCH QUESTIONS

A study to test the hypothesis established that linkage analysis do help in investigating card cloning fraud. It was revealed in the study that linkage analysis is one of the best tools that can be used in the investigation of card cloning fraud. Its usefulness can only be realised if there is an existence of a holistic approach in fighting this crime between investigators and Bankers. The study revealed that computerization of data gathering and analysis system, Real-time linkage analysis by banks,

implementing machine learning-based linkage algorithms and Collaboration and feedback of stakeholders is key in developing an intelligent system to fight card cloning fraud.

5.6 CONTRIBUTION

5.6.1 Theoretical Contribution

The study contributes to the theoretical body of knowledge. Previous studies on Linkage analysis were applying Broken window and Rational Choice, Social disorganization theories to explain the connection between crime, people and the society. The present study made theoretical contributions to the theoretical body of knowledge in the work of Routine activity theory, Crime pattern and Least effort theory to explain the criminological relationship that exit between Fraud criminals and how they are investigated.

5.6.2 Methodological Contribution

Past researches in this area have predominantly used qualitative research approach. The present study uses both qualitative and quantitative research using a relatively large sample size. This methodology is important as the findings of the study can be generalised to the investigation of other Fraud related cases like insurance fraud, money laundering and accounting fraud.

5.6.3 Empirical Contribution

The study found out that literature on Linkage analysis and card cloning in Zimbabwe is scarce. As such, the present study provides very important contributions to the empirical body of knowledge by providing the relevant information and intelligent system on investigating Card cloning fraud in Zimbabwe.

5.7. CHAPTER SUMMARY

This chapter covers the findings of the study, achievement of aim and objectives of the study, conclusions, recommendations. The research found out that linkage analysis is one of the best tools that can be used in the investigation of ad cloning fraud. All the aim and objectives of the study have been met and to achieve maximum benefits of linkage analysis it is recommended that investigators be equipped with the necessary skills through training, the general public we warned of how card cloning is perpetrated, use of EMV comply cards by banks and promote the use of mobile money payment platforms by the general public to reduce the changes of being defrauded. Section 5.0 introduced the chapter. Section 5.1 provided research aims and objectives while section 5.2 is for summary of finding, Recommendations are on 5.3, Areas of further study 5.4, answers to research question 5.5, Theoretical and other contribution of the study to the body of knowledge are on 5.6 and lastly chapter summary of 5.7.

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Appendix (A)

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GRADUATE SCHOOL OF BUSINESS

Where Great Minds Meet

Dear Respondent

My name is Blessing Mudzingadutu, I am a final year student studying towards attaining a Master of Leadership and Corporate Governance degree with Bindura University of Science Education (BUSE). I am carrying out a study on **Developing an intelligent system for investigating card cloning fraud in Zimbabwe.** The use of this questionnaire is part of my study. There is generally little knowledge on the subject of Crime linkage. I believe that this research can benefit your section/branch. Permission has been granted by the Institute authorities to carry out the research study.

Participation in this research is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

All the information you disclose will not be used for any other purpose but solely for this academic research and will be treated with utmost confidentiality.

If you feel you have any questions or concerns about participating in this study please contact the researcher without fear on the contact details below.

0772463432

Email: bmudzinga@gmail.com

Your contribution will be greatly appreciated.

Thank you.

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GRADUATE SCHOOL OF BUSINESS

Where Great Minds Meet

QUESTIONNAIRE

INSTRUCTIONS:

a. Tick in the appropriate box to show your response or write on the spaces provided to give your opinion.
b. Do not inscribe your personal details in this questionnaire.
c. Answer all questions truthfully and honestly.

Section A: Demographic Data

1. Indicate your gender.

Male	☐
Female	☐

2. Specify your age range.

Below 20 years	☐	20-29 years	☐
30-39 years	☐	40 years and above	☐

3. Specify your highest educational qualifications.

   Advanced level ☐

   Ordinary level ☐

   Certificate/ Diploma/ Higher Diploma ☐

   Degree ☐

   Other ☐ Please specify…….

   ……

   ……

   ……

   ……

   ……

4. What rank do you hold in the ZRP (Commercial Crime Division)?

   Detective Constable ☐

   Detective Sergeant ☐

   Detective Assistant Inspector ☐

   Inspector and above ☐

5. For how long have you been in CID Department (Commercial Crime Division Harare)

   Less than 4 years ☐

   4-9 years ☐

   10 years and above ☐

Section B

6. Do you know what is linkage analyse, origin and its use?

   yes ☐ no ☐

7. Do you use linkage analysis as a tool to investigate Card cloning Fraud?

   yes ☐ no ☐

8. How long have you been using linkage analysis as a tool in investigating Card cloning?

   a) below 5 years ☐

   b) 6-8 years ☐

   c) 9 years and above ☐

9. To want extent do linkage analysis help detectives in detecting Card cloning Fraud.…….

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10. The following opinions relate to the use of linkage analysis in detecting Card cloning fraud Please indicate your level of agreement to the opinion.

Opinion	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
Linkage analysis is useful as a tool in detecting Card cloning Fraud by Investigators					
Linkage analysis helps in detecting Card cloning fraud.					

Linkage analysis helps to predict characteristics of Card cloning offenders					
Linkage analysis helps investigators to identify patterns and targets for Card cloning offenders.					

11. What are the factors that can be considered by the investigating officers when conducting a linkage analysis?

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……..

12. Comment on the usage rate of the following factors in conducting Linkage analysis.

KEY:- ***1- very low usage***

2- Low usage

3- Moderate usage

4- High usage

5- Very high usage

Crime linkage factor	1	2	3	4	5
Geographical location of the offence					
Modus Operand					
Crime scene evidence					
Signature behaviour					
Name of bank					
Victim profile					
Card type					
Fraudulent transactions					

Section C: Factors affecting the effectiveness of linkage analysis in the investigation of Card Cloning fraud.

13. Which among the following factors can you cite as affecting the effectiveness of Crime Linkage in the investigation of Card Cloning Fraud?

    Lack of resources ☐

    Lack of expert knowledge and skills ☐

    Lack of literature on linkage analysis ☐

    Technological advancement ☐

    Lack of training ☐

14. What other factors you think are affecting the effectiveness of linkage analysis in the investigation Card cloning cases.

    ……

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Section D: Strategies to be adopted in addressing the challenges faced in using linkage analysis to investigate card cloning fraud

15. Have you ever applied any strategy personally or as a department to resolve the challenges faced?

Yes		No	

16. If your answer on question 14 is yes, what strategies have you applied personally, as a department to address the challenges f aced?

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.....

17. How effective were these strategies in addressing the challenges faced in conducting a linkage analysis?

Never		Less effective		Effective		Very effective	

18. What strategies do you suggest should be adopted to improve the effective usage of linkage analysis in detecting card cloning Fraud?

……

……

……

……

……..……

Thank you

Appendix (B)

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Participation in this research is voluntary. You may refuse to participate or withdraw from the research project at any stage and for any reason without any form of disadvantage.

All the information you disclose will not be used for any other purpose but solely for this academic research and will be treated with utmost confidentiality.

If you feel you have any questions or concerns about participating in this study, please contact the researcher without fear on the contact details below.

0772463432

Email: bmudzinga@gmail.com

Your contribution will be greatly appreciated.

Thank you.

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GRADUATE SCHOOL OF BUSINESS

Where Great Minds Meet

INTERVIEW GUIDE

Questions

1. For how long have you been with the Commercial Crime Division department?
2. To what extent is linkage analysis practised in the organisation?
3. To what extent is linkage analysis a valuable tool to be used by investigators is the investigation of Card cloning fraud?
4. How is linkage analysis helping in solving card cloning Fraud?
5. To what extent is Linkage analysis helping you in identifying Card Cloning offenders?
6. Do you consider the way in which linkage analysis is being practised by investigators effective especially in detecting Card cloning cases?
7. What obstacles are hindering the effectiveness of linkage analysis in the investigation of Card cloning Fraud?
8. What strategies if any are being implemented to deal with the obstacles?

Thank you.

Appendix **(C)**

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GRADUATE SCHOOL OF BUSINESS

Where Great Minds Meet

28 August 2024

TO WHOM IT MAY CONCERN

REF: REQUEST TO CARRY OUT RESEARCH: BLESSING MUDZINGADUTU [B1542847] MASTER OF LEADERSHIP AND CORPORATE GOVERNANCE (MLC), PART 2.1 STUDENT

This letter serves to confirm that **Blessing Mudzingadutu [B1542847]** is a Master of Leadership and Corporate Governance student in the Graduate School of Business at Bindura University of Science Education.

The student is the final stage of study which requires him to carry out a research. His dissertation is titled ***"Developing an intelligent system for investigating Card cloning fraud in Zimbabwe."***

We would be grateful if you could give him any assistance he may require.

For more details, please do not hesitate to contact us.

Yours faithfully,

Dr J. Mwenje
Director, Graduate School of Business

"Promoting Science for Human Development"