DEVELOPING A CRIME ANALYSIS INFORMATION SYSTEM FOR A POLICE SERVICE IN A DEVELOPING COUNTRY: THE CASE OF ZAMBIA POLICE SERVICE

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DEVELOPING A CRIME ANALYSIS INFORMATION SYSTEM FOR A POLICE SERVICE IN A DEVELOPING COUNTRY: THE CASE OF ZAMBIA POLICE SERVICE

by

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Dedication

To my daughter Sibusiso. You have always given me the courage and strength to fight for what is mine in life.

Thank you dear for the patience and love. Remember always that if you do your best, whatever happens will be for the best.

Acknowledgements

Abstract

Crime is a human experience and it has to be controlled. In order to control crime effectively, it has to be analysed. Crime analysis is attainable with the help of an effective information system. In an effort to improve their services, law enforcement agencies have embarked on computerising and improving their information systems. With the help of Geographical Information Systems (GIS), they are able to tie crime data to location and view the crime situation of an area on a map. The introduction of GIS has made possible the integration of spatial and non spatial data. GIS capabilities also allow police commanders to pin point where the problem areas are and allocate appropriate resources. Crime analysis combines crime, location and socio demographic data in order to understand the crime trends and patterns, who is a victim of which crime and who perpetuates what crime, this in order to better control crimes.

The overall aim of the research is to (re) design and prototype an information system for crime analysis to support police operations for the Zambia Police Service. Four specific objectives have been derived from this aim and these are,
1. To analyse the existing crime analysis information system and identify constraints and problems
2. To design a new/improved crime analysis information system
3. To test the new/improved system
4. To identify conditions for successful implementation of the system.

To achieve the stated objectives, relevant literature about the topic was reviewed so as to get an in depth understanding of the concepts and terminologies used in crime analysis. The analysis of the existing information system in the Zambia Police Service was done by visiting the study area during fieldwork. The aim was to identify the main stakeholders of the crime analysis information system, their information requirements and any bottlenecks existing in the system. Also analyzed was the environment (both internal and external) in which the Zambia Police Service operates. It became evident that the current system is not effective. It lacks comprehensive crime analysis with a spatial component in the form of a map. Equally, some socio demographic data both at micro and macro levels is missing. The system is manual and lacks resources both human and non human. An information system to help conceptualise the various components of crime analysis was therefore developed to serve as the basis for developing the database to store and manage relevant information. The functions and data requirements of the system developed are detailed.

The information system was implemented using Microsoft Access and ArcGIS software and this was tested to determine if it answered user information needs. There were problems encountered in the testing of the data model. It should be noted that linking location to crime does not always result in complete matching. There is often the need for human intervention by way of re-matching interactively.
Another problem was in the recording of names. Misspelled names may cause problems especially when one is trying to match, for instance, an accused person who has committed more than one crime with the crime id. Care must be taken at entry point so as to maintain the integrity of the database. Certain conditions must be available for the system to be effectively implemented: skilled manpower, evidence of what the system is capable of doing, financial resources, specific responsibilities in

maintenance of the system and the location of the crime analysis office are among the major conditions required.

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List of Acronyms

CAIS	-	Crime Analysis Information System
CID	-	Criminal Investigations Department
COMPOL	-	Commissioner of Police
CSO	-	Central Statistical Office
CSD	-	Community Services Division
DCP	-	Deputy Commissioners of Police
DD	-	Data Dictionary
DFD	-	Data Flow Diagrams
DIR	-	Daily Incident Reports
DISPOL	-	District Police
DIVPOL	-	Division Police
ER	-	Entity Relationship
GIS	-	Geographical Information System
GRZ	-	Government of the Republic of Zambia
ICT	-	Information Communication Technology
IG	-	Inspector General of Police
NRC	-	National Registration Card
NYPD	-	New York Police Department
OB	-	Occurrence Book
RDMS	-	Relational Database Management System
SDW	-	System Development Workbench
UK	-	United Kingdom
USA	-	United Stated of America
ZP	-	Zambia Police Service

1. Introduction

1.1. Introduction

Information is very important in crime management and analysis. Arguably, the most important weapon in law enforcement has always been information management especially location information. The location of crime is vital information for a law enforcement officer, the Police service, the public and the government. The correct use of information is highly dependent on the available information system. Traditional law enforcement for different types of applications deals with data collection and how this data flows from one section of police to another in order to respond to the needs of society (Bridges, 1999).

Law enforcement agencies, in their endeavour to improve efficiency and effectiveness in their service provision, are computerizing their information systems. Different data such as location, crime and socio-demographic are being integrated using the capabilities offered by technology. Non traditional sources of law enforcement data have been identified to provide data to the law enforcement agencies. The introduction of Geographical information Systems (GIS) has made integration of spatial data with other law enforcement data possible (Radoff, 1993).

A better and comprehensive technical approach for crime analysis is done by the applications developed in GIS. GIS is a tool available and user friendly software which makes it easier for law enforcement agencies to pin point the geographical location of crime incidents and to analyse the crime spot precisely and accurately. Crime location mapping has become widespread in developed countries across Europe and North America (Saddler, 1999). As crime related incidents are increasing day to day with the increase in population density, it is increasingly becoming difficult for law enforcement agencies to control the law and order situation in the cities where population is high.

GIS organises different types of data used by law enforcement agencies into an information system which stipulates the functions of the different sub systems and defines the data flow from one system to another and also the source of such data. A GIS provides information required to the police commanders or law enforcement agencies managers to analyse and make decisions by understanding where crime is occurring, where the density of crime is high. This technology supports a broad variety of problem solving. (Saddler, 1999). An Information system which is tied to a map helps the police commanders visualise the location of crime incidents. The ability to access and process information quickly while displaying it in a spatial and visual medium allows police to allocate resources quickly and more efficiently. In the mission critical nature of law enforcement, information about the location of crime, incident, suspect or victim is often crucial to determine the size and type of resource to be deployed in a specific location.

Occurrence of crime has varied factors such as social class, income level, poverty level, unemployment levels and other demographic factors. These social factors and crime data are overlaid to determine a pattern between crime and location. Equally, with Crime Information System, traditional statistical information used in crime analysis is made available in a map format that shows

specific crime patterns and geographical relationships among multiple factors associated with crime events (Reno, 1999).

The developments in technology have created opportunities for the development of optimal crime information systems and the improvement of existing ones. Law enforcement agencies, like any other organizations have to adapt to the new challenges of the environment they are in. Society is advancing in technology and law enforcement agencies have also to move with the trend or they will be unable to meet the demands of society (John, 2001).

A number of methods for developing information systems are available. These methods help in developing an information system which answers the information needs of the users. The Structured System Development Methodology is among the methodologies available and will be used in this research.

The correct use of an Information system is a very critical success factor for optimum functioning of an organization. There exists a positive correlation between the quality of information and the quality of decision-making (Paresi, 2000).

This research looks at the development of a Crime Analysis Information System (CAIS). The main research focus is on making information for crime analysis available and easily accessible so as to enhance police efficiency in responding to crime and designing crime prevention strategies.

1.2.   Problem definition

The current functions and structure of the Zambia Police Service in the Ministry of Home Affairs present a highly centralized system with all authority vested in the Inspector General of Police who is at Police headquarters. The structure was set up like this so as to exercise control on all other police units and that the Inspector General is accountable to all police actions. As a result, information within the police takes long to process as it has to pass through a lot of offices.

The communication channel and information flow in the Zambia Police Service is static and rigid based on the Standing orders which are laid down regulations for the organization (GRZ, 1994). The process is purely analogue and this results in delays in the processing and analysis of data because of the large amounts of data which the police handle. By regulation, all information before being passed on to the next level of policing, the in charge of the police formation in question must approve of it and confirm that it is correct.

Information sharing among departments within the police is not easy. It is hampered by the bureaucracy of writing formal requests to the heads of department seeking authority to access data required.
The crime rate in Zambia is on the increase. For instance, five cases of theft of motor vehicle are recorded per week, a case of theft from motor vehicle is recorded daily, and five assault cases are reported daily in the city centre of Lusaka City alone. The Zambia Police Service is overwhelmed by the rise and has to contain the situation with its meagre resources.

The efficiency and effectiveness of the police response to crime has in the recent past been condemned by the citizens, institutions and government alike. The President of the republic of Zambia is on record of having said that he is dissatisfied with police performance. These complaints have had an important implication for the policing of the country

Resource (both human and non human) allocation to police stations is done according to some fuzzy criteria depending on the figures of crime recorded. No crime analysis is done to further understand the socio-demography of the environment and its inhabitants and correlate it with the types of crime committed to effectively analyze the crime and decide on which resource will effectively combat that crime.

In order to successfully analyze crime in Zambia, an integrated and holistic review of the existing situation is required. What is required is an improved Crime Analysis Information System, which will allow information on crime to be integrated, viewed and analyzed in combination with socio-demographic statistics such as income level, poverty and unemployment. The system should be able to:

- Support crime analysis
- Support police operations such as resource allocation
- Analyze crime, location and demographic data
- Better exploit Information, Communication ant Technology (ICT) capabilities.

1.3. Research aim

The overall aim of the research is to (re) design and prototype a crime information system for crime analysis to support police operations for the Zambia Police Service.

1.4. Research objectives and questions

The objectives of the research in the boundaries defined by the research aim are given in table 1.1. Also the questions to be answered by specific objectives are outlined in the same table.

Table 1-1-1 Research objectives and questions

Objectives	Questions
1. To analyze the existing crime analysis information system and identify constraints and problems	1. what is crime analysis 2. What data is required for crime analysis 3. What are the functions of a crime analysis information system? 4. Is there a crime analysis information system in the Zambia Police Service? 5. What are the challenges faced by the CAIS in the Zambia Police Service?
2. To design a new/improved crime analysis information system	6. How can the existing system be improved? 7. How can the challenges of the existing system be overcome? 8. What are the functions of the new/improved system? 9. What data is required for new system?
3. To test the new/improved system	10. Can the physical database be queried to answer the questions in crime analysis?
4. To identify conditions for successful implementation of the new/improved system	11. What is required for the new system to work?

1.5. Research Methodology and Approach

A quality information system costs money, time and requires a consistent step by step well thought out approach in its development. The correct application of information technology is a critical success factor for the optimal functioning and competitive position of an organization, therefore, the integration of social needs, the resources (both human and non human) and the possibilities offered by technology in an organization is required (Paresi, 2000).

A number of methodologies such as soft, socio-technical, structured, object oriented and evolutionary systems development used in developing information systems (Paresi, 2000). However, for this research, the Structured System development methodology will be used because it is a proven one. It is worthy noting though that object oriented and evolutionary systems development methodologies are also good. The draw back is that they are still in their infancy.

The structured system development methodology takes an objective view of reality; provide elaborate planning guidelines, techniques and case tools. The method includes iterative activities which mean if there is a problem in one stage one can look at the earlier or later stages to rectify the problem. Figure 1.1 shows the main phases in system development using structured methodology. There are four major phases involved.

Figure 1-1 Structured Systems Development Methodologies; Phases and Interactions
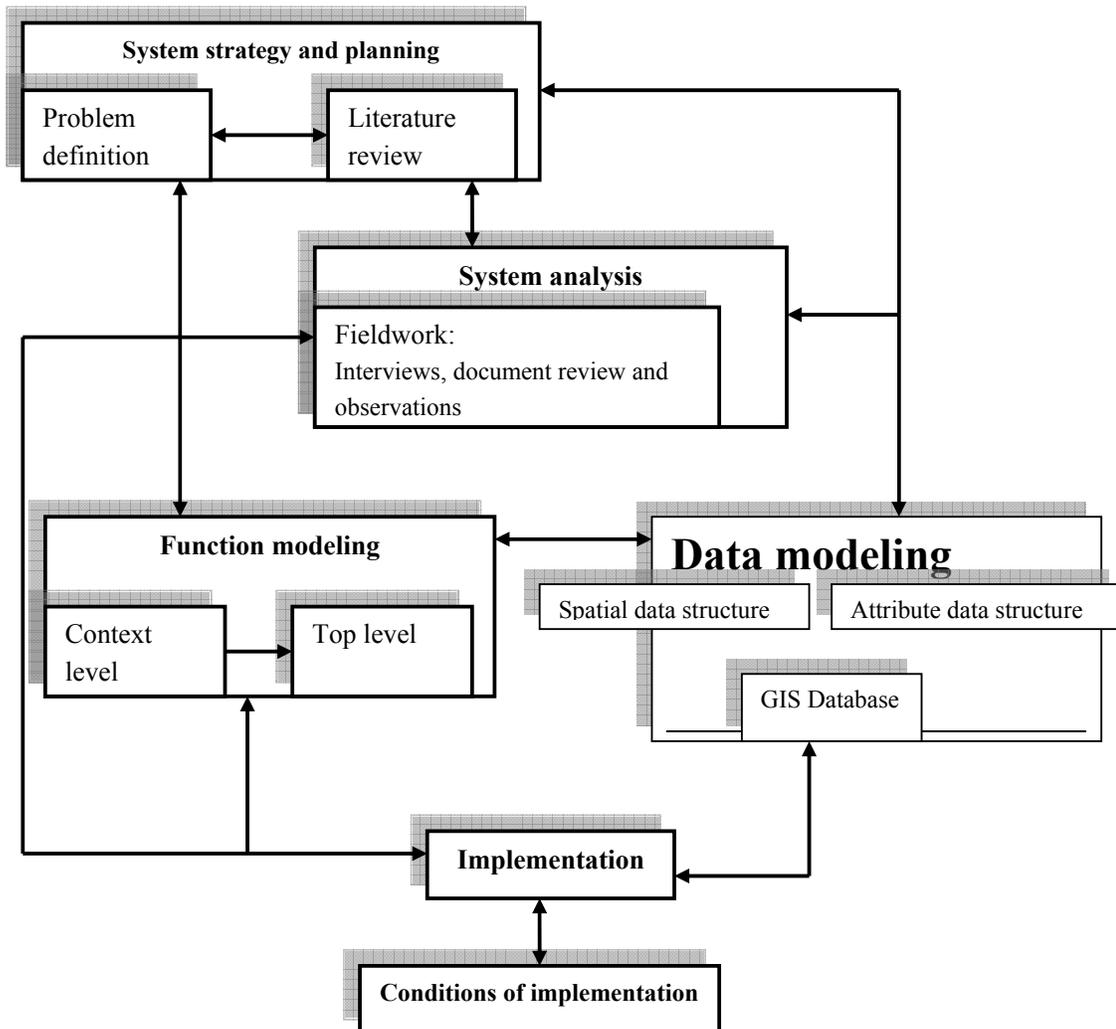
Adapted from Paresi (2000)

System strategy and planning, identifies and defines the problem and also how this problem may be solved. Goals and objectives are defined here and a plan of how to achieve them is outlined.

System analysis phase, which is, a detailed analysis of the existing information system is conducted. This phase defines why this information problem, where the problem is. It is in this phase that information requirements are found out and the constraints in meeting the information demand.

System design focuses on the conceptual and logical design of information system looking at the function and data models. The physical design on the other hand looks at design in terms of hard and software, databases and interfaces.
System realization, which is has three components and these are implementation, installation and operation. The implementation phase looks at building and testing the system; and integrating the

separately developed systems among other objectives. The installation and operation components of this phase are not part of this research.

This methodology will be used to develop a CAIS for the Zambia Police Service but with some modifications to suit the environment of the research, the time and resources available for the research.

1.6. Chapter Outline

The first chapter introduces the research theme, the problem, objectives, and methodology.

The second chapter looks at the literature reviewed relevant to crime management and analysis, what data elements constitute crime analysis. Examples of how other countries use crime analysis information systems are given and the importance of crime analysis information systems discussed.

Chapter 3 analyses the existing crime analysis information system in the Zambia Police Service. It looks at the methods of data collection and sources of data during the fieldwork. A system environment analysis which highlights the environment under which the Zambia Police Service operates is done. The general flow of information in the police, the producers and consumers of the police information are analysed also. Problems and opportunities identified during the system analysis are given so as to guide in the design of the new system.

The fourth chapter designs a crime analysis information system by defining the new functions and data required. The new sources and users of crime analysis data are identified.
This chapter attempts to bridge the gap between an ideal CAIS as defined by literature and the real crime analysis performed by the Zambia police.

Chapter 5 seeks to answer the user information requirements as discovered during fieldwork. Three databases (spatial, nom-spatial and personal geo-database) are created and populated with data obtained during fieldwork.

Chapter 6 proposes conditions which at least must be available for the system to be successfully implemented. These conditions are proposed bearing in mind the challenges the current system faces and the environment within which the system operates.

The final chapter discusses whether or not the objectives as stated in chapter 1 have been achieved. The chapter further recommends future research on the subject and actions needed for successful implementation of the CAIS.

2. The Importance of Crime Management and Analysis

2.1. Introduction

Crime is a human experience and is as old as the human race. Crime is geographical. It occurs at a specific place, specific time and specific reason. It can affect everyone and anyone at any time. A crime occurs at an office, for instance, and security is tightened at the office entrance and exit. All officers even those without any intention of committing crime are affected. Crime has a trickle down effect. Resources are spent to replace the stolen item or restore the victim of crime to the original state and to tighten security so that no incident of crime occurs again instead of being invested in social welfare for instance. In developing countries more money is spent on crime prevention which is a prelude to any investment. Crime prevention is a cost whose benefits are not visible in the nearest possible future.

Economies of countries and individuals worldwide are affected by crime. Crime is a social vice which has to be managed. In order to manage crime effectively, availability and easy accessibility to information is important for a Law enforcement agency.

Information about crime, where crime occurs and who is involved is critical in crime management. For this information to be of great use, it has to be managed. Information is managed through an information system which defines the functions of specific offices and the type of data they require. A crime information system is a tool which can help in the management of crime. A number of functions such as crime analysis, deployment of resources and event modelling can be performed by a crime information system.

The objective of this chapter is to define crime analysis and define functions and data required for crime analysis which is the focus of the research. As a benchmark, to better understand crime analysis, Crime management is defined and how it has evolved over time. Crime analysis and its elements are discussed in detail and examples of how countries such as Britain, USA, Pakistan and South Africa are using Crime Analysis Information Systems to help them in crime management are given.

Finally, Information System Development Methodologies are discussed. This is important because a crime information system has to be designed before it can be used. How the system is designed is important in information management. A conclusion is then drawn.

2.2. Crime Management

The occurrence of crime is not random. It is spatially distributed in patterns some patterns are discovered while others are not. Factors such as social class, income level, and environment play parts in the types of crimes that are committed. Resources and/or a lack of resources can influence the

probability of crimes committed in any given area (Bridges, 1999). Because of the complexity of crime, crime has to be managed.

Crime has various definitions depending on which angle one is looking at it from. For this research crime is defined as "violation of law, or an instance of this, punishable by the state," (Allen, 2002, p.179). Management on the other hand is the process of directing and controlling the resources of an organization, such as its personnel, materials, and equipment to achieve the goals of the organization. Crime management is, therefore, defined as controlling, directing, and coordinating police resources (money, equipment, and personnel) to prevent the violation of law and where it has been violated, to apprehend the criminals and take them to court and recover the stolen property.

The formal organized management of crime can be traced back to the mid 19th century in Britain advocated by Sir Robert (Musonda, 2000). From then on crime management has evolved. In the early 20th century; a professional model for crime management was developed in the USA and diffused to other areas of the world. The main operational goal of professional policing model was reactive crime control. Law enforcement officers sat in their offices waiting for complaints from the public and then react to them. The police system was closed to the public and communication was in one direction only, that is, from the top to the bottom (O'Shea, 2003).

However, in the mid 1980s community policing developed and started to attract serious attention. One critical change associated with community policing being addressed by this research is the importance that information processing and crime analysis have assumed in crime management.

Community policing emphasizes the analysis of data to examine the nature of complex community problems and to evaluate the effectiveness of crime reduction efforts. It calls for information from domains that had previously been neglected and calls for more complex analysis of that information. The core mandate of law enforcement is maintenance of law and order in society. Information management though inherently part of police management, had not really been given the importance it deserves until the advent of community policing (O'Shea, 2003).

Community policing model is more proactive than the professional model. It focuses on intervening before the crime is committed and constantly looking ahead (vision). It puts emphasis on planning which prevents being overwhelmed by the problems encountered in crime management. The model is open to the public as information gathered from the public is very important for the management of crime.

2.3.Crime Analysis

As an introduction to crime analysis, this section provides the definition of crime analysis as a general concept as well as definitions of four types of crime analysis. These definitions are meant to enhance the understanding of crime analysis and to help create commonly understood terminology, concepts and ideas in the field of crime analysis.

With the advent of the community policing model in the 1980s, crime analysis has played a vital role in crime management. Data such as where crime occurs, when crime occurs and who is involved in

crime guide police commanders in the deployment of their resources and design suitable crime preventive measures. Crime analysis is defined as;

The quantitative and qualitative studies of crime and law enforcement information in combination with social demographic and spatial factors to apprehend criminals, prevent crime, reduce disorder, and evaluate organizational procedure (Boba, 2001, p.9)

From the definition, a number of data are required in analysing crime so as to come up with informed decisions in the apprehension of criminals and planning for prevention. In order to understand the definition of crime analysis, major phrases and terms used are defined and discussed in detail in the following sections.

2.3.1. Qualitative and quantitative

Crime analysis uses both qualitative and quantitative data and it also uses analytical techniques. Qualitative data and analytical techniques refer to non-numerical data as well as the examination and interpretation of observations for the purpose of discovering underlying meanings and patterns of relationships. Quantitative data are data primarily in numerical or categorical format. Quantitative analysis consists of manipulations of observations for the purpose of describing and explaining the phenomena that those observations reflect and is primarily statistical.

Crime analysis employs both types of data and techniques depending on the analytical and practical need. The information such as date, time, location, and type of crime is quantitative in that statistics can be used to analyze these variables. On the other hand, narratives of crime reports are considered qualitative data in that a large number of narratives are nearly impossible to analyze statistically and are primarily examined to determine general themes and patterns (Sampson and Scott, 2000).

2.3.2. Study

Study is a systematic way of looking at crime and law enforcement information. That is, crime analysis is not examining information haphazardly but rather is applying formal analytical and statistical techniques as well as research methodology to law enforcement information according to the rules of social science (Boba, 2001).

2.3.3. Crime

Those that are not. Thus, the central type of data analyzed is crime and the information In a law enforcement agency, the central focus is crime, both those reported to the police and surrounding it, such as arrests, offenders, victims, property, and evidence (Boba, 2001).

2.3.4. Law enforcement information

In addition to crime, law enforcement agencies address many other issues and thus collect many other types of data. Examples of law enforcement data that are often available for crime analysts are calls for service (e.g., noise complaints, burglary alarms, and suspicious activity), traffic information (e.g. accidents and citations), and citizens' perceptions (e.g., fear of crime, crime prevention behaviour, satisfaction with the police), victimization, probation records, and parole information (Boba, 2001).

2.3.5. In combination with

This phrase refers to identifying patterns and studying relationships of crime and law enforcement data with other types of information, such as the ones listed in the following sections.

2.3.6. Socio-demographic

This type of information refers to characteristics of individuals and groups such as sex, race, income, age, and education. On an individual (micro) level, socio-demographic information is used in law enforcement to search for and identify crime suspects. On a macro level, socio-demographic information is used to determine the characteristics of groups and how they relate to crime. For example, the information may be used to answer questions, "Where can we find the suspect who is a white male, 30-35 years of age with brown hair and brown eyes?" or "Can demographic characteristics explain why one neighbourhood has a higher rate of crime than another?" (Boba, 2001).

2.3.7. Spatial

The location of where crimes or activities occur and the relationship of those places to one another and to other information is an important factor in the analysis of crime. It is not only important where a crime takes place but also the characteristics of those places and the environment in which the crime occurs. Thus, examination of spatial data such as streets networks, parcel information, orthophotographs, school locations, business and residential zoning, among others, is imperative for effective crime analysis.

The next four key points, apprehending criminals, prevent crime, reduce disorder and evaluating organizational procedures, describe the four goals of crime analysis.

2.3.8. Apprehending criminals

The main function of crime analysis is to support law enforcement endeavours. One of the primary goals of law enforcement is the apprehension of criminals; consequently, one of the primary goals of crime analysis is to assist in the apprehension of criminals. For example, a detective may have a robbery incident in which the suspect has a snake tattoo on his left arm. The crime analysts may assist by searching a database of field incident cards to identify individuals with such a tattoo. Also, a crime analyst may conduct a time of day/day of week analysis of burglary incidents that would assist officers in surveillance of an area to catch offenders (Boba, 2001).

2.3.9. Prevent crime

Another primary goal of law enforcement is to prevent crime through methods other than apprehension. This goal lends itself particularly well to assistance from crime analysis. For example, members of the police department are conducting a crime prevention campaign about residential burglary and would like to target their resources in the areas that need it the most. Crime analysis can assist in providing spatial analysis of residential burglary, analysis of how, when, and where the burglaries occurred, and analysis of what items were stolen. This information could be used to develop crime prevention suggestions such as closing and locking a garage door (Boba, 2001).

2.3.10.   Reduce disorder

Indicators of social decay left unchecked can attract crime and accelerate further decay. Thus, reducing Many criminologists contend that social disorder can lead to crime; that is, blight and other disorder is a law enforcement objective and, by extension, one for crime analysis as well. Crime analysis can assist with these efforts by providing research and analysis of disorder indicators such as traffic accidents, noise complaints, or trespass warnings that can assist officers in addressing these issues before they become more serious problems (Boba, 2001).

2.3.11.   Evaluate organizational procedures

The fourth goal of crime analysis is assisting with the evaluation of organizational procedures. Several examples include resource allocation, the assessment of crime prevention programs, realigning geographic boundaries, forecasting staffing needs, and developing performance measures

2.4.Elements of crime analysis

Three major elements of crime analysis emerge from the definition and these are crime, spatial and temporal data as shown in figure 2.1 below.

Figure 2-1 Elements of Crime Analysis
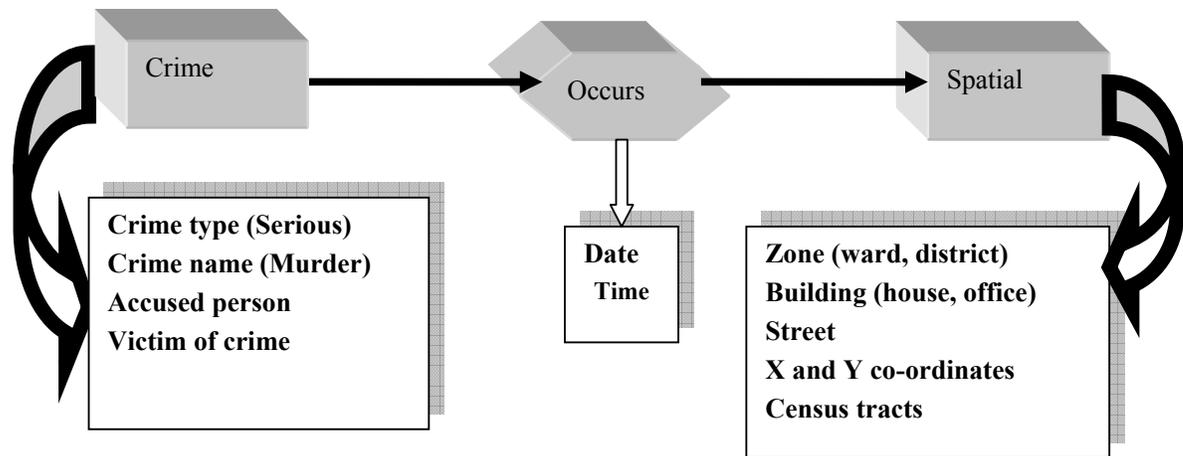
2.4.1.   Crime element

Crime data constitutes a crime type, crime name, victim of crime and a person accused of having committed the crime. Crime type: Type of crime is defined as either a felony (serious) or misdemeanour (less serious). This is the classification of type of crime used in most countries worldwide. Crime name: This is standard naming of crimes used in the world and all police officers are taught the names of crime. Crime name is an identity of a crime.
Accused person: Particulars of an accused person include identity number, name, sex, age, race, employment status and address (both physical and postal). These help the police know, for instance,

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which age group of a particular society is involved in what crimes; consequently devise crime prevention methods specific to the vice.

Victim of crime: The particulars of a victim of crime recorded are identity number, name, sex, age, race, employment status and address (both physical and postal). These data help the police know, for instance, which people are more vulnerable to certain crimes than others.

2.4.2.   Spatial element

Location and socio demographic data are part of information required by law enforcement agencies in the analysis of crime. They are both spatial as they are tied to where part of crime event.

2.4.2.1. Location

Crime analysis has a spatial element which can be defined with four attributes, distribution, environment, movement and action space (Copper, 2001). The spatial distribution of a crime describes how the locations of crime events relate to one another. This includes point distribution patterns (for example, clustered, random or even uniform), densities, progression, axes, and others. The presentation of location on a map or computer desktop makes it easy for police commanders to visualize where crime occurs and which types of crime tend to occur together or near each other.

The attribute of location does not reflect only spatial distributions of scenes of crime themselves but also of evidence of recovery sites, victim encounter sites, victim homes and work places, and any other spatial locations with a bearing on the problem (Copper ,2001).

The spatial environment like the temporal environment describes the correlation between significant locations and other spatial phenomena. For example, if all crimes in a series occur near schools, perhaps the school locations exert some influence on the spatial behaviour of the offender? It has also been argued in human geography that the environment has an effect on people's behaviour. The environment under which crime occurs provides further insight for crime analysts and decision-making. The most obvious type of correlation is for the majority, proximity. When looking at environmental factors, closest factors to crime of scene are considered.

Movement, on the other hand, describes the dynamics of the spatial element of crime. For instance, what is the movement of crimes, do they go east, west, south, north or do they cluster in the centre and spread from there? Are crimes getting closer together or farther apart as the series progresses Crime analysis helps understand the underlying factors of why specific crime types tend to take certain direction.

Distribution, movement and the environment of crime overlap and encroach upon one another to a high degree. Each factor influences the other. Crime analysts must constantly re-evaluate every part of the analytical process, returning again and again (iterative and recursive relationships) to areas already explored to see how the intervention of resource allocation may result into new perspective and open up new avenues to understanding the problem as a whole.

Information, especially location information is, very cardinal in crime analysis. Location is represented at different levels depending on the detail of the analysis to be done such as,

Point analysis is very detailed and shows the exact location of crime events. Point analysis normally uses the addressing system where all buildings and houses have an address and the address of a building is tied to a crime event.

Polygon analysis is less detailed as it gives crime location per polygon. A polygon is given same colour assuming the crime occurs uniformly in the area. The polygons used in the analysis of crime are mainly administrative boundaries as defined by Law enforcement agencies or national governments. Crime is certainly not evenly distributed over space and the notion of hot spots of crime has received increased attention in crime analysis. Hot spots are defined as "small places in which the occurrence of crime is so frequent that it is predictable, at least over a one year period," (Harries, 1999, p.112) Heaviest clusters signify areas with spatial clusters of criminal activity and highlighting such areas helps police direct resources where they are most needed, thereby optimizing the deterrent effect of police presence. Today, police departments frequently use computer – mapped crime locations to delineate hot spots.

Location of crime stands out as important information for crime analysis in general. This location information becomes more important when it is visualized as a picture (map) than merely writing it in a report. The advance in technology capabilities have equally made it easy for location information to be mapped and overlaid with other types of information such as time, crime type, the race, age, sex and income of offenders.

The accessibility of all these different types of information by the department concerned with crime analysis is very vital. Not only accessibility but also the quality of this information and how fast this information is accessible are of paramount importance for crime analysis.

2.4.2.2. Socio demographic data

Socio demographic data is represented in a map. An area is demarcated into different census tracts giving the details of the population per age group and gender. This data helps the police understand why certain crimes tend to occur where they do. This data is analysed in combination with the location of crime events.

Using crime analysis it is possible to identify the relationship between hot spots and local population, types of land use, the built environment and local crime history. "The identification of hot spots is very important both in understanding the underlying processes that may have contributed to the formation of that concentration," (La vigne and Groff, 2001, p.216).

2.4.3. Temporal element

Time and date of occurrence of a crime event are an important aspect of crime analysis. They indicate which crimes have a tendency to occur during which time of the day and which days of the month or even months of the year. Knowing when crime occurs is important for police commanders in deployment of their resources.

2.5.Types of crime analysis

Crime analysis is performed for different purposes and because of this, it has been sub divided into different categories which have been given specific names for the purpose. The following are four

types of analysis that fall under the umbrella of crime analysis. Each contains characteristics of crime analysis in general, but each is specific in the type of data and analysis used as well as in its purpose.

2.5.1. Tactical

The study of recent criminal incidents and potential criminal activity by examining characteristics such as how, when, and where the activity has occurred to assist in problem solving by developing patterns and trends, identifying investigative leads/suspects, and clearing cases. Tactical crime analysis focuses on information from recent crimes reported to the police. "Recent" can refer to the last few months or longer periods of time for specific ongoing problems. It also focuses on specific information about each crime such as method of entry, point of entry, suspects actions, type of victim, type of weapon used, as well as the date, time, location, and type of location. Field information such as suspicious activity calls for service, criminal trespass warnings, and persons with scars, marks, or tattoos collected by officers is also considered in the analysis. Although quantitative analysis is often conducted once a pattern has been identified, qualitative analysis (i.e., critical thinking and content analysis) is used to identify patterns and trends initially. Three purposes of tactical crime analysis are.
 1) Linking cases together and identifying the notable characteristics of the patterns and trends,
 2) Identifying potential suspects of a crime or crime pattern, and
3) Clearing cases. The focus of tactical crime analysis is examining data daily in order to identify patterns, trends, and investigative leads for recent criminal and potential criminal activity. Once a crime pattern, suspect, or investigative lead is identified, the information is compiled and disseminated to patrol officers and detectives. It is an analytical process that provides information used to assist operations personnel in identifying specific and immediate crime trends, patterns, series and hotspots.

2.5.2. Criminal Investigative Analysis

The study of serial criminals, victims, and/or crime scenes as well as physical, socio-demographic, psychological, and geographic characteristics to develop patterns that will assist in linking together and solving current serial criminal activity. This type of analysis has also been called "profiling," which is the process of constructing a "profile" of an unknown offender based on the nature of the crime, the facts of the case, and the characteristics of the victim. As with intelligence analysis, this type of analysis focuses primarily on qualitative data surrounding serious serial crimes such as murder and rape. Data are collected and analyzed on an individual level for those persons primarily or peripherally involved with the incidents. The spatial nature of the incidents and related locations such as the body dump sites or the encounter sites is also considered. The primary purpose of criminal investigative analysis is to develop patterns of serial crimes crossing city, state, and even national boundaries by linking behaviour and evidence within and among incidents in order to catch the offender and/or clear cases. This is a very specific type of crime analysis that is primarily done on the federal law enforcement level since these types of crime occur infrequently and cross jurisdictional boundaries.

2.5.3. Strategic

The study of crime and law enforcement information integrated with socio-demographic and spatial factors to determine long term "patterns" of activity, to assist in problem solving, as well as to research and evaluate responses and procedures. Strategic crime analysis consists primarily of quantitative

analysis of aggregate data. Monthly, quarterly, and/or yearly compilations of criminal and non-criminal information such as crime, calls for service, and traffic information are analyzed in aggregate form. That is, general categories such as date, time, location, and type of incident are analyzed instead of qualitative data such as narrative descriptions of incidents. Variables including race, class, sex, income, population, location, and location type are examined along with law enforcement information in the analysis process. The two primary purposes of strategic crime analysis are 1) to assist in the identification and analysis of long-term problems such as drug activity or auto theft and 2) To conduct studies to investigate or evaluate relevant responses and procedures. Both of these purposes correspond very well to the problem solving process (see Section IV for a discussion of crime analysis and problem solving specifically). These types of studies include evaluation of crime prevention programs, in depth examination of a particular crime problem, and implementation of a survey of citizens' perceptions of crime and the police. They incorporate pre- and post- measurement as well as both impact and process evaluation methodology. Procedures examined include such activities as deployment and staffing, redistricting of beats or precincts, data entry and integrity, and the reporting process. In sum, strategic crime analysis uses statistical techniques and research methods to investigate long-term problems and evaluate organizational procedures. Analysts who primarily conduct strategic crime analysis are also called problem or research analysts.

2.5.4. Administrative/Academic

The presentation of interesting findings of crime research and analysis based on legal, political, and practical concerns to inform audiences within law enforcement administration, city government/council, and citizens. Administrative crime analysis is different from the previous types of analysis in that it refers to presentation of findings rather than to statistical analysis or research. The decision of what and how to present information is the primary focus of administrative crime analysis. Often, the type of information that is presented represents the "tip of the iceberg" of all the work and analysis that has previously been done, for example, an executive summary of a report. The purpose and the audience of the information determine "what" is presented along with legal (e.g., privacy and confidentiality), political (e.g., union issues, election concerns), and practical concerns (e.g., complexity of the information presented). The primary purpose of administrative crime analysis is to inform audiences. These audiences may vary from one situation to the next, which is why the type and quantity of information should vary as well. Audiences can be police executives, city council, media, citizens, and neighbourhood groups or a combination. An excellent example of administrative crime analysis is the use of the Internet to provide information to the general public. Audiences of a police Internet site include citizens, police personnel, businesses, victims, criminals, and media—essentially everyone; therefore, the type of information published should be appropriate for an array of diverse customers. The information provided should be simple, clear, and concise and should not disclose sensitive information. One rule of thumb would be to only publish information that one would be comfortable seeing on the evening news.

2.5.5. Crime Analysis Model

Figure 2.2 displays how all of these types of crime analysis relate to one another in terms of the level of aggregation of the information. That is, types with low levels of aggregation focus on individual cases and use qualitative data and analysis techniques and those with high levels of aggregation focus on a limited scope of larger amounts of data and information.

Figure 2-2 Crime Analysis Model
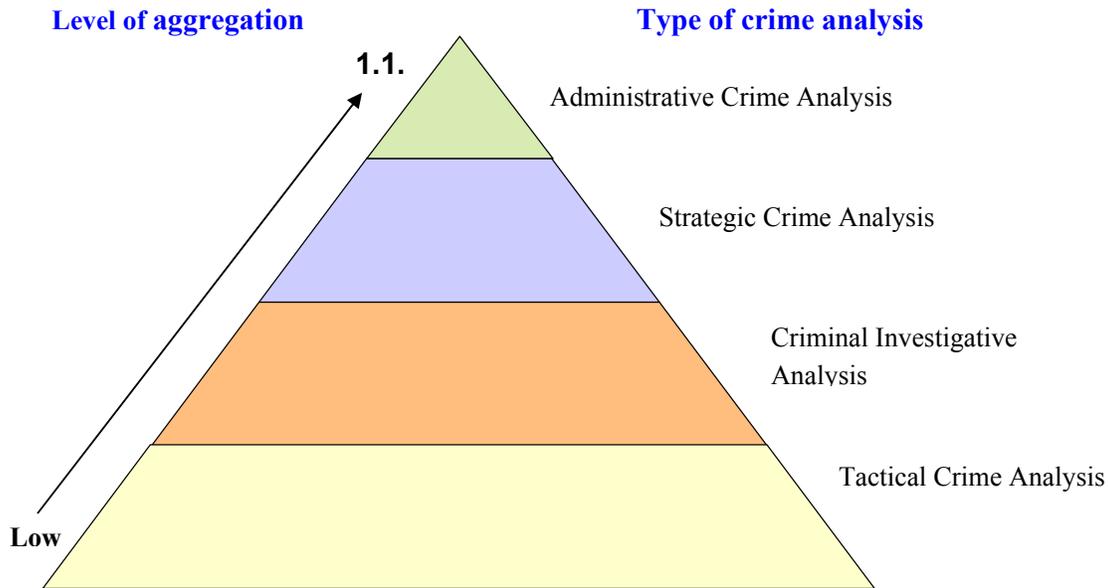
Source: Boba, 2001

At the bottom of the figure 2.2, criminal investigative analysis utilizes the least aggregated and most qualitative data. The data consist of information about informal networks of criminals and their non-criminal acquaintances and relatives as well as where individuals live, work, and "play." The focus here is on the specifics of criminals, the nature of their crimes, their relationships, and their lives in general. Tactical crime analysis utilizes only crimes and activity reported to the police so the data are more aggregate and somewhat less abundant than those used for criminal investigative and intelligence analysis. Tactical crime analysis is primarily qualitative in nature but depending on the data, quantitative techniques can be used to describe characteristics of a given pattern such as the most common time the crimes occur (time series) or where the crimes are located in relationship to one another. Strategic crime analysis utilizes large amounts of data that are even more aggregated than tactical and investigative data. For example, information used in tactical crime analysis is primarily made up of crime incidents but includes such information as date, time, location, methods of the crime, and detailed description of the crime. Strategic crime analysis focuses only on those variables that can be easily quantified, such as date, time, location, type of location, type of crime, and priority.

2.6. Crime mapping

Crime happens in both space and time. Crime is tied to geographical space which is represented in a map. For a long time maps have been used to show where crime occurs. Crime mapping has long been an integral part of crime management. The New York Police Department (NYPD), for instance, has traced the use of maps back to at least 1900 (Harries, 1999). The traditional crime map is a jumbo representation of an area with pins stuck in it. These are useful for showing where crimes occurred but have limitations. As they are being updated, the crime patterns are lost and as they are static, they cannot be manipulated or queried.

Despite the limitations of pin maps, they are still used today because their large scales allow patterns to be seen over an entire police precinct (boundary of each police establishment from national, provincial, local levels) in detail (Canter, 1997).

In the past decade or so, the manual approach of pin mapping gave way to computer mapping. The process was carried out on gigantic mainframe computers using extremely labour intensive process (Harries1999). Since the early 1990s when computer speed increased tremendously, desktop analysis and mapping became commonplace and fast. Modern Geographical Information System (GIS) software allows police to produce more versatile electronic maps by combining their databases of reported crime locations with digitized maps of the areas they serve (NIJ's Maps Bibliography, 2002).

The same GIS software used to map crime locations is used to calculate crime density values, which can be used to create a choropleth map. Colour is used to represent different values among land units within the study area such as police precincts, city voting districts, or census tracts.

2.7.Importance of Crime Information systems

Organizations must adapt in order to survive. Like all organizations, police departments must adjust their administrative arrangements to accommodate shifts in social, economic, and political conditions. While adjustments are usually incremental, sometimes change is dramatic.

The police departments are part of the greater society. The demands of society have great implications for police operations. In the quest to satisfy its customers (the public), a police department should improve its management of information. The correct use of information is highly dependent on the available information system. Paresi argues that there exists a positive correlation between the quality of information and the quality of decision-making (Paresi, 2000).

With a Crime Analysis Information System which has a geographical component, the traditional statistical information used in crime analysis is made available in a map format that shows specific crime patterns and geographical relationships among multiple factors associated with crime events. Drawing upon this integrated perspective, the law enforcement agencies can be more effective in crime prevention, intervention and community oriented policing.

It is widely argued that proper management of information leads to efficiency in performance of an organization. Management of information can be done through a quality information system (Paresi, 2000). Evidence is abounding as to how law enforcement agencies are using crime information systems in crime management in general and crime analysis in particular. Examples of how the United States of America, the United Kingdom, Pakistan and South Africa are given.

2.7.1.   United States of America (USA) and United Kingdom (UK)

In the 1990s, Geographic Information Systems (GIS) have provided foresight to crime analysis in the USA where GIS is used as a crime-fighting weapon on the street because every officer on the street accesses right information at the right time using ArcPad (ESRI, 2000). This is very cardinal in law enforcement because the mission critical nature of law enforcement requires fast access to information. In the USA and UK law enforcement agencies use GIS to analyze crime. They use GIS to identify the crime problem, where to concentrate resources and analyze whether the intervention has been successful. For example, an incident analysis map indicates the hot spots of specific incidents in a city such as car theft, burglaries and drug sales. The police department then analyses the emerging pattern, apply resources to them as well as analyze whether the patterns disappears after the intervention.

The crime analysis is very detailed. Location is precisely given using the addressing system which well designed through out the country. Maps show exactly where the crime occurred per city. Figure 2.2 shows the detail to which crime analysis in Washington DC in the USA is done.

Figure 2-3 Map of Washington D.C showing exact location of crime

Homicides in Washington, D.C. 1994-5

• Homicide Location

Source: Washington Metropolitan Police Department / Author: Dan Sadler
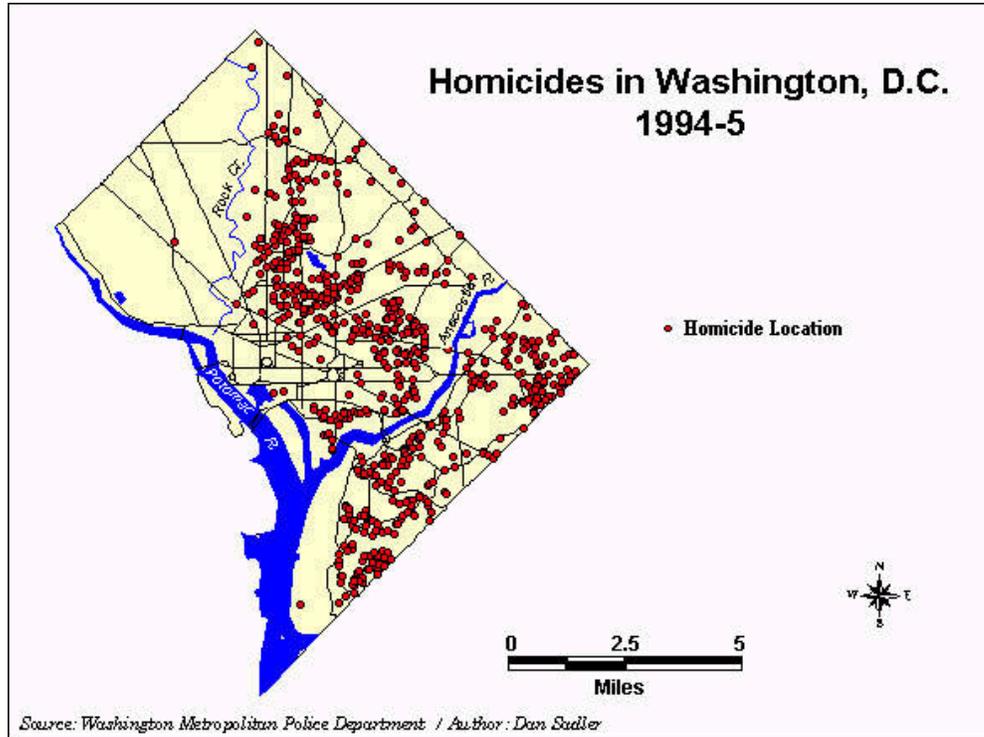
Source NIJ's M.A.P.S (1995)

The map shows the clusters of crime and indicates which areas need attention. It can also be deduced from the map that other types of data such as spatial and relief features are used in the analysis of crime.

The crime information systems in these countries are high-tech and highly developed. Equally, their economies are good and can support such developments in technology and management of crime information.

2.7.2.   South Africa and Pakistan

Unlike the USA and UK, South Africa and Pakistan are developing countries faced with a lot of economic challenges and low levels of technology. The South African Police (SAP) uses crime information systems as an important starting point from which, in collaboration with communities throughout the country, in developing strategies for preventing crime. A Spatial Information System allows the integration of information on crime and population statistics of a particular area (e.g. Cape Town) by the South African Police to come up with sustainable crime prevention methods and resource allocation (Schwabe 2000). The police have severe shortage of manpower, vehicles and funding, however, through a Crime Information System the South African Police (SAP) is able to optimally use its resources. SAP has devised a roster model which deploys officers at their points of duty depending on the number of crime committed and time of the day (resource allocation).

The police in Pakistan use police precincts in their analysis of crime. This is because there are no accurate, up-to-date street maps in either soft or hard copy (ESRI, 2000). Landmarks which are well known to the police and general public are used in describing crime location of crime.

Both in South Africa and Pakistan, crime is shown per police precinct. Crime events for a given period are summed up and shown per precinct. Figure 2.3 shows how crime is analyzed. Other data apart from crime data used is police precinct data.

Figure 2-4 Map of South Africa showing crime events per police precinct.
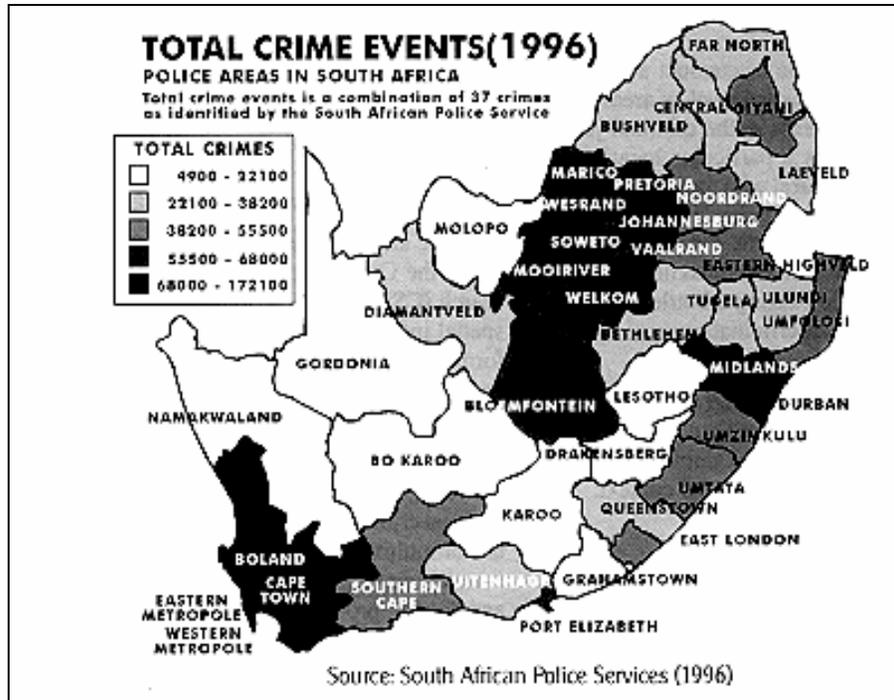
Source: Schwabe (2000)

The USA, UK, South Africa and Pakistan use location information in the analysis of crime. The developing countries use low level of detail of location. The crime events are aggregated and only reflected as having occurred in a specific area. Crime location is not precise. The precise location of crime information is difficult to get because street addressing system in developing countries is confusing and sometimes non existent. In planned residential areas street addressing system may not be a problem but in squatter settlements where most of the urban population lives it is cumbersome.

The use of GIS has increased exponentially in the recent past. Rudolf (1993) points out that in the past before the advent of computers, crime information analysis was accomplished using only human skills, but the introduction of computers has brought considerable help in crime data analysis. The countries given as examples consider all crimes for crime analysis. There is a department specifically for crime analysis and the crime analysts are not necessarily Police officers.

However, it is important to note that despite the importance of using GIS in crime analysis as observed in the countries given as examples, using it in The Zambia Police Service may be unattainable. This is because the level of computerization is low, there is also lack of Information systems experts, and

above all resources are scarce to acquire sophisticated technology. It is worthy noting though, that the Zambia Police Service can draw lessons from the USA, UK, Pakistan and South Africa that an effective information system is an important tool for crime management and analysis.

The Zambia Police Service can learn from the developing countries example which have similar economic and technological environment as itself. It can start with a down to earth crime analysis information system which can be sustained by the current situation and provide the pressing information requirements by the organization.

2.8.Conclusion

From the literature reviewed, it has been observed that crime is a human experience, it occurs at some location and that crime is a problem which has to be managed. For crime to be properly managed, quality information about crime, the environment it occurs and the socio-demographic data of the victims of crime and the perpetrators of crime are necessary for crime analysis. Crime, socio demographic and spatial data stand out as major data which have to be used to achieve crime analysis which is effective, efficient, detailed, encompassing and of great use to the decision makers.

It has also been revealed that a properly developed Crime Analysis Information System (CAIS) improves the management of information in a police department. A Crime Analysis Information System (CAIS) can be developed using different information systems development methodologies such as structured information systems development methodologies, which is used in this research.

The USA law enforcement agencies and South African Police are using Crime Analysis Information System in the management of crime. All crimes are considered for crime analysis. There is a specific department for crime analysis.

From the experiences from other countries, it can be concluded that any country would benefit from a Crime Analysis Information System if properly developed and the problem it is going to solve is well defined and a detailed analysis of the existing system made.

3. The analysis of the existing Information System for the Zambia Police

3.1. Introduction

As has been revealed in chapter two, crime analysis is important in crime management. Management of information for crime analysis is a critical mission in law enforcement. In order to improve the way information for crime analysis is managed, it is imperative that the existing situation and conditions under which the police department under study are understood first.

This chapter deals with the analysis of the existing crime information system. However, before the analysis is done, the methods of data collection and sources of data and limitation of data collected are discussed.

The Zambia Police Service which is the study area is described in terms of its role and mandate, functions and the environment it operates in; that is the external and internal conditions it operates under. The communication channel in general is also discussed because it gives an idea of how information flows from one section to another.

After describing the general communication channel, an analysis of what the Zambia Police Service considers crime analysis information system is made. The users and producers of this system are outlined and their functions discussed.

The problems the Zambia Police Service faces in crime analysis are discussed and opportunities which are available to improve the existing situation are also pointed out. A conclusion is then drawn as to what the gap is between literature and the existing situation which leads to the design of an improved system.

The sources of information in this chapter are the interviews (see appendix 1) carried out during fieldwork, observation of processes, reports and documents reviewed.

3.2. Methods of data collection and sources of data

The identification of what data is required is an important aspect of any research. Literature reviewed defined crime analysis and what it is used for. Hence the strategic selection of the data sources indicated in figure 3.1. Data requirements for a crime analysis information system are spatial (Location and socio-demographic) temporal and crime data. Figure 3.1 shows methods of data collection used in the field indicating also the major sources of this data.

Figure 3-1 Methods of Data Collection and Data Sources

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                        ┌─────────────────────────────┐
                        │  Methods of data collection │
                        └─────────────────────────────┘
                         │                           │
              ┌──────────────────┐         ┌──────────────────┐
              │  Primary sources │         │ Secondary sources│
              └──────────────────┘         └──────────────────┘
                 │          │                        │
          ┌───────────┐ ┌──────────────┐    ┌──────────────────┐
          │ Interviews│ │ Observations │    │ Document review  │
          └───────────┘ └──────────────┘    └──────────────────┘
```

Observing how information is passed from one department to another

a) *Police command*
b) *Operational personnel*
- Research and planning Unit
- Crime statistics office

a) *Police documents*
- Police standing orders
- strategic development plan
b) *Police reports*
c) *Location data*
- Lusaka water and sewerage
d) *Socio demographic data*
- Central Statistical Office
e) *Crime data*
- Lusaka Central Occurrence book

Source: Fieldwork data

Data was collected by primary and secondary means. The primary data collection method employed were interviews which entailed talking directly to the people identified such as the police command (top management of the Zambia Police Service). Observations were also made. Offices, especially the Research and Planning Unit and Crime Statistics Office, were visited on several occasions to get first hand information on how data is entered, stored, maintained and even processed. The interviews were conducted at two levels that is; administrative (police command) and operational (research and planning unit and crime statistics office). The two levels were chosen because the focus of the research is at strategic and administrative levels. A top down approach was used because the information system to be developed or redesigned is meant for management so it was important that they gave their information requirements first. Their requirements guided the interviewer to which offices their data comes from.

Secondary data was collected from police reports and documents. The interviews were conducted first and document and report reviews later because interviews pointed to which reports and documents were important for the study. The Police reports are those received by the police command from operational personnel. They supplemented the interviews.   The Second Strategic Development Plan

2001-2006 and the Standing orders are policy documents which guide and support police operations. These were reviewed to give insight on the legality and possibility of developing an information system for crime analysis and to help in the analysis of the existing system.

The Occurrence Book (OB) was reviewed so as to see how data entries are made and what particulars are recorded. The OB is the entry point for all crime data in the Zambia Police Service. It is a standard book for all police posts and stations and the procedures of entering data are also standard through out the country.

Crime data was collected from the OB of Lusaka Central Police station. This data will be used in the testing of the system to be designed. Spatial data was collected from Lusaka Water and Sewerage Company. The Central Statistical Office could not provide socio-demographic data at macro level. It required several weeks for it prepare such data.

The analysis of the current situation in the police is based on the data collected in the field.

3.3.The Zambia Police Service

The Zambia Police Service is a department under the Ministry of Home Affairs and employs about 14,000 officers. It is one of the major employers in the country. The Inspector General of Police who is the head of the department is appointed by the President of the Republic of Zambia. The Inspector General is assisted by the Commissioner of Police (COMPOL) who is also appointed by the President. There are a number of Deputy Commissioners of Police (DCP) who head specialized sections. For the organizational structure see fig.3.2.

The highlighted offices in figure 3.2 were the focus of the interviews during fieldwork. It is also worthy mentioning that the structure shown is for the Zambia Police Service Headquarters which was the focus of the research.
The Zambia Police Service is mandated with the maintenance of law and order in the country. It is charged with internal security of the country. Its primary goal is to prevent and reduce crime in the country and arrest and take offenders to court. From its main goal, it is evident that the Zambia Police Service does not operate in a vacuum. It interacts with society and it is society it serves.

Provision of quality services to the public is important for the Zambia Police Service. The quality service, however, is dependent on the environment the police service operates under. In order to understand the environment better, the external and internal analyses are conducted.

Figure 3-2 Organizational Structure
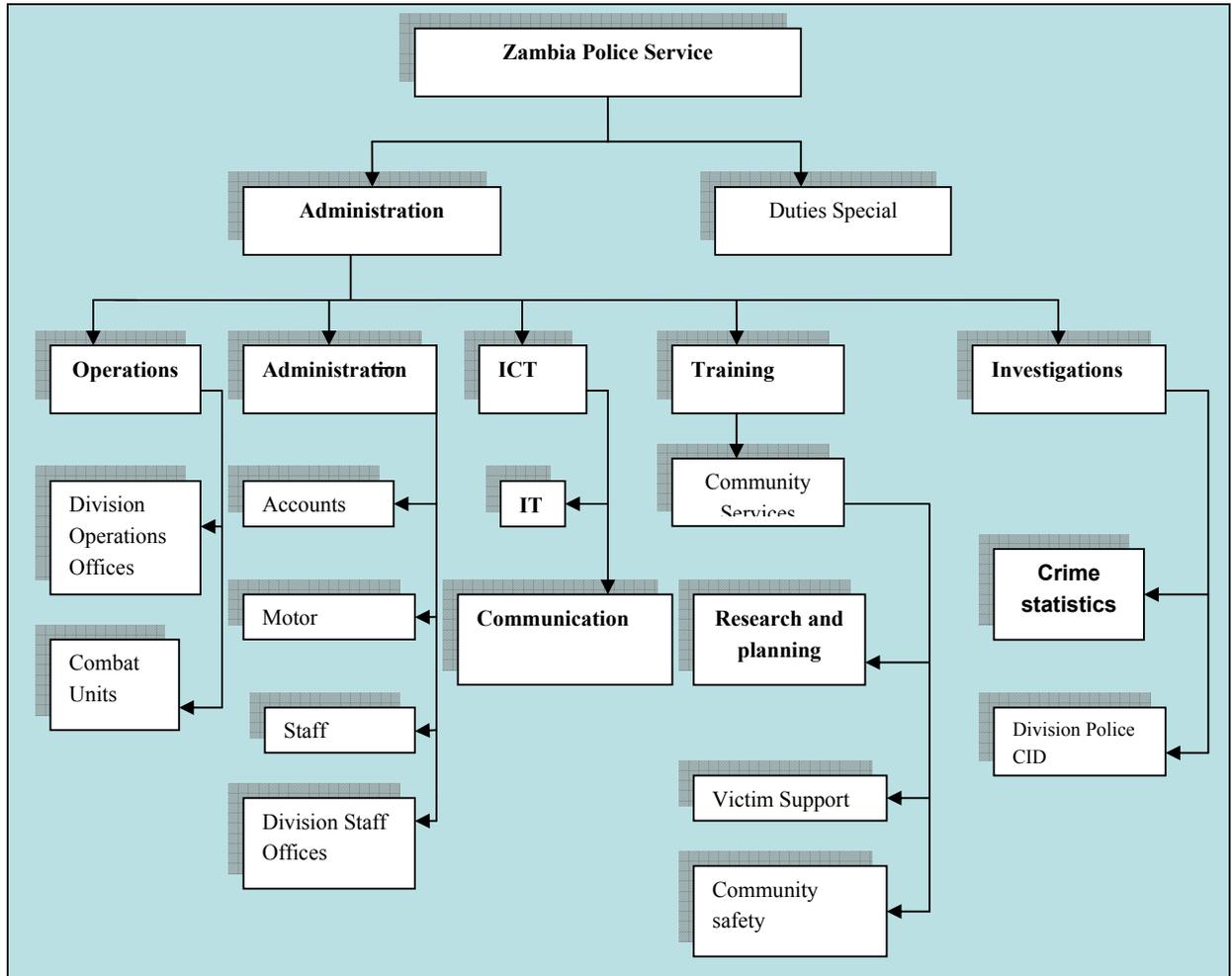
Adapted from Force Standing Orders

3.3.1. Environmental Analysis

The environment is divided into two that is external and internal.

3.3.1.1. External Analysis

Society expects the police to be proactive within its defined scope of implementing effective crime prevention measures. In discharging its demanding task of crime prevention, the Zambia Police Service (ZP) is expected to work in collaboration, consultation and close liaison and co-operation with various stakeholders whose concerns, views and opinions may be at variance with those of the police (Zambia Police Service, 2001)

The poor performance of the economy has resulted into reduced revenue for government. This with government's failure to make adjustments in levels of public expenditure has curtailed government institutions capacity to deliver. The Zambia Police Service (ZP) is not an exception. The economic

malaise has an impact on the overall quality of crime prevention measures put in place. The Zambia
Police Service (ZP) can no longer attract and worse still retain adequate numbers of qualified, skilled
and competent professionals due to general poor salaries and conditions of service prevailing in the
public service (Zambia Police Service, 2001)

Unemployment levels in Zambia are above 50% and about 80% of the population's income is below
the poverty datum line (World Bank, 2000). The crime rate is high. For instance, an average of five
vehicles are stolen from the Lusaka city per week, four aggravated robbery cases are recorded daily
country wide (Zambia Police Service, Research and Planning Unit, 2003). This creates social chaos.

However, the Zambia Police Service can exploit some opportunities such as government support,
potential donor support, support from the business community, international recognition and the
democratization process the country is undergoing (Zambia Police Service, 2001).

3.3.1.2. Internal Analysis

Apart from understanding the external environment the Zambia Police Service operates in, it also
needs to have a clear understanding of its internal environment. An analysis of the internal
environment conducted by the Inspector General's working group reveals that high command (top
management) is committed to reform the police in accordance with what is obtaining in other
countries, for instance South Africa where information management has proved to be an integral part
of police operations; the focused vision of provision of quality service to its clients; team work is also
prevailing as command has realized that it needs all officers on board if it is to realize its vision
(Zambia Police Service, 2001).

The drawbacks as highlighted by the working group are lack of material resources, lack of
collaboration and co-ordination with major stakeholders and lack of financial resources. For any
organization to successfully realize its mission and objectives as well as satisfy the needs of its clients
there is need for adequate and timely provision of material resources and logistical support.

Currently, the Zambia Police Service does not have enough material resources which include
transport, radio communication equipment and computers. As for co-ordination, the police is now a
community service oriented organization and therefore, needs stakeholders in order to enable a co-
ordinated approach to crime prevention which may result in the police being able to monitor the
impact of crime prevention measures.

Having the above background in mind, it is imperative for the Zambia Police Service to focus its
operations by setting targets within the current government policy in order to meet the current
challenges of crime prevention. In order to do this effectively, the Zambia Police Service has to have a
clear understanding of different communities it serves and their needs. The Second Strategic
Development Plan 2001-2006 has identified information, collaboration, net working with other
organizations, civic education on crime prevention and research as some of the major needs of its
internal and external environment.

Information is not only a need for society but also for the Zambia Police Service itself. For the police to make proper decisions on crime prevention measures and evaluate the impact of these measures quality information and easy accessibility to information are required.

The nature of the organization means policy decisions are made at headquarters always in consultation with the Inspector General's office. Most operations are done with the concert of the Inspector General's office.

3.4. The General Information Flow in the Zambia Police Service

There is an information system in the Police though it is manual and bureaucratic. It is also slow especially that there is a lot of data which passes through it and has to pass through so many offices before reaching its intended target. It has, however, faithfully served the organization from its inception; it has stood the test of time. Figure 3.3 shows this communication channel. This channel shows how information is passed on from the lowest level of police administration which is a police post to headquarters the area of concern for this research.

The offices are shown in the order of authority, headquarters being the highest order and post the lowest. Zambia Police Service is made up of nine police divisions which are made up of police districts. Police stations make up a police district whereas police posts make up a police station. The police divisions and districts are not in conformity with the national administrative boundaries.

A higher level supervises a level below and all communication going either top or down has to be approved by the supervisor. This takes a lot of time and communication may be delayed. This channel compromises efficiency in communication but checks what goes in and out of the specific police jurisdiction.

Figure 3-3 General Communication Channel
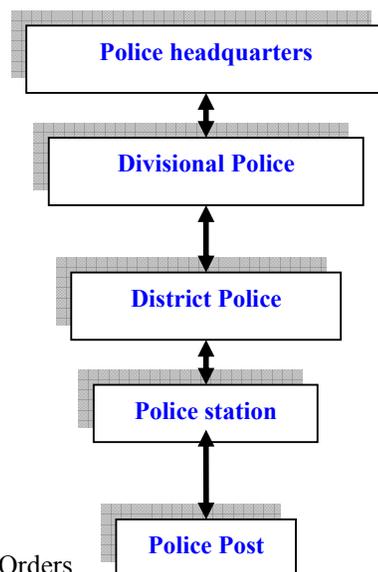
Source: Force Standing Orders

From the communication channel above it can be deduced that decision-making is centralized. There is a lot of bureaucracy in the movement of data from the source to the user. This is because data has to pass through a number of offices before reaching the intended target. Efficiency and reliability are in turn compromised.

Figure 3.2 shows the hierarchy of offices data passes through from the smallest unit of police administration, the police post to the highest, headquarters. No communication can be made for instance between headquarters and police station without passing through police division and district. The opposite is also true. It is worthy mentioning that these offices can further be decomposed and in each office there is another established communication channel.

All crime data passes through this channel. Crime data is recorded in the occurrence book (OB), which is found at every police post and station. All incidents of crime, accused persons, victims of crime, officers' movements, handing and taking over certificates, arrests, detentions, recoveries of property and visits from senior officers are recorded in the OB. A typical page of an OB is shown in Table 3-1 Occurrence Book Fields

Table 3-1 Occurrence Book Fields

Entry no	Reference no	Time	Subject	Occurrence
4565	4566	11:00	Theft from m/v	Reported today the 25th of September 2003 at Lusaka central police station by m/Chowani Malundu of cabinet office that a car radio was stolen from his car Toyota chaser reg.no ABA 5820 whilst parked in front of Shoprite along Cairo road around 10:00hrs
4566	4565	11:15	Docket of theft from m/v	Docket opened and forwarded to criminal investigations department (cid) for further action.
4567	4568	12:00	Murder	Reported today the 25th of September 2003 at Lusaka central police station by m/Jackson Mpundu of Kabwata high-rise flats who says his elder brother by the name of Eddie Mpundu self employed aged 65years was murdered by unknown people at his home in Kamwala south area between 10pm yesterday and 10am today.
4568	4567	12:20	Docket of murder	Docket of murder opened and forwarded to criminal investigations department for further action.
4569	4567	13:00	Scene of crime visit	D/constable Mwiinga and crew books out for scene of crime visit to Kamwala south area using ZP 143p with two AK assault rifles.

Source: Lusaka central police station OB for September 2003

The entry number is a serial number given to each incident reported. It uniquely identifies an incident. A reference number refers to action taken to an earlier reported incident. the subject defines what crime incident was reported for instance murder whereas occurrence gives details of the crime such as the accused person and victim particulars, time occurred, place occurred, modus of operandi, arrests made and any recoveries made.

Table 3.1 shows inconsistence in recording of crime location at the entry point. At times location of crime is completely left out and this does not give detailed information to the decision makers as some crime may not be located.

Using the data obtained from the OB every police formation sends a daily incident report to its supervisor as shown in figure 3.2 and the reports follow the channel till they reach headquarters. A sample of dir sent to headquarters by division police is given in table 3.2.

Table 3-2 Daily incident report (dir) for 26th September 2003

Division	Subject	Description
Lusaka	Murder	Occurred between 22:00hrs 24th September and 10:00hrs 25th September 2003 in Kamwala south area. One male person aged about 65 murdered by unknown people.
	Aggravated robbery	Occurred at Chilumbulu BP filling station on 25th September 2003 at 16:00hrs. Cash amounting to k40 million was stolen by 5 armed persons driving a Toyota corolla DX white in colour.
Southern	Aggravated robbery of m/v	A white Toyota Camry was stolen by 2 armed persons in Choma at 23:00hrs on 25th September 2003.
	Escape from lawful custody	2 prisoners escaped from Dambwa police station cells between 23:00hrs 25th September and 02:00hrs 26th September 2003.

Source: Research and Planning Unit DIR File

The inconsistencies in recording of location of crime at the entry point (OB) are reflected in the DIR. No standard way of recording location of crime is defined. Equally location of crime is not visualised on a map it is only mentioned.

3.5. Crime Statistics Producers and Consumers

It should be made clear from the onset that crime analysis as defined in Chapter 2 is different from how the Zambia Police Service understands it .The Zambia Police Service understands crime analysis as compilation of crime statistics by type per specific period. No spatial factors and socio-demographic data at macro level are considered. These crime statistics are compiled yearly by the crime statistics office normally they should be compiled quarterly due to lack of resources. The Research and Planning Unit also compiles crime statistics upon request from various offices within the Police and other institutions outside the police.

From the results of fieldwork the producers of crime statistics are research and planning unit and crime statistics office whereas the consumers are Inspector General's office, Commissioner's office, Operations division, Administration Division, Training Division and Information, Communication and Technology division, parliament, non-governmental organizations, Ministry of home affairs, the general public and other institutions for as long as they request. Non-governmental organizations, parliament and the general public were not interviewed. The focus of the research is provision of quality crime analysis for management. Figure 3.4 shows the crime statistics consumers. The production of the statistics is done by two offices and these are research and planning

Figure 3-4 Crime Statistics Context level DFD
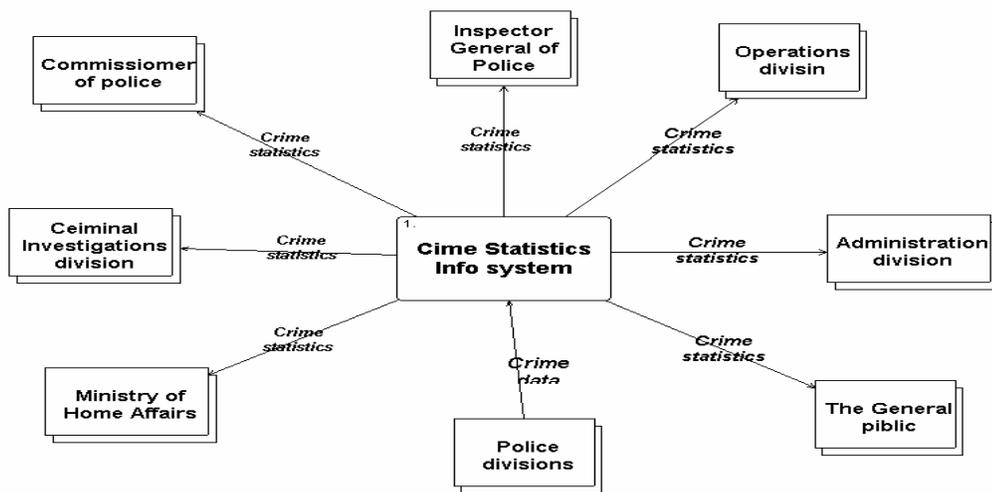
3.5.1.   Producers

The Research and Planning unit and Crime statistics office are described in detail in Table 3.3 outlining their functions, information requirements and the source of this information and problems in the production of these statistics.

Table 3-3 Crime statistics producers

Office	Functions	Information needs	Data source	Problems
Research and planning	-Crime, human, police equipment and building data collection -Crime data analysis -Preparation of special reports	Crime, human and equipment resource data, maps and accused and victim data	DIRs from police divisions,	Storage of data is manual. no filling system is available Maintenance; data is not updated on time Retrieval takes about 2-7 days to get the data required.
Crime statistics	-Crime data collection and analysis -Compilation of crime statistics	Crime, accused, victim data. maps	DIRs from police divisions,	As above

Source fieldwork Data

The DIR as discussed earlier on in the chapter lacks detail in the recording of location of crime and it does not include all crimes. It only reports on serious crimes and these are murder, aggravated robbery, rape, stock theft, theft of motor vehicle, escape from lawful custody, and attempted murder.

3.5.2.   Consumers

The top management of police is the major consumer of crime statistics. These statistics are used in decision making. The statistics sum up the number of crime events per division and group crime by type.

There are other users of crime statistics outside the Zambia Police Service and these are parliament, Non Governmental Organizations, Banks, Supermarkets and the General   public but these were not interviewed due to limited time for fieldwork. The functions of offices, information requirements and sources of this information are outlined in detail in Table 3.4.

Table 3-4 Crime Statistics Consumers

Office	Functions	Information needs	Data source	Problems
Inspector general's	administration of ZP advises president and govt on crime in country resource allocation	1. Where does crime occur? 2. When does crime occur? 3. What is the crime trend? 4. Where are crime hot spots?	1. Research and planning unit 2. crime statistics office	1. Crime statistics reports not received on time. 2. Only serious crimes are reflected in the statistics.
Commissioner's	chief administration officer of ZP deputy in charge of police acts in absence of inspector general			
Operations division	-day-to-day operations of police -protection of very important persons -provision of security to strategic -institutions, -provision of security to vital installations -advises inspector general police on crime prevention measures -principal adviser IG to the on police operations countrywide.			
Administration division	mandated with the welfare of officers' country wide advises IG on status of human resource and non human resource in relation to crime location advises the inspector general's office on promotions of officers	1. Where are crime hot spots?		
Criminal investigations	advises IG on crime situation in country and which people are involved	1. Who is involved in crime and which crime? 2. What is the crime trend?		
Training division	-mandated with career development for all officers and placing officers in their right positions -advises the inspector general's office on promotions of officers -co-ordinates all training programs for the police and supervises all police colleges.	1. Which crime is prevalent? 2.Which people commit which crime?		
ICT division	-responsible for the computerization of the information flow in ZP -advises the IG on the state of communication equipment in the country	1. Where are crime hotspots?		

Source Fieldwork Data

3.6. Challenges

3.6.1.   Lack of comprehensive Crime Analysis

The major problem is lack of comprehensive crime analysis. Location is not visualized on a map but merely mentioned. Factors such as socio-demographic and land use of locations where crime occurs

are not considered in the analysis of crime, as a result, crime causes and trends are not understood resulting into poor decisions on what crime prevention measures to be employed.

This is the problem this research endeavours to answer by designing a crime analysis information system, which answers the information requirements of the users identified earlier on in the chapter having in mind the definition of crime analysis as found in literature. Equally considering the economic environment the organization operates in and the policies available which can support such a design.

3.6.2. Lack of detailed data

The DIRs are the major source of information for crime analysis. There is, however, a draw back with DIRs in that they only reflect serious cases such as murder, aggravated robbery, arson, attempted murder, stock theft, and escape from lawful custody which occurred in a specific place in the past 24hours and reported within the same period. Cases that are not reported within 24 hours of occurrence are not included in the DIR. Other offences such as assault, burglary, and mere theft are not included. These less serious crimes are not used in crime statistic compilation. This does not give a clear indication of crime in the country.

The DIRs do not reflect the place of occurrence of crime in detail. The recording of crime particulars in the OB is not consistent and specific. The fields used in the OB are not specific about place of occurrence, which can be described as Lusaka or given as residential area. Also the socio-demographic data (age, tribe, race, status, sex, address) about the accused and the victim are not included in the DIR.
Information in the police is analogue and has to pass through a number of offices before reaching its intended target and this makes information flow slow.

3.6.3. Lack of Training and resources

There are no officers trained in crime analysis. Officers who can undergo such training are available. Only four (4) officers are trained in Information technology and management. Three officers have diplomas in computer sciences; one has an MSc degree in Computer sciences. Trained personnel do not stay long because salaries and conditions of service in the police are not able to sustain experts. A number of officers have left the organizations for organizations which pay well.

Funding from government is erratic and inadequate. The police have problems of transport, fuel, police equipment (such as police radios, computers, deconets,) which are important for smooth information flow. For instance, Proposals on computerization of the system started in 1994 the implementation has been a major problem because the computerization program is not on budget and it requires colossal sums of money. There is simply no money.

3.7.Opportunities

The Strategic Development Plan 2001 – 2006, discussed earlier on, includes the computerization of Management Information System as one of its major objectives to be achieved by 2006. Despite this inclusion, there is no detailed work plan as to how this objective is going to be achieved and specific activities to be undertaken to reach the objective. A new/improved crime information system is

supported by the existing development plan which has been approved by the Government of the Republic of Zambia.

An Information Technology department has since been created and is headed by a senior police officer who reports directly to the Inspector General of Police. This demonstrates the importance the police command has attached to information management unlike in the past when such a department never existed. Equally, the video on GIS and Law enforcement shown at the beginning of fieldwork aroused interest among command as to what a

3.8.Conclusion

A conclusion can be drawn that development of a crime analysis information system is tenable because there is a gap between crime analysis as in literature and what is obtaining in the Zambia Police Service. Reconciling literature and reality can fill this gap.

The users of information for crime analysis are already there and their information requirements indicate that the system is a necessity in crime management. The information and data flow structure is already there all that is required is making it efficient.

Above all the need for a computerized system has been identified by command and this has been translated in the Strategic development Plan.

The next chapter looks at the design of a crime analysis information system, which will answer the information needs, which were identified during fieldwork.

4. System and Database Design for Crime Analysis

4.1. Introduction

The Zambia Police Service but it lacks the spatial and some socio-demographic data about the victims of crime and accused persons to better perform crime analysis. The existing system is also mostly based upon analogue registers and manual operations that limit the system's functionalities and undermine its performances.

The objective of this chapter is to design an improved information system which bridges the gap between the ideal situation as found in literature and the real situation as discovered on the ground during fieldwork in Lusaka.
The functionalities of the improved system will be discussed in detail. Equally, the data requirements will be stipulated and a database designed

The previous chapter has revealed that there currently is an analogue information system in
To better analyse crime and put up proactive crime prevention measures, crime analysis components and their relationships must be understood. Apart from understanding the components that make up a crime analysis information system, the quality of information passing through these components is important. The quality of decisions made depend on the quality of information available. This means a well-organised database is important to effectively manage and maintain crime analysis data.

To achieve this, a crime analysis information system model, which shows functions and the data involved in crime analysis analyse crime effectively, is developed in this chapter using a case tool System Workbench Development (SDW). The process model is developed and is then translated into a data model. The Data Flow Diagrams in SDW are a powerful technique for information analysis and process modelling. The diagrammatic technique supports logic thinking.

Documentation technique supports communication. Data about processes, data flows and data stores (Meta data) are stored in Data Dictionaries.

4.1.1. Terminology in Data Flow Diagrams (DFD)

Terminator: A terminator shows the origin of data used by the system and the ultimate recipients. The terminator is outside the system. A terminator provides data/information and/or receives data/information from the system. It does not participate in the function but receives from the function.

Process: It is a function and works on the data received and sends the requested information to the users. It operates on the data by either physically transforming (computation) or changing the state of

the data for instance validation. A process is dynamic and can be subdivided into sub processes of an information system.

Data Store: It stores the data received by a process. It represents a logical file. The direction of the data flow arrow shows whether the data are being read from data store into the process or produced by the process and then output to the data store.

Data Flow: It describes the data/information that moves between/among processes, between processes and terminators and between data stores and processes. An arrow indicates direction of the data flow. The data are identified by name written on the corresponding angle. The symbols denoting each term are given below as a key to understanding the DFDs to be used in this chapter.

Key symbols used for DFDs
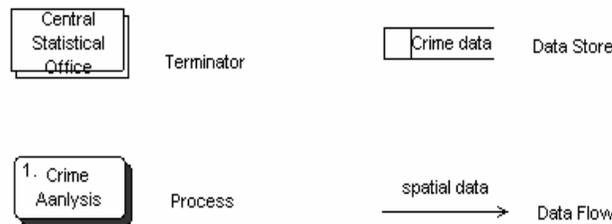
4.2.Crime Analysis Information System Design

A Crime Analysis Information System (CAIS) defines the processes, the data flows involved in order for crime to be effectively analyzed. The processes are defined first at context level which gives a global overview of the system and secondly at top level which gives a detailed view of the system. The context level presents the external view of the system and permits to identify the system's stakeholders, to delineate the boundaries of the system and to identify information requirements on the system. The top level presents the internal view of the systems and shows data stores, sub processes and how data flows among the sub processes.

The system being developed is to respond to the current information requirements of the users while looking at what it can perform in future. It is developed as a flexible system to enable a long life span. The system is also designed considering the environment within which the Zambia Police Service operates in, having in mind the limitations and the opportunities alike.

Having defined crime analysis in chapter two and crime analysis as understood by the Zambia Police service, the design seeks to bridge the gap between the two definitions and the inclination is more to the definition of crime analysis as given in literature. The design will not be as detailed as the ones from the United Kingdom and the United States of America.

An important difference is that the location of crime is captured with less detail. Because the addressing system in Zambia is not well developed use is made of so-called police post boundaries or surveillance areas. Such polygon based analysis is similar to the setup of the systems in of South Africa and Pakistan. A However, the system designed can accommodate changes, should the

addressing system improve in future; point analysis of crime using X and Y coordinates can be used to analyse crime as in the UK and USA when resources and data are available.

4.3. Crime Analysis Functional Model

4.3.1.   Context level:

The context level is a global design, which shows the system as one single process. It shows the data flows, the source and users of the information and the process. The system boundary is also defined at this stage. Figure 4.1 shows the users of crime analysis information and sources of information required for crime analysis as identified in chapters 2 and 3. The colour yellow depicts the new sources. White on the other hand shows the traditional users as found out in chapter three.

Figure 4-1 Crime Analysis Context Diagram
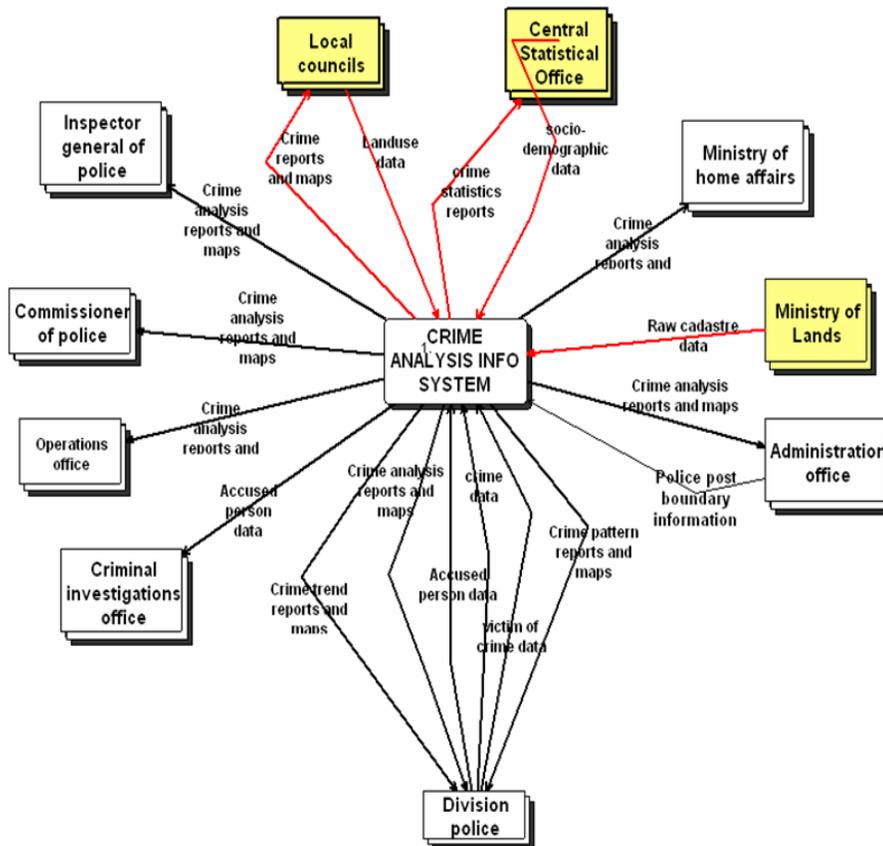
It is important to note that non-traditional sources of data for the police have been identified and these are:

The Local councils: these provide land use data in spatial format. They also provide administrative boundaries of municipalities. Police stations are found in municipalities' hence the importance of this data in crime analyses. Various land use types are affected differently by crime.

The Central Statistical Office (CSO): This office will provide the police with census data also in spatial format at ward level. The data shows census tracts which give the socio-demographic structure of particular areas macro level. The police will have to enter into some agreement with the CSO in order to access this data.

Ministry of Lands: This Ministry provides raw cadastre data for each municipality. Data collected will not include the names of the owners of the parcels (plots). It should also be borne in mind that this data may not be easily available now but in future can be used since the system being developed has a vision to use cadastre data to analyse crime.

The system has been described as Crime Analysis Information System whose major user is the police command (top management). The Police Command requires crime analysis information so that they are able to visualize, understand the crime trends, patterns and crime clusters while displayed on a computer.

4.3.2.   Top level

The top level decomposes the process into sub processes, which perform specific functions in the system. Data stores which store specific data are indicated and the processes, which have access to these data stores identified. Figure 4.2 shows the Top Level Crime Analysis Information System Data Flow Diagram (DFD).

Figure 4-2 Crime Analysis Information System Top Level DFD
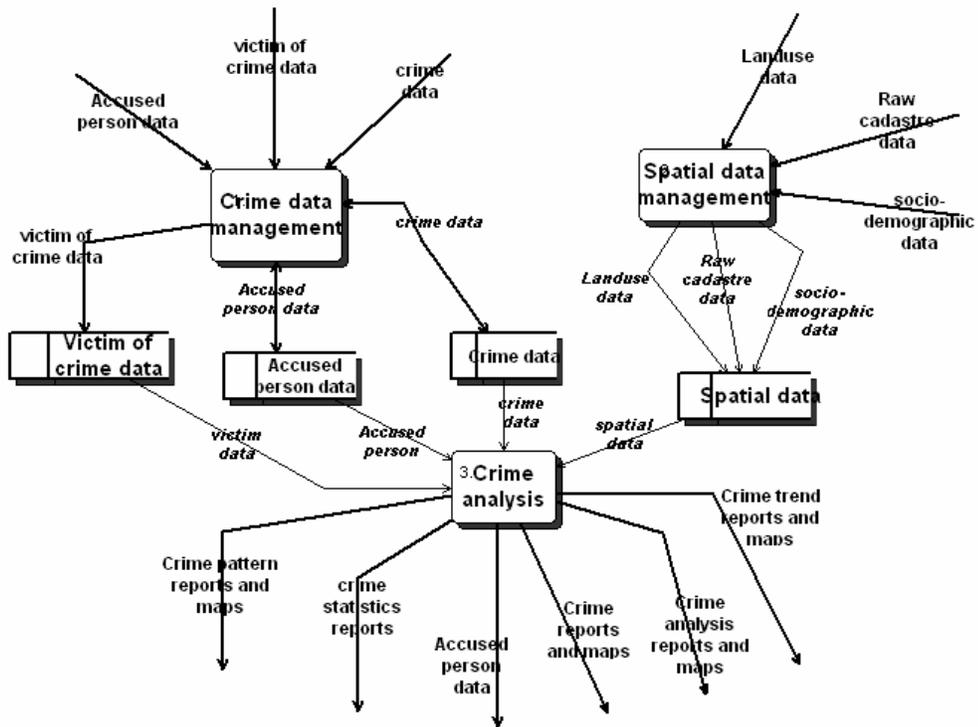
The Top-level DFD shows that a number of processes have access to the data stores. In order to ensure integrity and reliability of the data to be maintained, security measures have to be put in place. Different levels of access are defined for each process so that data is not lost, altered and deleted. These levels are entry, edit and retrieval. The non-spatial data and spatial data processes have the entry and edit access security levels whereas the crime analysis process has the retrieval access only. The rest of the users also will have read access only.

Three components of the Crime Analysis Information System have been identified and designed. The top level diagram shows the sub systems of CAIS and their data requirements. Equally, four data stores have been designed These stores are important in data management for crime analysis as identified earlier on in chapter 2 and 3.

4.3.2.1. Crime Data Management

The major functions of this sub process are to collate data sent by different police divisions. Updating, editing and maintenance of the data stores are performed in this sub process. The sub process also updates the crime, victim of crime and accused person data as they are received from the division police formations. The particulars of victims of crime and accused person are socio-demographic data at micro level and this data is recorded directly from the people involved. The particulars of these data are given in section 4.6 of this chapter.

The sources of data are mainly police divisions and this data is in turn stored in accused person, crime and victim of crime data stores, which are accessed by the crime analysis sub process.

4.3.2.2. Spatial Data Management

This sub process' functions are to collect police formation boundary (division, district, station and post), land use, census and cadastre data and process them. It also maintains and updates the spatial data store. Spatial data is important in the analysis of crime.

The major sources of data for this function are the local councils, the Central Statistical Office, the Ministry of Lands and the police administration division.

In situations where some data are not available at the source, the process could collect data using aerial photographs and/or satellite images as raw base data from which to obtain the required data. Where no soft copies are available data should be digitized.

Different formats of data from different sources are converted into the destination format, for instance reading a DXF file into a Shep file. The data is kept up-to-date and supportive

4.3.2.3. Crime analysis

This process answers the users' major information needs identified in Chapter 3. Its main function is to manipulate the spatial and non-spatial data using GIS.

This process uses geography and computer generated maps as an interface for integrating and accessing massive amounts of location based information. The ability to access and process information quickly while displaying it in a spatial and visual medium allows decision makers to allocate resources quickly and more effectively.

The Crime Analysis process is further decomposed into four sub processes and these are strategic, tactical, investigative and administrative as identified in chapter two. The information/data requirements of each type of crime analysis are discussed below.

Tactical analysis requires crime and land use data for the location of crime to be visualised. This analysis is a daily routine which aids police commanders to come up with short term solutions of crime prevention measures. It provides information used to assist operations personnel in identifying specific and immediate crime trends, patterns, series and hotspots.

Criminal Investigative analysis requires accused person data and crime data in order to make an analysis in finding out as to who commits which crime. This analysis leads to the apprehension of criminals.

Strategic analysis requires crime, socio demographic, temporal, and land use data in order to understand why, when crime occurs and who is a victim of crime, who commits crime and what type of crime. It is concerned with long range problems and projections of long term increases or decreases in crime and therefore provides long term solutions. It is done on over a period of time so as to compare the trends and patterns which emerge.

Administrative/Academic analysis this type requires mainly crime data so as to perform statistical analysis of crime. It is mainly concerned with the number of crimes committed per given area over a period of time. These statistical reports are normally requested by the public, other government departments, Parliament, Non Governmental Organizations.

Figure 4-3 Crime Analysis Information system Lower Level DFD
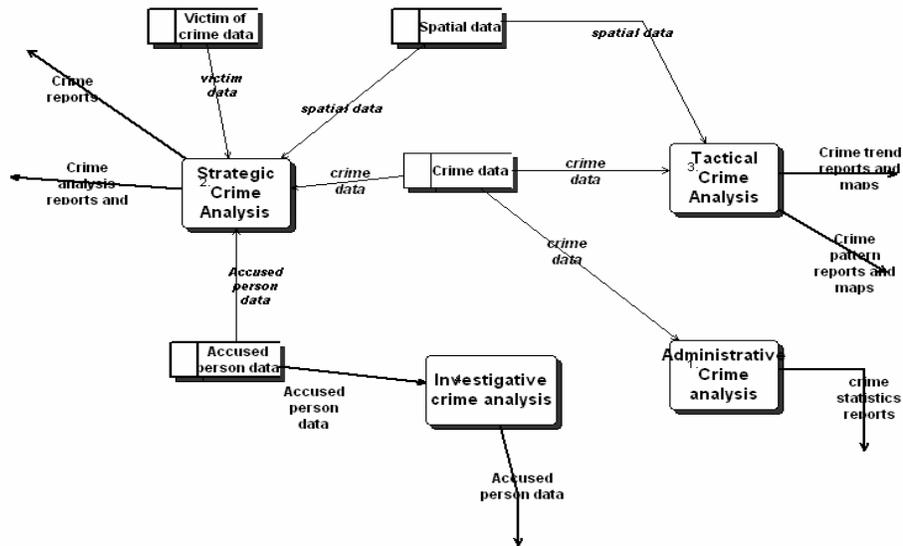
4.4.Crime Analysis Information Model

A database is defined as "a large, computerized collection of structured data," (By, 2001). Designing a database is not a simple job. The database purpose and its users have to be considered carefully. Equally, it is important to identify the available data sources, and defining the format (database structure) in which the data will be organised within the database. A database is designed to service the information needs of a group of users. There are classes of information needs and these are:

- Reliable information storage that allows retrieval at a later date.
- Up-to-date information, which requires well defined functions for updating the information
- Analytical functions

It is important to have a database which can answer the above needs. In order to get a good functioning database it is very cardinal to first focus on the database structure
The designing of a crime analysis database follows the standard procedure of database design having in mind the information needs identified in Chapter three. Below is figure 4.4, which shows the general phases of database design.

Figure 4-4 Database Design Phases
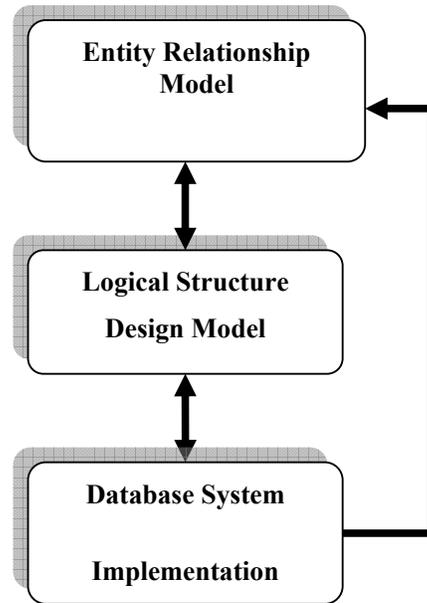
Database design process is iterative. This helps the designer understand whether the user requirements are being met.

4.4.1.   Development of E-R Model

The Entity Relationship E-R model consists of identification of entities, user requirements, enterprise rules and development of an E-R diagram, which shows the relationships between/among entities. It also shows cardinalities. The E-R model is shown at two levels; that is the Conceptual and Logical levels.

4.4.2.   Entities

An entity is defined as a thing (object, concept), which the area of interest recognises as being capable of an independent existence and can be uniquely identified. From the system design phase discussed earlier in the chapter in section 4.2.3 entities have been identified. These entities are divided into two categories that is spatial and non spatial.

- **Non Spatial Entities**

    - Crime
    - Accused
    - Victim

- **Spatial Entities**

    - Police Post boundary
    - Census Tract
    - Land use

In this study, crime is recorded using police post boundary code. Each police post boundary is given a code that is used in crime analysis.

4.4.2.1. User requirements

The analysis of the existing situation in chapter 3 section 3.5.2 has identified the user requirements. The answers to the user information requirements are supposed to be visualized in a map. The spatial entities identified will help connect the crime data to their location on a map.

4.4.2.2. Enterprise Rules

Enterprise rules define the relationships between the Entities and these rules are derived from legislation, regulations and rules of best practice (Paresi, 2000). These rules are also derived from the norms of the organisation, Police standing orders and natural dictates of society. Enterprise rules are the underlying rules governing how data elements in a system work together. These rules are usually determined from an in-depth understanding of how the data elements relate in the real world and these define how the data is going to be managed. For this crime analysis database the enterprise rules are given below;

- **Non spatial enterprise rules**

1. Crime affects one or more victims
2. A victim may be affected by one or more crimes
3. An accused person may commit one or more crimes
4. A crime may be committed by one or more accused persons.

- **Spatial enterprise rules**

5. Crime occurs in a police post boundary.
6. A police post boundary may record one or more crimes
7. One police post may belong to one or more census tracts.
8. A census tract may be part of one or more police posts.

4.5. Entity Relationship (ER) Model

4.5.1.   Conceptual model:

Relationship Diagram An Entity is a modelling technique in the framework of Relational Database Management System (RDMS). It represents entities and their relationships. Figure 4.4 shows the Conceptual E-R diagram developed in conformity with the entities and enterprise rules identified.

Figure 4-5 Conceptual ER Diagram
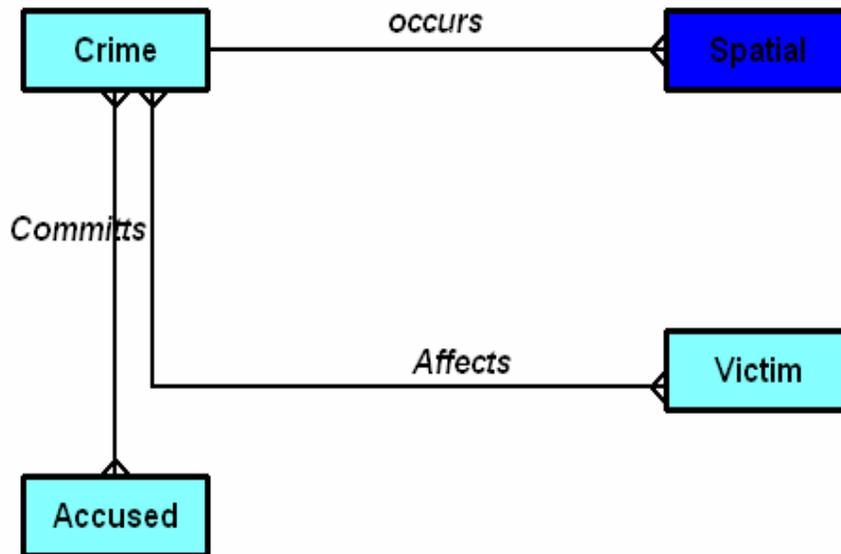
Figure 4.4 apart from showing the entities it also shows the degree of relationships between entities. The spatial entity has a different colour from the others because this is not a "normal" entity per say. It is made up of crime location as in police administrative boundaries, the census tracts and land use.

4.5.2. Logical model

The logical design transforms the conceptual design into the implementation data model. It identifies the primary keys which are attributes of a table uniquely identifying the table. Also identified are foreign keys which define relationships between/among tables. For each entity identified at the higher level, constraints are shown, which apply to the database designed. At this stage, for many GIS applications this is the most important phase, as operations mostly spatial are handled by the GIS not by the database system.

Therefore, the spatial operations have to be designed properly in the GIS environment so that they can be successfully realized when linked with the non-spatial database. This will be discussed in detail in the implementation stage in chapter 5. Figure 4.6 shows the logical model.

Figure 4-6 Logical Design
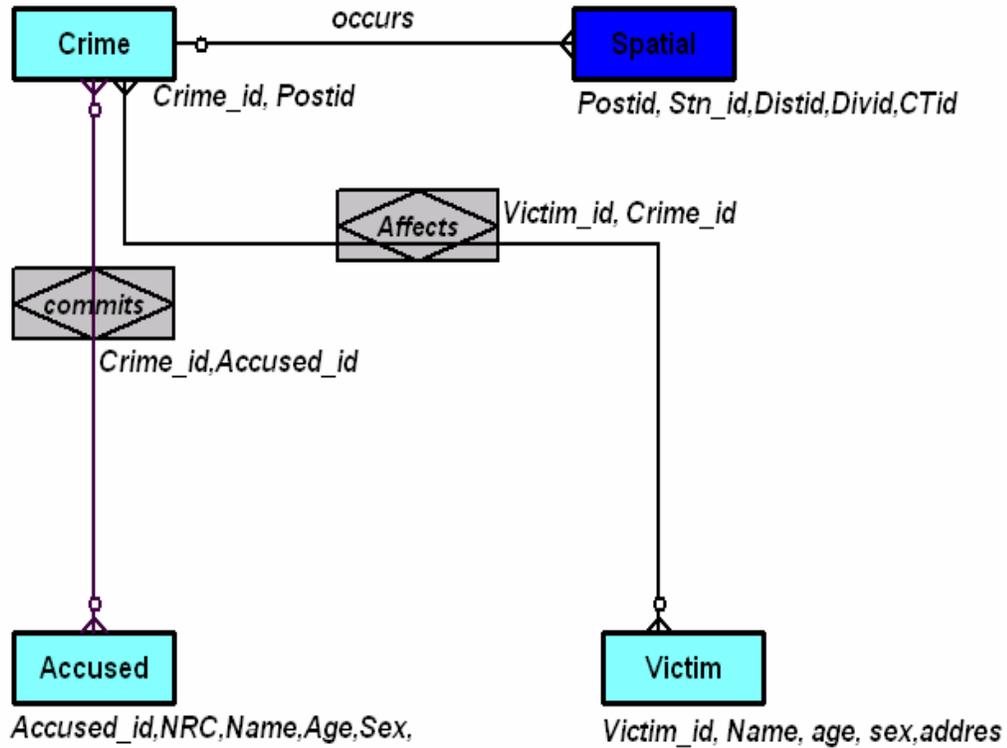
4.5.3. Skeleton tables

The skeleton tables are drawn from the logical design. The entities in the logical design may not necessarily be interpreted as tables! In designing tables care must be taken to avoid a large number of tables. Also when merging entities into single tables the rule that a posted identifier must not have null value must be observed. The tables created are:

Accused person: Accused_id National Registration Card No (NRC), Name, Sex, Tribe, Race, Nationality, Address, Educational level, Occupation

Commits: Accused_id, Crime_id

Crime: Crime id, Crime Name, Crime Type, Post id, Date Occurred, Time_ Occurred, Time reported, Date reported,

Affects: Victim_id, Crime_id

Victim: Victim_id, Name, Age, Sex, Tribe, Race, Nationality, Address, Occupation

Spatial:

 Police_post_boudary: Police_Post_id, Police post name

As indicated earlier, crime is going to be recorded at police post level. However, it can be analysed at different police administrative boundaries such as police stations, districts and divisions.

Census Tract: Tract_id (CT_id), name, district

Landuse: Lanuse_id Commercial, residential, industrial, educational

4.6.Metadata

Data about the data and processes are very important because they describe the whole process of the system and database design. They can also be used by anyone who may want to develop a similar system. Equally, they make it easy to improve the system since the manuals are already available and one does not have to start from the beginning.

A Data Dictionary (DD) contains definitions of all data in the DFD as designed for crime analysis. It includes definitions of processes, data flows and data stores. The DD is appended for easy reference as appendix 2.

4.7.Crime analysis information system

The major objective of the crime analysis information system is to help decision makers to plan for crime control strategies and police resource allocation. The other objective of this system is to improve data accessibility within the police service and by the general public. The data meant for the public, however, will have to be authorised and approved by appropriate authorities. This is due to the sensitiveness of the organization.

The system acquires data in digital and analogue forms. The crime data is acquired at the front desk(Inquiries office) in either digital or analogue form, depending on what a particular station uses. On the other hand, spatial data like police post boundary, landuse data and social demographic data at macro level are acquired by the spatial data management unit. Analogue spatial data when required in digital form is digitized or scanned into the data base. Digital data that may be acquired through photographic images, diskettes and compact discs is converted to the data base structure used by the system at the standardization interface.   Figure 4.7 illustrates how the system functions.

After the data has been captured, it is in turn   stored in a police data base in graphical and attribute forms. Crime data acquired from the front desk is converted and stored in attribute format while spatial data is digitized and stored in the graphic format. The data base is accessed through the data query interface by the authorised users. This stage also provides the interaction between the users and the data base system management unit. The internal users may suggest changes or inclusions - to the data base – to the system management unit.

The general public who are the external users may request for crime information on areas of their interest. Through the system , the police can also pass information to the public through crime awareness campaigns using news letters, news papers, posters, radio and television etc.

The attribute and graphical data and meta data are also stored in compact disks and diskettes which may act as back up should anything go wrong with the system..

Figure 4-7 Crime analysis information system architecture
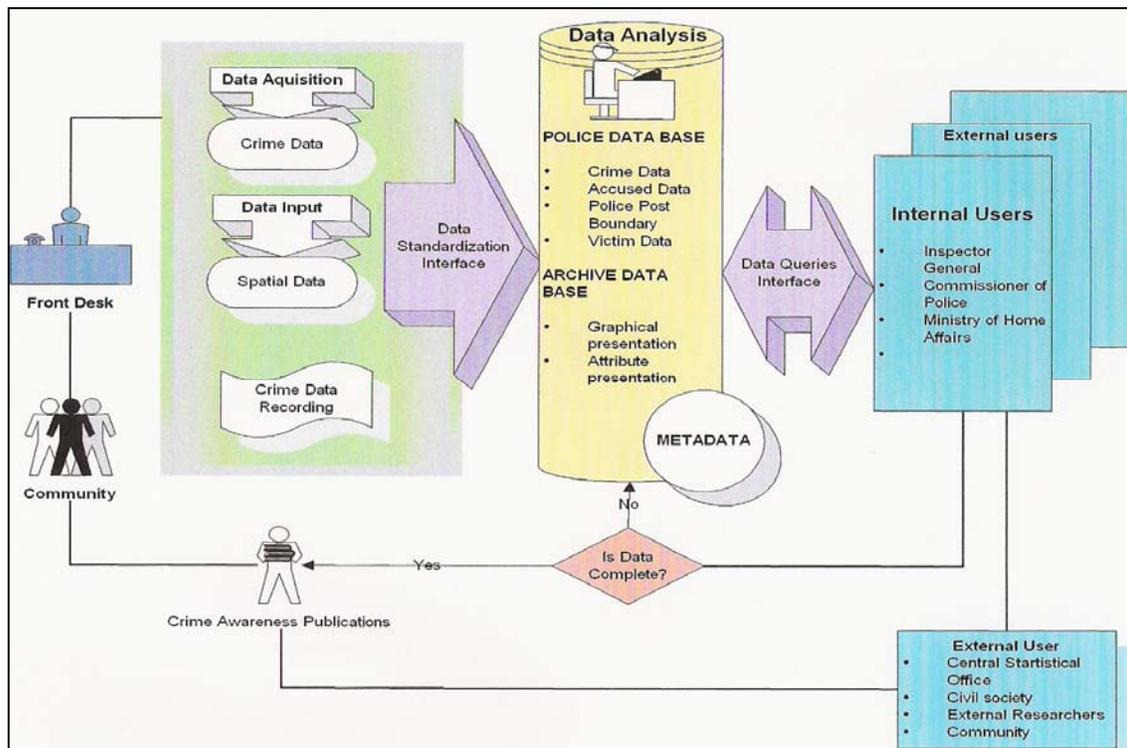
4.8.Conclusion

A new system has been designed detailing its functions and data requirements. The Ministry of Lands, Local councils and CSO are the new non traditional sources of data and users of police data are identified. These institutions will provide the police with spatial data (Cadastre, land use and census tracts data respectively) which are important for crime analysis The Police Post Boundaries will be provided by the administration division.

Police post boundary will be used in the analysis of crime due to lack of address data and X and Y co-ordinates. The system developed is similar to the ones used in South Africa and Pakistan because these countries have similar conditions with Zambia.

A Spatial data management sub system uses GIS as a tool to help in data management. GIS also used as tool in the analysis of crime.

The quality of the non spatial data captured from the police divisions has been improved by defining explicitly the particulars of data to be recorded at source.

In order for the Crime Analysis Information System to work properly, a Crime Analysis database has been designed carefully considering the information needs of the users and the environment the system will operate in. In the next chapter a prototype of the designed database is developed and tested.

5. Implementation of the Crime Analysis Information System

5.1.Introduction

The Crime Analysis Information System (CAIS) is implemented in this chapter. In implementing the system, only police posts under Lusaka Central Police Station are used as a case study. Using the data obtained during fieldwork, the user information needs and capabilities of GIS in crime analysis are addressed. However, before addressing the user information requirements, the software and hardware necessary for the successful implementation of the data model are discussed. Thereafter a crime analysis database is created and populated with crime, victim of crime and accused person and Police post boundary data collected during field work. Due to lack of data, social demographic data at macro level and land use data are not used in the implementation of the model. Also discussed in this chapter is how the non spatial and spatial databases were created.

Challenges of implementing a crime analysis information system are also discussed. A conclusion is then drawn.

5.2.Software and hardware

In order for the Crime Analysis Information System which was developed in chapter four to be successfully implemented a database is physically created by using Relational Database Management Systems (RDBMS) for this study, Microsoft Access. The spatial database is created using ArcGIS 8.3 and is linked with the non spatial database within the ArcGIS environment. ArcView 3.1 or any later version can also be used. As for hardware any personal computer of Pentium three version is sufficient. A lower version can also be used but may prove to be slow especially when dealing with large amounts of data
.

5.3.The process of creating and testing the database

Spatial data sets for Lusaka City which are used are first created from the Lusaka Base map data which is in DXF format and a personal geodatabase is created in ArcCartalogue. The non spatial data sets are created in Microsoft Access. Figure 5.1 gives the process of how the data sets were created.

Figure 5-1 Creation and testing of the database process
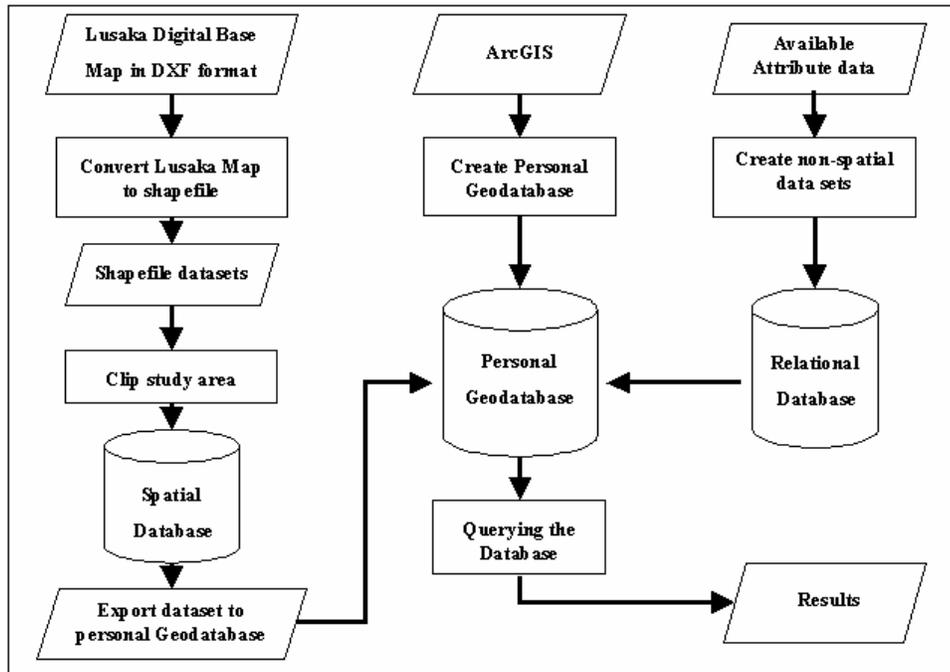
5.3.1. Spatial Database

The database was created from the Lusaka Base map data. The datasets used in the implementation process are.

- Police Post Boundary layer: This is a polygon feature class which shows boundaries of police posts which are the smallest spatial administration unit of the Zambia Police Service and on which crime analysis will be based.
- Police_Post layer: This is a point feature class which shows the location of police posts within Lusaka central police station.

These layers form the spatial entity as designed in chapter four and are used to visualize the location of crime.

5.3.2. Non Spatial Database

The crime analysis database is created in Microsoft Access and is automatically linked to the personal geodatabase in arc catalogue. The relationships between and among tables are created in Microsoft Access in accordance with the enterprise rules and entities identified in chapter four. The tables of Crime, Affects, Victim, Accused, Commits and spatial are linked. The police   zone code is used to join the non spatial tables from access to the crime polygon map. The combination of spatial and non spatial data is used to produce analysis maps which answer the user information needs as discussed later in the chapter. They are such created independently to allow exclusive and better management of the data. Figure 5.2 shows the fields of the crime table as seen in design view of Access.

Figure 5-2 Design view of crime table

The tables are also linked in access following the design of the skeleton table created in chapter four section 4.2.The unique identifier and referential integrity rules are applied so as to avoid errors and inconsistencies in the database. Figure 5.3 shows how the tables were linked in Microsoft Access.

Figure 5-3 Relationships between and among tables as seen in Microsoft Access
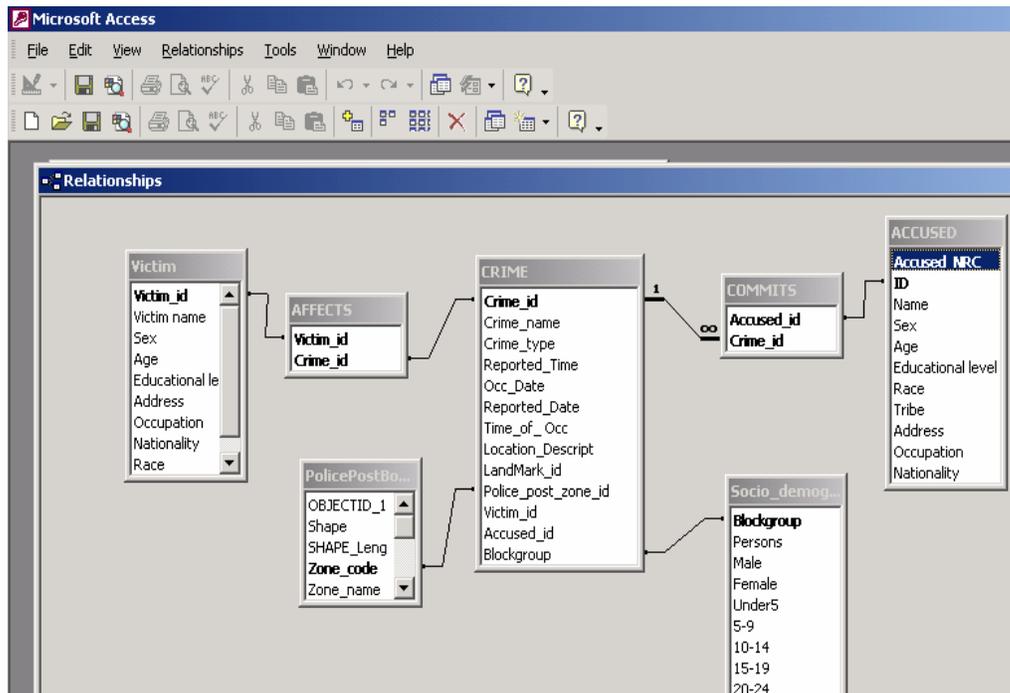
5.3.3.   Creation of the Personal Geodatabase

A Personal geodatabase is created to be the repository of all the datasets to be used by the crime analysis database. This is important for easy management of the spatial and non-spatial components of the database. The spatial datasets, which were in DXF format, were converted to shape file and

thereafter the study area was delineated. The data sets created were then exported to personal geodatabase. Figure 5.4 shows the dataset types used in crime analysis..

Figure 5-4 Personal Geodatabase in Arc Catalogue
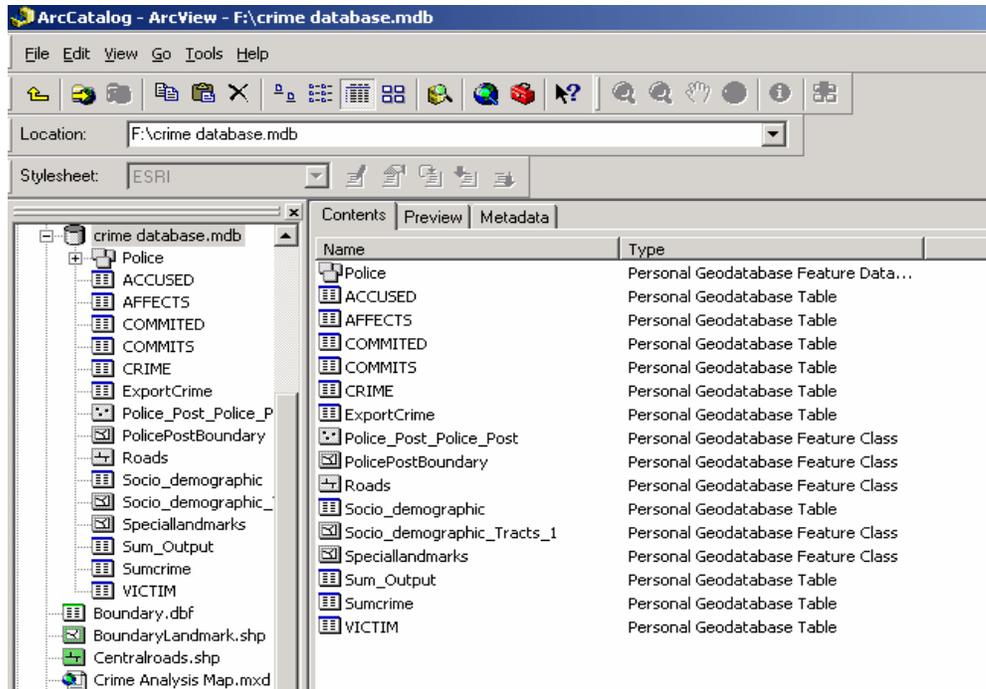
5.4.Testing the Crime Analysis Information System

This section answers the user information needs which are discussed in chapter three. The spatial (police post boundary) aspect of crime analysis is considered and is used to visualise the location of crime. The following sections try to answer the user information needs.

5.4.1.   Where are the crime hot spots?

GIS helps law enforcement officer's plan for crime control. Police commanders are able to know where crime is concentrated and focus resources in turn.

With GIS it is not only possible to give statistical summaries of crime events per given area but also to visualise the location of crime on a map. Figure 5.5 shows crime events per police post in the study area. The colour red depicts the crime hot spots whereas colour green shows that crime is low. Figure 5.5 answers the user information requirement of where the crime hot spots are. The user is able to visualise on a map the police post with higher crime than others.

Figure 5-5 Crime Hot spots
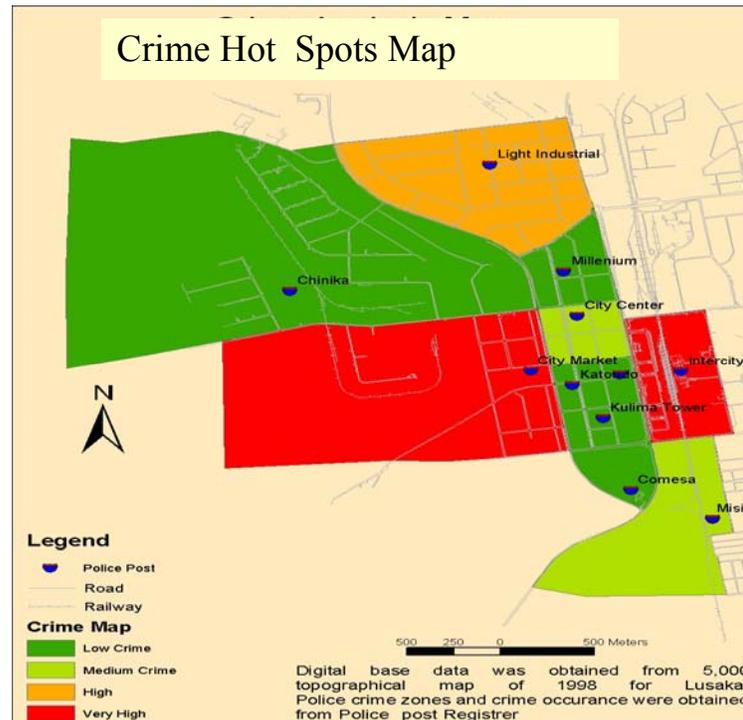
Figure 5.5 shows that Intercity Bus terminus and City Market police posts have higher crime than others whereas Chinika and Millenium police posts have the lowest. By looking at the map police commanders are able to see which areas need immediate attention in crime control and also see the location of these police posts in relation with other public infrastructure which may influence crime occurrence. For instance, City market and Intercity bus terminus police posts have bus stops and stations, which are over crowded, within their boundaries. Equally, most of the unemployed youths spend their time at bus stations and bus stops trying to raise money by calling for passengers to board buses and when they fail to raise the money from the drivers they resort to crime.

5.4.2.   When does crime occur?

GIS shows crime incidents by day, week, month or year. It is possible to know for instance which time of the month crime is high in a particular area. Once police commanders know when crime occurs it is easy for them to allocate resources both for prevention and fighting the crime. Figure 5.6 shows the proportion of crime occurring during the day and night per police post boundary in the study area. By visualising on a map when most crime takes place and where makes it very easy for the decision makers to understand crime occurrence. Understanding when crime occurs makes planning for crime control and resource allocation effective and efficient.

From figure 5.6 it can be deduced that City Market and Intercity police posts record higher crime incidents during the day than the night. These police posts are very active in the day because they have bus stops, stations and markets, which do not operate in the night, within their boundaries.. On the other hand, the Light Industrial police post records more crime in the night than during the day.

Police posts such as Katondo have more crime in the night than the day despite the city shopping centre being located there. There is heavy presence of police officers conducting foot patrols in the shopping centre after an outcry by the general public over high crime rate in the area. This gives further thinking for the police commanders as to why crime is low during the day in such a busy and crowded area.

Figure 5-6 When does crime occur?
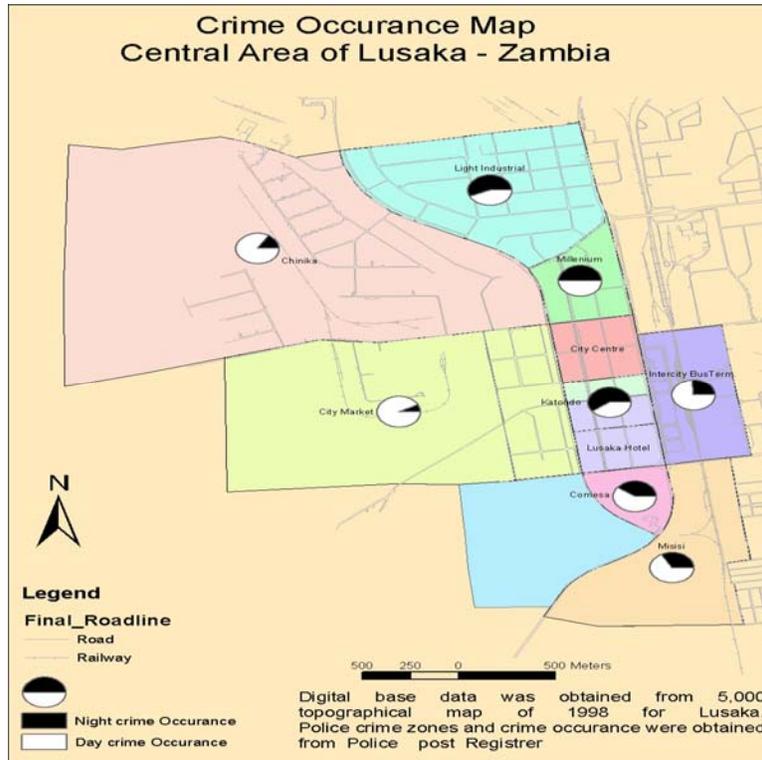
5.4.3.   Which type of crime is prevalent and where?

With GIS it is possible to map crime by type and to show which crime is prevalent in a particular area. Figure 5.7shows crime by type per police post using pie charts. This is important for police commanders because different types of crime need different strategies in preventing and controlling them. For instance, to reduce chances of murder being committed, assault cases must be controlled or prevented.

Figure 5-7 Mapping crime by type
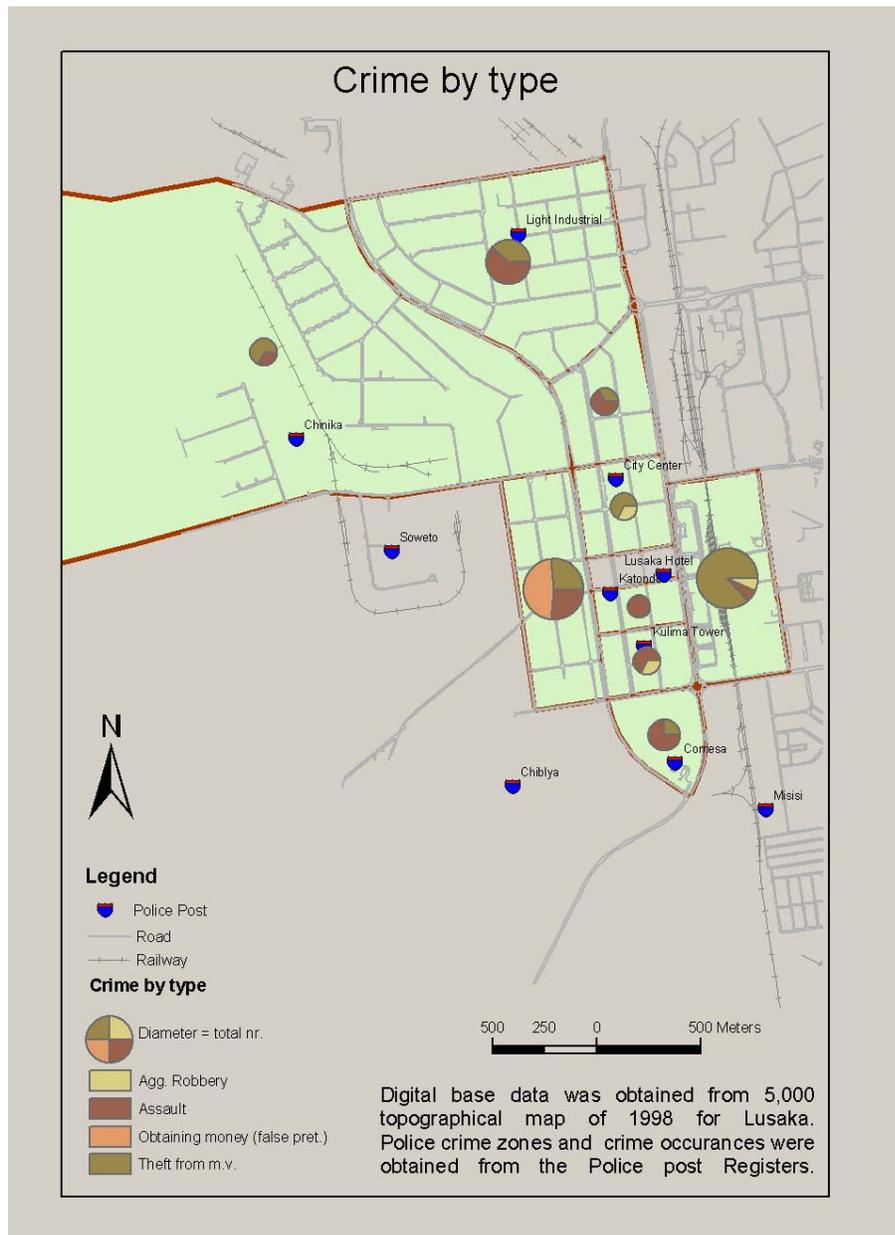
Figure 5.7 shows, that the crime of obtaining money by false pretences is common at the city market police post and assault cases common at Kulima Tower police post. The environment the crime occurs, gives insight as to why, for instance, obtaining money by false pretences crime is common at city market police post because there are a lot of business transactions taking place at the city market which is the busiest and biggest in the city. This type of information guides police commanders in making decisions on how to allocate specific resources for specific crimes. The information need of knowing which crime is common where is addressed by figure 5.7.

5.4.4. What is the crime trend?

Using GIS, it is possible to see the crime trend of an area. Several time periods can be compared with each other to find out whether crime is increasing, decreasing or stable. Mapping crime trend gives insight to decision makers as to whether the strategies employed in crime control are yielding results. Equally, the crime trend shows the movement of crime. It indicates to police commanders whether crime has really reduced or just shifted to another area and if it has shifted what direction is it taking. It also gives information on why crime follows a certain direction. The crime trend information need is visualised in figure 5.8

Figure 5-8 The crime Trend
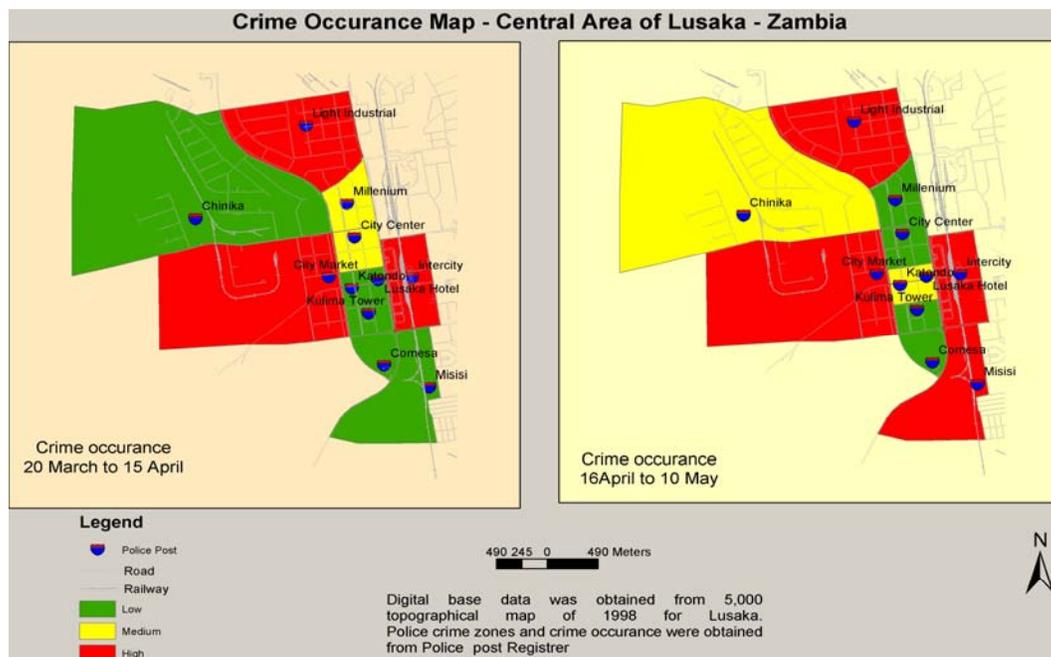
Figure 5.8 shows an increase in crime in Chinika, Millenium, City centre and Comesa police posts during the two time periods compared. A deduction can also be made that an increase in crime in Chinika police post boundary resulted into a reduction in crime in Millenium police post boundary. It is important to know that GIS as a tool has the capability of comparing crime per given period depending on the need of the user. Crime trends can be mapped for 1, 3 or even 5 year periods.

Mapping crime trend helps police commanders know whether the crime prevention and control strategies they use are yielding results by comparing the before and after intervention scenarios.

5.4.5. Extracting Information about accused persons

A select query can then be run by specifying the type of crime one is focusing on. For this case, Theft from Motor vehicle is chosen as an example. The particulars of the select project join query are:

SELECT A.Accused_NRC, A.Name, A.Occupation, A.Age, A.Tribe, A.Sex, A.Nationality, B.Crime_name

FROM ACCUSED AS A, CRIME AS B, COMMITS AS C

WHERE B.Crime_Name='Theft from M/V' AND A.ID=C.Accused_id AND C.Crime_id=B.Crime_id;

The query is run in Microsoft Access and the results of this query are a table as shown in figure 5.11. The crime name can be replaced by the one a particular officer is interested in.

Table 5-1 Theft from motor vehicle select query

From the results obtained, Criminal Investigators get a feel of who is involved in the crime of theft from motor vehicle. Equally, Police commanders get the information of who is involved in this crime and this allows them to find ways of how to prevent this crime. For example, from the results obtained, people who commit theft from motor vehicle crime are aged between 17 and 28 years, are male and are either unemployed or street vendors. The results have shown this crime is tribe independent.

5.4.6.   Extracting Information about victim of crime

A select query can be run from the tables indicating which crime name one is interested in. The crime id will link the Victim to the crime. The following select project join query was run and results are shown in Table 5.3.

SELECT V.Victim_name, V.Sex, V.Sex, V.Tribe, V.Race, V.Nationality, V.Address, V.Occupation, V.Educational_level, C.Crime_name

FROM VICTIM AS V, CRIME AS C, AFFECTS AS A

WHERE (((C.Crime_name)="Obtaining money by false pretences") AND ((V.Victim_id)=[A].[Victim_id]) AND ((C.Crime_id)=[A].[Crime_id]));

Table 5-2 Obtaining money by false pretences select query

Victim_name	Sex	Tribe	Race	Nationality	Address	Occupation	Educational_level	Crime_name
Dennis Mpundu	M	Bemba	African	Zambian	Kanyama	Marketeer	Junior secondary	Obtaining money by false pretences
Bitwell Mwilu	M	Tonga	African	Zambian	Chibolya	Businessman	Senior secondary	Obtaining money by false pretences
Welcome banda	M	Ngoni	African	Zambian	Misisi	Businessman	Senior secondary	Obtaining money by false pretences
Janet Mwanza	F	Ngoni	African	Zambian	Chibolya	Marketeer	Junior secondary	Obtaining money by false pretences
Jailos Mbewe	M	Ngoni	African	Zambian	Kanyama	Businessman	Senior secondary	Obtaining money by false pretences
Sam Nyirenda	M	Ngoni	African	Zambian	9878Busanga road Woodlands Lus	Businessman	Senior secondary	Obtaining money by false pretences
Cornrad Munkomb	M	Tonga	African	Zambian	Village Munansangu Siachitema K	Farmer	Senior secondary	Obtaining money by false pretences

Results obtained from the table indicate the occupation of the citizens of the city who are vulnerable to the crime of obtaining money by false pretences. In this instance, marketers and businessmen are vulnerable to the crime. With such information available, police commanders are able to design crime prevention strategies targeting a specific group of citizens.

5.5. Challenges

The implementation does not only answer the information needs of the users and shows the applicability of the information system designed but also gives an indication of the difficulties that may be encountered in the implementation so that they can be resolved before full implementation takes place. In the following subsections the actual and potential challenges to be encountered in the successful application of the database are outlined.

5.5.1. Location

It should be noted that linking location to crime does not always result in complete matching. There is often the need for human intervention by way of re-matching interactively. The people coming to the police station to report crime will not report crime location as within a police post boundary so it is important for the officers to locate the crime incident in an appropriate police post boundary.

5.5.2. Misspelling of names

Another challenge is in the recording of names. Misspelled names may cause problems especially when one is trying to match, for instance, an accused person who has committed more than one crime with the crime id. Care must be taken at entry point so as to maintain the integrity of the database.

5.6. Conclusion

This chapter has demonstrated that the linking of crime instance to a location and visualizing the location of crime is possible. Crime analysis can be performed in a GIS environment using the crime analysis database designed. It is also possible to extract information about accused persons and victims of crime from the database created. It must be pointed out that other datasets in the database such as Police station, police district, police division boundaries can also be used to locate crime depending on

the level of aggregation one is interested in. The database can accommodate such analysis. The same procedure used in this chapter can be followed. All in all, a number of other information requirements such as when does crime occur (day/night), which crime is common in which police post boundary can be provided for by the crime analysis database.

The actual and potential challenge that may be an inhibiting factor for the full implementation of the databases was outlined.

6.Conditions of implementation

6.1.Introduction

The functional and data models developed in Chapter 4 will play a core role in crime analysis in the Zambia Police Service. In order for the full potential and capability of the model to be achieved, there are certain conditions which must be put in place. These conditions have legal, institutional and organisational implications. This chapter discusses some conditions which are required for the system to function as defined in Chapter 4.

6.2.Legal implications

Every organisation has rules that govern the way it operates' The Zambia Police Service has some legal documents which it uses for data capture and has a legally established channel of communication through which information flows. For the purpose of this study only the occurrence book and the docket will be discussed.

Below are suggested improvements in data capturing and data specifications which may lead to successful crime analysis.

6.2.1.   Occurrence Book

As discussed in chapter three the occurrence book is where all crime incidents and particulars of a victim of crime are recorded. For the data model which has been designed to perform crime analysis optimally the fields in the Occurrence Book should be revised and be more specific especially in the recording of location of crime. Location of crime should be recorded in terms of police post boundary which is the smallest administrative unit of the police. Table 6.1 shows the fields to be used in the Occurrence Book for the data model created to be successfully implemented.

Table 6-1 New fields of the Occurrence Book (OB)

Crime_id	Crime name	Crime Type	Reported time	Reported date	Occurred date	Occurred time	Location Postid

Victim id	Victim Name	Address	Sex	Age	Occupation	Educational level	Nationality	Race	Tribe

Most of the particulars as shown are already recorded except that they are not as explicit as shown. The new way of recording particulars will enable police officers record location information using the police post boundary id. To guide officers who may not know the police post boundary id, a map showing the police post boundaries and their ids should be put on the wall in the Inquiries office which

is the front desk for the police as reference. It is at the inquiries office where the members of the public have first contact with the police and every inquiries office has an OB.

The victim of crime particulars should also include other socio-demographic data such as occupation and educational level which are not being recorded currently. This is important as it gives indication to law enforcement officers as to who is vulnerable to what type of crime.

Once this information is available officers, can then employ proactive methods in combating crime.

6.2.2.   Docket

A docket is a legal document used by the Zambia Police Service to record particulars of the accused person among others. The docket is mainly used by the Criminal Investigations Department (CID) which is charged with investigating crime in the Zambia Police Service in order to improve data capture for accused persons; particulars of an accused person should be recorded as shown in Table 6.2. These are particulars which are used in crime analysis and they help Investigators in tracking down offenders and knowing which group of society is likely to be involved in what crime and why. They also narrow the scope of the investigation.

Table 6-2 Particulars of Accused person

Accused_id	NRC	Accused name	Address	Age	Sex	Tribe	Race	Nationality	Educational level	Occupation	Date Arrested	Arresting Officer

6.2.3.   The Communication channel

The communication channel as stipulated in the Standing Orders which are the regulations guiding police operations should be revised The Standing Orders must be revised to open up the police in terms of communication unlike at the moment when all data going up or down the police command has to be approved by the supervisor of the unit concerned. In the absence of the supervisor, the data may be delayed as someone to approve will have to be found. It is important to note though that revising the standing orders requires involvement of all stakeholders in information management within the police and other security wings of the country so that sensitive information about the security of the country is protected. By revising the standing orders some offices will have to be skipped when passing on data to the intended target. This will allow for the direct access of information by the users cutting down on the bureaucracy and in the final analysis improve efficiency in crime analysis. Chapter three shows how bureaucratic the channel of communication is.

6.3.Institutional implications

In order for the system to be successfully implemented some institutional rules must be put in place. These will guide the operations of the crime analysis office. Below are some of the rules that may help in the implementation of the system.

6.3.1. Accessibility to the database

The data model designed in chapter four has shown that there are a number of users with access to the database. Integrity and reliability of the data recorded must be maintained. To achieve this security measures for different users must be stipulated.

Different levels of access are defined for each user so that data is not lost, altered and/or deleted. These levels are entry, edit and retrieval. The users of the non-spatial data and spatial data processes should have the entry and edit access security levels whereas the crime analysis process should have retrieval access only. The rest of the users also will have read access only.

6.3.2. Responsibility for maintenance and validation of records

Generally, everyday crime occurs in Zambia and the Zambia Police Service records crime incidents on a daily basis and continuously for that matter. The crime incidents, victims of crime and accused persons should be continuously be updated otherwise the system will rapidly become obsolete, particularly in circumstances where tactical crime analysis is done on a daily basis. The system developed must continuously be maintained and records kept up-to-date at all time to reflect the current situation.

The maintenance of datasets in the database developed should primarily be the responsibility of clearly defined units with clear mandates within the Crime analysis office. The most important datasets identified are the spatial (location), the accused person and the victim of crime.
The consistency in recording of location of crime is of paramount importance. Currently, there is no uniform way of capturing location data in the Zambia Police Service. It is important to validate the locations by checking them against an up-to-date map which shows the police post boundaries and their codes stored appropriately in a database or a hardcopy map pinned on the wall.

6.3.3. Data sharing

The Zambia Police Service must make arrangements with other institutions like the Central Statistical Office (CSO), Ministry of Lands and the Local Councils, to regularly obtain relevant data from these organisations. This is important because in the long run the police will not have to create for instance its spatial data. It will have to enter into an agreement with the institutions involved. This in turn will reduce the operating costs of the system.

6.4. Organisational implications

6.4.1. Hard and software

It should be stated that the system has been designed such that it can work manually as it has improved the quality of data captured and defined what data should flow to which function. However, for the system to be performing it requires automation and thus some hard and software components to answer the user information required in the framework of Crime Analysis.

- **Hardware**

For an automated system to work efficiently, it requires the following hardware
  - of Pentium 3 level

- Digitisers,
- Scanners,
- Plotter Personal computers s
- Printers

- **Software**

The software required is
- Office (this includes word, excel, and access)

- ArcGIS 8.1 or any later version

- ArcView 3.1 or any later version

The option of ArcView and ArcGIS is given so that depending on the financial capability of the institution a software which is within its means can be bought for as long as it performs crime analysis.

6.4.2.   Computer Network connections

For the system to work efficiently, all the users must be connected to some computer network within the organization.
There should be intranet for the flow of data to be efficient. This will also enable easy communication among the users and between users and producers. Internet is recommended but not a priority
Due to the sensitive nature of the organisation, security measures will have to be put in place to prevent wrong people from accessing the information.

6.4.3.   Training and Educational Campaign

Knowledge and information are important in any new concept introduced in an organisation. For this study, Officers who are going to work in the Crime analysis office should be trained in crime analysis, GIS and database. Where there are no officers capable of being trained in the above mentioned fields, the police may employ the already qualified professionals outside the police for as long as they are trained in police duties so that they understand what is involved in police work and the discipline required of a police officer. The officers at the inquiries office, Criminal investigation officers should also be trained in data entry and the importance of entering proper records. New positions should be created in the police organisation for Data manager, Database manager, System manager and specialised personnel employed for to fill the positions. The police officers should only be users of the system: data entry and information analysis.

Training goes along with improving the conditions of service of the professionals otherwise, after the police has invested so much in their training, they may leave and join organizations which pay better.

An educational campaign must be mounted in the Zambia Police service so that all officers understand the use of the system and its importance in crime analysis. The campaigns can get all officers on board and disperse fears that the system will take over officers' job.

6.4.4.   Finances

For the system to be effectively implemented there is need to support it financially. It costs money to develop an information system and police command should plan and budget for it adequately before

implementing it. It is also important to be aware that security is a cost and worthy investing in.: The development of a system does not only cost money but also its maintenance; budgets should also be reserved for maintenance

6.4.5. Creation of a Crime Analysis Office

Introduction of a new concept and office in any organisation receives a lot of mixed reactions from the members of staff. The crime analysis office should exist on its own, reporting directly to top police command. Office location is defined here as how direct the office is in contact with the top management. This will enable the office get all the necessary support for the successful implementation of the crime analysis information system since it will be close to command.

6.4.6. Project Management

Having in mind the environmental analysis of the Zambia Police Service done in chapter 3, for the system to be successfully implemented, it should be run as a project in the initial phases before integrating it in the main stream police administration. This will entail that specific resources assigned to it are available at the right time, otherwise, with the bureaucracy existing in the channel of communication the system may take longer than necessary to implement and this may lead to disillusionment among some users.

Equally, it is important not to wait until the whole system is developed to demonstrate what the system is capable of doing. A mid term presentation of the capabilities of the system may be given to the users to avoid lack of trust in the system and also to encourage the top police command that it is worthy continuing supporting. Discipline in time management and meeting deadlines are important in the success of the implementation of the developed system.
A detailed project plan on how to implement the system is proposed in Appendi3..

6.5.Conclusion

This chapter has revealed that a number of conditions must be in place in order for the system to be successfully implemented. Skilled manpower, information on what the system is capable of doing, financial resources, specific responsibilities in maintenance of the system and the location of the crime analysis office are among the major conditions required.

It has also been pointed out that running the implementation of the crime analysis information system as a project may prove to be more efficient than incorporating it in the main stream of the organization, at least at the beginning. The bureaucracy may prove to be a stumbling block in its successful implementation.

7.Conclusions and recommendations

7.1.Introduction

The main objective of this chapter is to draw conclusions whether the objectives as set out in chapter one have been met and make recommendations for future research and on the implementation of the designed system

7.2.Conclusions

From the literature reviewed, it has been found that crime is a human experience, it occurs at some location and that crime is a problem which has to be managed. For crime to be properly managed, quality information about crime, the environment it occurs and the socio-demographic data of the victims of crime and the perpetrators of crime are necessary for crime analysis. Crime, socio demographic and spatial data stand out as major data which have to be used to achieve crime analysis which is effective, efficient, detailed, encompassing and of great use to the decision makers.

It has also been revealed that a properly developed Crime Analysis Information System (CAIS) improves the management of information in a police department. A CAIS can be developed using different information systems development methodologies such as structured information systems development methodologies, which is used in this research.

7.2.1.   Objective 1. To analyse the existing crime analysis information system and identify constraints and opportunities

This objective is addressed by chapters 2 and 3. The question of what crime analysis is was answered by both chapters. There is though a difference between the definition of crime analysis in literature and how the Zambia Police Service understands it. The research question of what the functions of a crime analysis information system has been successfully dealt with in chapter 2. A crime analysis information system is a tool which can help in the analysis of crime.

A number of constraints are faced by the Zambia Police Service. The major one being lack of adequate information for crime analysis. Some information, where available, is not properly defined and its recording is not standard.

The other problem identified is that the Daily Incident Reports (DIR) which are the major source of information for crime analysis only reflect serious crimes Equally, crimes that are not reported within 24hours of occurrence are not included in the Daily Incident Reports (DIR). Information flow is slow because information in the police is analogue and has to pass through a number of offices before reaching its intended target .Lack of training and resources are other major constraints faced by the organisation. There are no officers trained in crime analysis, database management and system administration.

Funding from government is erratic and inadequate. The police have problems of transport, fuel, police equipment which are important for smooth information flow. For instance, Proposals on computerization of the system have been there since 1994 but the implementation has been a major problem because the computerization program is not on the budget and it requires colossal sums of money. However, the whole picture is not gloomy. The Strategic Development Plan 2001 – 2006, which has been approved by the Government of the Republic of Zambia, reflects the willingness of the police command to computerize the information system.

An Information Technology department has since been created and is headed by a senior police officer who reports directly to the Inspector General of Police.

7.2.2.   Objective 2. To design a new/improved crime analysis information system

Chapter 4 addresses this objective by bridging the gap between the ideal crime analysis as found in literature and the real crime analysis as found out during fieldwork.

The research question of how the existing system can be improved has been answered. New sources of data have been identified. The quality of data passing through the system has improved, because the recording of crime and spatial data has also improved.

New functions have been stipulated so as to improve the existing system. Different types of crime analysis can be performed by the new system.
GIS has been identified as an important tool in crime analysis. It combines non spatial and spatial data in the analysis of crime.

The objective has been achieved though it has also revealed that some data is not available at source.

7.2.3.   Objective 3. To test the new/improved system

Chapter 5 has demonstrated that the linking of crime instance to a location and visualizing the location of crime is possible. Crime analysis can be performed in a GIS environment using the crime analysis database designed. The database created answers the user information requirements.

There are actual and potential challenges that may be an inhibiting factor for the full implementation of the database. The linking of police post boundary to crime incident does not always result in complete matching. There is often the need for human intervention by way of re-matching interactively. Another challenge is in the recording of names. Misspelled names may cause problems especially when one is trying to match, for instance, an accused person who has committed more than one crime.

7.2.4.   Objective 4. To identify conditions for successful implementation of the new/improved

This objective addressed the question of what conditions must be available for a successful implementation of the system designed. Chapter 6 addresses this objective. A number of conditions such as skilled manpower, evidence of what the system is capable of doing, financial resources, specific responsibilities in maintenance of the system and the location of the crime analysis office are among the major conditions required. All crimes must be considered for crime analysis.

Running of the crime analysis information system as a project may prove to be more efficient than incorporating it in the main stream of the organization. The bureaucracy may prove to be a stumbling block in its successful implementation.

7.3. Recommendations

Information management is important in any organization which seeks to satisfy its customers. Information is managed through information systems whose benefits must be understood and appreciated by society. This section discusses the research and implementation recommendations, derived from this thesis.

7.3.1. Research Recommendations

- **Cost benefit analysis**

Literature reviewed indicate that introduction of a computerized information system in an organisation costs money and time. A further research is recommended to ascertain whether the benefits police organisation gets from a crime analysis information system outweigh the costs.

- **Social benefits**

Apart from the cost benefit analysis, a comprehensive social benefit analysis of a crime analysis information system is recommended. What does society in general benefit from such an information system?

7.3.2. Implementation Recommendations

For a crime analysis information system to be successfully implemented a number of conditions have to be put in place. It is, therefore, recommended that;

1. Police officers should be trained in crime analysis and database management. Also a general educational campaign to educate the officers on the importance of the CAIS is needed.

2. There should be adequate finances for the implementation and maintenance of the CAIS.

3. Hard and soft ware which can handle crime analysis should be put in place.

4. A specific office dealing with crime analysis should be created and the office should report directly to the Inspector General of Police.

5. The computers should be networked within the organization and security measures for data accessibility defined.

6. To avoid the bureaucracy in the police, the CAIS must be run as a project before being incorporated in the main stream organisation.

7. The police should share data with other organisations and improve data sharing among departments.

8. In order to maintain data credibility and integrity different levels of accessing the database by different offices should be defined.

9. The database has to be continuously maintained and updated

10. The recording of crime events must be improved by adding new columns in the Occurrence Book and Docket. The Daily Incident Reports (DIR) should include all crimes.

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Appendix 1: Interview Questionnaire

Interview questions for staff in charge of training

A) What is your vision for the Zambia Police service?
1.   Goals………………………….
2.   Strategies………………………

B) Information is important in crime management.
1.   How does information about crime reach your office?………..
2.   Which offices does this information pass through before reaching your office?……………………
3.   Why does the information have to pass through all these offices?…..
4.   How long does this information take to reach your office after being recorded at the inquiries office/front desk?……………………………….
5.   In your opinion is this process efficient?……………………….
6.   If not, where would you suggest changes should be made?…………
7.   If these changes were to be made, would they be supported by the Standing Orders of the organization? If not, how can they be made in order to conform to the current SO?………………………………
8.   What particulars of crime are included in the information transmitted to your office?…………………

C) Crime analysis is understanding why a particular type of crime is occurring in particular place and not that anywhere else.
1.   How is crime analysis done?……
2.   Which section is tasked with crime analysis?…………………………
3.   Which offices are crime analysis reports sent to before reaching your office?……………………………….
4.   Why these offices?…………………
5.   How often do you expect to receive these reports?…………………………
6.   How often do you actually receive these reports?…………………….
7.   What would you say causes the delay if any?…………………………..
8.   How would you suggest improving the situation?………………………..

D) Personnel
1.   How many officers are trained in crime analysis …………………….
2.   What are their qualifications?…….
3.   What is the highest rank of the senior crime analyst?………………….
4.   At what level is this office in the command channel?…………………
5.   What number and level of qualification would be appropriate considering the amount and type of work they have to do?…………………
6.   If no crime analysts, who does crime analysis for the police?…………..

7. If you are to train crime analysts what policies are in place to support this decision?……………………..

E) Pin mapping has long been part of crime management.
1. How much of pin mapping are you using currently in the police?………
2. If not much, why?………………….
3. If yes, in your opinion what are the advantages of pin maps in crime management?……………………….

F) How much are computers used in the police?………………………………….
If not much, why?……………………..
In your opinion, how can the use of computers improve crime management?

G) Computerization is one of the strategies in the 2nd Strategic Development Plan.
1. How would you rate the computer literacy level? Very low, low, moderate, high, very high……………….
2. What training strategies are in place?……………………………….
3. How much are they supported by the current budget?…………………….
4. Any future plans to improve support?……………………………….

H) Computerization often leads to change the way the organization operates. What effect would it have on the following;……………………………..
1. The deployment of resources
   -personnel………………….
   -funds………………………..
   -training needs…………………
   -Technology needs……………
2. The working culture of the officers……………………………….
3. Efficiency in responding to crime……………………………….
4. How much would computerization be accepted by the officers?………

I) Computers are used as a tool to help human beings in their jobs and consequently where many people were required to do the job before their introduction their introduction few are required after their introduction. Should this happen
1. Where would you deploy the excess police officers?……………………..
2. What are advantages of computerization in your opinion?…………….
3. What are disadvantages?……………..

Clarifications…………………………
Summary
Appreciation
Make next appointment to verify initial findings through design.

Interview questions for staff in charge of personnel

A) What is your vision for the Zambia Police service?…………………………
1. Goals……………………………
2. Strategies……………………….

B) Information is important in crime management.
1. How does information about crime reach your office?
2. Which offices does this information pass through before reaching your office?
3. Why does the information have to pass through all these offices?
4. How long does this information take to reach your office after being recorded at the inquiries office/front desk?
5. In your opinion is this process efficient?
6. If not, where would you suggest changes should be made?
7. If these changes were to be made, would they be supported by the Standing Orders of the organization? If not, how can they be made in order to conform to the current SO?
8. What particulars of crime are included in the information transmitted to your office?

C) Crime analysis is understanding why a particular type of crime is occurring in particular place and not that anywhere else.
1. How is crime analysis done?
2. Which section is tasked with crime analysis?
3. Which offices are crime analysis reports sent to before reaching your office?
4. Why these offices?
5. How often do you expect to receive these reports?
6. How often do you actually receive these reports?
7. What would you say causes the delay if any?
8. How would you suggest improving the situation?
D) Personnel
1. How many officers are trained in crime analysis
2. What are their qualifications?
3. What is the highest rank of the senior crime analyst?
4. At what level is this office in the command channel?
5. What number and level of qualification would be appropriate considering the amount and type of work they have to do?
6. If no crime analysts, who does crime analysis for the police?
7. If you are to train crime analysts what policies are in place to support this decision?
E) Pin mapping has long been part of crime management.
1. How much of pin mapping are you using currently in the police?
2. If not much, why?
3. If yes, in your opinion what are the advantages of pin maps in crime management?

F) How much are computers used in the police?
If not much, why?
In your opinion, how can the use of computers improve crime management?
G) Computerization is one of the strategies in the 2nd Strategic Development Plan.

1. How would you rate the computer literacy level? Very low, low, moderate, high, very high.
2. What training strategies are in place?
3. How much are they supported by the current budget?
4. Any future plans to improve support?

H) Computerization often leads to change the way the organization operates. What effect would it have on the following;

1. The deployment of resources
   -personnel
   -funds
   -training needs
   -Technology needs
2. The working culture of the officers
3. Efficiency in responding to crime
4. How much would computerization be accepted by the officers?

I) Computers are used as a tool to help human beings in their jobs and consequently where many people were required to do the job before their introduction their introduction few are required after their introduction. Should this happen

1. Where would you deploy the excess police officers?
2. What are advantages of computerization in your opinion?
3. What are disadvantages?

Clarifications
Summary
Appreciation
Make next appointment to verify initial findings through design.

Interview questions for staff in charge of Information Communication Technology

A) What is your vision about communication and technology in the police?
1. Goals……………………………………………………………………………………
2. Strategies…………………………………..
B) Information is important in crime management.
1. How does information about crime reach your office? ……………………………….
2. Which offices does this information pass through before reaching your office?...
3. Why does the information have to pass through all these offices?............................
4. How long does this information take to reach your office after being recorded at the inquiries office/front desk?..................
5. In your opinion is this process efficient?..

6. If not, where would you suggest changes should be made?...
7. If these changes were to be made, would they be supported by the Standing Orders of the organization? If not, how can they be made in order to conform to the current SO?..
8. What particulars of crime are included in the information transmitted to your office?..

C) Your office is tasked with the procurement and deployment of police radios which are a major resource in crime management. How does information about request for police radios reach your division?

1. Which offices does it pass through before reaching your office?................................
2. What details are included in these requests?..
3. Is the channel of communication efficient?...
4. If not, where would you suggest improvements to be made?.......................
5. On what type of information do you base your decisions for radio procurement and allocation?...
6. What other information would suggest using to make your decisions more accurate?..

C) Crime analysis is understanding why a particular type of crime is occurring in particular place and not that anywhere else.

1. How is crime analysis done……………..
2. Which section is tasked with crime analysis?..
3. Which offices are crime analysis reports sent to before reaching your office?..
4. Why these offices?......................................
5. How often do you expect to receive these reports?..
6. How often do you actually receive these reports?..
7. What would you say causes the delay if any?...
8. How would you suggest improving the situation?..

D) Personnel

1. How many officers are trained in Information Technology?............................
2. What are their qualifications?...................
3. What are their specific duties……………
4. What number and level of qualification would be appropriate considering the amount and type of work they have to do?..

E) How much are computers used in the police?...

If not much, why?...

In your opinion, how can the use of computers improve crime management?

F) Computerization is one of the strategies in the 2nd Strategic Development Plan.

1. How would you rate the computer literacy level? Very low, low, moderate, high, very high…………………………….
2. What training strategies are in place?...
3. How much are they supported by the current budget?...
4. Any future plans to improve support?..

G) Computerization often leads to change the way the organization operates. What effect would it have on the following;

1. The deployment of resources
      -personnel
      -funds
      -training needs
      -Technology needs
2. The working culture of the officers………
3. Efficiency in responding to crime………...

4. How much would computerization be accepted by the officers?.............................

H) Computers are used as a tool to help human beings in their jobs and consequently where many people were required to do the job before their introduction their introduction few are required after their introduction. Should this happen

1. Where would you deploy the excess police officers?...
2. What are advantages of computerization in your opinion?...
3. What are disadvantages?............................

Clarifications…………………………………..
Summary……………………………………….
Appreciation
Make next appointment to verify initial findings through design.

Appendix 2: Data Dictionary

Table	Attribute	Description
Accused	Accused_id	Unique identifier
	NRC_No	National identity number
	Name	Name of accused person
	Age	Hoe old the accused person is
	Sex	Male or female
	Tribe	The accused person"s native language
	Race	Accused person"s race e.g. white, black or coloured
	Nationality	Accused person"s country of origin
	Educational_level	How far the accused person went into his education
	Address	House mumber of where yjr accused person stays
	Occupation	What the accused person does for his living
Victim	Victim_id	Unique identifier
	Name	Name of victim
	Age	Hoe old the victim of crime is
	Sex	Male or female
	Tribe	The victim" native language
	Race	Victim"s race e.g. white, black or coloured
	Nationality	Victim"s country of origin
	Educational_level	How far the victim went into his education
	Address	House number of where the victim stays
	Occupation	What the victimdoes for his living
Crime	Crime_id	Unique identifirt
	Crime_name	The name the crime is officially known
	Crime_type	The degree of seriousness of the crime
	Date_occured	The date the crime occured
	Time+occured	The time the crime occured
	Date_reported	The date the crime is reported to the police
	Time_repoeted	The time the crime is reported to the police
	Post_id	
Affects	Victim_id	A Unique identifier of the victim of crime referring to the victim table
	Crime_id	A unique identifier of a crime incident referring to the crime table
Commits	Accused_id	A unique identifier of an accused person refering to the accused table
	Crime_id	A unique identifier of a crime incident referring to crime table
Police_posr_boubdary	Post_id	A code whuch uniquely identifies a police post boundary
	Post_name	Name of the police post
Census Tract	Tract_id	A unique identifier of a census tract
	Name	Bame if a census tract
	District	The name of the district in which the census tract is found

Appendix 3: Project Plan for Crime Analysis Information System Development for Lusaka City, Zambia

PROJECT INITIATION
Project Charter

Name:

Crime Information System Development for Lusaka city, Zambia

Purpose:

The Zambia Police Service relies on an old and traditional information system, which is bureaucratic, slow and out of touch with the current needs of the society. The problem has affected the community, which the police are supposed to serve. In the recent past the concerned citizen, institution and government have aired a number of complaints about police's slow reaction to complaints and crime in general. In the quest to address these shortcomings and also position the police with the new demands of the modern society a Crime Information System has been suggested as a strategy. The system should be able to:

- Support decision-making in resource allocation
- Give crime detailed spatial location and examine spatial data at ward level
- Offer a central database which can be accessed by all police officers
- Analyze crime and socio-demographic data

Objectives:

- To improve information flow between departments by allowing concurrent access to the database by department
- To create a crime digital database with the following specification:
- Location of crimes (street number, house number, geo-coordinates)
- Information of victims (name, gender, address, age, description of crime, date)
- Statistical analysis information (crime density by ward, etc.)
- To perform overlays of crime type information (theft of motor vehicle, murder, aggravated robbery, arson) with social demographic information such as poverty, income, education and unemployment levels at ward level to support decision making in resource allocation;
- To train four members of staff for operation of the system.

Projects resources:

- **Human resources:** Project manager (1), GIS experts (2), Information system analyst (1), programmer (1), secretary (1), assistants (2)
- **Equipment/software:** Computer (4), plotter (1), scanner (1), GPS (1), SDW, ArcGIS, MS Office

- **Facilities:** office space, telephone, faxes, Internet, stationery
- **Data** (analogue, digital)
- **Funds: 4**00,000 which includes human resources: 100,000, materials: 250,000 and miscellaneous 2,000, (profit rate 12%)
- **Contingence**: 20,000(5%)

Approach

- The work will be approached through:
- Planning before action.
- Participatory and consulting approach involving all the stakeholders (Statistical office, map producers of municipality, clients, research and planning unit of police and others).
- Progressive reports monthly to client.

Timetable

The project will last 1 and a half year (see Activity Schedule below)

Deliverables

The project deliverables are:

- Intermediate products:
- Situation analysis and crime information system planning report
- System specification

- System design documentation
- Information system prototype
- System test report
- User manual
- Feasibility report

Final product:

- Crime Information System

PROJECT PLANNING

Project Scope

The projected will be carried out under the following phases:
- Project preparation
- Feasibility analysis
- System analysis
- Design
- Develop
- Implement
- Acquisition of hard and software
- System installation
- Project closing

Deliverables and methods:

Work package	Methods	Deliverables
Project preparation	Meetings, briefings, Brain storming	Action Plan
Feasibility study	Interviews, observations	Feasibility report
System Analysis	Conceptual diagrams, Interviews, observations	analysis report
Design	Case tools e.g. SDW,	System design report
System Development	Structured methodology, Testing	Database, technical and user manuals
Implementation	Testing, training	Testing reports, training manuals
Acquisition of hard and software	Analysis and procurement	Analysis report, physical hard and software,
System installation	Test	Working system, installation report
Project closing	Meeting, evaluation.	Evaluation report, project report

System specifications:

✓ **Information required**
- Attributes data on poverty, income, age, employment, crime type, crime statements.
- Digital maps of Lusaka city at the ward level.

✓ **Functionality required**
- Perform data input, output and visualization, information retrieval, spatial and attribute analyses to produce the above specified information requirements.

✓ **Constraints:**
- Policy about releasing information to non authorized persons.
- No people with skill in IT and GIS.

- Inadequate technoware.
- Bureaucratic system

✓ **Risks factors:**
- Lack of co-operation from the old crop of officers who may fell insecure about their jobs.
- Government not releasing funds on time.
- Change of police command.
- Diversion of project funds.
- Police may not get the information on time.

✓ **Assumptions**
- Crime GIS development part of The Police Strategic Development for 2000-2007.
- Users have been educated about the importance of information system in the police.
- Users will be trained on how to use the crime information system.

✓ **Strength**
- Support from the Permanent Secretary Home Affairs.
- Support from police command.

Activity Schedule
(See next page)

ID		Task Name	Duration
1		**Crime Information System Development**	**407 days**
2		**W1 Project preparation**	**12 days**
3		A1 Project team meeting	2 days
4		A2 Purchase of working materials	6 days
5		A3 resources allocation	4 days
6		**W2 Feasibility analysis**	**17 days**
7		A1 Define Business problems	3 days
8		A2 Define Business Objectives	5 days
9		A3 Define Alternative Solutions	7 days
10		A4 Business Justification	2 days
11		Feasibility repport	0 days
12		**W3 System analysis**	**75 days**
13		A1 Functional Requirement	2 wks
14		A2 Performance and Reliability Requi	2 wks
15		A3 conceptual Design Alternatives	4 wks
16		A4 Cost/Benefits analysis	1 wk
17		system analysis report	0 days
18		**A5 Development and Implementatic**	**30 days**
19		1 Development planning	3 wks
20		2 Implementation planning	3 wks
21		**W4 Design**	**108 days**
22		**A1 System Design**	**35 days**
23		1 Global design	1 wk
24		2 Detailed design	5 wks
25		3 Documentation	6 wks
26		4 Review	1 wk
27		**A2 Database design**	**41 days**
28		1 Enterprise rules and definition	1.5 wks
29		2 User's views	3 wks
30		3 ER model (conceptual design)	15 days
31		4 Data model building (mapping)	3 days
32		5 Meta-data documentation	41 days
33		**A3 Security, Backup and Recovery**	**20 days**
34		1 Security design	2 wks
35		2 Recovery design	2 wks
36		A4 Program Specifications	2 wks
37		A5 System maintenance planning	2 days
38		Design report	0 days
39		**W5 Develop**	**30 days**
40		A1 System interface design	2 wks
41		A2 User and Technical documentation	1 wk
42		A3 Integration Testing	3 wks
43		Development report	0 days
44		**W6 Implement**	**148 days**
45		**A1 User training**	**43 days**
46		1 Training preparation	2 wks
47		2 Training	6 wks
48		3 Evaluation	3 days
49		A2 system Testing	2 wks
50		**A3 Data input**	**95 days**
51		1 Coding system development	4 wks
52		2 Data standardization	3 wks
53		3 Data input	12 wks
54		Implementation report	0 days
55		**W7 Acquisition of hard and software**	**34 days**
56		**A1 Technical analysis**	**20 days**
57		1 Inventory of specifications base	2 wks
58		2 Search for available products ir	1 wk
59		3 Evaluation	3 days
60		4 recommend	2 days
61		**A2 Financial analysis**	**20 days**
62		1 Analysis of current financial situ	2 wks
63		2 Cost inventory of products	8 days
64		3 Cost evaluation	2 days
65		**A3 Acquisition**	**4 days**
66		1 Negotiation with seller	1 day
67		2 Place order	1 day
68		3 Receive goods	1 day
69		4 Check and pay	1 day
70		W8 System installation	2 wks
71		procument report	0 days
72		**W9 Progress meeting**	**212 days**
84		**W10 Project closing**	**7 days**
85		A1 Project reporting	3 days
86		A2 Project evaluation	4 days

Legend:
Task | Progress | Summary | Rolled Up Critical Task | Rolled Up Progress | External Tasks | Group By Summary
Critical Task | Milestone | Rolled Up Task | Rolled Up Milestone | Split | Project Summary