DEVELOPING A LAND INFORMATION SYSTEMS (LIS) APPLICATION FOR COMMUNAL LAND DISPUTE RESOLUTION

A Case Study of the Oshana Communal Land Board

LTT Kavela

MEnvDev: LIM

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By

LTT Kavela
MEnvDev: LIM

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Examiners and Supervisors:

Principal Supervisor : Dr. D. Rugege, CEAD, University of KwaZulu-Natal, RSA
Second Supervisor : Mr. K. Sinvula, Polytechnic of Namibia, Namibia
Internal Examiner : Mr. D. Chimhamhiwa, CEAD, University of KwaZulu-Natal, RSA
External Examiner : Dr. H. van Gils, ITC, The Netherlands

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Signed:.................................

LTT Kavela (Candidate)

Signed:.........................

Dr. Denis Rugege (Supervisor)

Acknowledgements

ADR	Alternative Dispute Resolution
CEAD	Centre for Environment, Agriculture and Development
CLRA	Communal Land Reform Act
CODI	Committee on Development Information
CSO	Central Statistics Office
DBMS	Database Management Systems
ECA	Economic Commission for Africa
ECN	Electro Commission of Namibia
FAO	Food Agriculture Organisation
FIG	International Federation of Surveyors
GIS	Geographical Information Systems
GPS	Global Positioning Systems
LIS	Land Information Systems
LIM	Land Information System
LIMS	Land Information Management System
LAC	Legal Assistance Centre
LBTA	Land Boards, Tenure and Advice
LUPA	Land Use Planning and Allocation
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
MLR	Ministry of Lands and Resettlement
NPC	National Planning Commission
NGO	Non Governmental Organisation
NNFU	Namibia National Farmers Union
OSHCLB	Oshana Communal Land Board
PTO	Permission to Occupy
SADC	Southern African Development Community
TA	Traditional Authority
UNIGIS	Universities of Geographical Information Systems
UNECA	United Nations Economic Commission for Africa
UNECE	United Nations Economic Commission for Europe
UKZN	University of KwaZulu-Natal

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Abstract

The issue of land recording and keeping in the Communal Area of Namibia has been a severe dilemma to the Government. Various types of land disputes are on increase and continue to be predominant despite various Acts, Policies and other related Legislations on the Land Administration and Management passed by Namibian Parliament. Since the establishment of the Oshana Communal Land Board, effort was made to keep conventional records of information pertaining to land parcels in communal areas of Oshana Region. However, spatial information about the land ownership records is still not available in a well-designed and organised system.

The non-existence of Land Information Management (LIM) System using Land Information Systems (LIS) application as management tool contributed to this problem. However, Oshana Communal Land Board used manual based system with incomplete coverage and less comprehensive information. In most cases decision makers have to make critical decisions based on little or no information.

Therefore, LIM System and data sharing are the major features of the OSHCLB and in order to facilitate these processes there is a need for the introduction of LIS application. Adequate land information is crucial to sustainable development and sound information systems are of vital importance to land management systems. This is also been expressed in the various reports including the Operational Manual for Communal Land Board in Namibia.

The user needs and requirements were carefully considered during the data collection stage. The system was designed using proven methodologies, which were explained and reasons for the choice is discussed. However, the detailed LIS applications can be pursued by other researchers or consultants in the future to make the system complete.

CHAPTER 1:
RESEARCH PROPOSAL

1.1   Background

This research is geared towards the development of Land Information Systems (LIS) application for communal land dispute resolution for use by the Oshana Communal Land Board (OSHCLB). The OSHCLB is established in terms of the National Land Policy (1998), and implemented in 2003. The Communal Land Reform Act, No. 5 of 2002, governs the work of the OSHCLB. The overall objective is to improve the administration and protection of land rights of people. It also seeks to uphold and formalize rights of Communal Land, held at the time of promulgation of the Act.

The OSHCLB will use LIS to help in making decision on the land dispute; control and exercise over the allocation and cancellation of customary land rights made by Chiefs or Traditional Authorities. It helps in creating and maintaining of a register where the allocation, transfer and cancellation of customary land rights and rights of leasehold are recorded and kept up to date. The system would be useful in explaining selection process from different alternatives and predict the unforeseen circumstances.

1.2   The Problem Statement

Land disputes in Communal Areas of Oshana Region are increasing drastically. Among other major land disputes experienced and continued to be predominant are land boundary disputes between individuals, double allocation by Traditional Authorities. Illegal fencing by wealth individuals, self-extension by some wealth individuals, and widow eviction by the headman or deceased relatives are on the other hand. These land disputes pose serious implications on the regional resource base if solutions are not found, and may leave many unsustainable uses of natural resources unattended *(Ministry of Lands, Resettlement and Rehabilitation, 2005)*.

Various forms of land disputes resolution have been used in the past to find possible solution to different cases. There has been no proper system of recording and keeping of events, despite manual based system with incomplete coverage, supply most of the available land information. There is no alternative source of comprehensive

information for land management is available or has been developed for use by OSHCLB. This has been difficult to get information in a structured format that can be availed timeously in a transparent manner to decision-makers.

The absence of well-designed Land Information Management (LIM) System using LIS application as a management tool, has forced decision makers often to make critical decisions based on little or no information. The current manual based system used is not designed to help resolve land use conflicts or facilitate decision-making process. It is rather for recording purposes only. Misplacement of records and land disputes has been blamed on the manually based system in many developing countries. According to Mothibi (2003), this has not only an impediment on the effective functions of the Communal Land Boards but also negatively affected the Land Information Management often resulted in other numerous land related problems. Factors contribute to the inadequacy use of LIS are shown in *Figure 1 - 1*.
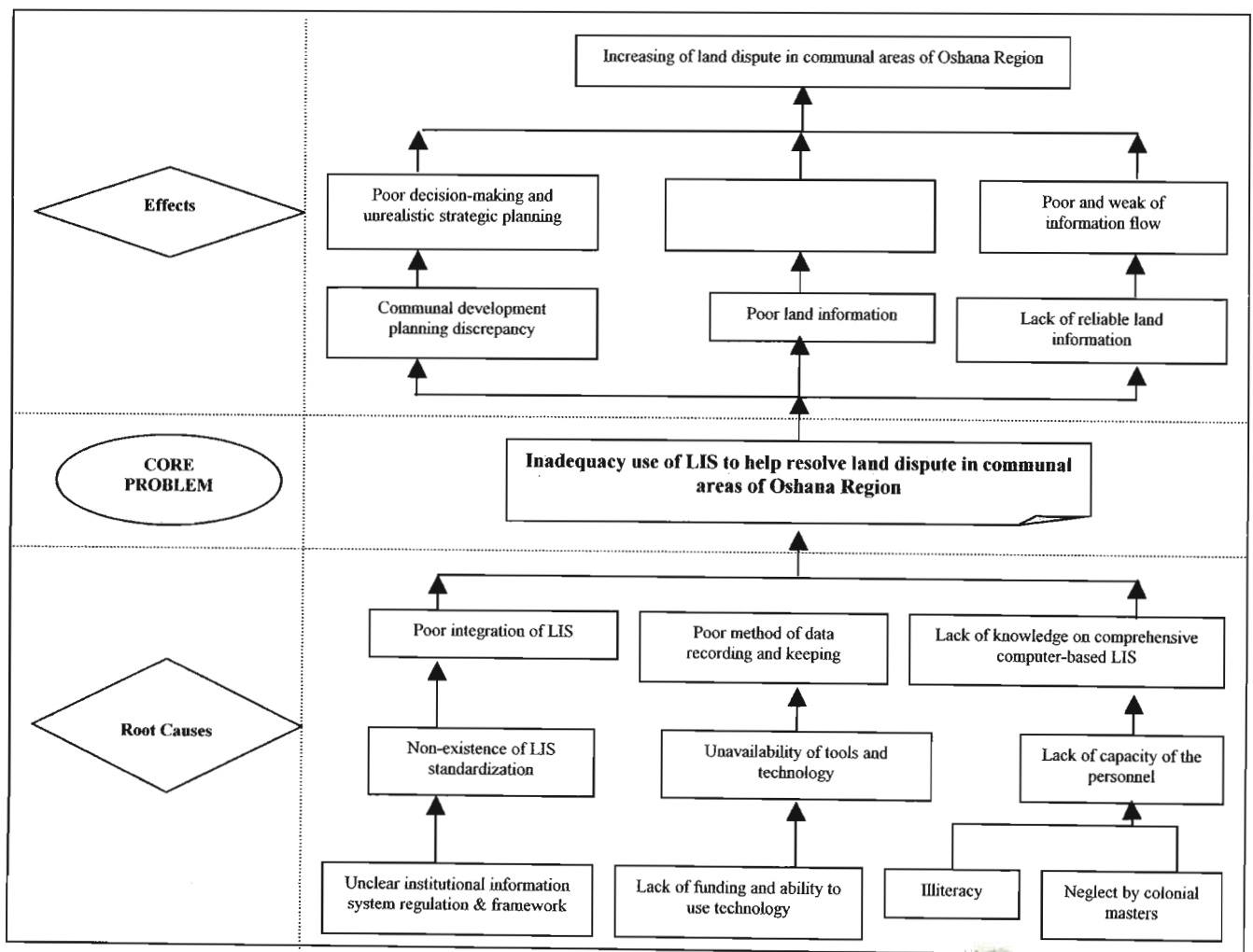
Figure 1 - 1: Inadequacy use of LIS in land disputes by OSHCLB

Therefore, this research is a design study in nature that will develop a Land Information Management (LIM) System using Land Information Systems (LIS) application as management tool to help in resolving land disputes in the Oshana Region Communal Areas. The study relies primarily on the Oshana Region as a case study. Various quantitative and qualitative methods such as questionnaires, interviews and observations with OSHCLB were used to develop this case study. All observations were based on responses from interviews and available secondary information.

1.3   Research Objectives

This study aims to examine, analyze and develop a LIS application for communal land disputes resolution in Oshana Region. This main objective will be complimented by the following sub-objectives:

- o To analyse the role and promote application of LIS in communal land disputes resolution;
- o To identify the sources and causes of land disputes and propose alternative solutions using LIS application.
- o To assess and review the existing land dispute resolution methods and tools and scrutinize their strengths, weaknesses, opportunities and threats (SWOT);
- o To develop a LIS application interface for OSHCLB that will help in systematic land disputes resolution, decision-making, land management and efficient service delivery.

1.4   Research Questions

In order to fulfil the above objectives and guide this research, the following questions have been formulated in relation to the research objectives and problem statement:

- o What role does LIS application play in communal land disputes resolution?
- o What are the main sources, causes and impacts of land disputes in Oshana Region Communal Areas?
- o What current methods and tools are used in managing communal land disputes and their strengths and weaknesses?

o What are the LIS application requirements in terms of data, technical, standards, human resource base, funding etc?

1.5 Research Hypothesis

Land Information System (LIS) can be a useful tool for managing land information and helps in resolve communal land disputes by Oshana Communal Land Board.

1.6 Structure of the Thesis

Chapter 1: Research Proposal

This chapter concentrates on the background of the research topic, objectives and questions that will guide this research. Much of the material introduced in this chapter will be covered in details later in the thesis.

Chapter 2: Literature Review

It provides a brief overview on what is land dispute and LIS are. The role and application of LIS in land dispute resolution with more emphasis in SADC is analysed. The problems associated with LIS and proposals thereof are also reviewed.

Chapter 3: Study Area Overview

This chapter describes the study area. It highlights the natural and socio-economic aspects of the Oshana Region and justification of the choice of the study area.

Chapter 4: Research Methodology

It provides the research design and strategy as well as the data collection methods. It also presents the data analysis and interpretation methods used.

Chapter 5: Data Description and Analysis

This chapter described and analysed data used in the study. Data analysed includes both the secondary and primary data to answer research questions, test hypothesis and report writing.

Chapter 6:   Results and Design of Land Information Management System for Oshana Communal Land Board

This chapter presents the findings of the results and design of LIM System for OSHCLB. The existing LIM System is reviewed and analysed. The conceptual data modelling, database design and creation, system implementation, hardware and software that would facilitate the operations the OSHCLB are presented. It also provides the testing of the proposed OSHCLB LIM System.

Chapter 7:   Summary and Discussion

This chapter presents the summary and discussion of the research findings introduced in the previous chapters. The current situation and environmental analysis are analysed to assess the gap situation.

Chapter 8:   Conclusion and Recommendations

In this chapter conclusion and recommendations are made in relation to the predefined research objectives. Due to the limited research time and the limit of research boundary there are recommendations made to further this study.

CHAPTER 2:
LITERATURE REVIEW

2.1   Introduction

This chapter presents a review of essential literature on concepts and theories of land disputes resolution and Land Information Systems (LIS). The literature review includes Land Tenure System in Namibia and in particular Oshana Region with more emphasis placed on Communal Land, major sources and causes of land disputes, and its effect on land management and administration in communal areas. The role of the Oshana Communal Land Board (OSHCLB) in land allocation, administration and dispute resolution was reviewed to give a better understanding as well as the available methods and tools currently used to resolve land disputes.

The lack of reliable information on land, in particular, remains one of the most significant problems in land management throughout the world. In effect, the land administration process manifests various uncoordinated record-keeping systems and duplication of efforts by myriad of agencies responsible for different aspects of land administration. Land disputes and misplacement of information in many developing countries like Namibia has been blamed on the manually managed system of paper files. This has not only an impediment on the effective functions of the land institutions but also negatively affected the land information management often resulted in other numerous land related conflict *(Mothibi, 2003)*.

LIS have proven to be invaluable tools for land administration, enabling among other things better land use planning, property tax management, utility service management, emergency service planning and environmental management (Mothibi, 2003). However, many countries that have large proportion of Communal Lands held under customary land tenures where land rights are common, are also wishing to establish LIS. These countries LIS is a tool to facilitate the management and administration of their land resources, preserve their customs and traditions as well as promote the development of a market economy. For the system to be effective, LIS introduced into these countries will need to incorporate customary land tenure data (Rakai and Williamson, 1995).

2.2   Historical Background of Land System in Namibia

The land question in Namibia is of central importance since about 90% of the population derives its subsistence from the land, either as commercial or subsistence, or as workers employed in agriculture (National Land Policy, 1998). As a matter of urgency to address the land issue a National Conference on Land Reform and Land Question was held in Windhoek from 25 June – 01 July 1991. Almost half of the recommendations of the 1991 National Conference are related to the resolution of land-related issues in Communal Areas.

Access to and land tenure were among the most important concerns of the Namibian people in their struggle for independence. The land problem in Namibia is a direct result of the land policy of the apartheid colonial system that created discriminatory and imbalances in property relations in the territory. The colonial policy of property relations, including land tenure and access to land, were based on racial lines and were implemented by legislation (National Land Policy, 1998).

Namibia's land comprises 824 200 km^2 with a population of 1, 826, 854 million according to the 2001 Namibia Population and Housing Census (Central Bureau Statistics, 2005). The total landmass of Namibia can be divided into the following categories, shown in Table 2 - 1 below (International Development Consultancy, 2002):

Table 2 - 1: Total landmass of Namibia (International Development Consultancy, 2002, p.2)

Land Use	Total area covered in square kilometres (sq km^2)	Total % of the area covered
National parks	114 500 km^2	13.9%
"Registered" Diamond Area	21 600 km^2	2.6%
Registered Urban Land	5 900 km^2	0.72%
Title Deed/Freehold Rural Land	463 200 km^2	56.2%
Non-Title Deed/Communal Land	218 300 km^2	26.5%
Others	700 km^2	0.08%

From the above total landmass, 99.9% is available to the urban and rural population of Namibia in terms of land rights for occupation and utilization. The density rate for rural and urban land increased from 1991 to 2001 with 30% and 26% respectively. At

an estimated population growth rate of 2.6% per annum and with the same ratio applied, the situation will change drastically over the next 30 years as indicated in the table 2 -2 below:

Table 2 – 2: Namibia Population Growth Chart (International Development Consultancy, 2002, p2)

Year	1991	2001	2030
Total Population	1 409 920	1 826 854	3 845 527[1]
Urban land	15 420m^2/person	11 837 m^2/person	5 640 m^2/person
Rural land	0.66 km^2/person	0.51 km^2/person	0.24 km^2/person
Total	**0.58 km^2/person**	**0.45 km^2/person**	**0.25 km^2/person**

[1] Estimated at a growth rate of 2.6% per annum

2.3   Land Tenure System in Oshana Region

In Oshana Region, four different forms of land tenure exists, namely freehold, customary grants, leasehold and state land, each having evolved in response to specific land use and production requirements. According to the National Land Policy (1998), categories of land rights holder are: individuals; families which are legally constituted as family trusts in order to assure specified individuals and their descendants of shared land rights; legal constituted bodies and institutions to exercise joint ownership rights; duly constituted co-operatives; and the State. All forms of land tenure are accorded equal recognition and status, and the rights thereto are entitled to inventory and/or registration with the OSHCLB.

Freehold land tenure has made up of 26.8% of Oshana region, of which all land is surveyed and registered (Oshana Regional Council, 2001). The National Land Policy (1998), states that, freehold title is the only form of secure, registerable title available in urban areas which affords the holder ownership that is transferable, inheritable and provides collateral against a loan. Although freehold tenure may offer advantages to those who have it in terms of mortgage-ability and security, these advantages are often exaggerated and can in fact be enjoyed through other forms of tenure if these are properly recognised by law and by financial institutions. It is not necessary to convert to freehold in order to redress the 'weaknesses in current communal tenure systems. Individuals and local authorities own and manage this land tenure.

Leasehold offers a long term leases which are secure, registerable, transferable, inheritable, and renewable and mortageable. The lease period is up to 99 years. Leases will only be granted where OSHCLB is satisfied that no person or group of person has existing rights to the land, and where they do, only where they consent thereto. Such leases include the granting of tourism concessions and business purposes. Individuals own land under customary land tenure for the period of 99 years, which is also renewable, registerable and transferable. Such a system guarantees an absolute ownership of land as security of tenure.

2.4   Land Administration

Land administration embraces matters such as the delivery of land rights, the planning of land uses, demarcation and survey of land parcels, the registration and maintenance of land information. It also includes conveyance, policies to facilitate decisions on mortgages and investment, development management, property valuation for assessment purposes and monitoring the environmental impact of all land based activities. Adapted from LAC and NNFU (2003), since Namibia independence in 1990, land allocation and administration in communal areas have been impeded by the absence of clear and coherent communal land legislation.

In the Namibian context, land generally refers to the surface of the Earth and everything contained therein (trees, rivers, mines, and minerals) or fixed thereon (such as structures or buildings) (LAC and NNFU, 2003). It implies interests and rights and estates in or over land. Land administration as defined by Karikari et al., (2005), is the process whereby land may be effectively regulated and includes the identification of those people who have interests in real estate and the provision of information about those interests such as the nature and duration of rights to land. It also includes information about land parcels, such as their location, size, improvements, ownership and value.

Throughout most English-speaking countries in Africa according to Karikari et al., (2005), land registration has been concerned with land administration and delivery, whilst land administration has been restricted to ownership means rather than to land taxation or to the wider issues involved in optimizing the use of land as a resource (land management). However, in this research, land administration will be limited to

cadastral or ownership means (property records and associated maps and rights to land and buildings on public land) since it analyze and design the LIS application for communal land dispute.

2.4.1 The Oshana Communal Land Board (OSHCLB)

The main objectives of the OSHCLB are to administer land policies and legislation on communal land; management and administration of communal areas; and render advisory services on land tenure systems to various types of land arrangements (Ministry of Lands, Resettlement & Rehabilitation, 2004). Therefore, the OSHCLB has been established to carry out the following functions as enshrined in the CLRA (2002). These includes:

- o Exercise control over the allocation and cancellation of customary land rights by Chiefs or Traditional Authorities;
- o Consider and decide on applications for rights of leaseholds;
- o Establish and maintain a register and a system of registration for recording the allocation, transfer and cancellation of customary land rights of leaseholds;
- o Advice the Minister in the making of regulations or any other matter pertaining to the objectives of the Act; and
- o To perform such other functions as assigned to the Board by the Act.

The Communal Land Board may establish Communal Land Board Committees as provided for in CLRA (2002), Section 8, to perform the following functions:

- o To investigate matters pertaining to land allocation.
- o To render advise to the Board on their findings.
- o To verify land allocation to avoid double allocation.
- o To interview people in order to establish facts related to land disputes.
- o To report on their findings to the Board and draw recommendations.

2.5   Characteristics and Definition of a Land Dispute

2.5.1   What is a Land Dispute?

Various definitions do exist of what is land dispute entails. In the simplest word land dispute can be defined as a disagreement over the right over a piece of land or practices of land between two individuals and/or institutions. What could be picked it up from this definition is the fact that there is a need to establish some mechanisms in order to add practicality to some principles of managing land related information, such as the development of Land Information Management System.

2.5.2 Types of Land Disputes

In most cases the land disputes are either between individuals themselves or between individuals and the land managing institutions / authorities concerned. The latter is mainly a result of the reaction of individuals against decisions of the land managing institutions or authorities concerned such as refusals to grant land, refusal to allow a transfer or change of use and double allocation. Land disputes between individual are in most cases about boundaries between fields or plots. Illegal fencing forms another type of land dispute that arise between the well off individuals and the authority, whereby the wealthy people fence off the common land. Boundary disputes and double allocation exists in many part of the SADC countries due to bribery and neglect of the legislations.

In general, conflict can be grouped into constructive and destructive groups. Constructive groups develop clarification of an issue, increases involvement (participation), strength relationship and improve problem-solving quality. While destructive groups destroys morale, decreases productivity, obstructs cooperative action and diverts energy from real task. Basically, there are four main forms of conflict namely: **man vs. nature:** problem with force of nature; **man vs. himself:** problem with deciding what to do or think; **man vs. society:** problem with the laws or beliefs of a group; **and man vs. man:** problem with another character (Hussein, 1998).

2.5.3 Main Sources and Causes of Land Disputes

Land disputes may arise from a wide range of different situations and are commonly found where there is intense population pressure on land, where different types of

land use adjoin or overlap one another, and where boundaries are not well demarcated.

Ownership and land use rights are major sources of conflict in Africa. Land disputes can lead to extreme violence. Mass expulsions, displacement, destruction of property, and deaths continue to be the hallmark of unresolved land disputes in Africa. Land disputes first became critical in Africa under the colonial occupation when Africans were disposed of land and moved into reserves. The struggle for independence was largely a result of the fight to recover land lost to settlers. Land disputes occur at various levels, from the local community to the national level. These land disputes can cripple beneficial development activities, including sustainable land management and resettlement (Hussein, 1998).

The following are cited as possible causes of land conflicts in Hussein (1998). These are classified as socio and natural resources conflict:

o   Access to pastoral resources & damage to crops between herders and farmers;

o   Over grazing and watering areas between different groups of herders;

o   Poorly defined customary boundaries between neighbouring communities;

o   Between migrant and indigenous farmers;

o   Where expanding cities place pressure on peri-urban areas between the urban elites and peri-urban populations;

o   Where population pressure reduces the sizes of holdings below uneconomic levels; and

o   Where state allocations of land for forestry or large-scale development schemes conflict with customary landholders interests.

The sources of conflict can be many and varied. The most common causes of land conflicts are, which are grouped into institutional arrangement or management:

o   Scarcity of resources (finance, equipment, facilities, etc).

o   Different attitudes, values or perceptions.

o   Disagreements about needs, goals, priorities and interests.

o   Poor communication; poor or inadequate organisational structure;

o   Lack of teamwork.

o   Lack of clarity in roles and responsibilities.

2.6 Methods and Tools Used in Communal Land Dispute Resolution

According to Ramutsidenla (2002), many various Acts and Policies had been passed by different organizations to create an enabling environment aimed at Land Reform Programme. The causes of land disputes can be reduced to a significant extent by:

- o Better defining the roles and responsibilities of various actors, so that unscrupulous people are less able to take advantage of uncertainties.
- o Clarifying boundaries between chiefdoms.
- o Providing better access to information and making sure that decision-making is transparent.
- o Enabling and promoting consultation with all stakeholders throughout the process of planning and resettlement. When land disputes arise, it needs to be clear of which institution has the power and the responsibility to judge that land dispute.

Below are some of the well-established methods and tools currently used to resolve land disputes in many parts of the world (Ramutsidenla 2002):

(i) Conflict management: Conflict management is the practice of identifying and handling conflict in a sensible, fair, and efficient manner. Developing new and using current skills such as effective communication, problem solving, and negotiation with a focus on "interests" can manage conflict.

(ii) Arbitration: An Alternative Dispute Resolution (ADR) process in which a third-party decision maker, selected by the parties, conducts an abbreviated process of information exchange, presides over a mini hearing, and renders a decision. Arbitration may be binding or non-binding.

(iii) Mediation: An interest based ADR process in which a third party neutral (the mediator) meets with two or more parties who have a conflict, facilitates discussions, and assists the parties in reaching a mutual resolution of their differences. The mediator does not have decision-making authority; resolution rests with the parties

(iv) Neutral Evaluation: A process in which a neutral fact finder considers the relative merits of the parties' cases. The parties generally provide the highlights of their respective positions in an informal presentation to the neutral submits a nonbinding objective evaluation of the case to the parties that often results in more productive future negotiations.

(v) Negotiation: Is one of several processes whereby interested parties resolve disputes; agree upon courses of action, bargain for individual or collective advantage, and/or attempt to craft outcomes, which serve their mutual interests. In the advocacy approach, a skilled negotiator usually serves as advocate for one party to the negotiation and attempts to obtain the most favourable outcomes possible for that party. In this process the negotiator attempts to determine the minimum outcome(s) the other party is (or parties are) willing to accept, then adjusts her demands accordingly. A "successful" negotiation in the advocacy approach is when the negotiator is able to obtain all or most of the outcomes his party desires, but without driving the other party to permanently break off negotiations.

(vi) Conciliation: Is a process whereby the parties to a dispute (including future interest disputes) agree to utilize the services of a conciliator, who then meets with the parties separately in an attempt to resolve their differences. Conciliation differs from Arbitration in the sense that the conciliation process, has no legal standing, and the conciliator usually has no authority to seek evidence or call witnesses, usually writes no decision, and makes no award. Conciliation differs from Mediation in that the parties seldom, if ever, actually face each other across the table in the presence of the conciliator.

2.7   Characteristics and Definition of Land Information Systems

2.7.1   What is a Land Information Systems?

The International Federation of Surveyors (FIG) has defined Land Information Systems (LIS) as follows:

"... a tool for legal, administrative and economic decision-making and an aid for planning and development. A Land Information Systems consists, on the one hand, of a database containing spatially referenced land-related data for a defined area and, on

the other, of procedures and techniques for the systematic collection, updating, processing and distribution of the data. The base of a Land Information Systems is a uniform spatial referencing system, which also simplifies the linking of data within the system with other land-related data" (UNECE, 1996).

By analysing the definition and matching it to the needs of the Namibian Government, it is obvious that a LIS is needed. The base of a LIS is a uniform spatial referencing system for the data in the system, which also facilitates the linking of data within the system with other land-related data. According to UNECE (1996), to effectively manage land, it is vitally important that a uniform, comprehensive and integrated computerised system be established to provide graphic textual information on every parcel of land.

2.7.2 Major Concepts of LIS

Computerized storage, retrieval and analysis techniques are the universally accepted methodology for numerous information management applications. An LIS is a computer-based solution for addressing the requirements of Land Records Management System. It attempts to preserve, maintain and analyze records in computer form accruing in the numerous benefits associated with this technology (Raja Rao and Shekhr, 2005).

An LIM system consists of a number of broad dimensions such as, first, a technological dimension (for example, hardware and software). Second, it consists of a set of organizing procedures, which structure the relationship among the functional components, and third, an institutional element, which includes a corporate structure. Fourth, it includes a platform or a resource base, on which data are stored and from which meaningful land information can be produced, analyzed and disseminated. Finally, it includes an explicit, or implicit, policy towards users with transparency, information dissemination, and so on, often reflective of the state of the country's land policy, or lack of policy (United Nations Economic Commission for Africa, 1998).

Therefore, LIS concepts can be defined as follow:

(i) Geographical Information Systems (GIS): There have been so many attempts to

define GIS that it is difficult to select one definitive definition. Various definition exists depend on who is giving it, and their background, application and viewpoint.

Some definitions includes, Burrough (1986), 'a set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from real world for a particular set of purposes'. While the Heywood et al., (1998), define GIS as a system for capturing, storing, checking, integrating, manipulating, analysing and displaying data which are spatially referenced to the Earth'.

In general, the definitions of GIS cover three main components. They reveal that GIS is a computer system. This implies more than just a series of computer boxes sitting on a desk, but includes hardware (the physical parts of the computer itself and associated peripherals – plotters and printers), software (the computer programs that run on the computer), and appropriate procedures (or techniques and orders for task implementation. They indicate that GIS uses spatially referenced or geographical data, and that GIS carries out various management and analysis tasks on these data, including their input and output (Heywood et al., 1998).

(ii) Database Management System (DBMS):   A DBMS is a set of computer programs for organising information, at the core of which will be a database. A database is defined by Worboys (2001), as an unified computer-based collection of data, shared by authorized users, with the capability for controlled definition, access, retrieval, manipulation and presentation of data within it. It can be used to handle both the graphical and non-graphical elements of spatial data. An ideal DBMS as cited by Heywood et al., (1998), provide support for multiple users and multiple databases, allow efficient updating, minimize repeated (or redundant) information and allow data independence, security and integrity.

The UNIGIS (2003) defined DBMS as software with capabilities to define data and their attributes, establish relationships among data items, manipulate the data and manage the data. In figure 2 -1, shows how databases facilitate search for information from data.
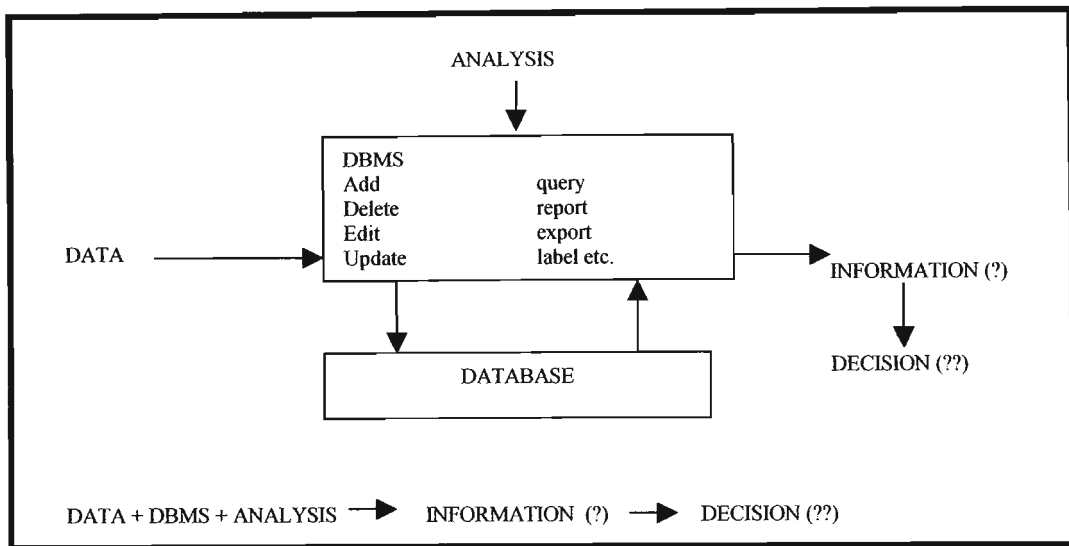
Figure 2 - 1: DBMS creates information from data (UNIGIS, 2003)

(iii) The System Development Life Cycle

According to Robinson (2003), development must begin by defining what the system do and specify its requirement before actual construction begins. To actually move from conception to delivery very structured approach must be employed. This system is referred to as the system development life cycle. In the system life cycle, the development process is partitioned into distinct stages, each stages consisting of basic activities that must be performed for successful completion of the development effort. There are 8 phases in the system life cycle, which are given below while some other cycles show 4 phases. However, they all say the same e.g., phases 1 and 2 in the cycle depicted here are simply referred to as the System Planning Phase, in another cycle.

- o Phase 1: Statement of the terms of reference and specification of requirements
- o Phase 2: The feasibility study
- o Phase 3: Systems analysis
- o Phase 4: The logical design of new system
- o Phase 5: The physical design of new system
- o Phase 6: Programming
- o Phase 7: Implementation
- o Phase 8: Post implementation review

2.8   The Role and Application of LIS in Land Dispute Resolution

The United Nations has been involved in cadastral and land information issues since its inception. In the early 1950s, FAO published a series of monographs including one on the registration of rights in land.   The improvement of land-registration systems and the construction of LIS or GIS are very important prerequisites for the efficient management of land in a developing-world context. This was recognized by the Global Strategy for Shelter for the Year 2000 by United Nations Centre for Human Settlements in 1990 and by the Sub-Committee on Geo-Information of the Economic Commission for Africa (ECA) Committee on Development Information (CODI) at its meeting in Addis Ababa in 1999, yet the transfer or diffusion of geotechnology to developing countries, especially Africa, continues to be plagued with many problems and challenges (Karikari et al., 2005).

According to Potdar (2005), effective land information is of particular importance to developing countries. They are the ones who are in the dire need of a LIS prevent wastage of their scarce resources. The cost of introducing new system is high and the availability of skilled manpower is almost non-existent. The challenge is to produce better Land Information to support better decision-making as indicated in figure 2 – 2 below.
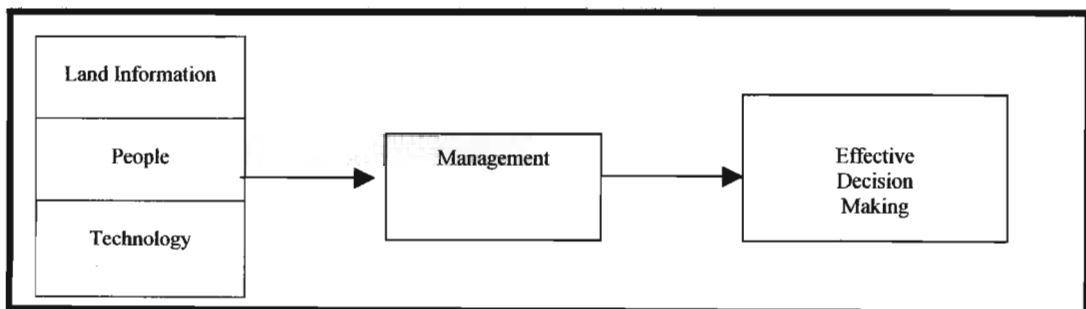
Figure 2 - 2: Land Information Management flow in an organisation (Potdar, 2005)

According to Landman (2004), the need to record details of land parcels within a cadastral system from a need for better administration of the land – land after all is the ultimate resource from which almost all wealth comes. Improvements in the management of land are essential to the betterment of both the rural and the urban poor. In most developing countries, the inadequacy of land information poses serious constraints on what can be done.

The benefits of such land registration include as cited by Landman (2004) are:

(i) Certainty of ownership: the compilation of land records will necessitate the formal identification and recognition of the ownership of the land, a process known as adjudication. This should provide certainty not as to who is the landowner but also what other rights exist in the land. This in turn led to greater social cohesion.

(ii) Security of tenure: Through the adjudication process, existing defects in any titles to land can be cured by the judicious use of appropriate powers. In many countries the official record is supported by a State guarantee of the title to the land. Greater security should in turn lead to increase productivity, especially in rural areas where farmers have an incentive to take greater care of the land and to invest their capital and resources in it.

(iii) Reduction in land disputes: Disputes concerning land and boundaries can give rise to expensive litigation. The settlement of such disputes should be part of the process of adjudication and will not only lead to greater productivity from the land but also reduce the money wasted on litigation and going to court.

Information is needed in decision-making on a wide variety of issues (Mothibi, 2003), such as:

i.   The resolution of conflicts, where information is needed to facilitate adjudication and negotiation of land rights and land use.

ii.   For management and efficient exploitation of natural resources as well as undertaking environmental impact assessments and enforcements of laws against those who degrade the environment.

iii.   Management of natural disasters.

iv.   Management of cities where information is required on human settlements patterns, tenure patterns, existing services and infrastructure.

A LIS has a number of functions that it plays. These are, among others, as observed by Mothibi (2003):

i.   Storage of the land data information

ii.   Inquiry, updating and cleaning of the land information

iii.   Sharing of the land data information

iv.   Quantity statistics of the land data information

v.   Comprehensive analysis and auxiliary planning of land use

vi.   Manifold output functions

vii.   Dynamic inspection and forecast

2.9   LIS Application and Land Dispute Resolution in SADC

For the past few years some Southern Africa Developing Community (SADC) have been trying to introduce the LIS and move away from manual-based system of record keeping. SADC comprises of 14 countries, which can be described as developing countries in terms of national income and economic growth. Mothibi (2003), observe that there have been few successes regarding GIS / LIS systems in Africa, and decision makers often have to make critical decisions based on little or no information.

According to the study by Mugabe and Magaya (2003), developing a LIS for Rural Land Use Planning for Zimbabwe is feasible. It was evident from the study that for an effective and efficient system to be created there are some issues pertaining to policy, data and equipment standards, acquisition and maintenance standards, a good human resources base that should be addressed and funded.

In Botswana, prior to the establishment of Land Board, Mothibi (2003) argues that, land use data consisted of witnesses' recollection of allocations made in their neighbourhood. The accounts were passed from one generation to another, verbally. The Chief, together with his land overseers were empowered, using traditional taboos and other methods to manage the land and ensure that it was used for the purpose it was allocated. The Land Boards have encountered problems ranging from lack of skilled manpower to poor records management.

2.10   LIS Application in Namibia

Since the established of Communal Land Boards country wide in 2003, there has been a need to keep a track of land records in communal areas for proper land administration and management. There had been some proposals to develop proposals for computerized database (Communal Land Registration System) for Communal Land Boards. At the moment the both Land Board and Traditional Authorities has kept quite a lot of important data and/or information on land, which need to be

accessed and shared between various end users *(Ministry of Lands, Resettlement and Rehabilitation, 2005)*.

But due to the non-existent of LIS application in place, poor record keeping, unavailability of records, inadequate and unreliable data and/or information, lack of skilled manpower, this has for the past years proved to be a challenge to the institutions dealing with land management.

2.11 Problems Associated with LIS

It is widely accepted that organisational rather than technological issues are most likely to endanger the effective implementation of computer-based LIS in Africa and elsewhere. Among other reasons underpinning these are the: outcry for better land management in the country; security; certainty of title; and access to land information. It is not the manual systems *per se* that the causes of the problems (although they have contributed significantly), it is that there are costs involved, delays and uncertainties in the land administration system in the country (Sagoe, 2003).

The use and application of a LIS poses some challenges though. The critical issue is data maintenance and the creation of cost-effective way of keeping land data up-to-date. This problem will occur when the land sector agencies start converting existing land records into digital form. Another problem will be found in the area of data processing as cadastral and land registration systems have focused on records management rather than information exploitation. Another crucial area is the data interoperability, integration and sharing that appears bleak (Sagoe, 2003).

Some deficiencies which have been a major cause of dysfunction of the Land Information Management System (Sarma and Kaur, 2004), are listed below:

i. Cadastral maps and record of rights are not up-to-date and do not confirm to the ground realities.

ii. Up keeping of the records and maps is a tedious task due to lack of will, qualified people and complexity of the problem.

iii. Lack of will to adopt newer technology.

iv. The non-uniformity of record of rights being in different regional languages results in a database, which cannot be used for planning and analysis.

2.12   Proposal Solutions to Overcome LIS Problems

Sagoe (2003) made the following recommendations towards improving the Land Information Management Systems:

i.   Recognise appropriate staff with the requisite training in *sine qua non* in the successful implementation of LIS, and every effort should be made for well-planned training programmes tailored to suit all implementing agencies.

ii.   Motivation of staff members through incentives and good remunerations under appropriate conditions of service.

iii.   Recognise the cultural change in land agencies if LIS is to be successful.

iv.   There is a need to establish a National Framework of Geo-spatial Information Management in a country to standardized geographic data protocols and database formats to support national development and to provide consistent and harmonized framework for the exchange of geo-referenced data.

Mothibi (2003), highlighted the proposed solution to overcome LIS problems:

i.   Institutional matters

ii.   Public awareness and participation

iii.   Technical, financial and personnel requirements

2.13   Concluding Remarks

Most African countries do not have land information management system using a LIS application as a management tool. This has some detrimental effect on communal land information management and administration. Poor land records keeping has resulted in land disputes between various users due to misplacement and non-existence of information. This signifies the realization of the necessary land information keeping, records handling and management.

The problems associated with LIM System in developing countries are many and diverse. These range from finance, technology to personnel. For the success of a LIS application; management and decision makers should know, appreciate and understand the contribution that a LIS could make in the development of an organisation. Setting a LIS requires that the systems and institutions dealing with it change legislation, modification of institutional and administrative arrangements.

CHAPTER 3:
STUDY AREA OVERVIEW

3.1 General Description of the Oshana Region

The Oshana Region is one of the 13 Administrative Regions of Namibia, located in the north-central part of the country. It is the smallest Region in terms of size according to the Mendelsohn et al., (2000) with a surface area of 5 291 km². There are four other regions bordered Oshana region, namely; Ohangwena to the north, Oshikoto to the east, Omusati borders to the west, and Kunene to the south as indicated in the figure 3 - 1.
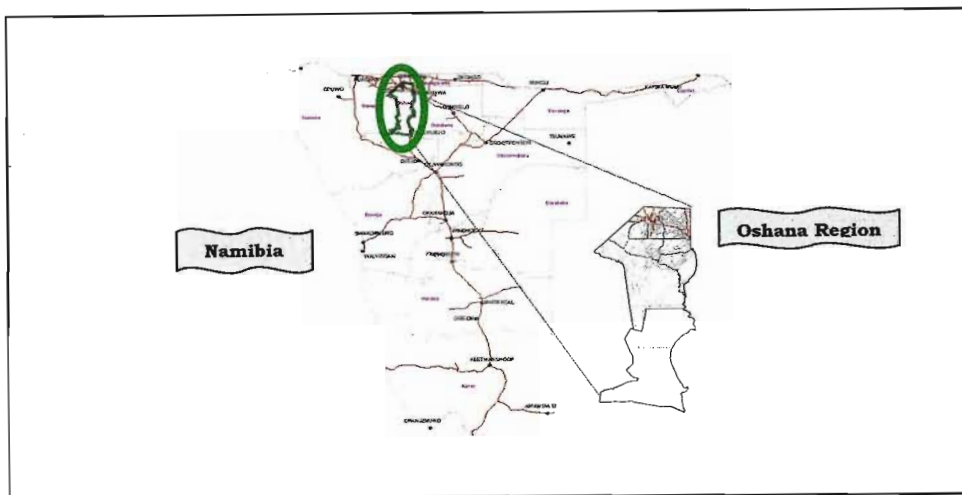
Figure 3 - 1: Study area location, Oshana Region, Namibia

The Region is relatively homogenous in terms of climate, topography, vegetation, water resources and cultural composition. The northern part of the region is relatively densely populated while the central part of the region, north of the Etosha Pan is sparsely populated. The provision of infrastructure has consequently been concentrated within the densely populated area where a system of water pipelines; grid electricity; and roads provide the settlements with basic infrastructure.

The Region according to the Oshana Regional Development Plan (2001) is characterized by a communal land tenure system utilized under customary forms of land tenure. The main urban centers of Oshakati, Ongwediva and Ondangwa, located in the northern part of the region, are linked to the national road network. The road infrastructure within the communal areas of the region is generally underdeveloped. A railway line, which will link Ondangwa with Tsumeb, under the construction stage

while the Namibian Airports Company has recently upgraded the airport facilities at Ondangwa. With the exception of the Oshakati – Ondangwa urban mode the telecommunication network especially the cellular network is poorly developed within the rural parts of the region.

3.2   Population Size and Density

In 2001, the population of Oshana amounted about 161 916 people according to the latest Population and Housing Census in 2001 (Central Bureau Statistics, 2005). The population growth rate in 2001 was 1.8% per annum, while the population density in 2001 was 3.2 people / km².

The Oshana Region has a strong rural character. About 69% of the population lived in the rural areas in 2001 compared to 31% in the urban areas. The northern portion of the region, inclusive of the three urban centres of Oshakati, Ongwediva and Ondangwa, is densely populated. Subsistence farming and few settlements characterize the less densely populated central areas. No settlements found in the area of the Etosha National Park (Oshana Regional Development Plan, 2001).

3.3   Landscapes and Land Types

The extremely flat topography of the Oshana Region is characterized by the *oshana* system (floodplains), which dominates the central area. The elevation varies from 950 meters to 1100 meters above the sea level. The complex ephemeral system of broad, shallow, vegetated channels that flow from southern Angola after good rains received, meandering through the sandy soils and mostly ending in larger pans, characterize the area.

There are four (4) major land types in Oshana Region namely; Cuvelai Drainage, Kartsveld; Pan and Grasslands; and Shrub Mopane. The vegetation in these land types is mainly influenced by three factors, namely soil, flooding and fire.

The northern Kalahari Sandveld dominates the region, consisting mainly of an aeolin sand mantle of about 50 metres thick, covering tertiary calcretes and sediments. The common parental material is remarkably uniform and relatively unweathered, medium textured sand. The soils are generally sandy and, due to the high evaporation rate in

the oshana system, salinity is also higher. Fertility is low, and crop production potential is limited. Large-scale irrigation is not suitable as it increases salinity *(Oshana Regional Development Plan, 2001).*

3.4 Climate

The Oshana Region can be classified as semi-arid, with an average annual rainfall ranging between 400 – 500 mm. However, the Region rainfall is highly variable from year to year and from one place to another and experience serious droughts from time to time. The mean annual evaporation figures are relatively higher, reducing the effectiveness of dry land agriculture. Almost all the rainfall during the summer months roughly January, February and March each year. Summers are hot with mean temperatures of 31.7°C and mild winter with mean minimum temperatures of 8.7°C during June/July *(Oshana Regional Development Plan, 2001).*

3.5 Farming

The land in Oshana Region is either under state or communal administration. State controlled areas consist primarily of protected areas and national parks. The dominant form of land use in the communal areas is subsistence farming. Three different types of farming are made in this region: stock farming (dominated by cattle, goats, sheep, donkeys), crop farming (mostly *mahangu*, sorghum and maize) and mixed farming (stock and crop farming). A major characteristic of the land use in many parts of the Oshana area is that land use is often uncertain, uncontrolled or arbitrary in nature *(Oshana Regional Development Plan, 2001).*

3.6 Justification of the Study Area

Little, if none, research on the development of LIS as a tool for land management, administration and allocation for Oshana Communal Land Board (OSHCLB) in Namibia, has been conducted. Notwithstanding, the work done in other part the Southern African Developing Communities (SADC) countries, there is a tremendous need for either similar work or other researches of the same magnitudes to be pursued, especially when there is a different view on the land management and allocation procedures in different countries.

The area of study was chosen for a number of reasons. The following factors also influenced the choice:

i.   Most of the spatial data and non-spatial data are readily available to the researcher at ease.

ii.   The proximity of the area to the Researcher in terms of conducting the research (carrying out interviews and collecting missing data).

iii.   The OSHCLB is eager to have a computerized Land Information System (LIS) in place for their operation.

iv.   Geographical location of the study area to the Researcher in terms of the cultural background and language (no language interpretation needed).

v.   Cost consideration in terms of acquiring / collection of spatial data

CHAPTER 4:

RESEARCH METHODOLOGY

4.1 Research Design and Strategy

To fulfil the research objectives, all processes involved were defined systematically. These processes adapted from Begu (2003), integrate all the research stages i.e., research design and strategies, as shown in figure 4 - 1 below:
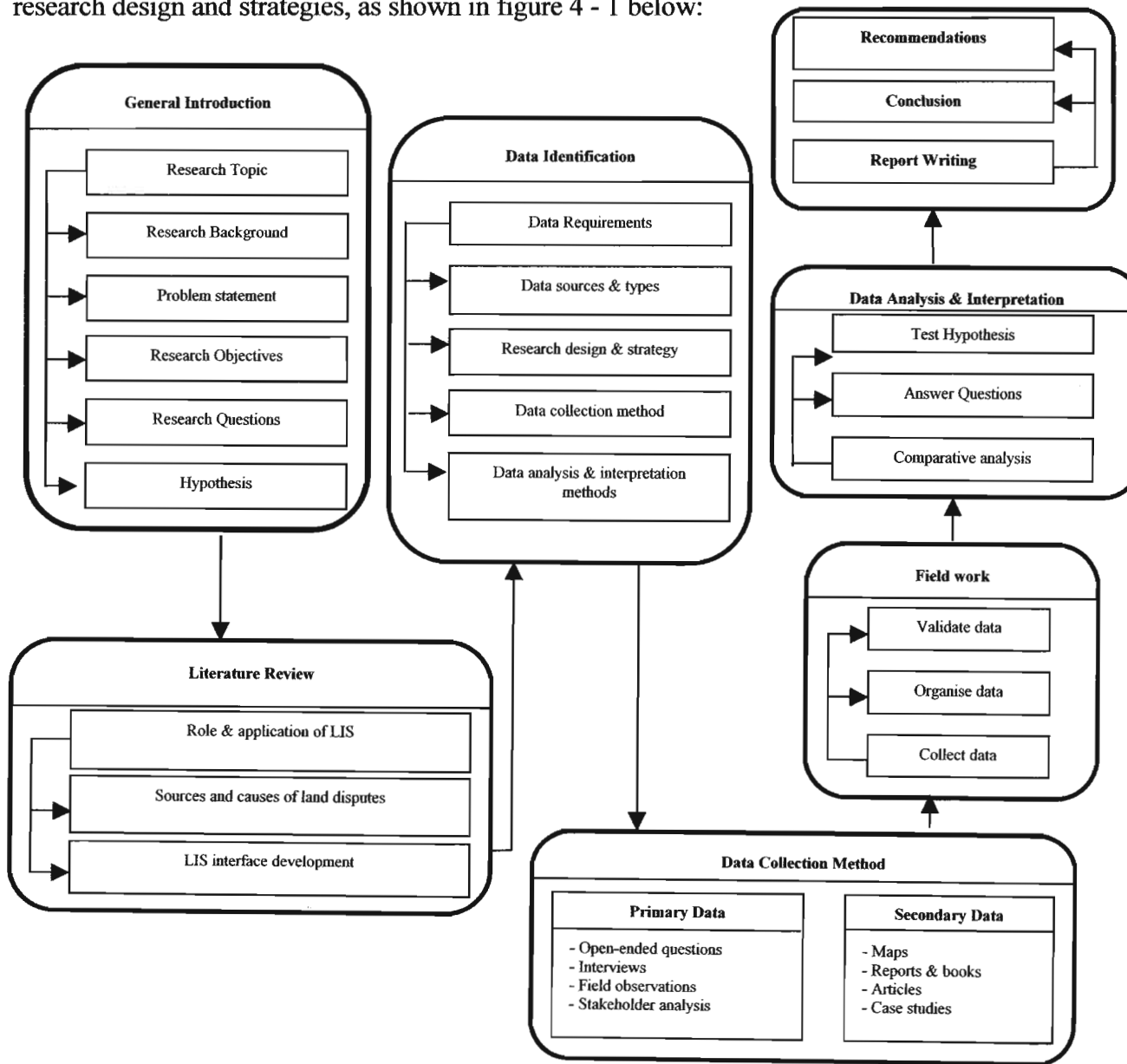
Figure 4 - 1: Research design and strategy processes (Begu, 2003)

4.2 Research Methodology

The research processes were achieved as per specific study objective. An example was drawn from the Jacobs and Mugabe (2002). These include:

1. Completing questionnaires and an interview-based research with OSHCLB about communal land disputes resolution and information management needs. The questionnaires were circulated to all OSHCLB members with the follow up done upon receipt from them. A list of questions used can be found in *appendix 1*. The purpose of these interviews was to:

    ✓ Assess the interviewees' perceptions of the requirements for a digital LIS for communal land dispute resolution.

    ✓ Assess their understanding of how and by whom such a LIS would be used.

    ✓ Determine their understanding of existing databases (if any) that might be integrated into such as system.

2. Compile an inventory of existing major sources and causes of land dispute and their resolution methods and tools. Collect and analyse all LIS (and GIS) data layers already developed by different organisations, which would have relevance for communal land dispute resolution. This task included contact with Government Departments, Non-Governmental Organisations (NGOs), OSHCLB, Traditional Authorities, and other identified stakeholders.

3. Assessment of the current methods and tools used by OSHCLB in the land dispute resolution by reviewing and scrutinizing their strengths and weaknesses, as well as opportunities and threats (SWOT) (if any). The purpose of this assessment was to:

    ✓ Assess and review how the land disputes are handled.

    ✓ Assess how effective are the methods / tools in place.

    ✓ Determine how such methods / tools might be integrated into LIS.

4. Construction of a theoretical / conceptual Land Information Management (LIM) System prototype using LIS application as a management tool, for communal land disputes resolution, based on the information contained in the steps above. Such conceptual LIM System assume or show what an integrated (from existing, available and accessible) LIS would contain. Table 4 - 1, shows methodology used to each of the research question.

Table 4 - 1: Research Methodology

Questions Number	METHODOLOGY			
	Comparative Analysis	Literature Review	SWOT Analysis	Interviews
i. What role does LIS applications play in communal land disputes resolution?		X		X
ii. What are the main sources, causes and impacts of land disputes in Oshana Region' Communal Areas?		X		X
iii. What current methods and tools are used in managing communal land disputes and their SWOT analysis?	X	X	X	X
iv. What are the LIS application requirements in terms of data, technical, standards, human resource base, findings, etc?	X	X	X	X

4.3   Data Collection Methods

To maximize the research benefits, multiple data collection methods had been used in this study as shown in figure 4 - 2. The quantitative and qualitative data were collected using primary and secondary data methods. Primary data collection emphasis had been placed on field observation using GPS, open-ended questionnaires for interviews with the Oshana Communal Land Board members. While secondary data methods involved literature review on the land disputes in communal areas and the role and application of LIS on land dispute resolution. A sample adapted from Welman and Kruger, (2001), was used to collect data in the field.
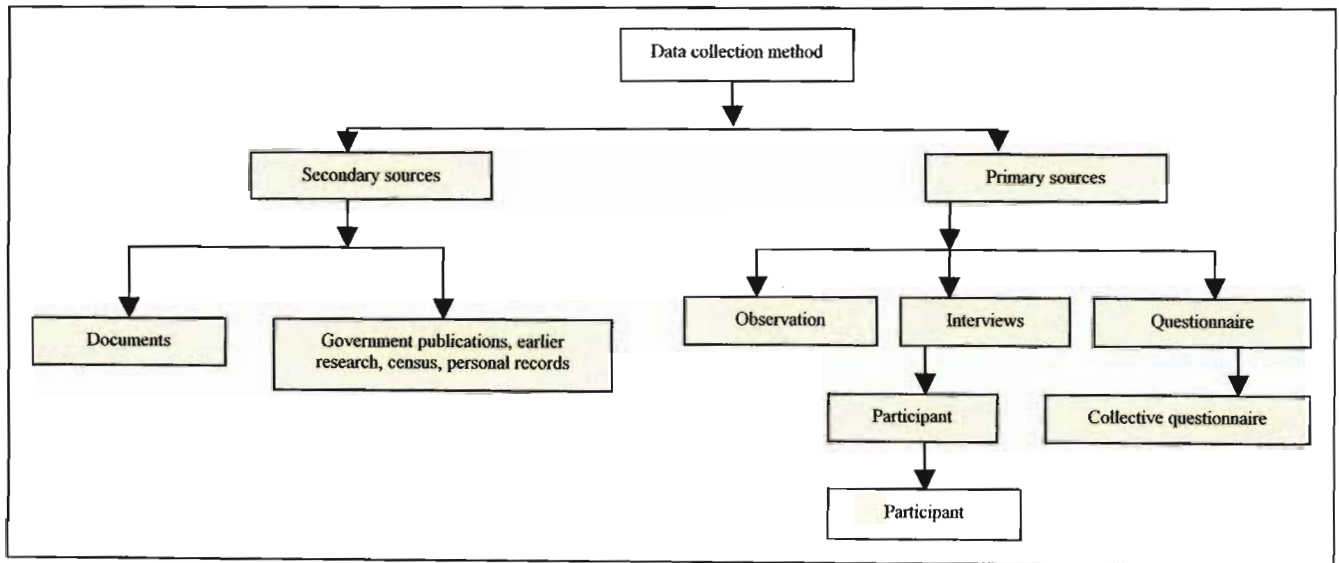
Figure 4 - 2: Data Collection Methods and Sources (Welman and Kruger, 2001)

CHAPTER 5:

DATA DESCRIPTION AND ANALYSIS

5.1   Data Types and Sources

The main source of data used in answering questions related to the research were the Oshana Communal Land Board (OSHCLB), Traditional Authorities, Government Departments, NGO, field observation, individuals and archives. Primary and secondary data methods were employed to acquire the data. Data types collected include the land dispute sources, causes and their impacts on communal land. Information related to the current methods and tools for resolving land dispute and their strengths and weaknesses were collected. Relevant available documents, reports, articles and case studies on the LIS application role in communal Land Information Management were reviewed and analysed. *See figure 5 – 1 below.*
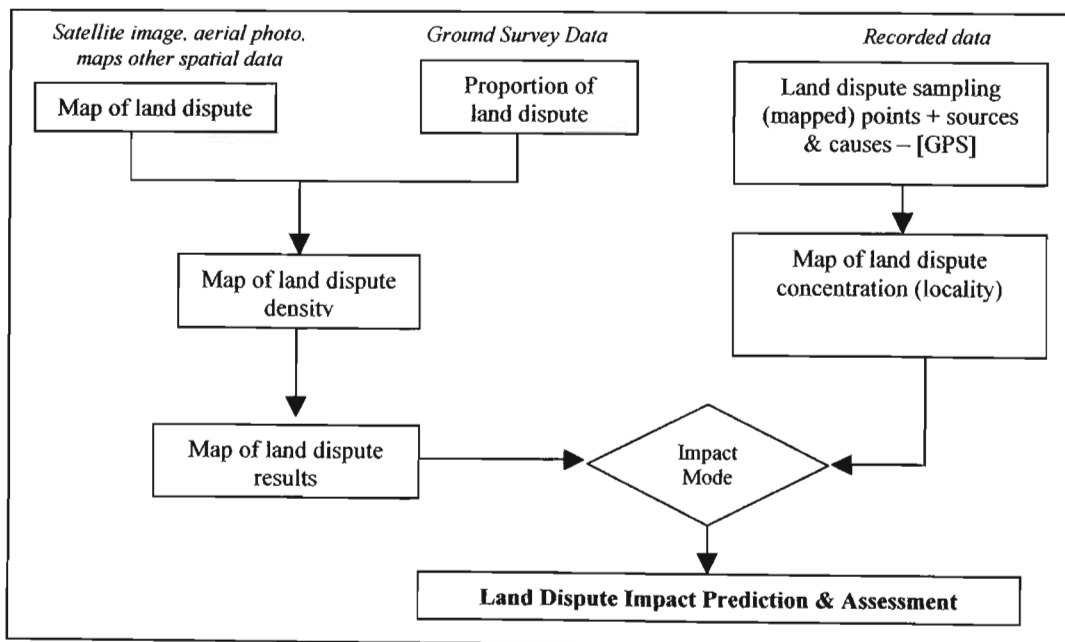
Figure 5 – 1: Data Source and Types

5.2   Questionnaires and Interviews

The questionnaires were circulated to all OSHCLB members with the follow up done upon receipt from them. Information relating to spatial information was obtained from various Governmental Department and private organisations. The interview focused on the existing types of data, its sources, and format, processes performed on it, storage and accessibility. Questionnaire were formulated and used as a guide, a copy is attached in *appendix 1*.

5.3   Review of the Existing Records and Documents

Spatial data on land disputes were obtained from various Government Departments and private organisations. This was in the form digital ArcView format. However, there were some data such as sketch maps and survey diagrams that were provided in hard copies. Information regarding the attributes for the spatial data were also obtained from various sources in digital format. The OSHCLB provided much needed data in the form of hard copies that were used in the analysis of the land dispute and Land Information Management (LIM) System prototype development.

5.4   Observation

This method was used to observe the process that involve in land dispute resolution, data entry (manual), storage and the products. The researcher spent a week with the OSHCLB' members and the Division of Land Boards, Tenure and Advice (LBTA) and staff observing how land dispute were received, processed, stored, updated and more importantly handled and/or resolved. This method also entails observing all the methods and tools used in the data entry, processing, storage and products. This method helped viewing how things were done and permitted the researcher to ask related questions. This gave an additional perspective and a better understanding of both the system and the procedures involved.

5.5   Field Data (GPS Coordinates)

The researcher collected some field data using hand held Global Positioning System (GPS). The data were collected in Degrees, Minutes and Seconds (hddd° mm' ss.s"). These degrees of latitude and longitude were used to identify the absolute location of points on the Earth's Surface.

The latitude and longitude coordinates were stored in GPS as waypoints. The same waypoints were also stored manually on a designed data collection form to minimise data loss and ensure that each point stored is properly documented. The form in Annex 7, is an example of a data collection form used.

Below were the parameters / format used configure the GPS during data collection:
- o   Mode   : Normal
- o   Position   : Hdd° mm' ss.s"
- o   Datum   : Schwarzeck
- o   Units   : Metric

These were the data on mapping out illegal fencing and boundary disputes area and location. The collected data were download in the computer using the Garmin Software. The downloaded coordinates were saved as text file into Microsoft Excel software and transferred into ArcView GIS. Maps and sketch were produced using these coordinates (x , y) in ArcView GIS software.

The projection used in this study was Transverse Mercator (Gaus Conform) and Bessel as Spheroid. Since the study area is located in Namibia, the following parameters were used:

- o Central Meridian   : 16
- o Reference Latitude : -19
- o Scale Factor   : 1
- o False Easting   : 0
- o False Northing   : 0

5.6 Data Analysis and Interpretation

The data analysis used includes the data organisation from sources, answering research questions, hypothesis testing and report writing. ArcView GIS as a software was used in data analysis and map production. The interpretation methods took into account the category, review and description of sub-questions and formulation of meaningful topics. Complete analysis critically provides detailed information to either accept or reject the hypothesis and propose recommendation is shown in *Figure 5 - 2.*
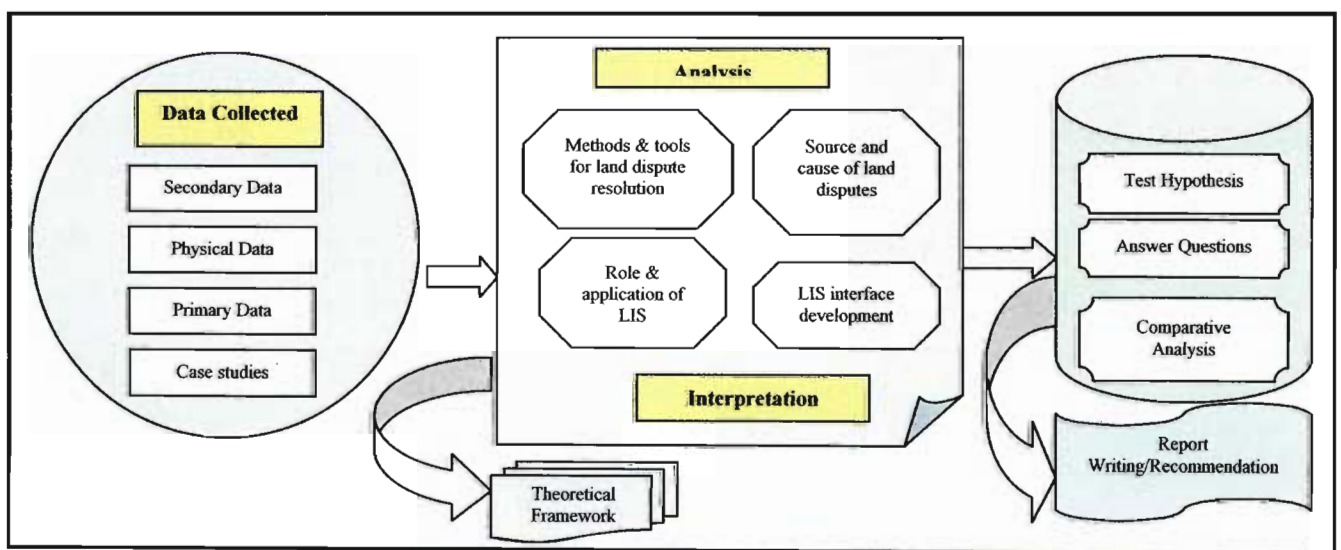
Figure 5 - 2: Data Analysis and Interpretation

5.7 Geographical Data Analysis with GIS

ArcView GIS was used to analyze and map land dispute data for Oshana Region from geographical and environmental-land dispute perspectives. A base map for the GIS was constructed by adapting a digital land use map for the study area of the mapping land dispute. Land dispute statistics obtained from the Oshana Communal Land Board were processed and digitized on overlays of the land use map. Maps that depict the temporal and spatial dimensions of land dispute in the study area were compiled and mapped with ArcView GIS, making of GIS techniques like overlaying, digitizing etc.

In the description of these maps the researcher succeeded in identifying and demarcating areas and illustrating the relationship between the mapped land dispute patterns and characteristics of the area. On the practical level the results show that OSHCLB can utilize GIS instead traditional colour pin maps. The results show that GIS is a useful, effective and necessary tool in help to resolve land dispute. The researcher concludes that the practical application of geography, aided by GIS, is indispensable for land management and administration in Oshana Region.

5.8 Concluding Remarks

The geography of land dispute provides a perspective on the spatial analysis of land dispute and the distribution of OSHCLB resources, promising a new insights regarding the optimal use of these resources. The value of GIS would eventually be measured according to its usefulness in practice. In this regard, GIS has the ability to integrate large volumes of geographical data from diverse sources, which facilitates multi-criteria decision-making.

The primary function of GIS maps is to enable the map-reader to establish the relationship between spatial features. In this instance the temporal and spatial features of land dispute locations on the one hand, and the physical features on the environment and land dispute on the other land. Mapping with GIS involves similar processes as traditional mapping; expect that the mapping process is quicker and easier because it is computerized. An important aspect to bear in mind is the difference between the display of GIS data on the computer screen in digital format, and data displayed on paper.

CHAPTER 6:

RESULTS AND DESIGN OF LAND INFORMATION MANAGEMENT

SYSTEM FOR OSHANA COMMUNLA LAND BOARD

6.1   Introduction

This chapter reviewed and described the main types of existing land disputes, resolution mechanisms used by OSHCLB at the moment. It also analyzed the existing LIM Systems used by the OSHCLB in recording and safe keeping of land related data and/or information. Finally, it present the design of OSHCLB LIM System prototype using LIS application as a management tool for communal land dispute resolution. The LIM System is described based on its data sources, data processes and storage, products and its problems associated with it.

6.2   Administration of Communal Land in Oshana Region

Land administration in rural areas of Oshana Region is governed by the CLRA (2002). The CLRA (2002) governs access, use and disposal of 73.2% of land in Oshana Region. The Act provided for the establishment of Communal Land Boards whose functions center around the allocation of leasehold land rights in communal areas, and verification and ratification of the allocation of customary land rights done by the Chiefs or Traditional Authorities (MLRR, 2004).

The CLRA (2002) spelt out the core functions of the OSHCLB with respect to land administration has been identified as land allocation, land registration, cancellation of rights, verification and ratification of land rights allocated by Chiefs or Traditional Authorities, appeals and hearing, land disputes resolutions.

Land Management Systems in figure 6 - 1, as per CLRA (2002) shows the roles and relationship played between the Minister of Lands and Resettlement, OSHCLB and Traditional Authorities residing within Oshana Region.
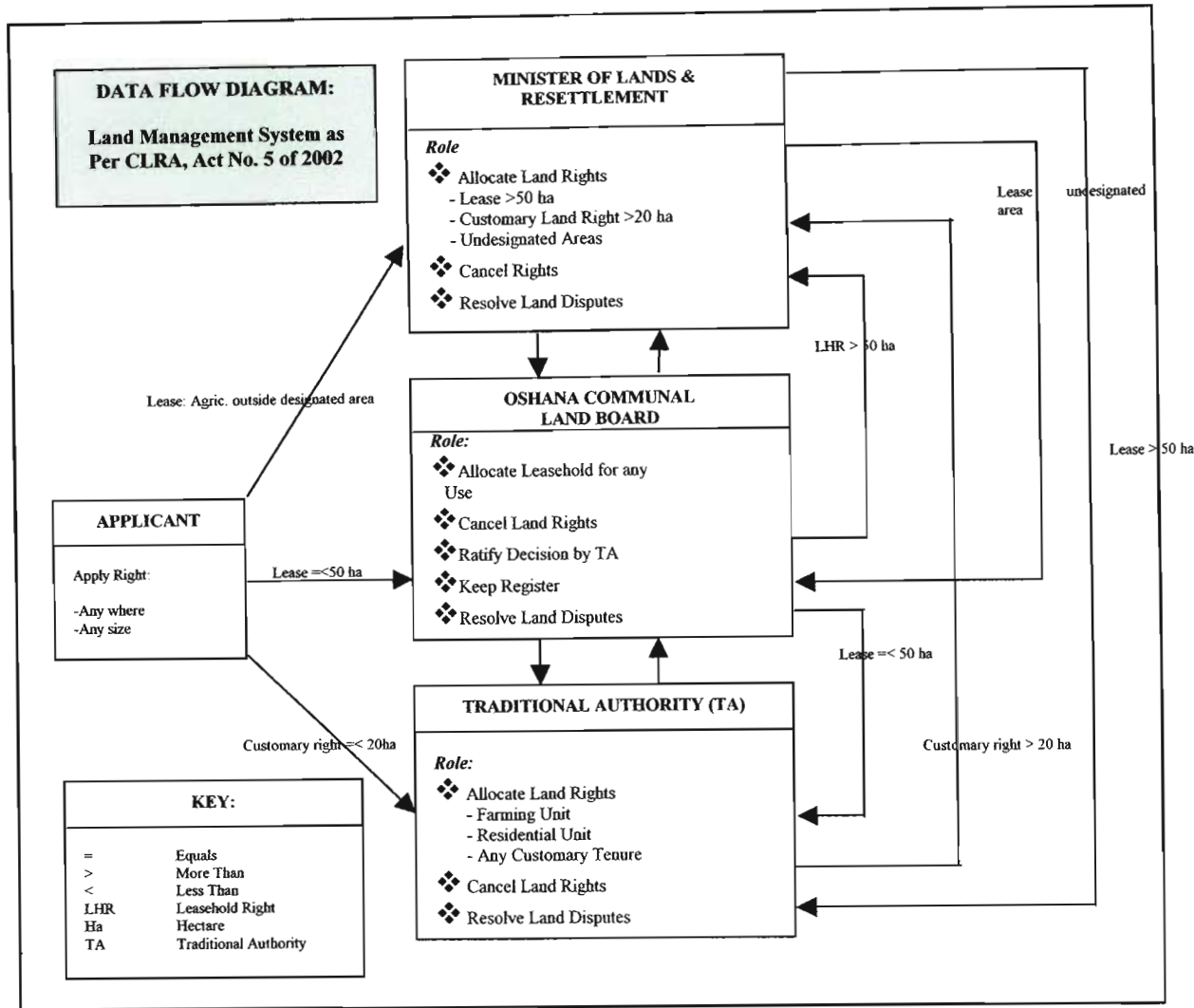
Figure 6 - 1: Land Management System as per Communal Land Reform Act (No. 5 of 2002)

6.3 Sources and Causes of Land Disputes in Oshana Region

Among others major sources and causes of land disputes recorded in Oshana Region for the past years as observed by both Oshana Communal Land Board are as follows:

6.3.1 Illegal Fencing

The problem of illegal fencing has its roots in the pre-Independence history of Namibia when the previous government attempted to build up a buffer zone between the overwhelmingly white commercial farming areas and the former homelands. This involved the richer farmers and to some extent top civil Government officials, politicians and others who fully understand the content of the CLRA (2002), in the homelands to fence off large ranches.

The CLRA (2002), takes a strong position against the erection of fences of communal lands. No new fences may be erected without proper authorization obtained in accordance with the Act. Similarly, fences that exist at the time that the Act came into operation have to be removed, unless the people who erected these fences applied for and were granted permission to keep the fences on the land (LAC and NNFU, 2003).

In terms of section 44 of the CLRA (2002), if a person erects a new fence or retains a fence for 30 days after his or her application for permission to retain a fence has been refused, that person commits a criminal offence. The Act provides penalties for this offence, namely a maximum fine N$ 4 000.00 or one year's improvement or both. In addition, if the person still refuses to take down the fence, even after being convicted of a crime, that person is guilty of committing a further offence, called continuing offence, for which they can be fine up to N$ 50.00 for each day that the fence remains standing (LAC and NNFU, 2003).

6.3.2   Double Allocation

These occur where the Traditional Authority and Land Board respectively mistakenly allocate and ratify one piece of land to two parties. From the planning and Land Information Management point of view, this is normally the case where one's portion of land does not clearly show its boundary or due to none existence of proper records. This is also due to poor planning as far the Land Information Management and record keeping is concern. In some cases double allocation occurs purposeful through exchange of money and other bribes.

6.3.3   Boundary Dispute

A boundary dispute is a disagreement over the location of a property line. Boundary disputes often occur because the land or deeds was not surveyed. Boundary disputes, even if they do not end up in court, can be very expensive. The Ministry of Lands and Resettlement (2005), observed that these occur when one or more party in the process of developing their land either by design or mistake encroaches into their neighbours's plots.

Over 90% of the communal land in Oshana Region is not surveyed and individual land or plot, boundary lines are being demarcated and allocated to individuals'

applicant by the Chiefs or Traditional Authorities. The OSHCLB verify the plot or any customary land right allocated by Chiefs or Traditional Authorities with hand held Global Positioning System (GPS) by the OSHCLB. This is done to determine the actual size of 20 hectares permitted by law as well as the boundary between the two plots.

6.3.4   Self-Extension

These occur where someone extend his / her plot beyond the legal allocated dimensions. This often results in blocking public roads, water points or encroachment into other people's properties. Given the fact that large areas of the Oshana Region communal areas is not surveyed, individuals take laws into their own hand by extending their plots or lands.

However, Section 40 allows the Communal Land Board to have communal land surveyed and to have plans and diagrams of these areas. The survey of an area must be done in accordance with a layout plan, which is prepared with the cooperation of the Traditional Authority concerned.

6.3.5   Widow Eviction

In the past, under customary law, women were allowed to remain on the land and to farm on the land only because the land was allocated to their husbands, fathers or some other male relative. This places women in a very difficult position (LAC and NNFU, 2003).

However, today in the independent Namibia, by law, women are represented on the Land Boards. Women have equal rights as men when applying for customary land rights in communal areas. However, this yet to be fully recognised by some Traditional Chiefs, despite the fact that the law on communal land was translated into most indigenous languages and widely distributed. In addition the CLRA (2002), protects the surviving spouse of a deceased holder of the customary land right by giving the surviving spouse, who may be the wife of the husband, the right to apply to the Chief or Traditional Authority for the re-allocation of customary land right in her name or his name.

This is supported by Article 10 of the Namibian Constitution (1990), which guarantees the equality of all people, including women, before the law. Also Article 23 of the Namibian Constitution (1990), states that, women should be encouraged and enabled to play a full, equal and effective role in the political, social, economic and cultural life of the nation.

6.3.6   Illegal Occupation of Communal Area

These occur where someone allocate himself or herself a plot of land in communal land for any use. This often results in the rightful applicants can access to land within communal areas. Many people in the Region had been in the past and continue to allocate land themselves without going through the right channel. This has to do with neglect of the legislation, and to some extent some people refused to recognise the role and responsibilities given to the Traditional Authorities on land allocation within communal areas.

Communal land can only be occupied or use in accordance with a right granted under CLRA (2002). A person who occupies communal land without given the right thereto, may be evicted. A Chief, Traditional Authority or a Communal land Board may institute legal action for the eviction of a person.

6.3.7   Illegal Grazing

These occur where someone or groups of farmers graze in an area(s) without getting the authorization from the Traditional Authority of the concerned area. This usually creates tensions between the rightful local farmers within that area over the grazing conditions, which become overgrazed if many livestock are kept there. In some cases it creates problems between tribes or ethnic groups when farmers crosses borders between the tribes to seek and settle in other areas for grazing purposes. However, is against the farmers allocating themselves grazing areas or occupying grazing areas with the consent of the Traditional Authorities.

6.4   Procedures for Land Disputes Resolution and Conflict Adjudication

In most cases the Traditional Authority is the first Authority where individuals report their cases on land dispute. If the Traditional Authorities fails to seek a possible solution, the case will be referred to OSHCLB for intervention. In all cases, land

disputes whatever nature, the Traditional Authority or OSHCLB launches an investigation whereby all disputant parties involve consulted Site or land disputed will be inspected before the decision is taken. The decision taken is communicated to all the disputant parties in writing. The disputant parties are given 30 days to appeal against the decision taken by the OSHCLB or Traditional Authority to the Minister via the OSHCLB upon receipt of the decision. The Minister will then appoint an Appeal Tribunal to investigate the case. The disputant parties are again given 30 days to appeal to the Minister upon receipt of an Appeal Tribunal. The Minister will then intervene to seek and take the final decision.

6.4.1 Strengths of the Methods and Tools

This methods or tools used have little strengths compared to the weaknesses. Among other strengths are: the Authority that allocate land to individuals get involved when land dispute arise i.e., Traditional Authority. They know much better the area that the often they do not need an aid or visual immediate output to resolve the dispute. However, even if an aid and/or visual output are not needed, the recording of the events became a problem.

In addition to the above-mentioned strengths, these are:

- o The bottom-up approach is applied in the sense that the participatory planning of all institutions or individuals involved and affected by the land dispute are consulted for their views and inputs.
- o Information (in hard copy) available at the regional and community levels.
- o The main two authorities on land management namely; Traditional Authorities and OSHCLB are close to the people, land dispute can be resolve with ease.
- o Cooperation in resolving the land disputes between the Traditional Authorities and OSHCLB do to exist.

6.4.2 Weaknesses of the Methods and Tools

It has been proved in some developing countries especially in SADC that misplacement of records and manual based system of paper files are to be blamed for the increase of land disputes. Manual based system does not provide tools for modelling and analytical capabilities for spatial data. The available cadastral maps used are old and mostly do no contain any physical existing permanent point of

location. Most of these maps do not contain any administrative boundary, which are physically locatable.

Despite the richness of information used in the planning process, efficient geographical information gathering and relevant spatial analytical tools necessary to support the negotiations among the stakeholders are lacking.

Therefore existing methods and tools by OSHCLB to resolve land dispute are poorly designed because:

- o Lack of unique identifiers within the data sets.
- o Lack of parcel-based information.
- o Not designed to resolve conflicts over land use or facilitate decision making
- o Not transparent or user friendly. Wasting time when searching for information.
- o Lack of up-to-date records, which hinders land readjustment, consolidation and provision of service.
- o Cumbersome, lengthy, time consuming and administrative procedures.
- o Problems in updating and storage of information. It takes a lot of space to store data in filling cabinets.
- o Loss and misplacement of information. Often the information of a particular land parcel is misfiled or lost.

6.5 Analysis of the Existing Oshana Communal Land Board – Land Information Management System (OSHCLB – LIM System)

6.5.1 Current Registration System

The MLR engaged a team of consultants in 2004 to carry out a capacity assessment of the newly established Communal Land Boards. One of the consultant's specific tasks was to identify the requirements for a system of land registration, which could be linked with Head Office to allow for a smooth sharing of information between Head Office and the respective Land Boards (Ministry of Lands, Res. Rehabilitation 2005).

The Consultant team found that all Communal Land Boards have not yet started with proper registration for both customary land rights and rights of leaseholds. However,

record books have been developed by the MLR and made available to all Communal Land Boards (Ministry of Lands, Resettlement and Rehabilitation, 2005).

These record books are presently used for the recording of the following information for every piece of land allocated: name, sex, nationality, Date of Birth (DoB) / Identity Document (ID), name of spouse(s) and dependents, type of right, certificate number, geographical location, size, period of lease (for leasehold rights), Traditional Authority, and name of communal area. No Computerized database is developed for OSHCLB at the moment.

6.5.2   Sources of Spatial Data

Spatial data have are available in various forms especially in map form. The biggest sources of spatial data of the OSHCLB are the national mapping agency, i.e., Directorate of Surveying and Mapping in the Surveyor-General Office. However, many municipal authorities have also gathered spatial data, mainly cadastral records. Some of these Authorities have also been involved in mapping. Other thematic data sets are available from agencies like the Ministry of Lands and Resettlement (MLR); Ministry of Environment & Tourism (MET); National Planning Commission (NPC); Electoral Commission of Namibia (ECN); Ministry of Agriculture, Water and Forestry (MAWF); Central Statistics Office (CSO); and private institutions, which also provides socio-economic data.

The only spatial data OSHCLB collects from the field using Global Positioning System (GPS) are customary land rights, leasehold rights and mapping of disputed areas. The Land Use Planning & Allocation (LUPA) Division in the Ministry of Lands and Resettlement process and store the data in digital format while the hard copy i.e., sketch maps and diagrams kept by the OSHCLB.

6.5.3   Databases and Metadata

Much of the available data are in the forms of maps and paper records. However, there has been a realisation that the use of computers in spatial data management necessitates availability of such data in digital format. Plans are underway to create digital databases through conversion of existing maps collected from various sources into digital format.

Compiling land inventory projects have been going on since 2003, and the OSHCLB maintains a manual-based paper file on the allocated plots in communal areas. Metadata systems are still in rudimentary stages, making it difficult for potential users to know what data sets really exist and if they could satisfy their needs. *See appendix 5.*

6.5.4   Spatial Data Types and Format

Most of the data held and received by the OSHCLB are in analogue. The LUPA Division is currently helping the OSHCLB to interpret the analogue and digital data received or collected. However, as mentioned earlier, GPS is used to collect coordinates of the parcel boundary corners, homestead location, disputed area(s) and other features on the land. The LUPA Division processes and maintains digital data while OSHCLB and LBTA Division kept analogue data (i.e. maps, certificate for customary land rights, leasehold etc.).

6.5.5   Process Performed on Spatial Data

Field data (customary land rights, leasehold and land dispute) are collected from the field using GPS. The LUPA and LBTA Divisions are currently working hand-in-hand to assist the OSHCLB to collect and record data from field. The OSHCLB Secretariat is hampered by the limited technical capacity.

The Garmin Software is used to download the GPS data into the computer. The coordinates are imported and saved as text file into Microsoft Excel software before being transferred into ArcView GIS. In ArcView GIS, maps and sketch are drawn using coordinates (x , y) collected in the field with GPS.

6.5.6   Non-Spatial Data

The OSHCLB Secretary maintains the non-spatial data in analogue formats. These include ownership, location, size, size of the plot, date of allocation, lease type, sex, marital status, land use etc. Information is kept on the customary land rights namely; the existing customary land rights and new customary land rights, as well as the leasehold rights.

The OSHCLB had adopted a filling system for land records keeping. However, the system is manual-based file system as shown in table 6 - 1 below.

6.5.6.1 Filling System for OSHCLB

Table 6 - 1: A model illustrating the Oshana Communal Land Board Filing System

HOLDING FILES	- Customary Land Rights (New)
	- Customary Land Rights (Existing)
	- Leasehold (New)
	- Leasehold / PTO (Existing)
	- Transfer of Rights
PERMANENT FILES	**A. Approved Applications**
	- Customary Land Rights (New)
	- Customary Land Rights (Existing)
	- Leasehold Rights
	B. Rejected Applications
	- Customary Land Rights (New)
	- Customary Land Rights (Existing)
	- Leasehold Rights
	C. Referred to the Minister (Applications)
	- Customary Land Rights (New)
	- Customary Land Rights (Existing)
	- Leasehold Rights
	D. Investigation
	E. Public Participation
LAN DISPUTES	**A.**
	- Residential
	- Cropping
	- Grazing
	- Groups
	B.
	- Individual
	- Public
	- Groups
APPEALS	- Customary Land Rights (Residential)
	- Customary Land Rights (Cropping)
	- Customary Land Rights (Grazing)
	- Leasehold Land Rights
ADMINISTRATION	- Internal
	- External

6.5.7 Data Storage, Updating and Accessibility

Most of the OSHCLB data and /or information are kept into paper files. Updating, retrieval and indexing are done manually. The manual method is cumbersome because

more time is spent looking for information in the files; often files are misplaced, torn or lost.

Data are updated manually when necessary. However, updating is not done on a regular basis. New data on customary land rights are being captured and updated from the field when applications received. However, updating can also done when ownership or land use change or occur. The sketch maps and survey diagrams are stored in analogue formats together with the lease information. The file numbering system of paper file used is shown in table 6 - 2 as follows:

Table 6 - 2: OSHCLB Filling Numbering System

File Number	Description/Topic/Subject	Disposal
1/3/1/…	Customary (New)	
1/3/2/…	Customary (Existing)	
1/3/3/…	Lease Hold (New)	
1/3/4/…	Lease Hold (Existing)	
1/4/1/…	Cancellation of Land Rights	
1/5/1/…	Transfer of Land Rights	
1/6/1/…	Relinquishing of Rights	
2/1/…	Land Disputes & Conflicts	
3/1/…	Administration	

6.6 Design of a Proposed Oshana Communal Land Board - Land Information Management Systems (OSHCLB – LIM System)

6.6.1 Data Model

"A data model is logical design of the structure of the database components (not the records that a database holds), including table definitions (Columns, data types, other constraints), table relationships, views, etc. Data models implement some business rules by how it defines the structure of the database. Such logical definitions frequently determine some of the physical characteristics of a model's implementation. A data model is often represented graphically with an Entity Relationship (ER) Diagram" (Robinson, 2003).

6.6.2   Conceptual Data Modelling

In conceptual database design the overall data requirements for development of LIS application for communal land dispute resolution has been analyzed. This was done to build a new LIS application, which at the moment does not exist. The OSHCLB data requirements for operational were formulated in order to fully describe the relationships among them:

i.   A District must have more villages.

        A village must belong to one District only.

ii.   A village must have more land parcels.

        A land parcel must belong to a village.

iii.   An applicant can occupy one or more parcels in one or more villages.

        One or more land parcels in same or different villages belong to an applicant.

iv.   A land parcel must have one lease only.

        A lease must belong to one land parcel only.

v.   An applicant may have one or more leases.

        A lease must belong to one applicant only.

vi.   A file must be associated with one land parcel only.

        A land parcel must be associated with one file only.

vii.   A file must be associated with applicant.

        An applicant may be associated with more than one file.

viii.   One or more land dispute may occur in land parcels.

        A land parcel may be subjected to more than one land disputes.

(ix)   A land dispute may be associated with one or more file.

        A file may be associated with one land dispute.

Parcel, Applicant, File, Ward, Village, and Land Dispute are entities. The use of symbols represents the option or obligation of the concerned entity to participate in a relationship, while *one* or *more* reflects the degree of membership.

These enterprise rules are then transformed into an Entity Relationship (ER) diagram. Figure 6 - 2 depicts an ER for the Conceptual Model developed for the design of a database to support land management of the OSHCLB based on the enterprise rules. The entities identified at this stage are further developed into attributes and used to determine table contents.
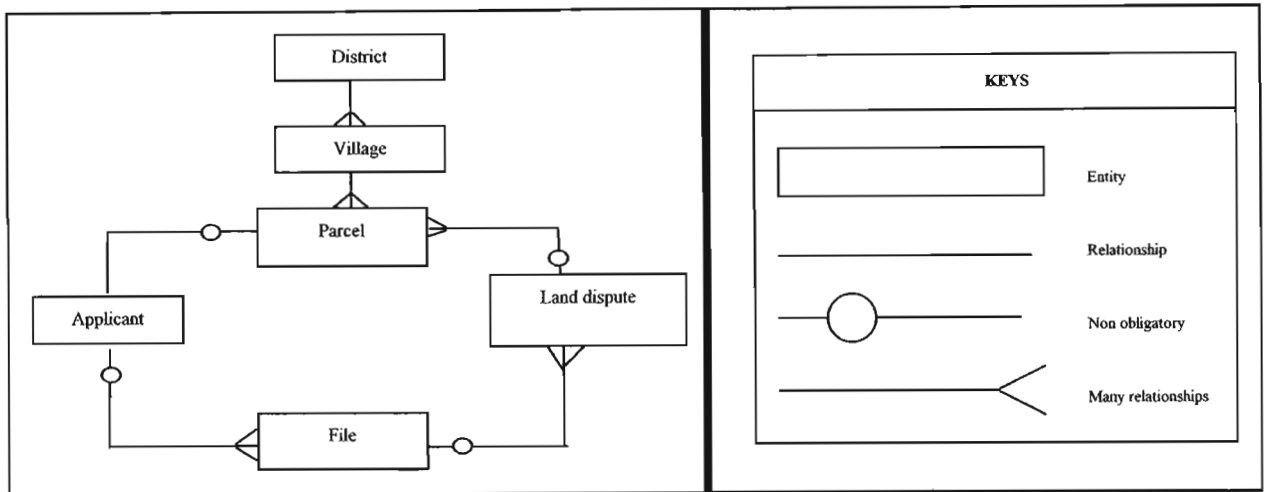
Figure 6 - 2: Entity Relationship for OSHCLB Conceptual Data Modelling.

6.6.3 Logical Database Design

In logical database design, a detailed review will be performed on the OSHCLB processes supported by the database. Individuals' reports, transitions, screens and on required by these processes, and determine exactly what data are to be maintained in the database and the nature of that data. The individuals' views will be combined, or integrated, into a comprehensive database structure. The result is a complete picture of the database without any reference to a particular database management system for managing this data. This logical database design is then compared with the conceptual design, and discrepancies are reconciled. With the final logical database in place, a computer program(s) will be identified to maintain queries and report of the database contents.

However, appropriate tables were formulated starting with well-normalized skeleton tables and later fully normalized tables showing all attributes relevant for implementation on a relational database management system.

6.6.3.1 Skeleton Tables

From the previous identified entities relationship diagram, skeleton tables were created to identify what each entity could contain. These tables are representation of entities or relationships in a relational data model showing key attributes, which are important for linking various tables in the database to create views, which constitute a basis for various applications. The following well-normalized skeleton tables were formulated. Normalization is a process whereby inherent problems and complexities are identified and corrected.

(i) Well Normalized Skeleton Table

From the previous identified entities relationship diagram, skeleton tables were created to identify what each entity could contain. These tables are representation of entities or relationships in a relational data model showing key attributes, which are important for linking various tables in the database to create views, which constitute a basis for various applications. The following well-normalized skeleton tables were formulated. Normalization is a process whereby inherent problems and complexities are identified and corrected.

(i) Well Normalized Skeleton Table

- o District (district_id,……………….., village_id)
- o Village (village_id,…………………)
- o Parcel (parcel_id,……………, district_id, file_id)
- o Applicant (applicant_id,……………………..)
- o File (file_id,…………….applicant_id)
- o Land_dispute (dispute_id, parcel_id………….)

(ii) Fully Normalised Table

At this stage a further normalization was performed in order to add other attributes, other than the key attributes, and to remove redundancies by removing functional dependencies.

Attributes defined by Mothibi (2003), as details that qualify, identify or express state of an entity. Attributes could be single or multi-valued and composite. An entity may have more than one possible key attribute, which is referred to as candidate identifiers. Identification of attributes involves serious consideration of details that describe entities. Once identified these are given unique names, length, types, synonyms and other related details that best describe entities.

When assigning an attribute to an entity the following guidelines in table 5 – 3, are applied as observed by Mothibi (2003):

Table 6 - 3: Entity-Attribute-Relationship (EAR) Table (Mothibi, 2003)

1. If relationship is 1:1 and membership is:	o	Obligatory for both entities, then attributes of both entities should be put into a single table.
	o	Obligatory for only one entity, then two tables should be defined for each entity. The identifier of the non-obligatory entity should be posted into the obligatory entity's table.
	o	Non-obligatory for both entities, three tables should be defined one for each entity and one for the relationship. The identifiers of both entities become the identifier of the relationship.
If relationship is 1:M and membership is:	o	Non-obligatory both sides, three tables should be defined, one for each entity and one for the relationship. The identifiers of both entities become the identifier of the relationship.
	o	Non-obligatory on the '1' entity and obligatory on the 'M' entity, two tables should be defined for each entity. The identifier of the '1' entity should then be posted into the 'M' entity table.
	o	Obligatory both sides, two tables should be defined with the identifier of the '1' entity posted into 'M' entity table.
	o	Obligatory on the '1' entity and non-obligatory on the 'M' entity, then their tables should be defined one for each entity and one for the relationship. The identifiers of both entities become the identifier of the relationship.
If the relationship is M:N	o	Three tables should be defined regardless of the membership. One table for each entity and one for the relationship. The identifiers of both entities become a composite identifier of the relationship.

The fully normalized tables were obtained from the skeleton tables using the above rules and the results were as follow below:

o District (district_id, village_id, trad_authority_name, headman_name, constituency_name, region_name)

o Village (village_id, district_id, trad_authority_name, headman_name, constituency_name, region_name)

o Parcel (parcel_id, land_use, area_size, allocation_date, locality_info, file_id, village_id, district_id, trad_authority_name, headman_name, right_type, development_ status, constituency_name, region_name)

o Applicant (applicant_id, parcel_id, surname, firstnames, sex, birth_date, citizenship, address, business_name, telephone, village_id, district_id, constituency_name, region_name)

o File (file_id, applicant_id)

o Land dispute (dispute_id, parcel_id, dispute_type, village_id, district_id, trad_authority_name, headman_name, constituency_name, region_name, dispute_status).

6.6.4 System Implementation

The system implementation was achieved by developing a database that mapped the fully normalized tables described above in relations using a relational database management system software package MS-Access. This resulted in the development

of a non-spatial database. A spatial database using digital spatial data acquired in ArcView software was also developed and the two were later linked to facilitate data querying.

6.6.5 Non-Spatial Database

The non-spatial database was developed using MS Access. Each entity identified had its own table containing relevant attributes. In addition there were relation tables to facilitate relationship between certain entities in the database. Each of the involved tables had its structure defined in Design View and later populated with simulated data values. Real data values could not be used to avoid the violation of the privacy. The tables were developed as follows:

6.6.5.1 Parcel Table

In the parcel table, it contains all the attributes that relate to it. The parcel can be defined as a plot or farm. The *parcel_id* is the parcel identity number, which refers to plot or farm certificate number allocated, while the *file_id* is the file number according to the OSHCLB Filling System. The *parcel_id* is a primary key and serves as the link to other related tables between the spatial and non-spatial data sets. Table figure 6 - 3 shows the view of the parcel table once populated with simulated data values.

Parcel id	Land_use	Area siz	Allocat date	File_id	District id	Village_id	Locality I	Dev_status	Authority n	Right_type	Constituency
OSHCLB (CR) 001	Farming	210	10.10.2004	1/3/1/2/CR/F/ D5		V002	Old	Developed	Uukwambi	Farming Uni	Uuvudhiya
OSHCLB (CR) 002	Residential	27	12.05.2004	1/3/1/1/CR/R D4		V005	Old	Developed	Oukwanyama	Residential	Ongwediva
OSHCLB (CR) 004	Residential	15	17.03.2004	1/3/2/1 CR/R/ D9		V015	Old	Developed	Oukwanyama	Residential	Ongwediva
OSHCLB (CR) 005	Residential	17	12.01.2005	1/3/1/3/CR/RI D4		V007	New	Not develope	Uukwambi	Residential	Okatana
OSHCLB (CR) 006	Residential	19	23.07.2004	1/3/1/1/CR/3 D7		V010	Old	Developed	Onkinga	Residential	Ondangwa
OSHCLB (LR) 007	Business	7	18.05.2004	1/3/3/1/LR/B/ D7		V025	Old	Developed	Ondonga	Business U	Okafjali
OSHCLB (LR) 009	Business	10	19.01.2004	1/3/3/1/LR/B/ D1		V011	Old	Developed	Uukwambi	Business U	Okatana
OSHCLB (LR) 010	Business	12	22.10.2005	1/3/3/1/LR/B/ D2		V008	New	Not develope	Ondonga	Business U	Uuvudhiya

Figure 6 - 3: The Parcel Table

6.6.5.2 Applicant Table

Applicants referred to an individual or organisation owner qualify of leasing or holding a piece of land under customary land right. A National Identity Document (ID) number is used as the *applicant_id*. If it is an organization the registration number is used as the identity. The *applicant_id* is a primary key and a link between the applicant and other tables. Figure 6 - 4 shows the view of the subject table once populated with simulate data values.

Applicant: Table : Table												
Applicant id	Parcel id	Surname	Firstnam	Village id	District id	Region	Address	Telephc	Sex	Citizens	Birth dat	Business nam
540912001	OSHCLB (CR) 004	liyambo	Frans	V003	D3	Oshana	Box 1126, Osl	224530	M	Namibiar	12/09/54	PK pty ltd
670912345	OSHCLB (LR) 009	Nuule	Maria	V004	D5	Oshana	Box 3452, Onc	243423	F	Namibiar	12/09/67	YaNehale Co
700807243	OSHCLB (CR) 002	Vambuletu	Haleluja	V010	D5	Oshana	Box 8726, Out	253425	F	Namibiar	07/08/70	Nafidi Nounona
750504003	OSHCLB (LR) 011	lita	Shongomt	V019	D9	Oshana	Box 4587, Osl	221234	F	Namibiar	04/05/75	Namibian Lodg
760912001	OSHCLB (LR) 005	Jose	Maria	V008	D2	Oshana	Box 888, Ond:	241900	F	Namibiar	12/09/76	Kunakonasha
820330981	OSHCLB (CR) 015	Mutembi	Moses	V007	D7	Oshana	Box 543, Ond:	243425	M	Namibiar	30/03/82	Gecko

Figure 6 - 4: The Applicant Table

6.6.5.3   The File Table

The file table relates to applicant and parcel tables through the *applicant_id*. The *file_id* is a unique identifier and must not be duplicated. The *file_id* is the primary key for the file table. A file_id is also associated with a particular parcel. The file referencing system used was adapted from OSHCLB Filling System. An example:

o **1/3/3/1/LR/B,** read as file volume number and Leasehold **Right / Business**

o **1/3/2/1/CR/R,** read as file volume number and Customary **Right / Residential**

o **2/1/4/LD/ IF,** read as file volume number and Land Dispute / Illegal Fencing

In Figure 6 – 5 shows the view of the file table once populated with data values.

File: Table : Table	
File_id	Applicant_id
1/3//1/3/CR/RF/1	770702134
1/3/1/1/CR/R/2	801230111
1/3/1/2/CR/F/3	750606002
1/3/2/1/CR/R/4	560412345
1/3/2/2/CR/F/5	450125923
1/3/3/1/LR/B/1	501010001

Figure 6 - 5: The File Table

6.6.5.4   The District and Village Tables

The district and village tables contain district and villages respectively found in the communal area of Oshana Region. All these villages fall in the communal areas. Unique identifies, *district_id* and *village_id*, are assigned to each district and village respectively as a codes. The primary key for ward is *district_id* and village is *village_id*. Figure 6 - 6 and 6 – 7 shows the district and village tables respectively once populated with data values.

District: Table : Table					
District_id	Village_id	Authority_name	Headman_name	Constituency	Region_name
D1	12	Oukwanyama	Jonas Petus	Ongwediva	Oshana
D2	2	Uukwambi	Halolye Shilongo	Uuvudhiya	Oshana
D4	2	Ondonga	John liyambo	Okatjali	Oshana
D5	2	Uukwambi	Vatileni lita	Ompundja	Oshana
D9	2	Uukwambi	Maria Wetu	Uuvudhiya	Oshana

Figure 6 – 6: District Table

Village id	District id	Authority name	Headman name	Constituency	Region name
V006	D1	Uukwambi	Moses Iita	Uuvudhiya	Oshana
V012	D3	Oukwanyama	Helao Nafidi	Ongwediva	Oshana
V017	D9	Uukwambi	George Petrus	Uuvudhiya	Oshana
V023	D8	Ondonga	Maria Nuule	Ondangwa	Oshana
V035	D7	Uukwambi	Tresia Shikongo	Ompundja	Oshana

Figure 6 - 7: Village Table

6.6.5.5 Land Dispute Table

The land dispute table contains details about land dispute area / plot. These include disputed area / plot, location, size and type of dispute. The *dispute_id* is the unique identify key and primary key, which serves as a link to other tables. In figure 6 – 8 shows the view of customary land right table once populated with simulated data values.

dispute id	parcel id	dispute type	Village id	District id	Headman name	Constituency name	Region	Status
LD1	OSHCLB (CR) 003	Illegal fencing	V011	D5	Helao Nafidi	Uuvudhiya	Oshana	Pending
LD2	OSHCLB (CR) 012	Double allocation	V015	D6	Joel Taati	Okatjali	Oshana	pending
LD3	OSHCLB (CR) 019	Self extension	V007	D1	Loini Eelu	Uukwiyu	Oshana	Resolved
LD4	OSHCLB (LR) 004	Boundary	V023	D2	McLeod Hafeni	Okatana	Oshana	Referred to TA
LD5	OSHCLB (CR) 021	Widow eviction	V015	D8	Maria Nuule	Oshakati-West	Oshana	Referred to TA
LD6	OSHCLB (LR) 027	Illegal occupation of co	V009	D5	Tresia Shikongo	Ompundja	Oshana	Pending
LD7	OSHCLB (CR) 033	Illegal grazing	V018	D9	Pandelia Joseph	Uuvudhiya	Oshana	Resolved

Figure 6 - 8: Land Dispute Table

The entire tables depicted and described above form a database that can be queried for more information as there is a relationship existing amongst them. Information contained in all the tables can be queried from various applications. The database generated here would be joined to spatial attribute data table to make it one.

6.6.6 Spatial Database

Spatial database deals with the spatial or location aspect of parcels. Spatial context is reflected by way of maps or layouts that are linked to the non-spatial data. As an example to the development of the information system, land dispute location is used to demonstrate a link that exists between spatial and non-spatial data sets. The parcel identities used in the parcel table of the non-spatial database correspond to those on the cadastral layout in order to facilitate the linking of spatial and non-spatial datasets to facilitate querying later.

6.6.7   Linking Spatial and Non-Spatial Database

The graphical and geodetic framework should be linked so that measurement experts can work from the geometric data to the graphical and back again. The base map should:

o   Supply a common frame of reference that could be visualized and used by both decision makers, experts and planners.

o   Make it possible to use information of various scales by referring either to the major features depicted or to the measurements, depending on the level of skills of the map or data user.

o   Make it possible to link spatial information of various degrees of accuracy, either by cleaning up the data or through eyeball generalizations related to graphical information.

o   Make it possible to link graphical information to any existing cadastral surveys; existing information from sporadic surveys could be linked to such a base map, as could any additional future surveys, either graphically or geometrically, depending on the resources available

o   Be created for a manual or paper system, but be capable of being transformed into a GIS / LIS.

GIS links features on map or information about them. This link between the map features and their attributes is the fundamental application of GIS. Querying the database tables to make an all inclusive query table does this. In this regard, applicant and land dispute tables are queried. Firstly, applicant and land dispute tables were queried to establish the relationship. Figure 6 - 9 illustrates how a query can be formulated using *applicant* and *land dispute* tables, while figure 6 – 10 shows the results of one of the queries formulated.
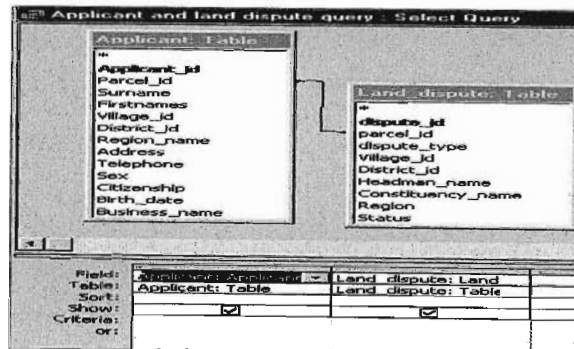

Figure 6 - 9: Applicant and Land Dispute

A relationship that exists between the two tables is shown by the link, that of *parcel_id*, a field contained in both tables.

Applicant_id	Applicant	Surname	Firstname	Appli	Region	Address	Telephc	Sex	Citizens	Birth_dat	Business	disput	dispute_	Land_di
670912345	OSHCLB (L	Nuule	Maria	D5	Oshana	Box 3452, Onc	243423	F	Namibiar	12/09/67	YaNehale (	LD5	Widow ev	V015
750504003	OSHCLB (L	lita	Shongomb	D9	Oshana	Box 4587, Ost	221234	F	Namibiar	04/05/75	Namibian L	LD5	Widow ev	V015
700807243	OSHCLB (C	Vambuletu	Haleluja	D5	Oshana	Box 8726, Out	253425	F	Namibiar	07/08/70	Nafidi Nour	LD5	Widow ev	V015
760912001	OSHCLB (L	Jose	Maria	D2	Oshana	Box 888, Onda	241900	F	Namibiar	12/09/76	Kunakonas	LD5	Widow ev	V015
540912001	OSHCLB (C	liyambo	Frans	D3	Oshana	Box 1126, Ost	224530	M	Namibiar	12/09/54	PK pty ltd	LD6	Illegal occ	V009
820330981	OSHCLB (C	Mutembi	Moses	D7	Oshana	Box 543, Onda	243425	M	Namibiar	30/03/82	Gecko	LD6	Illegal occ	V009
670912345	OSHCLB (L	Nuule	Maria	D5	Oshana	Box 3452, Onc	243423	F	Namibiar	12/09/67	YaNehale (	LD6	Illegal occ	V009
750504003	OSHCLB (L	lita	Shongomb	D9	Oshana	Box 4587, Ost	221234	F	Namibiar	04/05/75	Namibian L	LD6	Illegal occ	V009
700807243	OSHCLB (C	Vambuletu	Haleluja	D5	Oshana	Box 8726, Out	253425	F	Namibiar	07/08/70	Nafidi Nour	LD6	Illegal occ	V009
760912001	OSHCLB (L	Jose	Maria	D2	Oshana	Box 888, Onda	241900	F	Namibiar	12/09/76	Kunakonas	LD6	Illegal occ	V009

Figure 6 – 10: The Results of the Query for the Applicant and Land Dispute

6.7 Testing of the Proposed OSHCLB - LIM System

6.7.1 Spatial Queries

Information associates with graphic objects displayed on the map can be obtained even without the use of queries. This is through the identifier tool, which link the map to the attribute information. This was possible even before the two tables were joined. Figure 6 – 11 below shows the spatial link between the layout and its attributes table. The selected feature highlighted in yellow on the map. The id, area, perimeter and hectares were shown on the results.
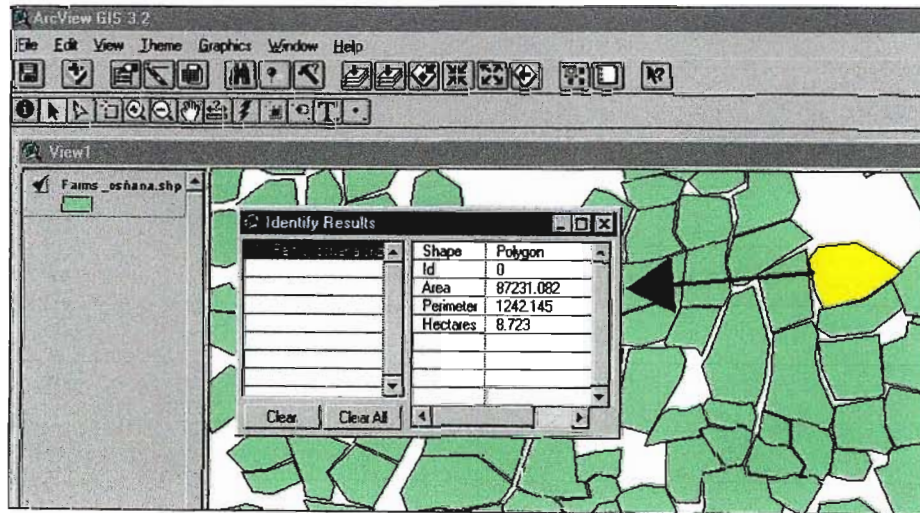
Figure 6 - 11: Spatial Identification

A map can also be queried to obtain information about a particular parcel prior to joining datasets. Figure 6 - 12 shows the results of a query to find out parcels of area less than or equal to 20 hectares. Parcels that satisfy the query condition are in yellow.
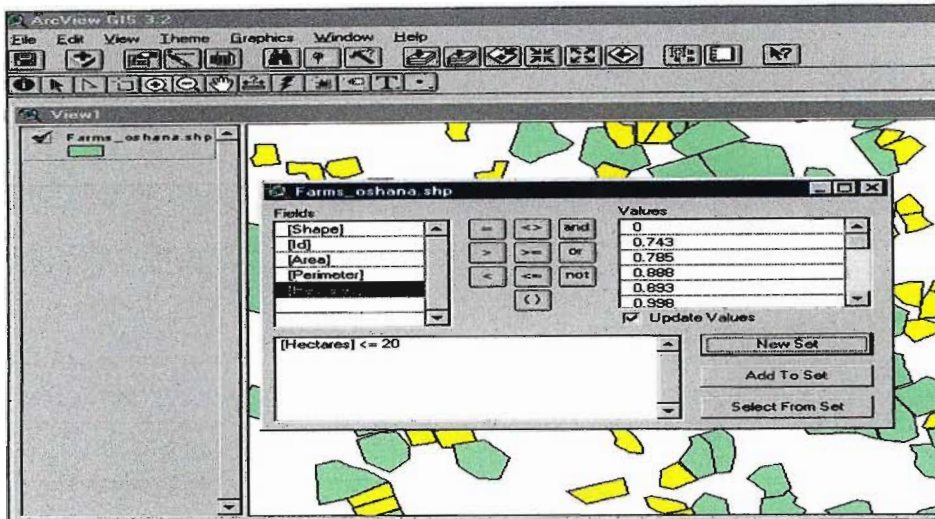
Figure 6 - 12: Map Query

6.7.2   Non-Spatial Queries

Non-spatial queries are conducted on the spatial attribute data in the MS-Access database. The following was an example of such queries:

> Identify parcels that are under customary land right, and the land dispute, which occurs or disputed areas.

The relationship that exists between the File, Parcel and Land Disputes Tables are shown by the linkages in query, Figure 6 - 13.
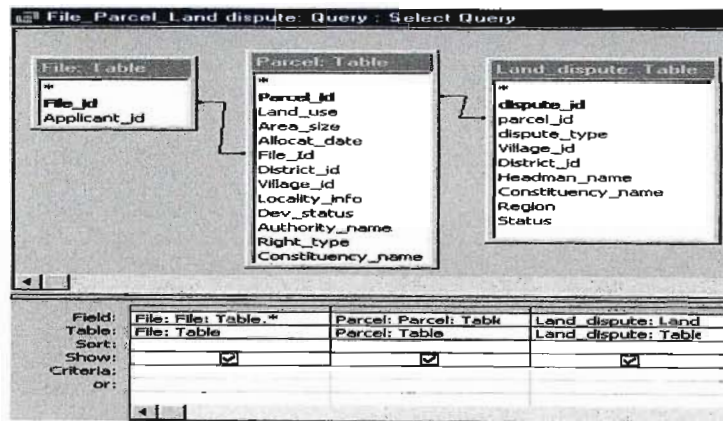
Figure 6 - 13: The Relationship Between Tables

6.7.3   Integrated Queries

Integrate queries were also used to test the system after combining the two attribute datasets. Figure 6 – 14 below shows results of parcels that meet query condition, that of parcels, which are less than or equal to 20 hectares. These are highlighted in yellow on both the map and table of attributes.
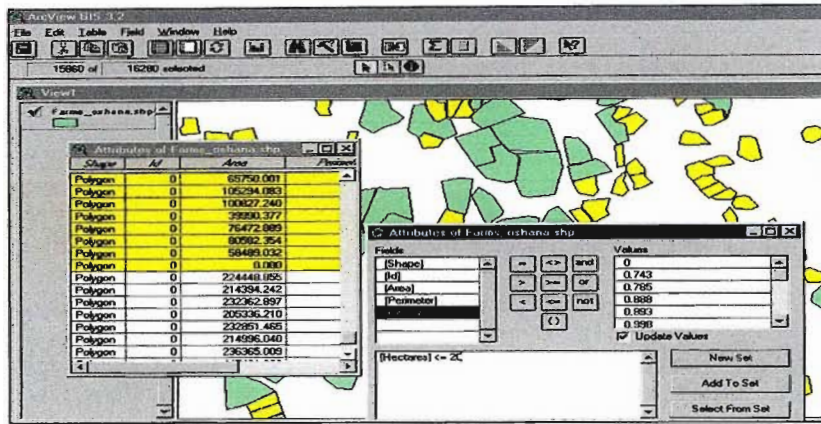
Figure 6 - 14: Integrated Map Query

6.7.4 Creation of Forms

Forms can be created from tables or virtual tables (queries). Forms were a means by which an interface between the user and the system were developed. They enable the user to interact with the system without necessary having any knowledge of how data was organized. Such interfaces should be easy to use and understand. Different software provides different ways of creating forms. However, only forms developed in Microsoft Access were discussed in this study.

Forms based on tables display data available in a single table only. Figure 6 - 15 depicts a form created from the Applicant Table.
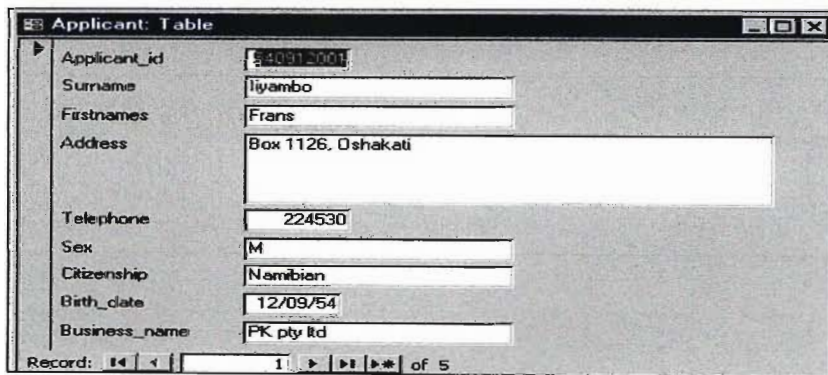
Figure 6 - 15: Applicant form

6.8 Results

The proposed system was tested by running test queries on the developed database in order to assess its effectiveness in handling routine queries attended by the Oshana Communal Land Board using spatial, non-spatial and integrated queries as demonstrated above. Queries and analysis tools were used to investigate geographical relationships in data and define relationship among sets of data.

6.9   Concluding Remarks

The results obtained in the system through the performed testing reflect that the system could be designed and developed for implementation using the proposals suggested. Both spatial and non-spatial data sets were queried from the system to double check if it works. In addition to the queries, forms can also be created from both the original Tables and Query Tables.

6.10   Recommendation

o   Spatial data and non-spatial data sets could be linked to complete the Land Information Systems. The current practice whereby spatial and non-spatial data sets exist independently weakens the information system. Designing a Land Information Systems application can provide the link between the two data sets (spatial and non-spatial).

o   The proposed OSHCLB - LIM System need to be evaluated operationally, technically and economically before implementation.

o   Development of professional training programs is a necessity to ensure the human capability for geo-information management.

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CHAPTER 7:

SUMMARY AND DISCUSSION

</div>

7.1 Introduction

This chapter present the summary and discussion of the results. These include the key role played by the OSHCLB in the communal land dispute resolution and the design of the LIM System. The fact that over 85% of the OSHCLB work involves land and geographically related data, it need to invest in LIS application that will help in managing information services and support all decisions. LIS contains digital data concerning all relevant aspects of the region, and to computer processing and analysis.

Since the establishment of the OSHCLB, it had been trying to keep conventional records of information pertaining to land parcels; new customary land rights, recognition of the existing customary land rights and rights of leasehold allocated, and land disputes reported and resolved in communal areas of Oshana Region. However, spatial information system about the land ownership records is still does not exist in a well-designed and organised manner.

7.2 The Communal Land Reform Act, No. 5 of 2002 (CLRA, No.5, 2002)

Before the enactment of the CLRA, No.5 (2002), Chiefs and Traditional Authority played a key role in communal land allocation. They have exercised this function according to the Customary Law and tradition. Often, their administrative actions pertaining to land allocation have been challenged as unfair and bias (MLRR, 2005).

It is against this background that the Communal Land Reform Act was developed to provide for the establishment and empowerment of Communal Land Boards in this regard. This Act does not only provide for the establishment of Communal Land Boards as trustees of Communal Land, it also placed Communal Lands under the administration of the Communal Land Boards and Traditional Authorities and defined the rights and duties of Communal Land Boards.

7.3 The Oshana Communal Land Board (OSHCLB)

The OCLB began its work in 2003. Its creation however, did not affect any land allocations made before its establishment. Land allocations lawfully made by Chiefs

or Traditional Authorities in the past were still valid. But after March 2003, all allocations made by Chiefs or Traditional Authorities are being registered and ratified by OSHCLB before they become valid.

Among others functions of the OSHCLB is to create and maintain a register where the allocation, transfer and cancellation of customary land rights and rights of leasehold are recorded and kept to date. Therefore, there is need to have a properly database which allows for data storage in the correct format as well as quick and easy retrieval of information. The LIS is an integral part of the realization of the OSHCLB and its service provision.

7.4   Information Flow

The purpose of the OSHCLB LIM Systems' is to provide the stakeholders and beneficiaries with the required services (information) and products (customary land rights maps and certificates). Data collection, processing and storage in a manner, which makes information easily retrievable, is of utmost importance. This necessitates a thorough understanding of what is expected of the OSHCLB's and a database designed accordingly. The figure 7 - 1 shows the information flow through the OSHCLB, which supports its operation. This entails the collection of the necessary spatial and attribute data, which in turn would be used to populate the database and thus provide answers to queries, which would arise.
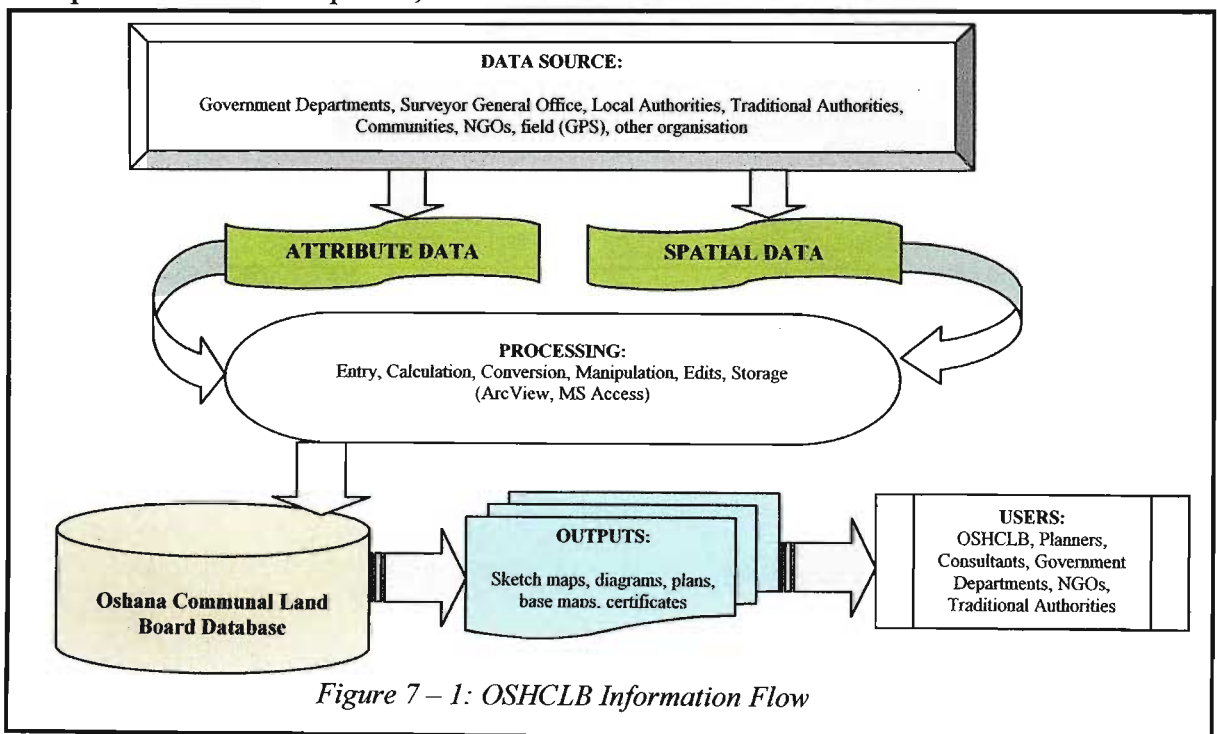
Figure 7 – 1: OSHCLB Information Flow

Among others of the main stakeholders with whom the OSHCLB's interact are identified as shown in the context diagram, figure 7 - 2.
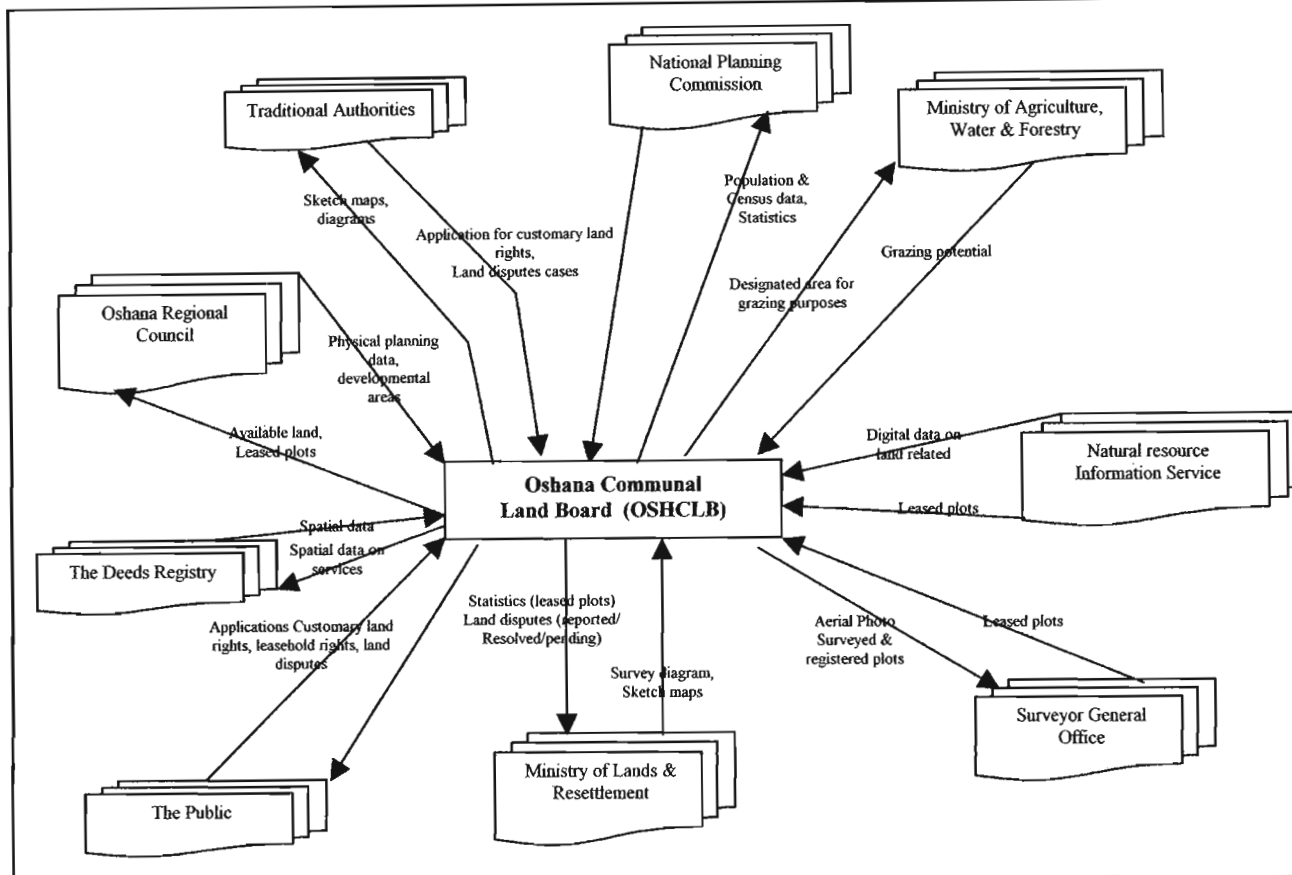
Figure 7 – 2: Context diagram of the OSHCLB

7.5   Land Dispute Resolution Process Analysis

7.5.1   Current Situation

The interviews done with the OSHCLB members which were complimented by the fieldwork in Oshana Region' communal areas reveal that there is a need for proper system on land record keeping. The system will be able to store, retrieval and analyse information at ease and in a quick manner to help in communal land dispute. The existing methods of land dispute in figure 7 – 3, depicts some characteristics.

- o   The system lack up-to-date records on land parcel information.
- o   The current system is not designed to resolve conflicts over land use or facilitate decision-making.
- o   The system is not transparent or user friendly.
- o   Cumbersome, lengthy, time consuming and administrative procedures. *See also appendix 2.*
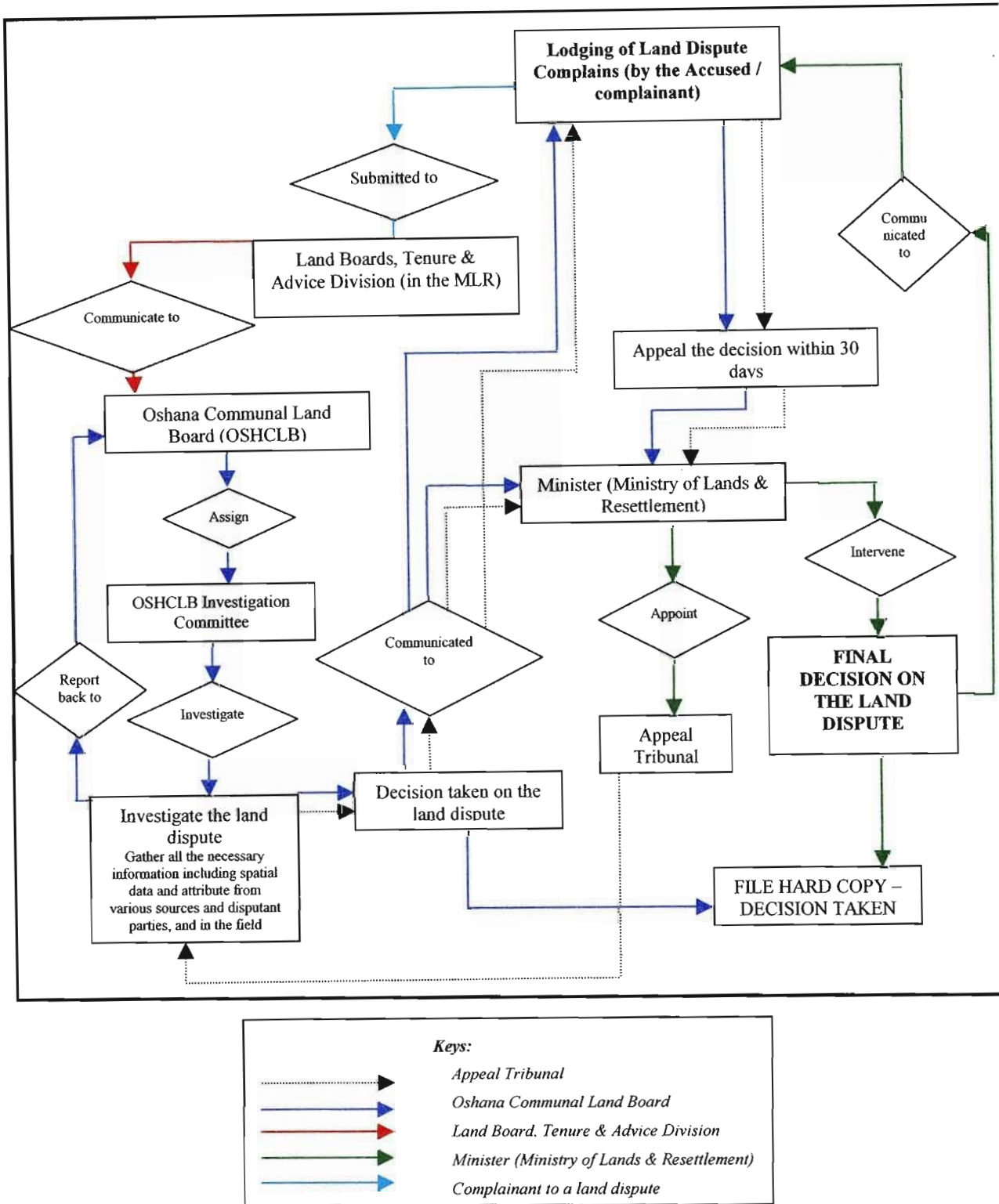
Figure 7 - 3: Current Situation Analysis of Land Dispute Resolution

As a tool for data collection, Global Positioning System (GPS) is very excellent for creating and sustaining LIS / GIS. GPS will be used to record data inputs for every land parcel allocated. With the GPS recorded data inputs, accuracy of the mapped feature/s will be quantified, because every feature/s on the map will have its

geographical linked location. GPS will be used to spatially records land records coordinates on all land allocated. During the field collection for this research, some data were collected with GPS and analyzed with computer software such as MS Excel and ArcView GIS to produce the map shown in figure 7 – 4 *(See also appendix 3).*
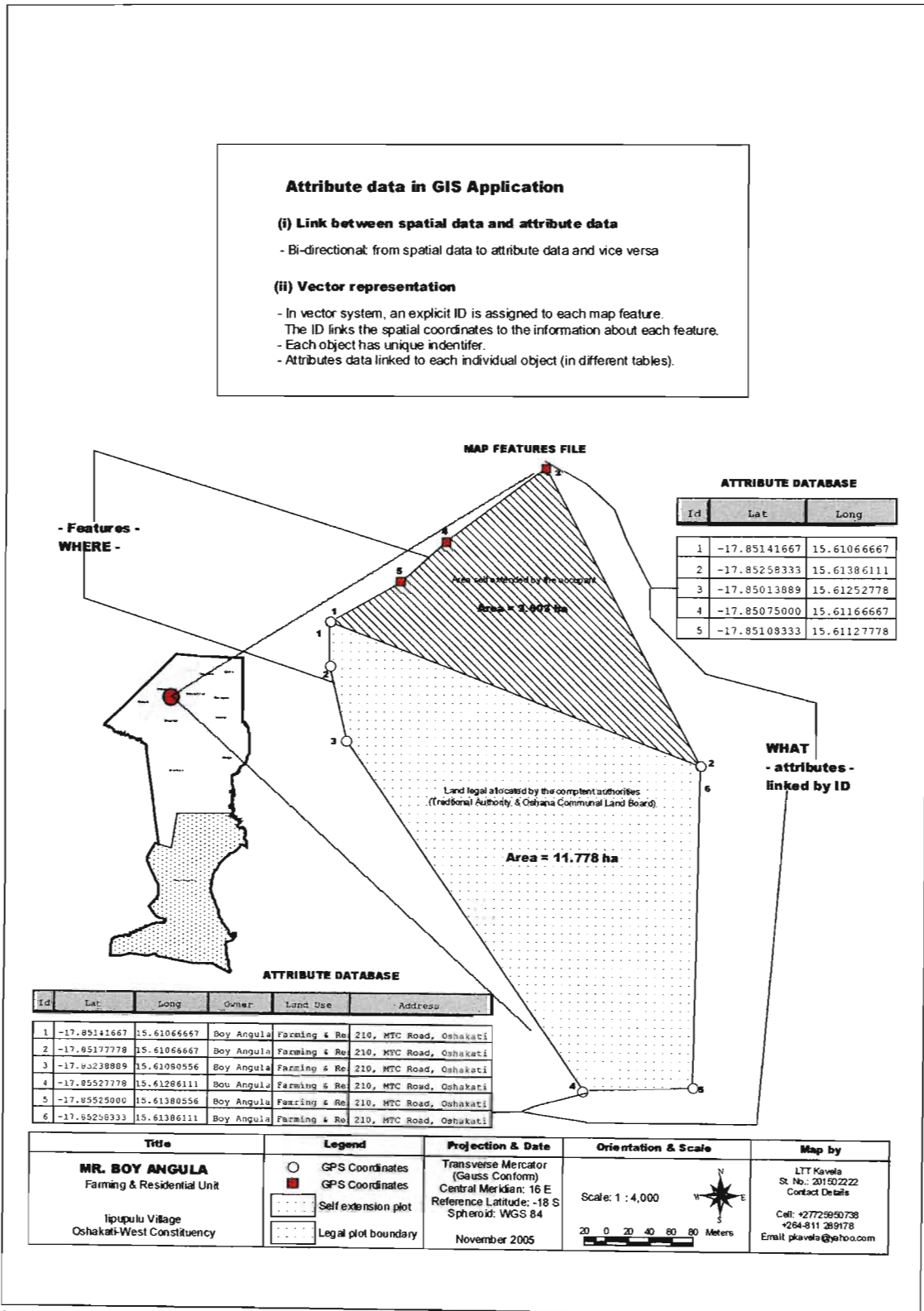
Figure 7 - 4: Linking Spatial Data and Attribute Data

7.5.2 Environmental Situation

The designed system should interact with the stakeholders and other users. For the OSHCLB to meet its beneficiary's requirements, it must determine what opportunities and threats do exist. This necessitates scrutinizing its surroundings to determine what opportunities it must take of and threats to avoid then innovate system to mitigate against them as shown in figure 6 - 5. In order to do this external scan, it is incumbent on the organisation to look within and analyze its own strengths and weaknesses. It is only by being internally ready that it can take advantage of its surrounding. By looking at the internal and external situation in Oshana Region, the following environmental issues in table 7 - 1 were apparent:

Table 7 – 1: Internal and External Scan

Internal Scan	External Scan
Lengthy process in land dispute resolution	Government want the system that meets the needs of all stakeholders.
Lack of personnel capacity on LIS application and other computerized system e.g. GIS application.	Scarce of financial to support and sustain the envisaged system from the Government.
Inaccessible of land related information between the communities and other end users.	Cheaper alternative land information management exist and computerized information systems can support them
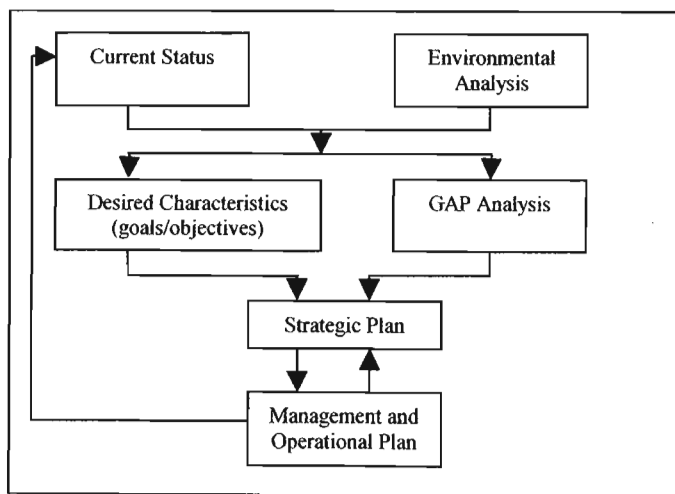
Figure 7 – 5: Planning Model (Robinson, 2003)

7.5.3 Desired Characteristics of an Organisation

The desired future of the organisation dictates (Robinson, 2003):-

- o What the organisation is?
- o What the organisation should be?
- o What the organisation can be?

In order words, it provides the vision, goals, priorities, targets and an accompanying time frame for achievement. This proceeds as a natural progression from the analysis of the current situation and the environmental scan.

7.5.4   Gap Analysis

Analysing of the present situation that exists in the communal land dispute resolution in Oshana Region, Namibia and on analysis of the desired future, there are clear gaps present. These gaps manifest themselves in the following ways:

- o   The communities have different expectations than those of the OSHCLB with regards to communal land dispute resolution.

- o   The existing system for land dispute resolution is unable to accommodate other stakeholders with regards to land dispute resolution and sharing of much needed already collected spatial data.

- o   Lack of capacity building for its staff members.

- o   The OSHCLB need to be an autonomous body, but financial allocation from the Government hampers this proposal.

- o   Lack of funds.

7.6   SWOT Analysis

In order to properly analyze the mess into which land dispute resolution process has found itself, it is important to collate the environmental scan scenarios and their consequences thus producing strategies to chart the way forward. According to Robinson (2003), Strengths, Weakness, Opportunities, Threats (SWOT) analysis can be employed to study environmental factors.

There is a need to look at the available opportunities, which could be exploited. The threats that exist must never be forgotten, as they would indicate obstacles that need to be surmounted. To be able to successfully face these opportunities and threats, a thorough introspection must be undertaken. This entails itemizing one's known strength and weaknesses. By matching the internal strengths and weaknesses against the external opportunities and threats, clear strategies charting the way forward can be formulated in appendix 4.

7.7   Design, Operation and Maintenance of OSHCLB - LIM System

For the OSHCLB to meet the needs of the communal land residents within Oshana Region, specific services must be offered. The result is the communal land dispute resolution; certain activities must take place in order to facilitate this service delivery. This is shown in table 7 - 2 below

Table 7 - 2: Design, Operation and Maintenance Plan of OSHCLB LIM System

SERVICES	OBJECTIVES	EXPECTED OUTCOME	PERFORMACE INDICATOR	RESOURCES
Customer service	- Assist the public - Link between the stakeholders and users - Answer relevant issues and concerns.	- Public confident and cooperation - Simplified of the land recording and keeping process	- All land queries, disputes and transactions completed on time upon request.	- Human resources; and finance - Hardware and software equipment - Field equipment
Spatial Data Collection	- To Assist in adjudication -To map customary land rights and leasehold rights	- Up-to-date information - Complete dataset for Oshana Region.	- Spatial data collected and computed within one week of application as well as maps produced. - Back up and update of data on a regular basis.	- Human resources; and finance - Hardware and software equipment - Field equipment; and transport
Attribute Data Collection	- Records of all transactions - Keep a register of all land parcels	- Better service provision - Analysis and predictions of future of current and future land dispute.	- Increased service delivery/improved quality services. - All land related disputes resolved within one month of lodging a complainant. Reports on land disputes resolved.	As Above.
Data Processing	- To check acquired data for completeness and correctness - To ensure correct procedures are followed in land dispute resolution.	- Error free. - Land dispute resolved - Land allocated and owner given certificates.	- Reduction in time for the processing of land application, dispute resolution and processing of certificates. - Number of certificate issued.	- Human resources - Finance - Hardware and software equipment.
Data storage	- To have update and easily accessible database	- Current and functional database	- Continuous updating of the database	- Human resources - Hardware and software
Data Dissemination	- Respond to stakeholder and user requests - Cooperation and data exchange among geo-information producers.	- Exchange of geo-information.	- A weekly exchange of data among stakeholders - Reduction in duplication of data collection, gauged by an increase in data sharing.	- Human resources - Hardware and software
System Maintenance	- To ensure the optimal performance of personnel, office and machinery.	- Dedicated and motivated personnel. - Perfectly operational equipment.	- Continued positive remark on end of year evaluation forms. Considering 75% satisfaction is minimum.	- Human resources - Finance

7.7.1   The OSHCLB Land Information Management System
7.7.1.1   The System Architecture

Architecture, in this context may be defined as 'the manner in which the components of a computer system are organised and integrated. The manners in which these components are organised depend on the circumstance under which they are supposed to realise their stated products and services. The main constraints are usually operational costs, equipment acquisition and the lack of trained and/or trainable personnel (Robinson, 2003).

7.7.1.2   Components of System Architecture

(i)   Hardware

According to Robinson (2003), from the hardware perspective, each of these software packages suggests the minimum-operating environment needed for proper performance. The recommended requirements are stated below:

- o Computer with Pentium 650 megahertz (MHz) of higher processor. Pentium IV are recommended.

- o 128 MB of RAM plus an additional MB of RAM.

- o 245 MB of available hard disk space. An additional 115 MB is required on the hard disk where the operating system is installed. Users without Windows XP, Window 2000, Window Me, or Office 2000 Service Release 1 (SR – 1) require an extra 50 MB of hard disk space for System Files Update.

- o Windows NT 4.0 with Service Pack 6 (SP6) or later, Windows 2000, or Windows XP or later.

- o CD-ROM drive.

(ii)   Software

The use of ArcView and Microsoft Access (MS Office) software are widely used by many organisations in Namibia, thus, it will be wiser for OSHCLB to use the same software to avoid complication. At present the software costs for the recommended packages are:

- o ArcView (single user yearly licence):   US $ 1,600.00

- o Microsoft Office XP Professional (Single user yearly licence): US $ 600.00

- o **SUB-TOTAL:**   **US $ 2,200.00**

7.7.1.3   LIS Standardization

There is a direct and paramount need for standardization of technologies and interfaces in use by various geo-information to ensure creation of compatible LIS at all levels, be they national, municipal, local, or institutional. These standards, for data transfer and exchange, also need to be included in the legislation.

7.7.1.4   Storage (backup digital and analogue archiving)

All data entered into the system must be backed-up in order to prevent all data and production capability being lost due to some mishap. The simplest and cheapest form of data backup is by the use of a Compact Disk Burning Rom and rewritable compact disks regiment on regular weekly downloads.

7.7.1.5   Data Capture, Exchange and Dissemination Equipment

At the moment geo-information being generated by the OSHCLB is in analogue form. This ranges from maps to customary and leasehold certificates. However, this does not make durable of data just by share and tear. The alternative here is to have all data digitally stored. This entails the photocopying and scanning of all paper-based documentation and having them stored in the digital databases.

These requires the following equipment:

- o   Scanner (regular, commercial flat bed scanner, 1200 x 2400 dpi): US $ 150.00
- o   Hand held GPS: US $ 150.00
- o   Photocopy machine (accepts A3 printing):   US $ 800.00
- o   A3 printer: US $ 300.00
- o   **SUB TOTAL :**   **US $1400.00**

Various organisations are currently involved in the collection of wealth information as it pertains to the land management. All of these data are essential to OSHCLB. Starting collecting this data, spells duplication of tasks and wasting of well-needed finance. There is a need for the establishment of a policy for the exchange of data among stakeholders. This policy must concern itself with data formats, levels of accuracy and timeliness to allow the use of data from external sources.

7.7.2 Staff Training

To support the capital investment by the execution of the required services, the need for training of staff becomes necessary. Added to this, staff members need to understand their role in the Office and the use of technological tools provided, to assist in the execution of their tasks. Rapid technological changes would dictate that there is constant upgrading of software, hardware and equipment; staff training is thus unavoidable (Robinson, 2003).

The OSHCLB staff members in table 7 – 3, will need training from time to time to be able to perform the required services efficiently and effectively. Against this background, the following staff compliment duties and their responsibilities need to be clear defined.

Table 7 - 3: Proposed OSHCLB Staff and Their Duties

POSITION	FUNCTION	ORGANISATION
Regional Deputy Director	o Coordinates & supervises the preparation of Business Plan o Submits quarterly report to MLR o Monitoring activities of Communal Land Boards in the regions.	MLR; North-North West Region Division
Chief Control Officer	o Overall responsibility for Land Board staff, vehicles & equipments o Supervises Land Board Staff. o Day-to-day operations of Land Board o Prepares a working calendar for Land Board Programme o Handles Regional correspondence, official reports etc.	MLR; North-North West Region Division
Control Officer	o Act as an accounting officer of the Board. o Provide secretarial services to the Board. o Execute decisions of the Board. o Handle applications for leaseholds, transfer, changes of users, and appeals against these decisions.	MLR; Land Board, Tenure & Advice Division
Development Planner / Land Use Planner	o Provides technical assistance and policy advice on all aspects of Land Use Planning. o Co-ordinates the preparation and implementation of Regional land Use Plans. o Co-ordinates and collects data on Land Utilization. o Provides assistance and advice to Land Boards on Land Use Matters.	MLR; Land Use Planning & Allocation Division
Survey Technician	o Assist in measuring fields / plots and preparation of sketches. o Records land allocations on sketch plans which are drawn to scale. o Assist in organizing the Land Board's record systems. o Assist in settling disputes by checking plots dimensions. o Interprets aerial photographs and Land Use Planning to the Board. o Accompanies Land Board members on allocation information gathering trips (e.g. boundary disputes demarcations).	MLR; Surveyor-General's Office

Sustainability of the OSHCLB's is dependent on the staff motivation and their ability to perform. To keep their performing at high levels, emphasis must be placed on creating a conducive work environment and keeping staff well trained and informed. Incentive programs, which reward performance, preferably not by financial means, must be an integral part of the Office culture.

7.7.3   Budget / Financial Autonomy

There is a need for OSHCLB to be financial autonomy. In most cases information at Central Governmental level has proved to be very difficult to access. The collection of geo-information and subsequent storage, querying and updating is a very expensive venture and thus need financial boost.

7.7.4   Evaluation and Maintenance

The impact of establishment of the new system is measured and analysed here. Since there is no LIM System exist for OSHCLB presently, what need to be evaluated are the user requirements, the impending legislation, and the compatibility between them. An evaluation of the implementation cost of the LIM System must also be conducted. Based on the rapidity of which hardware and software are being upgraded, a total evaluation of performance after 2 years must be necessary in order to get a true picture of the system operating at full performance.

7.8   The Contribution of the Designed OSHCLB LIS to Land Dispute Resolution Methods

The designed of OSHCLB LIS will help in recording and keeping of land records for use by OSHCLB. The System will make it possible to integrate spatial and kinds of geographical location. It enables the operator to put maps, graphic documents and others to manipulate and display geographical information in a new and exciting ways that were not possible in the conventional mapping systems.

As for DBMS, it contribute to methods for representing data in digital form, procedures for system design and handling large volume of data, accessing data and updating it. The computer can act as an expert in such functions as designing maps and generalizing map features. Manual processes of managing map information present problems related to capability to managing large amounts of information and the difficulties of updating information. It is no way to change information related to an individual parcel that appears with other parcels.

Analogue storage limits accessibility of data and is not capable of handling data manipulation processes. It generates large amounts of data for which there is no

capability to perform integrated analysis. Decision-making has become more complicated because of the nature of problems being addressed; globalisation has created a strongly integrated world community where simple data manipulation processes have not relevance and functionality.

For illegal occupation of Communal Area, it will be easy for the OSHCLB to know who occupy which portion of land, nature of uses of land, original use for which land was allocated and type of right. All the illegal occupiers will be detected, controlled and monitored. Boundary dispute, all portion of land demarcated and allocated to individuals will be mapped with GPS, and each plot coordinates will be recorded and kept for future reference. The double allocation, which occur because responsible Authority had allocated one piece of land to two parties will be minimised. All land records as per allocation done to individuals will be kept showing clear boundaries between individuals. All forms of communal land disputes including self-extension, illegal fencing will be controlled, as up-to-date information is available.

The benefits of the designed LIS application for OSHCLB can be summarised as follows:

- o The System that will minimise loss, misfiled and misplacement of information of a particular land parcel.
- o It will be easier to update, store, analyse, delete and output of information.
- o It requires less space as opposite to the currently storage of land records and other OSHCLB information in the filling cabinets in hard copies.
- o It is not cumbersome, less time will be consumed and less administrative procedures and support staffs are needed.
- o The LIS System will primarily designed to assist decision makers and increase OSHCLB's capacity to collect, interpret, and apply information, and to establish trends for improved decision-making.
- o The OSHCLB will computerize all their data pertaining to land management and administrative. All the spatial and non-spatial data sets will be linked together by using Geographical Information Systems (GIS). GIS has proved its capabilities and effectiveness in the link between map features and their attributes, data analysis, querying, manipulation and presentation.

o The envisaged LIS will be designed in such a user-friendly manner, that land information from diverse sources within a LIS system will be used, but referencing system and range of identifiers will be needed.

o More importantly, the parcel-based with up-to-date information will be created to guide in the resolution of land dispute that may arise on it. All the information on the land use (use rights), individuals' details (name, sex, address), property details (land use, location) etc., will be held and kept in the designed OSHCLB LIS. And all these will be linked to each other (spatial and non-spatial linkage), to provides cartographic and attributes data.

7.9 Concluding Remarks

The development of OSHCLB LIM System requires one to analyse the present situation and the information needs of the stakeholders and beneficiaries. This must be matched with the necessary information, through a proper database design, DBMS and System, through a technological configuration of PC's hardware and software to support the information requests.

However, issues of costs involved in the acquisition, maintenance and improvement to system maintenance, hardware and software need to be evaluated accordingly to sustain the system. Also, evaluation phase on the designed system and match it to the use requirements.

CHAPTER 8:

CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

The overall objective of the study is to develop a Land Information Management (LIM) System using Land Information System (LIS) as a management tool, that can be used by Oshana Communal Land Board (OSHCLB) in the management of land information and to help in communal land dispute resolution. The role and application of LIS was reviewed and analysed with more emphasis placed on communal land dispute resolution. The major sources and causes of communal land disputes in Oshana Region were identified. The methods and tools used in land disputes were assessed and reviewed; and their strengths and weaknesses scrutinized.

There is a serious problem with record keeping in OSHCLB. Records are kept in manual based files system. In most cases updating is not done, while in other available not available or inadequate and unreliable. Therefore a proper land records in the form of LIM System is essential for efficient administration of land. It serves both the land managers and the public with source of reliable and easily accessible information.

Recommendations are made on how the problems that slow down the development of effective information management could be conquered by implementing a LIS application. The LIM System prototype was designed to see how spatial and non-spatial data sets could be used and linked together, to help in systematic land disputes resolution, decision-making, land management and efficient service delivery. A series of queries were done on the spatial and non-spatial data sets collected from various sources to answer some questions.

The cost of acquisition of data and machinery, all the hardware proposed is commercially available in Namibia with the guarantees and service warranty. Since presently, data is exchanged between organisations, at no charge, then the logical low-cost approach would be purchase machinery and software, which is compatible with what exists. The software suggested is also readily available with necessary training

and support attached and provides the functionality to handle the service requests, which are envisaged.

Therefore the main objective of the study of developing a LIM System using LIS application has been achieved, in the sense that that the LIM system prototype was developed. The designed prototype can be useful to the OSHCLB in helping to resolve land dispute in communal area. However, due to the limited time of the study the development of a detailed System can be pursued by other researchers in the future.

From these conclusions, it is clear that further work is necessary in some key areas, which could also form an integral part of a comprehensive study on the realization of OSHCLB - LIM System. These areas are recommended below under recommendations.

8.2 Recommendations

Key recommendations that emerged from this study are as follow:

o LIM System should be primarily designed to assist decision makers and increase the OSHCLB's capacity to collect, interpret, and apply information, and to establish trends for improved decision-making.

o An analysis of user's requirements should be undertaken. All related land data required by the OSHCLB should be defined spatially.

o Policy development should take place within the institutional development. A comprehensive technology business plan should be developed before OSHCLB acquires any hardware or software.

o Using experiences from best-practices programmes, a pilot programme or projects should be used to demonstrate the feasibility, viability, or replicability of a LIM System based on the visualization approach the present study has developed.

o A cost–benefit analysis of the pilot LIM System should be undertaken to assess the extent to which such an approach is self-sustainable, both economically and technically.

o The OCLB should computerize all their data pertaining to land management and administration. All the spatial and non-spatial data sets be linked together by using Geographical Information Systems (GIS). GIS has proved its capabilities and effectiveness in the link between map features and their attributes, data analysis, querying, manipulation and presentations. The GIS is not only user friendly but has been used worldwide by many institutions.

o Data updating and back up as well as maintenance should be done on a regular basis. The OSHCLB Secretariat should be trained on the application of GIS and LIS for effective service delivery on the implementation of the suggested system.

o Integrate land information from diverse sources within a LIM System but referencing system and range of identifiers are needed and should be used respectively.

o There is a need for work to be done on translating the Logical design into a detailed working Physical model.

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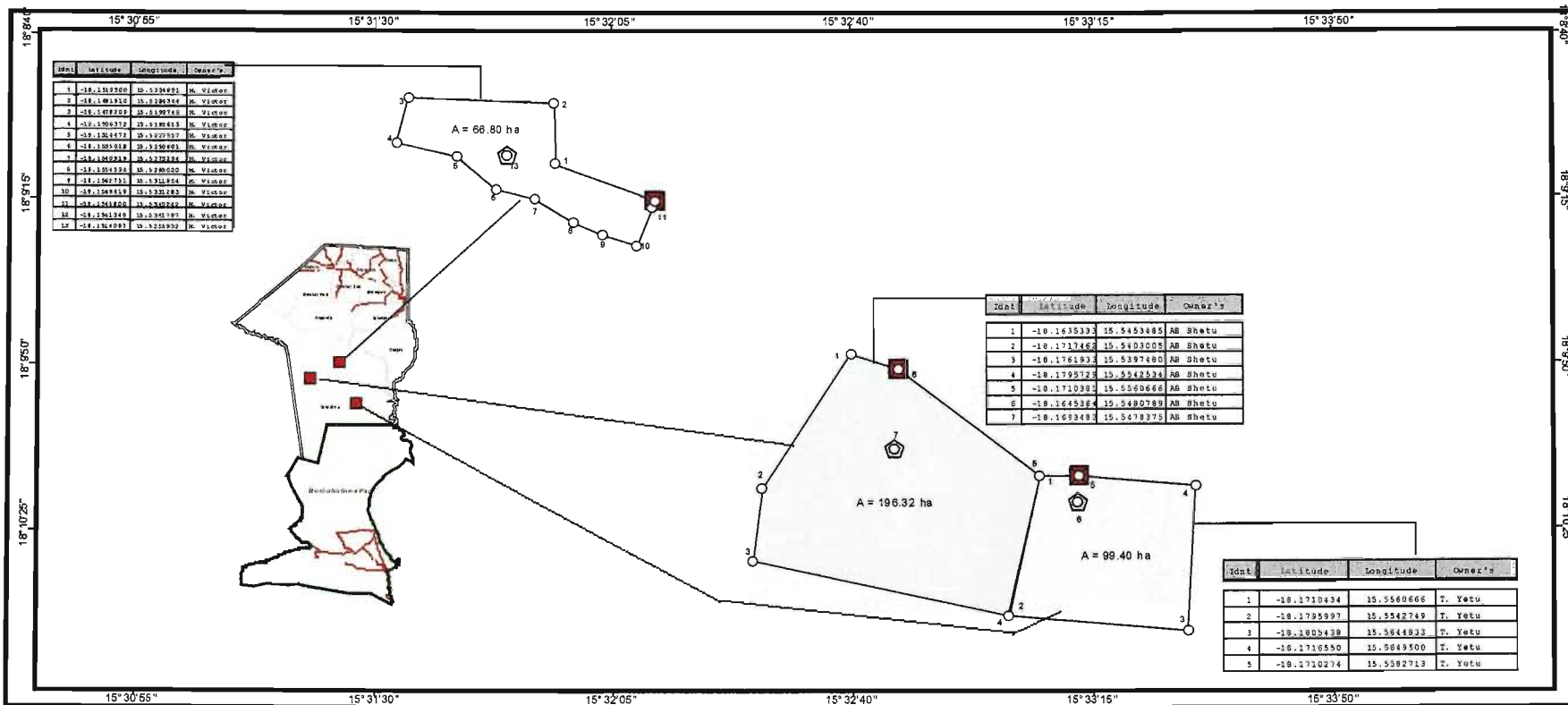# Appendix 1: Important Questionnaire for the Thesis

Oshana Communal Land Board Members

- o Who got the primary power to allocate or cancel any land rights in the Communal Area within Oshana Region?
- o Is there any Directorate/Division(s) that needs or rely on OSHCLB output(s) in order to carry out its mandate?
- o What role is expected of OSHCLB in the land allocation, management and administration with respect to land dispute resolution and registration and mapping of customary land right?
- o What are the common and sources of land disputes recorded with OSHCLB?
- o What are the procedures, methods and tools currently used by OSHCLB to resolve land disputes and conflict adjudication? What are their advantages and disadvantages?
- o Is there presently any functioning Land Information System (LIS) in place?
- o In what way do you think LIS will benefit the OSHCLB?
- o Who would be (are) the main beneficiaries of the LIS if it is to be developed?
- o What data do these users may request or need from the envisaged system?
- o At what mapping scale do you consider appropriate for cadastral mapping of communal land dispute resolution and registration and mapping of customary land right?
- o In what format are cadastral data (maps) maintained by the OSHCLB?
- o What type of data and sources needed in order to carry out land disputes resolution in Oshana Communal Land?
- o What methods and tools are currently used for collecting and recording (document) data needed to carry out land dispute resolution? What are their strengths , weaknesses, opportunities and threats?
- o How is the data/information recorded, processed and retrieved?
- o Are there any problem(s) encountered in the data collecting, recording and processing and retrieving of the land dispute data / information at the moment?
- o What plans, if any, are in place to make up for the shortcomings in future?
- o How do Traditional Authorities within Oshana Region communicate to the Land Board on the land allocations made and disputes resolved?
- o How would the OSHCLB's assist in providing information for decision making process and management to various organisations and other end users?
- o What information / attributes would the OSHCLB need to collect in order to be of use to an organisation?
- o Could there be some form of data and/or information exchange on land dispute resolution between Traditional Authority and OSHCLB?
- o Could there be low cost land dispute resolution techniques employed? If so, what methods would be accepted?
- o How is the communal land surveyed?
- o Are there any data sets from communal area on land dispute resolution? In what format are they kept?
- o What would be the spatial and legal jurisdiction of the OSHCLB?
- o How is the data security guaranteed, both physical and copyright?
- o Do you see the development of LIS application for OSHCLB as the solution to communal land dispute resolution? Does LIS have a positive economic impact?
- O Generally, does LIS provide better and faster information and can be considered useful in decision-making process?

Appendix 2: Data and Process Involved in all Stages of Land Dispute Resolution

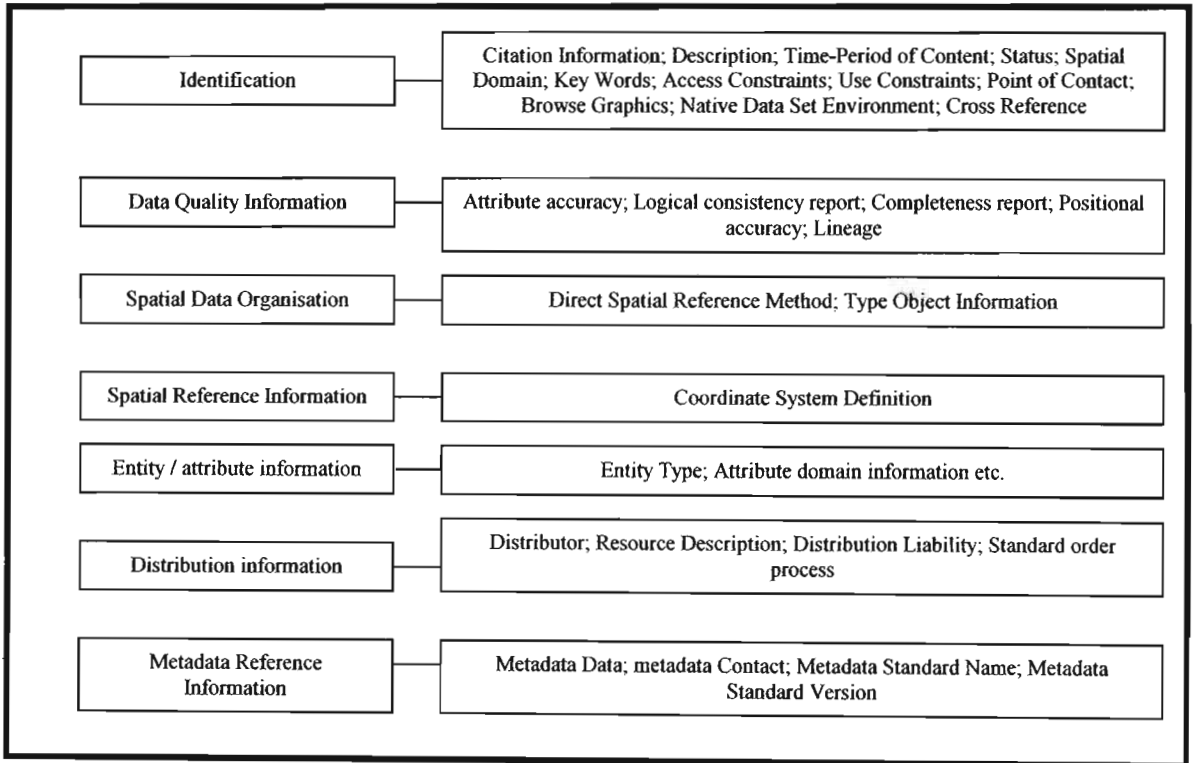| Processes No.	Process Name	Process Description	Input Flows	Output Flows	Data Storage	Process Type
1	Complaint in writing.	A complainant in writing lodged complains with the OSHCLB; contains all detailed particulars of the dispute.	An individuals or Community report a land dispute.	OSHCLB request all the necessary detailed particulars of the land dispute and grounds for complaining.	Oshana Communal Land Board (OSHCLB) archive.	Offline document delivery.
2	Investigation of the complainant.	Upon receipt of the complaint the OSHCLB investigate the facts of the dispute.	This may involve site visits, examining documents and interviewing disputing parties. Concerned parties notified of the place, venue and time of the dispute hearing.	Inform the disputing parties in writing of the dispute hearing 30 days prior to date.	OSHCLB keep data in analogue.	Data are retrieved in analogue form by OSHCLB. Data are collected by field survey, various sources and interviews.
3	Preliminary land dispute hearing.	Each party interviewed separately to give information pertaining to the case.	Preliminary hearing of the dispute by the OSHCLB.	Gather data or document carefully examined and analysed.	OSHCLB keep data in analogue.	Data are retrieved in analogue form by OSHCLB. Data collected from field survey and interviews.
4	OSHCLB meeting / dispute hearing	Complainant appears before the OSHCLB for questioning.	Complainant presenting their case and the OSHCLB ask questions to the complainant.	Record of the proceeding on the land dispute.	OSHCLB in analogue archive.	Document delivery.
5	OSHCLB Decision.	OSHCLB deliberate on the case, through considering of the facts and opinions.	Field Report by OSHCLB Investigation Committee.	OSHCLB make decision, which will be communicated to the disputing parties in writing.	OSHCLB archive.	Document delivery.
6	Application for Appeal.	Appeal from individual contain detailed particulars and reasons fro appealing decision taken by OSHCLB.	Aggrieved person appeal within 30 days from the date of receipt of the decision of the OSHCLB.	Application of appeal from the aggrieved person. OSHCLB forward the appeal application to Minister concerned.	OSHCLB archive.	Document delivery.
7	Appointment of the Appeal Tribunal	Appointment of Appeal Tribunal with adequate skills and expertise.	OSHCLB forward the appeal application to the Minister concerned via the Permanent Secretary of the Ministry.	Appointment of the Appeal Tribunal.	OSHCLB archive.	Document delivery.
8	Investigation of the case	Appeal institutes an investigation.	Request for comments and proceedings on the case from the OSHCLB.	Make necessary arrangements for the appeal to be heard by the Appeal Tribunal.	OSHCLB archive.	Document delivery.
9	Hearing of the Appeal	Disputing parties attend the Appeal Tribunal hearing, which would make a valid decision.	Confirm a decision; set aside a decision; amend decision; and make an order it may think fit.	Appeal Tribunal passes a resolution to the OSHCLB, and later to the disputing parties.	OSHCLB archive.	Document delivery.

Appendix 3: Illegal Fencing Map, Oshana Region, Namibia

Appendix 4: SWOT Validation

INTERNAL FACTORS EXTERNAL FACTORS	STRENGTHS - Legislative base to learn from. - Available of hand and soft equipments.	WEAKNESSES - Inaccessible of land data. - Budgetary constraints. - Limited use of digital spatial data for analysis. - Shortage of human resources. - Limited knowledge in IT potentials. - No copyright policy. - No policy for data organisation and management that will be used in land dispute resolution. - Lack of metadata.
OPPORTUNITIES - Increasing demand for land dispute resolution - Enabling power of LIS technology - Capacity building - Local pride and hence a will to improve. - Improves the existing land records and keeping systems	S / O - Support local knowledge with sound legislation. - Provide better land-use management by using the wealth of LIS and up-to-date information. - Keep staff motivated by provision of capacity building and incentive programs.	W / O - Accessible of OSHCLB land data and/or information so as to improve nation land information and local conditions. - Need to generate finance so as to maintain OSHCLB. - Need to invest in capacity building in order to strength the OSHCLB's operation.
THREATS - No legislation - Current system does not meet the needs for land dispute resolution. - External stakeholders not compliant with existing system of land dispute resolution. - Quick changing of technology	S / T - Ensure that enacted legislation meets stakeholders and users needs. - Use legislative base to ensure cooperation between organisation. - Need for a registration service, which is impervious to rapid technological change and compatible with stakeholders systems.	W / T - Urgent need for the enactment of the necessary legislation. - Need for investment schemes to fund operations.

Appendix 5:   Local Metadata Specification

The Federation Geographic Data Committee approved the Content Standard for Digital Geo-spatial Metadata (FGDC-STD-001-1998) in June 1998. These metadata are used in Internet-based clearing-house to facilitate searching of a certain data set. An overview of the metadata content is given in figure below (Begu, 2003):

Identification	Citation Information; Description; Time-Period of Content; Status; Spatial Domain; Key Words; Access Constraints; Use Constraints; Point of Contact; Browse Graphics; Native Data Set Environment; Cross Reference
Data Quality Information	Attribute accuracy; Logical consistency report; Completeness report; Positional accuracy; Lineage
Spatial Data Organisation	Direct Spatial Reference Method; Type Object Information
Spatial Reference Information	Coordinate System Definition
Entity / attribute information	Entity Type; Attribute domain information etc.
Distribution information	Distributor; Resource Description; Distribution Liability; Standard order process
Metadata Reference Information	Metadata Data; metadata Contact; Metadata Standard Name; Metadata Standard Version

FGDC Metadata Standards (Begu, 2003)

However, there are three levels of metadata specifications, each containing different level of details in accordance with user needs. The following figure illustrates this:
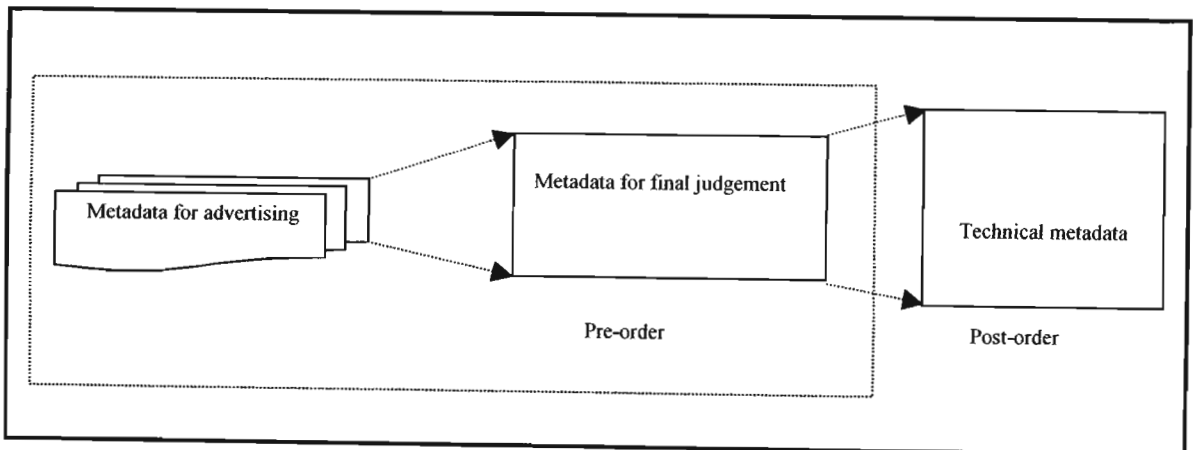
Levels of details for metadata (Begu, 2003)

Appendix 6: Glossary

This glossary contains the definition of most of the non-standard words used in the text. It is not intended as a comprehensive LIS or GIS glossary.

Attributes: Non-graphical descriptors relating to geographical features or entities in a GIS.

Communal land: Land that belongs to the State. Individuals cannot own land, but have customary land rights or rights of leasehold with regard to certain areas of land.

Conceptual Data Model: A model, usually expressed in verbal or graphical from, that attempts to describe in words or pictures quantitative and qualitative interactions between real-world features.

Data: Observations made from monitoring the real world. Data are collected as facts or evidence, which may be processed to give them meaning and turn them into information.

Database: Collection of data, stored as single / multiple files, associated with single general category.

Database Management System (DBMS): A set of computer programs for organizing information at the core of which will a database.

Geographical analysis: Any form of analysis using geographical data.

Global Positioning System (GPS): A system or orbiting satellites used for navigational purposes and capable of giving highly accurate geographic coordinates using hand-held receivers.

Leasehold: The form of land tenure under which leased land is held. For example Oshana Communal Land Board grants a right of leasehold to a person in terms of which she / he has the right to use the land for the purposes for which the land was leased.

Parcel: Individual portion of land that is occupied by a household.

Primary data: Data collected through first-hand observation. Field notes, survey recordings and GPS readings are examples of primary data.

Tenure: The right or title by which property such as land is held. Under Communal Land Reform Act, communal land can be held under a customary land right or as leasehold.

Secondary data: Data collected by another individual or organisation for another primary purpose. Many data sources used in GIS and LIS, including maps, aerial photographs, census data and meteorological records, are secondary.

Spatial: Anything pertaining to the concepts of space, place and location.

Spatial data: Data that have some form of spatial or geographical reference that enables them to be located in two or three-dimensional space.

Spatial data model: A method used by which geographical entities are represented in a computer.

Spatial entities: Discrete geographical features (points, lines and areas) represented in a digital data structure.

Spatial model: A model of the real world, incorporating spatial data and relationships, used to aid understanding of spatial from and process.

Spatial query: Action of questioning a GIS database on the basis of spatial location. Spatial queries include 'What is here?' and 'Where is...?'

Spatial referencing: The method used to fix the location of geographical features or entities of the Earth's surface.

Appendix 7: Example of a data collection form

Name of Observer:	Pele Kavela								
Institution:	University of KwaZulu-Natal, Pietermaritzburg								
Date:	13 April 2005								
			Latitude: S			Longitude: E			
Place name:	Description	GPS Wpoint no	deg	min	sec	deg	min	sec	
Engombe village, Uuvudhiya Constituency – Oshana Region	Fencing for Mr. AB Shetu	001	17°	47'	29.2"	15°	46'	24.3"	