Vrije Universiteit Amsterdam

The Netherlands

The Use of GIS in Flexible Land Tenure System (FLTS) at City of Windhoek – Namibia

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Mr. Lisho Christoh Mundia

Vrije Universiteit - Amsterdam

Abstract

In order to uplift the economy of the low-income people in Namibia, the Government of Namibia has started investigating alternative forms of land tenure aimed at uplifting the socioeconomic status of the lowest income sectors of the community. The Ministry of Lands and Resettlement launched the lands project to look for innovative solutions to this challenge. An approach referred to as "Flexible Land Tenure System (FLTS) for Namibia" was developed, which will be debated in parliament soon, aimed at providing simpler, more affordable and faster forms of secure tenure to low income communities in the country and to urban informal settlement residents in particular.

This research concentrates on the pace of land administration, specifically on how the GIS can help in handling the land administration of the FLTS projects at City of Windhoek which is responsible for such tasks of managing and analysing the FLTS spatial and non-spatial data already in position of the City of Windhoek. Scientific literature review, focus group interviews and field observations were used as the methods of acquiring data. A prototype based on Microsoft Access and ArcView was developed using the City of Windhoek's data. This was done mainly to prove the capabilities and role of GIS in FLTS to the implementation team of FLTS of the City of Windhoek.

The findings of this research are that, although the flexible land tenure bill is not yet gazetted (fully enforced in operation and implemented), the City of Windhoek has already started implementing the FLTS bill by allocating its land to the poor and the low-income people on the standards set in the flexible land tenure bill. In the recent development this research has further revealed that the City of Windhoek has started motivating informal settlers to form associations, referred to as saving groups (inter changeably known as 'schemes') in order to acquire block erven (big plot of land) for security of tenure and affordability of services. The current data of land information of the low-income people is managed by paper and pen methods. The other result is that the focus group members supported the use of GIS in administering the FLTS data, which is used to motivate the need of GIS for the AutoCAD and GIS software vender supplying and administering Autodesk Map 3D to the City of Windhoek.

Although the flexible land tenure system is based on two new types of tenures, starter title and land hold title. Starter title being the lowest tenure system, the City of Windhoek are currently motivating existing saving groups (schemes) with good reputation on basic services payments to start looking at the possibility of acquiring such block erven on this title and subsequently to land hold title as soon as the act is gazetted. This paper also reveals that FLTS has been tested and still needs to be introduced in other parts of the country.

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DISCLAIMER

The results presented in this dissertation are based on my own research at the Vrije Universiteit Amsterdam. All assistance received from other individuals and organizations has been acknowledged and full reference is made to all published and unpublished sources used.

All assistance provided is acknowledged; any views and conclusions expressed in this study are those of the author

This thesis has not been submitted previously for a degree at any institution.

Signed: Mr. Lisho Christoh Mundia
Date: June 2007

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1. Introduction and Research Outline

This chapter outlines the background of the study. It comprises of the problem statement, the aim and objectives of the study, the hypothesis, the description of the study area and the document overview.

The theme of this study is "The use of GIS in Flexible Land Tenure[1] System (FLTS) at City of Windhoek (CoW), Namibia". According to the Flexible Land Tenure Act of 2006 local and regional authorities are responsible for the implementation of the FLTS in their respective areas of jurisdiction. In Windhoek the implementation of the Act is the responsibility of the City of Windhoek as a local authority. Currently, there are no GIS existing for handling FLTS data. This will be the first time that GIS is used to deal directly with issues related to FLTS. The result of this study will form a basis for future research in the area related to the use of GIS in the implementation and handling of land tenure related matters in the country.
Various organizations, private land surveyors, town planning practitioners and private individuals are currently randomly managing both cadastral, attribute data and other geographical data of FLTS. The City of Windhoek who has responsibility for land administration within the boundaries of the city has not been perceptive to this effect of FLTS data management.

This thesis is divided into seven main parts. The first chapter gives a general idea about introduction and research outline where the problem statement and the main objectives of the study are outlined. The second chapter is about the theory concepts and their background. Chapter three explains the research methods used for this study. The fourth chapter shows the analysis and results of this research. Chapter five covers the discussions of the results. The sixth chapter is the conclusion drawn for this research and lastly the recommendations in chapter seven. The section research levels in this chapter below briefly explain what is covered in each of these chapters and how there are interlinked to each other.

1.1 Background of the Study

At the beginning, the informal settlement land in Windhoek city was managed separately by pen and paper method. This was because the land occupants were not recognized on the existing land title – freehold which is managed by the City of Windhoek using Autodesk Map 3D supported by Munsys 9.3 Applications with Oracle database and Town Management System of Progress Systems Access Control software, after registration in the Deeds' Office. Other important reasons include lack of cost recovery by the communities in terms of managing these lands and maintaining the services. Provision of services

[1] Land Tenure is the condition of how and why you are occupying a certain part of land. In other words, in which rights do you own a parcel, e.g. do you rent it, is it your property etc.

such as water, electricity, street access, etc was very limited to this land due to un-planned (structured) and un-surveyed land which resulted in poor health conditions for these communities.

Then the City of Windhoek realized the need for a healthy city and initiated the provision of optimal services delivery to these communities on cost recovery bases. This was done through by registering all the new land occupants and re-allocates them to serviced land. The initiation brought the election of community leaders within blocks of erven for administration purpose, which saw several community members forced to belong to a community leaders in order to save/contribute fees for drinking water and access to community toilets. The entire procedure was then managed by pen and paper method for statistical reasons, where the initiation resulted in less payment of water and sewerage bills for more community groups.

Thereafter in the past few years, the City of Windhoek realized the need for a new favorable land project in order to help the poor. The City of Windhoek then initiated the 'Saving Group' land project. This allowed the communities to form groups of poor and low income people to save money daily in order to afford a block of erf and payments of municipal services such as water, sewerage street access, etc. About forty seven saving groups exists currently and are registered within the City of Windhoek.

Moreover, the current development is that the Government of Namibia under the Ministry of Lands and Resettlements[2] has launched the FLTS lands project as a bill which also supports the saving group technique. Lastly, there is a need for this change because these land blocks will be properly recognized and managed with appropriate technology such as GIS.

Geographic Information Systems (GIS) are used increasingly in variety of application areas. In all kinds of sectors of society, applications, and research areas, GIS systems are very helpful. For Public service in general and especially in local authorities like the City of Windhoek, GIS systems can be used as a tool for supporting the tasks which have to be performed. There is a need for a tool to combine several data sources. Residents and other public organizations do not only ask for more and accurate information; there is also a need to provide in an easy and reasonably accessible manner. The possibilities to increase the accuracy and to create combinations of all kinds of information sources are available through the GIS technology.

In addition, there is currently no Local Property Office (LOP) yet, and the fact that each local authority has a responsibility for managing their spatial and non-spatial data it is therefore the responsibility of the City

[2] The responsibility of the Ministry of Lands and Resettlement in FLTS project is to see to it that flexible land tenure act is implemented in local authorities. This duty is performed in close consultation with other ministries, including the Ministry of Regional, Local Government, Housing and Rural Development (with reference, inter alia, to urban and regional planning, Regional Councils and local authorities)

of Windhoek to start investigating for an innovative tool for handling its FLTS data, for which this research is a tool of such investigation. The City of Windhoek[3] is responsible for managing and monitoring all the FLTS activities within their jurisdictions. Except for FLTS data, all other spatial data of all the erven in Windhoek city, held on freehold rights are managed by the Geomatics Division.

From the above background, an assumption can be made that having all the FLTS data on GIS will help with managing these data, information dissemination to the public and other relevant stakeholders, if not today, in future all these geo data will be valuable.

1.1.1 Problem Statement

No research regarding the use of GIS for implementation of the Flexible Land Tenure bill has been conducted in Namibia; neither do GIS existing for FLTS. This research investigates the need for GIS tools for FLTS for the City of Windhoek.

What is the potential and use of GIS in handling FLTS data at the City of Windhoek? This is one of the main questions to be answered by this study. This includes examining the current methods and techniques used by the City of Windhoek as well as determining the role and the need for GIS in handling FLTS data by developing and carrying out a pilot model established by means of focus groups. The theoretical framework for the research will be the current debate on the role of Information Technology (IT) in land administration for poverty reduction. Figure 1.1 below shows FLTS clients for the City of Windhoek. GIS for FLTS will replace existing paper records, maps, and attribute data. It will increase the internal efficiency, and also the services to the public as well as to businesses and industry.

[3] The Division of Geomatics, in the Department of Planning, Urbanization and Environment is responsible for surveying; mapping and GIS at the City of Windhoek. Therefore, the implementation of the Flexible Land Tenure System (FLTS) in Windhoek is to be carried out by the Division of Geomatics.

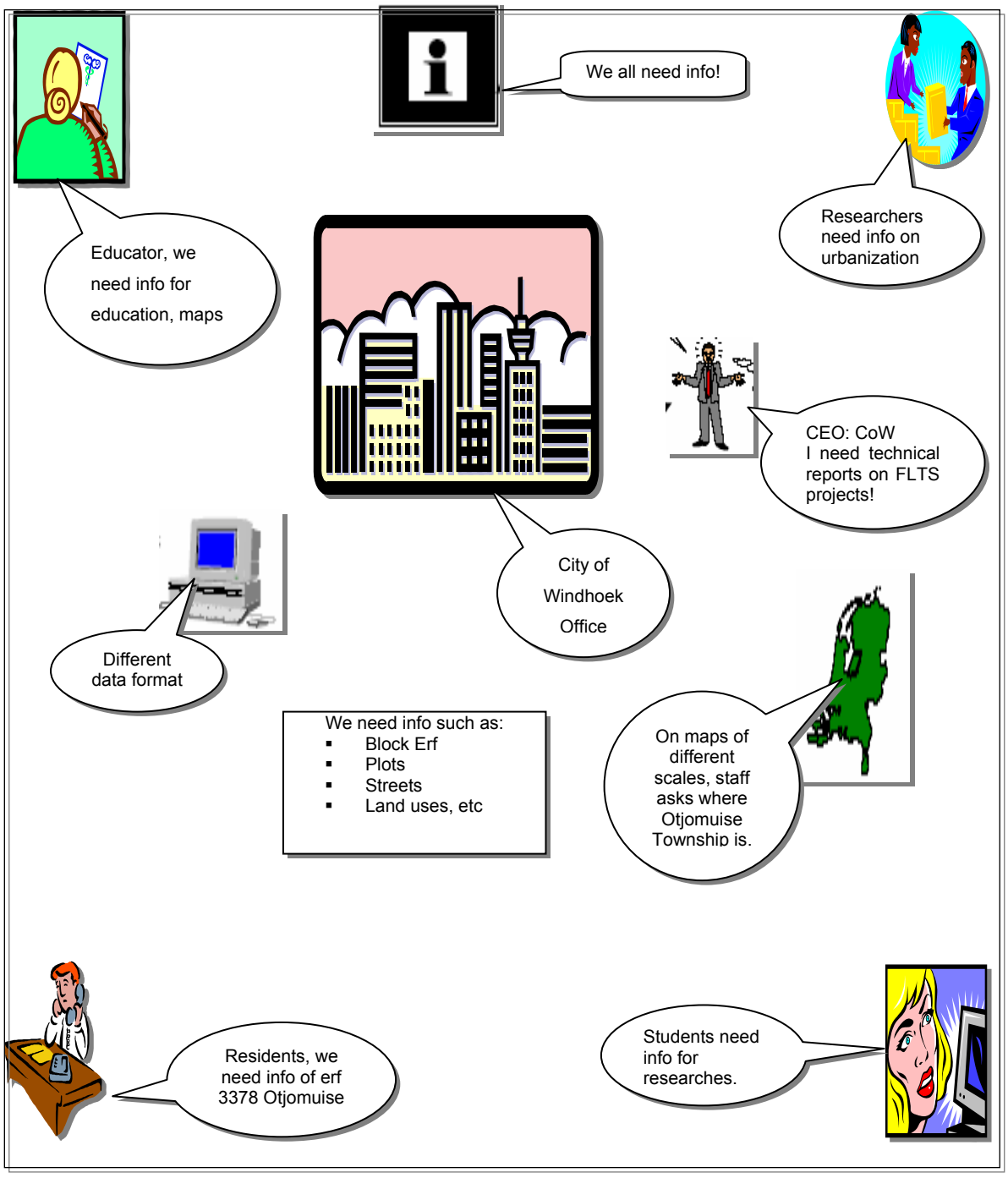

Figure 1.1: FLTS clients for the City of Windhoek

FLTS data of the City of Windhoek are diverse and complex; therefore the City of Windhoek requires a good overview of its geographic data. Accessibility and integration of data are the main statements for a good information system. This research attempts to confirm these statements.

1.1.2 Aim and Objectives of the Study

The research aims to examine the role of GIS in FLTS, examining the advantage and disadvantage for using GIS in flexible land tenure, and the efficiency and benefits of GIS in handling FLTS data at the City of Windhoek.

The main objectives of this research are to:

- Complete a scientific literature review for the Flexible Land Tenure bill of 2006, and the Flexible Urban Land Tenure bill of 1999,
- Study the scientific literature on IT, land administration and poverty reduction,
- Examine the role of GIS in the implementation of the FLTS in Windhoek,
- Discuss the efficiency and benefits of GIS in the implementation of the Flexible Land Tenure bill to the City of Windhoek,
- Develop an example (pilot) of a GIS/LIS (Land Information Systems) solution for handling and managing FLTS data using Arc View GIS and Microsoft Access,
- Measure focus group's opinions and expectations through a focused group interview technique on the proposed use of GIS for handling and managing Flexible Land Tenure data.

1.1.3 Hypothesis

To fulfil the above objectives, the following hypothesis focusing on each of objectives need to be answered, they are as follow:

- GIS software techniques are increasingly more user- friendly and comprehensive. The reason for struggles in the implementation phase can be ignorance of spatial data. In addition, there is a lack of availability of the needed budgets and consistent data.
- Early studies e.g. Bayer (2000) suggests that the initial possess of obtaining the necessary commitment for the introduction of a system is influenced by the status and respect the promoting department/division or group of individuals' possess within the authority.
- GIS implementation requires professional skills.
- To increase experience and enthusiasm for GIS techniques, the (potential) users need good training and education.

1.1.4 Study Area

The research focuses on the use of GIS in Flexible Land Tenure System (FLTS) at City of Windhoek in the Republic of Namibia. The study will concentrates on how geographical data of the FLTS can be analyzed and managed by a GIS.

The City of Windhoek is situated in the central part of the Republic of Namibia. It teams with life and dynamic cultural activities. Windhoek's population is about 240 000 excluding the temporary residents amounting to approximately 7033 persons.

The study area is situated in the township of Otjomuise[4] (figure 1.2 in the locality map) in Windhoek city, the study area block erf 3378 (figure 1.2) measuring 1.2083 hectares comprising of approximately 115 people, consists of Owambo, Herero, Damara, Nama and Kavango indigenous groups.

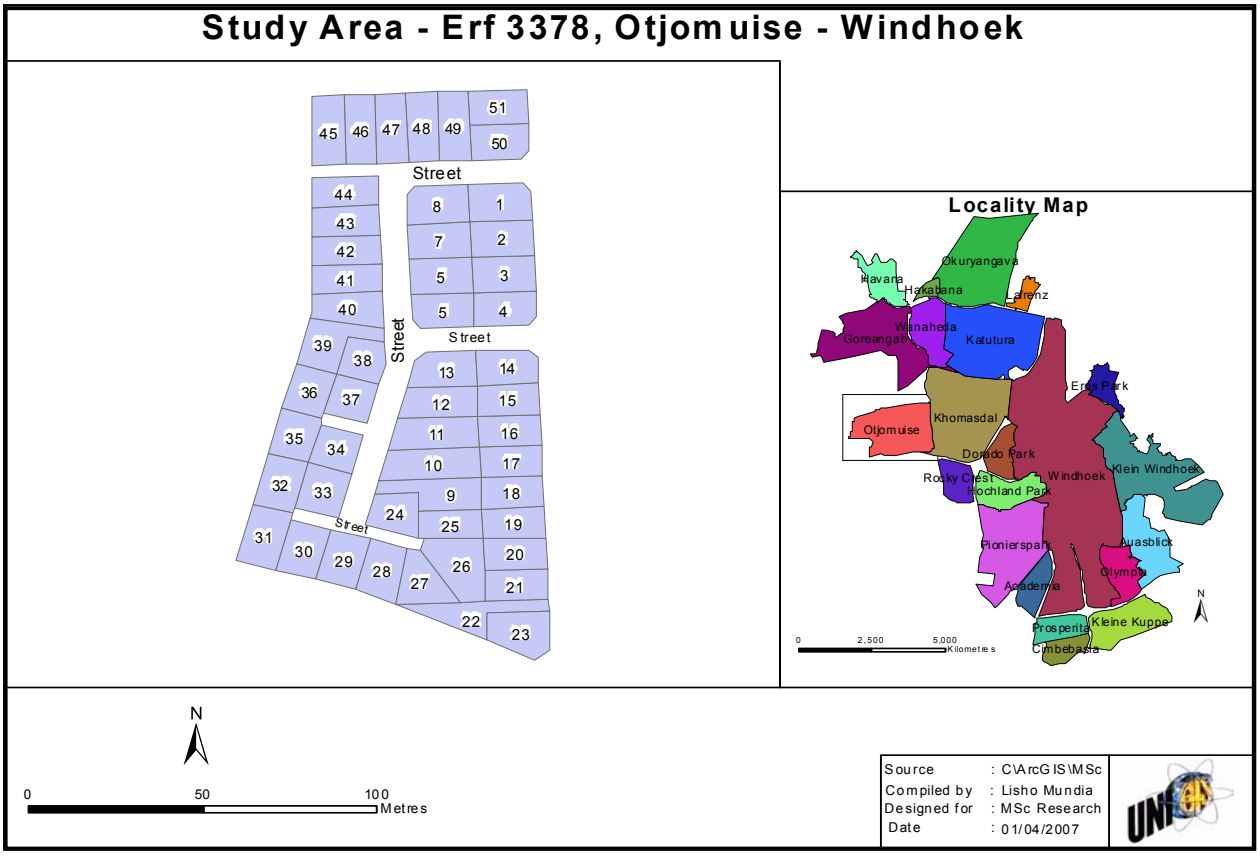

Figure 1.2: Study area

The township was conceived as a new settlement area in 1989 due to pressure of immigrates from rural areas and other towns into the city; eventually it was regarded for middle-income housing. Later in 1998 the City of Windhoek brought in the low-income settlement areas on FLTS standards, like erf 3378 after it was identified as the flattest area and close to town centre (±4 km).

The study area contains 51 demarcated erven in the Otjomuise Township of Windhoek, which are used for different purpose. Including residential, municipal land, etc - this will be analyzed and be indicated

4 The name Otjomuise is a Herero word, one of the Namibia's indigenous languages and it means smoke.

using ArcView GIS software. The area is selected due to its suitability of FLTS standard, including suitable street access of between 6 and 10m wide, basic services like water, sewerage and electricity. The erven are allocated to individual clients on individual lease agreements, with the intention for the current individual leaseholders to purchase it on new FLTS standard as a saving group in future.

1.1.5 Research Levels

This dissertation consists of five main research levels as outlined in figure 1.3 below:

- Scope and outline of the study
- Concepts and theoretical background of framework
- Research techniques
- Analysis
- Evaluation

In Chapter 1 the problem statement and outline of this study is made. The aims of the study are described and the objectives are pointed out. The hypothesis is stated, which will be tested in chapter five. In Chapter 2 the theoretical background is explained mainly of how GIS can help in FLTS data analysis and management, the theoretical concepts of land administration, land rights, IT and LIS and the services available at the City of Windhoek are explained.

Chapter 3 is reviews the methodologies used to gather the required information of results. Two research levels are set out. The first one is to research the way on how FLTS spatial and attribute data can be acquired and administered with GIS, done through scientific literature review, field observations and cartographical technical aspects with pilot data. The second level is to research the need for the usefulness of GIS for Flexible Land Tenure System (FLTS) at the City of Windhoek, done by focus group interview technique, interlinked with research level one.

Chapter 4 deals with the analyzed results of the scientific literature review and focus group interview including the OPAFIT C+ concept. Results of GIS and LIS approach, General GIS SWOT analysis including the advantages and disadvantages of GIS to determine the right usage and efficiency of a GIS are provided in this chapter. Chapter 5 provides the discussions of results and conclusion of this study in chapter 6, and lastly recommendations in chapter 7 (see figure 1.3 for the structure of the theses).

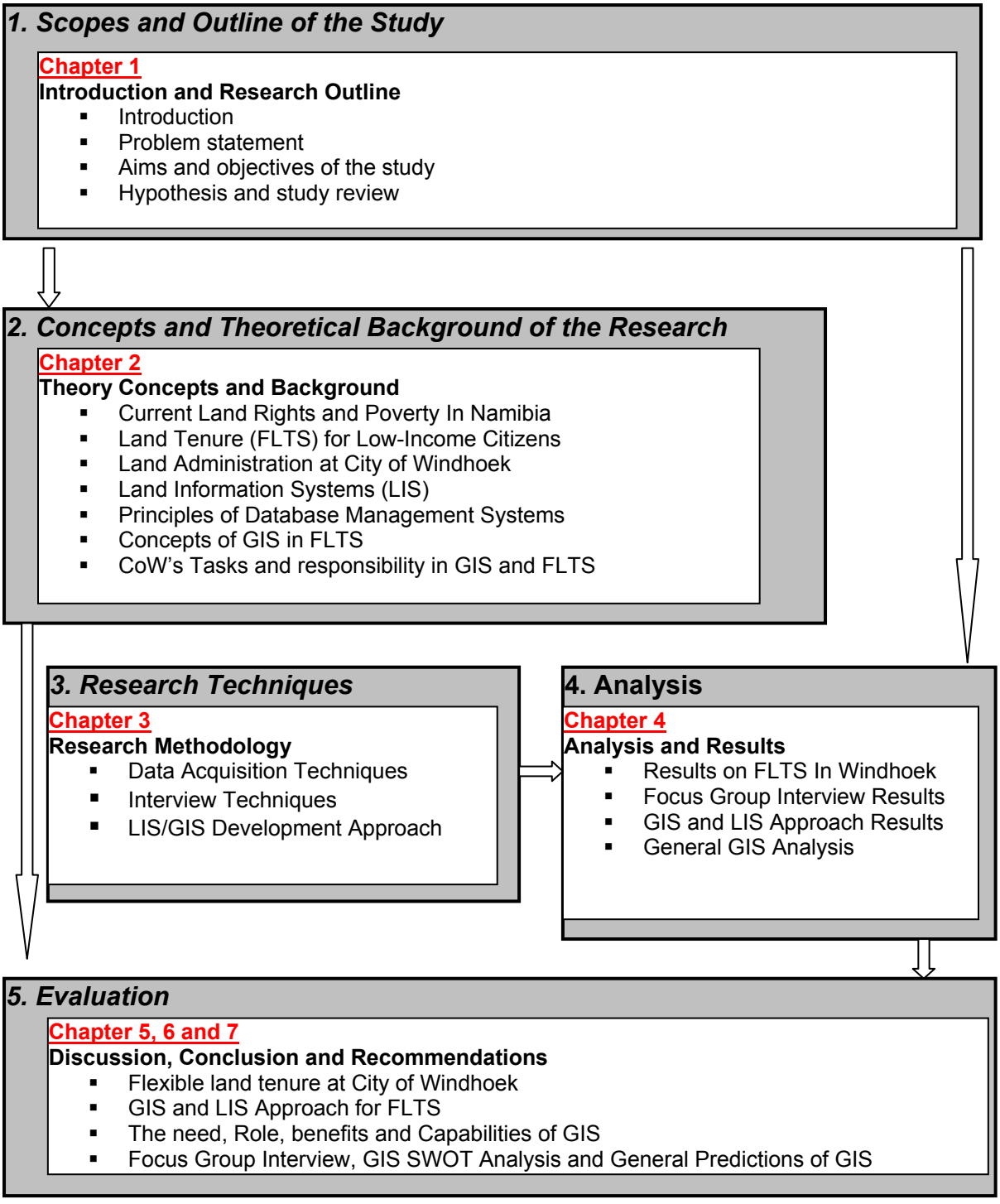

Figure 1.3: Structure of the thesis

2. Theory Concepts and Background

2.1 Introduction

This chapter is a review of literature on land rights, flexible land tenure system for low-income citizens, land administration, GIS, Land Information Systems (LIS), Database Management Systems (DBMS) and Information Technology (IT). This thesis deals with the implementation of the flexible land tenure system at City of Windhoek. The research is in line with the Namibia's vision 2030 (of the technological ideal) thus, the following points will be examined: objectives, clarification, success factors and problems of flexible land tenure system. Further review of the functionality of land tenure system, land rights, land administration, LIS, database management systems, IT and GIS in Africa as an overview will be done.

2.2 Current Land Rights and Poverty in Namibia

Land rights are the powers entitled to the occupant of the specific land in accordance to the conditions set in the title deed, lease agreement or a deed of sale. Therefore, an overview of the most common land rights is given in order to compare them to that of the FLTS. Land is a primary means of both survival and income generation in urban-rural economies, therefore access to land and security of land rights are of primary concern for households and the eradication of poverty (Drimie 2002, p.6). Currently, there is only one land tenure system for urban land in Namibia which is freehold tenure. Land rights of freehold tenure as commonly known in Namibia may include:

- Rights to occupy and to make permanent improvements;
- Rights to transact, give, mortgage, lease, rent and bequeath areas of exclusive use;
- Rights to exclude others from the above-listed rights, at community and/or individual levels; and
- Rights to enforcement of legal and administrative provisions in order to protect the rights holder (Drimie 2002, p.6).

There is in addition, to any land tenure right recognized in terms of the common law for the time applying in Namibia recognized land tenure rights; namely the starter title tenure and the land hold title tenure (Government of Namibia, 1999) which are described below in section 2.3 with their detailed rights.

Namibia comprises of a population of 1, 830,330 people (see figure 2.1 for Namibia population map). According to the 2001 Housing and Population Census report of the National Planning Commission (2003, p.4), the majority of the population resides in the rural areas and are mainly traditional hunter-gatherers, herders and farmers and tend to depend largely on limited livestock grazing and marginal farming. Approximately 12% of the Namibian population lives in urban areas on land to which they have no formal

legal rights. This issue has been one of the major focuses of the Ministry of Lands and Resettlement, working with a Danish NGO called Ibis-Wus (Augustinus, 2003, p.2).

In many developing countries or emerging markets, property rights do exist. However, they do not have the complementary legal framework that is present in developed countries and that allows these property rights to become legal theirs. This legal framework provides a kind of scaffolding[5], which allows property to move to its highest valued use with a great deal of security (De Soto, 1996, p.2).

In the mid 1990s, the total population of Namibia was in the region of 1.5 million people. It rose to approximately 1.8 million of the current population (National Planning Commission, 2003, p.4), with 71% of this population (67% of households) living in the rural areas. The population is unevenly distributed.

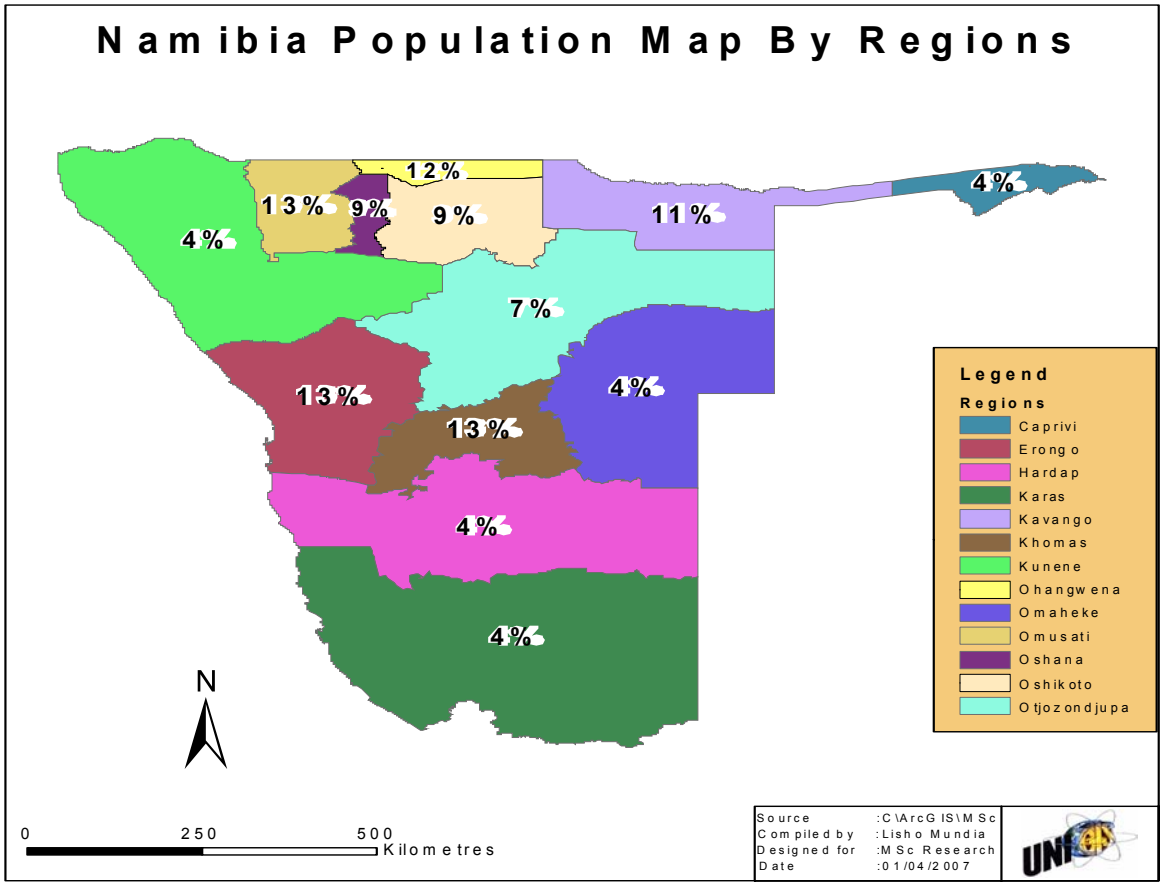

Figure 2.1: Namibia population map

Four regions in the north of the country accommodate 43% of the total population namely Ohangwena, Omusati, Oshana and Oshikoto. Windhoek (Khomas region), situated at the centre, has 13% of Namibia's

[5] Scaffolding means poles and boards that are used to make a frame around a building for workmen to stand on.

total urban population (figure 2.1) and the average annual growth rate from 1991 to 1995 has been 5.4% (Juma and Christensen 2001, p.2). Other regions represents between 4 and 7 percent, except for the unique high population number of 11% in the Kavango Region.

Non-agricultural employment opportunities in rural areas are limited, which leads to an increasing number of people migrating to major urban towns like the City of Windhoek in search for job opportunities, as well as better education. Widespread poverty is one of the major reasons for the lack of investment in informal settlements (Juma and Christensen, 2001, p.2) or vice versa. It is also essential to look at the impact of HIV/AIDS on land administration systems and other institutions charged with issues around urban-rural development such as health services, welfare and land. Clear rights to land can contribute positively to households affected by the epidemic of HIV/AIDS[6], as it can underpin livelihoods and economic development by removing uncertainty and by encouraging families to utilize the asset through leasing, renting or sharing for the production of nutritious food and other goods for sale (Drimie, 2002, p.6).

In 2000, Namibia had an HIV prevalence rate of 22.3% among pregnant women (Phororo, 2002, p.9). There are significant variations in HIV prevalence in the regions indicating that there are four different levels of maturity of the epidemic, with the highest rates of 31% and 33% in Khomas and Caprivi. As Phororo (2002, p.9) has emphasized that the severity of HIV/AIDS on the household depends on what the household member contributes to the household.

As Drimie (2002, p.6) has emphasized, available evidence indicates that land policies that aggravate tenure insecurity, ignore the rights and/or interests of women and children, make it easier for individuals or families to enter distress sales, labor and financial resources in order to get a return, are not addressing appropriately the impact of HIV/AIDS on poor urban-rural people. Ensuring secure land tenure will be of particular relevance for groups who were traditionally discriminated against. Attention to women's rights will be warranted where women are the main cultivators, where out-migration is high or control of productive activities is differentiated by gender, or where adult mortality and unclear inheritance regulations undermine women's livelihood if their husband dies, as in Africa with HIV/AIDS (Deininger, 2004, p.5).

Land policy addresses structural (planned, surveyed block erven, land rights, land administration, etc) issues, which, in the longer term, will need to be addressed in order to ensure that the economic opportunities opened by other policies changes will benefit the broad majority of the poor.

[6] HIV/AIDS stands for Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome.

To overcome compartmentalization[7] that may result from such arrangements, it will be essential to have a long-term vision and to include land issues in the framework of a broadly backed development strategy. The extent to which goals are achieved should be monitored independently and jointly with other government programs aimed at poverty reduction (lack of housing, poor security of land, etc) and economic development (Deininger, 2004, p.13). Good governance[8] is perhaps the single most important factor in eradicating poverty and promoting development (Magel, 2006, p.4). This can be archived through introducing land administration tools such as an LIS Cadastre for the entire Namibia by involving all stakeholders in supporting and building land security issues in Namibia.

2.3 Land Tenure (FLTS) for Low-Income Citizens

2.3.1 Introduction

This section briefly explains and describes the Flexible Land Tenure System (FLTS) for low income people in Namibia, citing the situation in Windhoek city for upgrading and formalization of informal settlements as one of the biggest challenges facing local authorities in Namibia.

The present land registration system in operation in Namibia – Freehold system – is highly cumbersome and costly (Vries et al. 2003, p. 0). However, due to the high cost the system is not affordable to the majority and disadvantaged people. It has been difficult for the public sector to respond to the dramatic demand for urban land and this has lead to a rethinking of the whole paradigm for official planning. It has become evident that conventional planning, surveying and registration create scarcity and high costs. It is generally agreed that the role of the government should be to perform certain planning and control functions and protect basic rights of people, including land rights.

The Ministry of Lands and Resettlement has developed during the past years an affordable land registration system “Flexible Land Tenure System (FLTS)” to benefit particularly poor informal urban settlers. The FLTS aims at addressing the need for urban land for all sectors and most disadvantaged groups of the society. It focuses on providing security of tenure rights for people living in urban informal settlements. The new system of tenure offers two different levels of tenure i.e. starter title and land hold title (Government of Namibia, 2006) as mentioned earlier.

Consequently, in 1998, the Cabinet has grated approval that a new parallel tenure system (Flexible land tenure system) be adopted for Namibia, and the draft bill was prepared as a result thereof. The Ministry of

[7] Compartmentalization means dividing something (land policies) into separate areas, categories, or compartments.
[8] Good governance is the process whereby public institutions conduct public affairs, manage public resources and guarantee the realization of human rights.

Lands and Resettlement will do its best to get the Bill before Parliament as a matter of urgency (Government of Namibia, 2006).

2.3.2 Objectives of the FLTS

The objectives of the Flexible Land Tenure Act are:

- To create alternative forms of land title that is simpler and cheaper to administer than the existing ones.
- To provide security of title for persons who live in informal settlements.
- To empower the persons concerned economically by means of these rights.

This Act is only applicable to land situated within the boundaries of a municipality, town, and village council or within the boundaries of a settlement area but not in un-proclaimed town land i.e. like farm land, communal land etc (Government of Namibia, 2006).

2.3.3 Land Rights Offices and Officers

Land rights offices (also known as Local Property Office (LPO[9]) will be established near to the beneficiaries in local authority area as well as in regional councils in respect of areas falling outside proclaimed local authority areas. The land rights offices should be geographically located where the pressure for land registration is greatest. Decisions on establishing land rights offices must be carried out in cooperation with the Minister of Regional, Local Government, Housing and Rural Development (Government of Namibia, 2006).

The Minister of Lands and Resettlement will appoint the staff of the rights office. A land rights office comprises the following staff:

- A land rights registrar,
- A land measurer, and
- A Registration Officer.

The land rights registrar will be responsible for the operation of the office, the land measurer and registration officer will, under the control of the land rights registrar, perform anything which may be done under this Act (Government of Namibia, 2006).

[9] A Local Property Offices are designed to be responsible for the registration of FLTS land rights including land use, land value and ownership.

2.3.4 Registers

All freeholds land tenure in Namibia is registered in the Directorate of Deeds registration system under the Ministry of Lands and Resettlement, whilst, the geometric information (maps) are registered at the Surveyor General's Office (SGO) under the same ministry. In order to create one property registration system, the new titles should be stored in the same registration system. At the full implementation, it will be possible to access information via computer terminals situated in each land rights office. This makes it possible to provide information about land widely accessible.

The Registrar of Deeds will establish a register for starter and land hold title, but the staff member of the Land Rights Office (LRO) records the information from the computer access points to be accessed by the national register of freehold tenure title. In order to ensure good governance, the Registrar of Deeds will ensure directives and perform inspections of the information recorded in the land rights office (Government of Namibia, 2006).

2.3.5 Nature of FLTS Titles and the Establishment of the Title Schemes

The proposed starter title is a statutory form of tenure registered in respect of an erf block consisting up to 100 households. A local authority, a private sector developer, a community organization or a non-governmental organization may own the block. The outside boundary of the erf block is surveyed according to the existing survey regulations and the erf block is registered as freehold ownership title in the deeds registration system. The starter title provides the holder with the right to live on a piece of land in perpetuity, without fear of being evicted without providing them with an alternative piece of land. Furthermore, it provides the holder the right to transfer, lease, and utilize such services as may be provided to the scheme. It will be compulsory for the holder to be member of the saving group [10](association) of the scheme (Government of Namibia, 2006).

The land hold title provides the poor communities with almost all the rights entailed in the freehold title under the common law but without the complications of full individual ownership, but the saving group (associations) as registered owner. The land hold title provides the owner with the right to occupy a defined and surveyed plot in perpetuity (Government of Namibia, 2006).

The preliminary steps before the establishments of the starter and land hold title schemes is that, the relevant local authority may on its own or on application by the owner of a piece of land consider the establishment of a land hold title or starter title scheme. Although people in many parts of the country already live on the land, it might however not be suitable as a residential area (e.g. regular flooding).

[10] Saving group (s) is interchangeable to mean saving scheme (s) or association (s).

Therefore the relevant authority must conduct a feasibility study (geological, environmental, existing planning regulations, etc.) of the area according to prescribed procedures in the regulations. Only if the relevant authority is satisfied that the establishment of the scheme is desirable, can it continue (Government of Namibia, 2006).

The establishments of the land hold and starter title will be based upon approval of the desirability to establish the scheme, the procedures of establishments of schemes (currently known as saving groups) will be investigated too. The procedures were already tested in Otjiwarongo in the Otjozondjupa Region, Rundu in the Kavango Region and other parts of the northern regions of the country was proven to be operating successfully, this will have to be tested in other several informal settlements also. They will have to be proved to operate exactly towards the objective of the FLTS act (Government of Namibia, 2006).

2.3.6 Upgrading of the Title Schemes

Upgrading of starter title scheme to land hold title scheme will be possible if 75% of the holders of the starter title rights have consented to upgrade. Thereafter the relevant authority may approve such an application. The procedures set out above must be followed. A layout of the area needs to be approved by the relevant authority. When the new Town Planning Act is promulgated some relevant authorities will become “approving authorities” and others will have to liaise directly with the Ministry of Regional, Local Government, Housing and Rural Development. However, during some years it is anticipated that most relevant authorities will become “approving authorities” (Government of Namibia, 2006).

When a starter title scheme is upgraded to land hold title, every holder must be allocated a plot, which corresponds as closely as possible to the piece of ground actually occupied. The regulations will describe the minimum size of plots, the width of roads, etc. The land measurer will then survey and map the area. As land hold title rights are substantially more individualized than starter title rights, a process of adjudication will need to take place when upgrading from starter title rights in order to ensure that the right parties become land hold title owners. The procedure of adjudication will be prescribed in the regulations. When survey and regulations are completed the holder will be issued with a land hold certificate (Government of Namibia, 2006).

Although it is envisaged that, particularly in the residential context, land hold title rights will offer sufficient security of tenure, it will always be possible for land hold title owners to upgrade their title to full ownership. The same applies to starter title owners, who do not want land hold title. They can go straight for full ownership referred as freehold title.

The procedures set out above should be followed and the cost for such upgrading must be born by the holders themselves, these costs are optimal cost due to the poor financial status of this community member.

2.3.7 Associations and Title Commencement

The group approach is becoming much more popular as a way of protecting poor people's property rights while giving them access to land and security of tenure, because the associations are registered in the Deeds Office of the Ministry of Lands and Resettlements (MLR) as legal entities. The block members must form an association to manage and control the block. It will be compulsory to establish an association for both starter title and land hold title schemes, also known as saving groups. To date, there are a few success stories and majority of the communities are already registered with schemes.

The association and the elected leadership of such association will be responsible for direct liaising with the relevant authority. The elected leadership could play a key role in solving disputes in the erf block. The civil laws and operational rules of such association would have to be within the Namibian constitution and would not be able to discriminate on the basis of race ethically of gender.

This act is called the Flexible Land Tenure Act, 2006 and will come in operation on the date to be determined by the Minister by notice in the Gazette (Government of Namibia, 2006).

2.3.8 Flexible Land Tenure State in Windhoek City

Informal settlements in Windhoek are found in the townships of Goreangab, Hakahana, Havana, Okuryangava and Otjomuise, see figure 2.2 below. The locations of informal settlements and low-income land in these townships are evenly distributed in order to form a uniform of related land development. It can also be seen on figure 2.2 below that these townships are available in the northern part of the city. According to my discretion, currently the township of Goreangab is dominantly visible with low income houses and highly visibility of informal settlement, as of Hakahana township it is mostly dominated by the structured low income housing, jointly to the township of Havana which is a complete informal settlement area and is under upgrading process (see the map of informal settlement areas in figure 2.2 below). The township of Okuryangava is highly dominated by the informal settlement and the visible mixed poor to low-income houses in some parts.

Informal settlements land in these townships are cheap, and at reasonable prices for poor and low-income people considering the demand of land, basic services provided and the high number of people flocking

into the city. These townships are very much suitable for poor and low-income people because the land is also flatter in terms of slopes, flooding, services provision and maintenance.

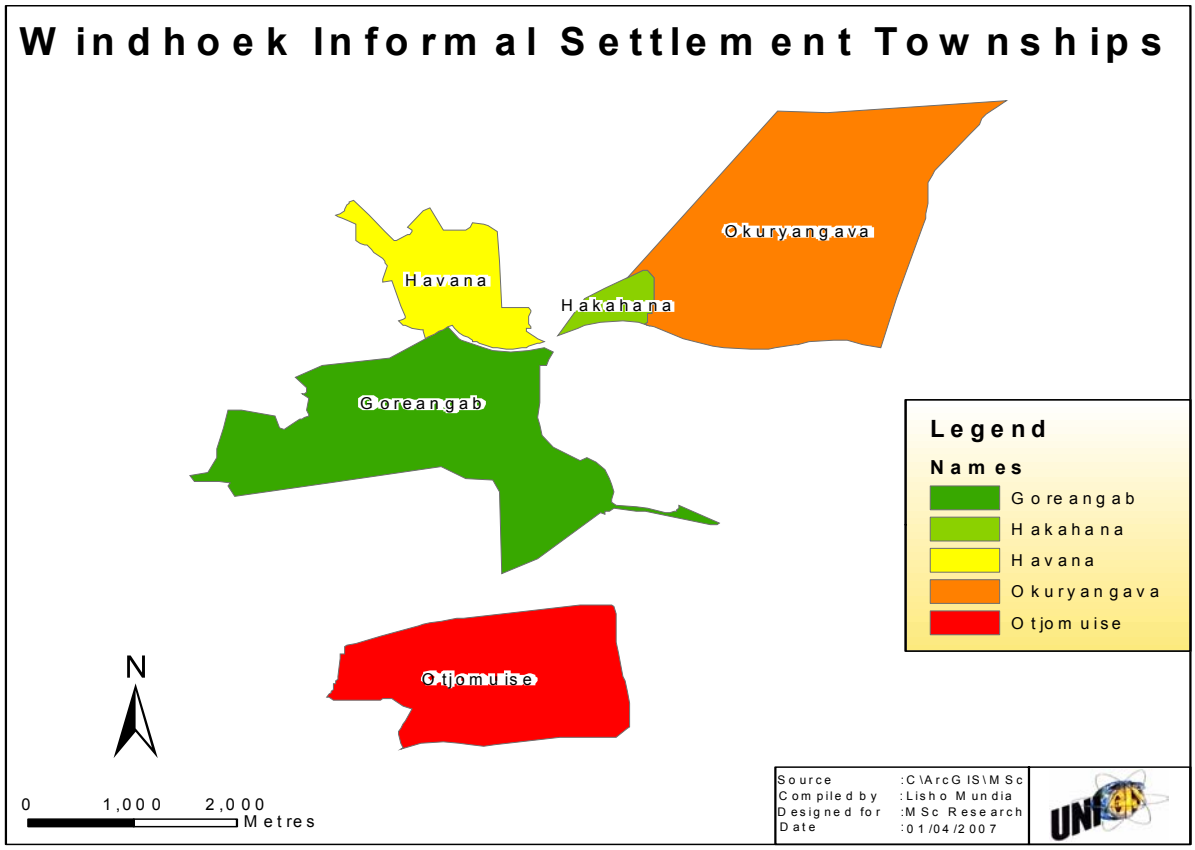

Figure 2.2: Windhoek informal settlement townships

Different developmental activities and land allocation operations exist currently in these different townships, such as feasibility studies, upgrading of services etc. In Windhoek, the low-income people are willing to sacrifice in securing their land by trying to comply with the City of Windhoek's regulations and guidelines, such as the formation of saving groups (schemes). Block erven exists for different saving groups who have started saving money of plus minus N$50.00 monthly (about ± € 7.00) in order to secure their land.

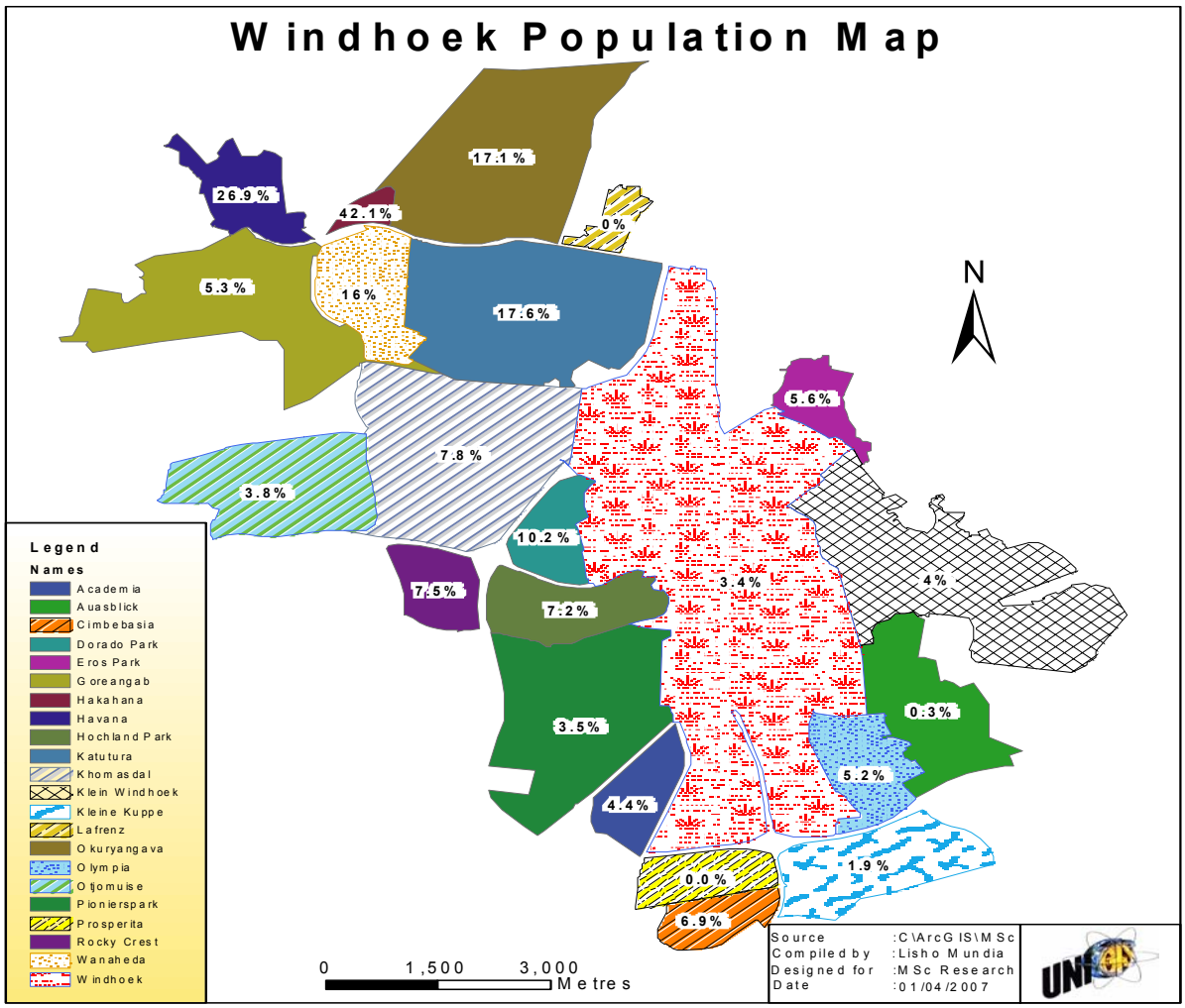

Figure 2.3: Windhoek townships population map

The population of Windhoek city is increasing at a higher rate in the northern part of the City; this is because the land in the northern part is cheaper than in other parts. Figure 2.3 above shows that Okuryangava represents 17.1% of Windhoek population, 26,9% in Havana is seen also in the northern part of the City because Havana is a 100% informal settlement and is currently being upgraded to the FLTS standard. According to the National Planning Commission (2003, p.4) Otjomuise township represents 3.8% and 5.3% in Goreangab, the population there is still low due to the fact that these two townships we proclaimed to host FLTS land recently in five years ago. Note that the townships Prosperita and Lafrenz both represent 0.0% of the Windhoek population because they are industrial townships.

At present, the Flexible Land Tenure System is not yet operational. However, the City of Windhoek has started practising allocating land in the informal settlements using procedures stipulated in the Flexible Land Tenure bill. As part of its ongoing commitment to improve the lives of low-income people living in the informal settlements, the City of Windhoek commits a huge amount of money in its capital budget

every year to the upgrading of informal settlements. For the 2006/2007 budget of the City of Windhoek, it has allocated N$700.000.00 for the feasibility study project of one nation (a block erf of ±70 hectares of informal settlement) in the township of Okuryangava and a total of N$3.5 million for mast lights and electricity connections for Okuryangava, Havana, Hakahana and Goreangab Townships (City of Windhoek, 2006, p.1).

The upgrading process is aimed at providing basic infrastructure and services as well as formalization of the areas through physical planning. Because of unavailability of tenure to accommodate the low-income people living in the informal settlements, in early 2004 the City of Windhoek introduced some basic categories to regulate the land allocation process in the informal settlements. The categories are as follows: Purchased by Group, Individual Leasehold (lease cards or formal leasehold), No Leasehold Agreements (community committees) and Land Earmarked for Resettlement. With the introduction of the Flexible Land Tenure System the current informal settlement land system which is been practiced by the City of Windhoek has already started to be improved to the new system (FLTS), because the old system does not favor the FLTS standards in some other ways of practice.

The schemes were created to suit the future needs of the low-income people in Windhoek city, who still need to acquire land by purchasing and those who cannot afford it now on individual basis. Like the requirements of the FLTS bill of 2006, the low-income people who have been on individual leasehold agreements are encouraged to form associations (saving groups) or join the existing ones. However, those who have been staying on land with no lease agreements (community committees) have also been educated on the need for joining any of the existing saving groups (schemes) or form their own in order for them to afford purchasing their own land in future.

2.4 Land Administration at City Of Windhoek

2.4.1 Introduction

This section provides brief details of land administration at the City of Windhoek. It explains the drivers of land administration and its aims. It starts by defining what land administration is all about and lastly by mentioning the benefits of Information Communication Technology (ICT) and land administration.

According to the Government of Namibia (2002, p.2) urban land administration will continue to be carried out by local authorities in Namibia. However, the Minister of Lands and Resettlements, after consultation with the Minister of Regional, Local Government, Housing and Rural Development and the relevant local authority council, may in respect of every local authority area proclaimed as such under section 3 of the Local Authorities Act, 1992 (Act 23 of 1992) establish a Local Property Office (LPO).

Developing countries like Namibia are challenged with poor land management and administration (Tuladhar 2005b, p.2) and aim at enhancing the services of the authorities as soon as possible. These countries are concerned with the organisation of relevant land information as support of their governance.

2.4.2 Land Administration Definition and Background

Steudler et al. (2004, p.2) defines “Land Administration (LA)” as the process of recording and disseminating up-to-date information about ownership, value and use of land and its associated resources. Such a process includes the determination (sometimes known as the “adjudication") of rights and other attributes of land, the survey and description of their detailed documentation and the provision of relevant information in support of land markets.

The potential contribution of an efficient land administration system to national development objectives include: alleviating poverty and enhance economic growth, improve the security of land tenure and efficiency of land markets through development of an efficient system of land titling and administration, based on clear and consistent policies and laws and supported by an appropriate institutional structure.

Steudler et al. (2004,p.2) further defined land administration as "the process of regulating land and property development and the use and conservation of the land, the gathering of revenues from the land through sales, leasing, and taxation, and the resolving of conflicts concerning the ownership and use of the land." Dale and McLaughlin identify ownership, values, and use as the three key attributes of land (Figure 2.4a). Furthermore land administration functions can be divided into four functions: juridical, fiscal, regulatory, and information management. The first three functions are traditionally organized around three sets of organizations while the latter, information management, is integral to the other three components" (Steudler et al. 2004, p 2) see figure 2.4b below.

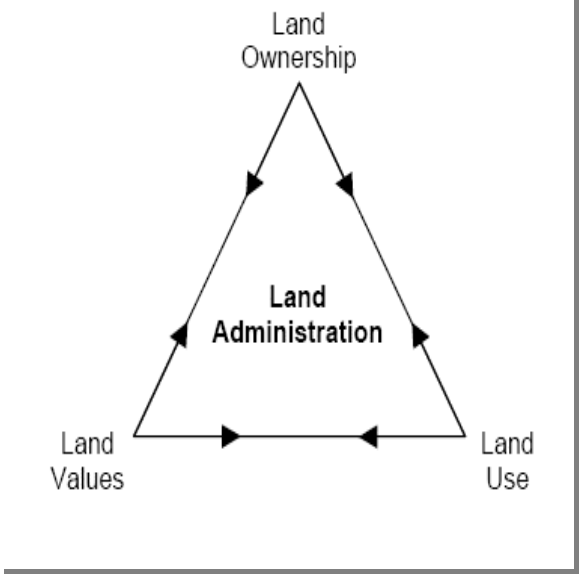

Figure 2.4a: The three key attributes of land administration (Steudler et al. 2004, p3)

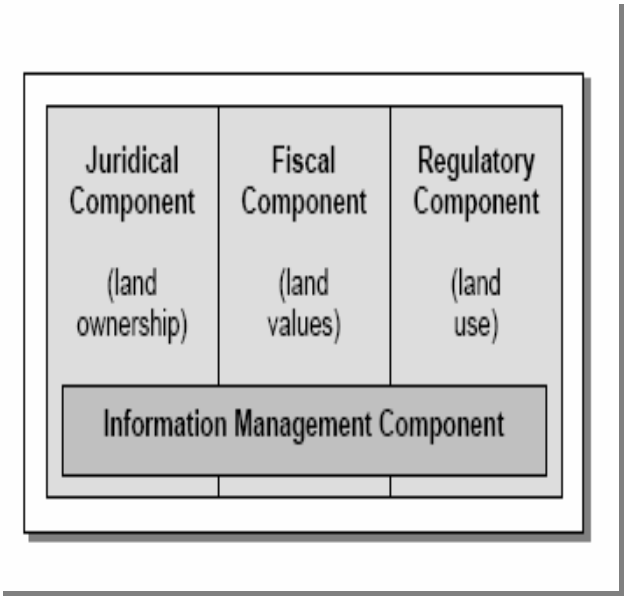

Figure 2.4b: The four basic components of land administration (Steudler et al. 2004, p3).

Along with the staggering progress in information technology, the information management function has considerably been developed over the last few decades, with many efforts to establish information systems dealing with land information (Steudler et al. 2004, p.3). In Namibia, a feasibility study to introduce LIS for Namibia is currently being done by the Swedesurvey AB, a Swedish agency, and the overseas agency of the national land survey consulted by the Surveyor General's Office (SGO) of the Ministry of Lands and Resettlements. This feasibility study is headed by the Ministry of Lands and Resettlement and it has already seen its first stakeholders' meeting where the City of Windhoek was represented by the Geomatics Division. Key attributes of land such as ownership, value and use were extensively discussed and the FLTS tenure system is involved. This research can only reveal that the Namibian has finally seen the potentiality in multipurpose cadastre for the entire nation. The Ministry of Lands and Resettlement are the drivers of the project and they are commented to it. The stakeholders involved and a brief relation for spatial information management in Namibia are explained in section 2.5.4 of this chapter.

2.4.3 ICTs and Land Administration Developments

A common characteristic of land administration organizations is the great deal of effort they devote to the determination, registration and dissemination of information pertaining to the ownership, value and use of land. This involves a large amount of data that are subject to many changes; need to be kept up to date,

and accessible for consultation. Consequently, these operations constitute a highly transactional environment. The efficient and effective performance of these duties is mostly less cost efficiency with the support of Information Technology (IT).

The very true statement about Information and Communication Technologies (ICTs) and poverty reduction as Kenny et al. (2004, p.407) makes is that lack of access to ICTs is clearly not an element of poverty in the way that insufficient nutrition or inadequate shelter is, but ICTs are increasingly important in the effort to escape poverty. Kenny et al. (2004, p.407) in the world bank report for information and communication technologies further states that ICTs provide access to information that can create earnings opportunities, improve access to basic services, or increase the impact of education and health interventions. ICTs also give the poor a medium through which to demand government support and reform.

Kenny et al. (2004, p. 411) claims that security wise ICTs play a major role in reducing vulnerability, especially during times of natural disasters, and to powerlessness. One of the reasons for this is the part that ICTs can play in amplifying the voices of the poor, for example, with the use of GIS it can be determined which land of the informal settlements are affected by flood and identify the effect using the GIS technology.

Flower countries which are in a further stage of development enjoyed benefit of IT-application at an earlier stage. Many of them now face the renewal of their ICT architecture because their existing information systems cannot cope with evolving customer demands and ICT opportunities (FIG, 2003). Currently, most countries, information technology has improved in relation to land administration, this improvement means that the price of processing both spatial and non-spatial data for dissemination to the clients of specific public organizations like the City of Windhoek decreases.

With regards to data collection, positioning systems can be integrated with less time consuming, affordable and less labor intensive. As Barodie and Barry (2004, p.2) recognize effective upgrading of informal settlements requires accurate and up-to-date social and spatial information, this is mainly to avoid costs in future for data collection and processing when new development comes along. As it was said by Home & Jackson (1997, p.3) use a point position (collected with hand held GPS) to relate the property identifier number, land cover, soil condition, and number of structures, etc.

2.5 Land Information Systems (LIS)

2.5.1 Introduction

The review of this section is to outline the potentiality of Land Information Systems (LIS) in relation to Land Information (LI) that the GIS for FLTS will be able to manage. It is proven that the success of GIS in FLTS projects lies firstly on review of the cadastral and LIS in Africa at lager, strategically to build relationship with the existing international stakeholders. Firstly a definition of LIS is given, followed by a description of LIS issues for the poor which explain how LIS can be applied in recognizing the poor urban settlers, then a detailed review of LIS stakeholders. Lastly, the general overview of LIS and LI will be outlined which is important for comparison to GIS in FLTS application.

2.5.2 LIS Definition

Several formal definitions of LIS are a matter of debate. The fundamental issue in all the definitions is whether the definitions address the context in which the definition is being applied. Kaufmann and Steudler (1998, p.2) define a Land Information System as “a tool for legal, administrative and economic decision-making and an aide in planning and development which consists of a database with spatially referenced land-related data for a defined area, and on the other hand, of procedures and techniques for systematic collection, updating, processing and distribution of the data. From the above definition, LIS is clearly understood as a uniform spatial referencing system for the data in the system, which facilitates the linking of data within the system and other land related data.

Tuladhar et al. (2003, p.1) have said, ‘the interaction of human societies with land is becoming crucial for the economic, social, political and environmental development’. In Namibia, the main causes for the increased scarcity of land and destruction of natural resources (deforestation and degradation of agricultural land) and increasing uncontrolled urbanization are mainly due to the rapid population growth and high migration from rural to urban and terrain (Tuladhar et al. 2003, p.1). In managing and controlling the use of land and resources, a reliable land information system (LIS) is a prerequisite (Tuladhar et al. 2003, p.1).

In brief, LIS is not some software package lying somewhere on a computer, but a tool for legal administration in planning and development. LIS is a tool to answer a particular question or query, or to support a particular planning process. Such questions, queries or processes can range from simple questions such as: What is the address related to this plot? In my view, land information is any information with regard to a piece of land. These plots or units can be parcels, erven or land use units, and are the

information that relates to ownership, value of the land or land use. Other questions that can be answered are those relating to geometry of a particular plot and/or thematic information.

Geometric information in a LIS is often described in form of coordinates, maps or spatial databases. The other type of information is captured in a number of ways. The thematic information in a LIS must relate to the geometric aspects in the same LIS. Because of the nature of geometric data, many organizations have settled on a hybrid system of a corporate GIS and a powerful database management system.

2.5.3 LIS and Poor Land Management System Approach

In order to bring informal settlement in the cities into the formal systems, among others, one of the possible ways in low cost and sustainable manner is to use the "poor land management system" in upgrading process (Tuladhar, 2005b, p.3). Its main characteristics are:

a) Make the poor visible, legal citizens of the city enabling participation in the decision making;
b) Include the informal settlements in the planning;
c) Develop a procedure for tenure security and providing services that the poor can find accessible and affordable; and
d) Allow local land information systems transparent and close to the poor and civil societies who require the information for making decisions on their land (Tuladhar, 2005b, p.3).

The approach in poor land management system would normally include informal processes, which can be considered as an asset for the formal system. Such informal process is community participation, which consequently induces social obligations on the use of land. Land management responsibility is decentralized to the local authorities, and this includes land administration activities i.e. recording, processing, storing and disseminating land information. An example is the City of Windhoek who manages its spatial and non-spatial data for their planning activities and makes provision to the public on cost recovery basis.

2.5.4 Land Information Systems Stakeholders

As there is no complete multipurpose national LIS for the entire Namibia, it is important to review and outline the inter-relationship of other stakeholder to the City of Windhoek (CoW) in the implementation of the FLTS projects in terms of data exchange and the current development. This section describes the situation of the stakeholders involved in support of spatial information management and land administration particular those in Windhoek, see figure 2.6 below for the technical integration model of the LIS stakeholders in Namibia. Although there is a topographical database for the entire Namibia at the Directorate of Survey and Mapping (DSM) and the national register at the Deeds Office (DO). There are a

number of challenges with regard to spatial data management in Namibia, there is a lack of agreement concerning standardization, and redundant data production adds to the complexity of spatial data management problems.

The tasks of the stakeholders are very much interlinked to the tasks of the CoW in FLTS. Figure 2.5 shows the functional exchange between the CoW and involved stakeholders. For instance, the Deeds Office (DO) receives a monthly report concerning farm sale. The report is sent to Directorate of Survey and Mapping (DSM) in paper format and reentered into the Microsoft Access sales database. The DSM is responsible for checking the farms manually from noting sheets and farm diagrams. The Ministry of Agriculture, Water and Forestry (Min of Agric) then receives the information on a CD with farms boundaries and detailed agriculture information such as carrying capacity, etc. However this information is not send on a regular basis. Some farms boundaries are contrary to DSM records, the Min of Agric manage this information using ArcView on Shape files.

On the other hand, the Directorate of Land Reform (DLR) under the Land Use Planning Division (LUP) uses cadastral data of farms for expropriations and land use planning. They also provide subdivision plans to Resettlements and Land Boards. Another task is to issue the exception and waiver certificate[11] which are used by the Deeds Office. The same data is required by the CoW if it contains farms within the Windhoek boundaries.

On regional level, the Directorate of Resettlement (DRO) and other regional offices receives the subdivision plans from Land Use Planning Advice (LUPA) Division, ownership information from the Deeds Office (DO) or the Land Boards Tenure Advice (LBTA) Division (12 land boards maintaining manual registry of leases and customary rights in different regions) and valuation information from the Directorate of Valuation and Estate Management (DVEM). This is information required by the CoW for administration of their land (figure 2.5).

The Directorate of Survey and Mapping (DSM) is the key to motivating the uses of LIS for Namibia because of their massive spatial data currently being handled manually. The National Planning Commission (NPC) is very much involved in this process due to the cadastral boundaries, topographical maps, and ortho-photos they require from the Survey General (SG) for processing the population data. The NPC currently operate a system based on Simple Query Language (SQL) Server, ArcGIS and GeoMedia. Lastly, the City of Windhoek require updated cadastral and ownership information from the DSM because of the responsibility they have for maintaining their cadastral erven data set, as mentioned earlier and outlined in figure 5.1 in chapter 5 below, the CoW operates a GIS system based on Oracle, Autodesk Map 3D and currently ArcGIS. Urban Planning Information (UPI) is maintained and

[11] Waiver certificate is a legal document that gives the right of selling the farm land to members of the public by the government.

management by the DSM of the Deeds Office under the real property registers and the CoW also keeps a copy of this data and captures it on their LIS system.

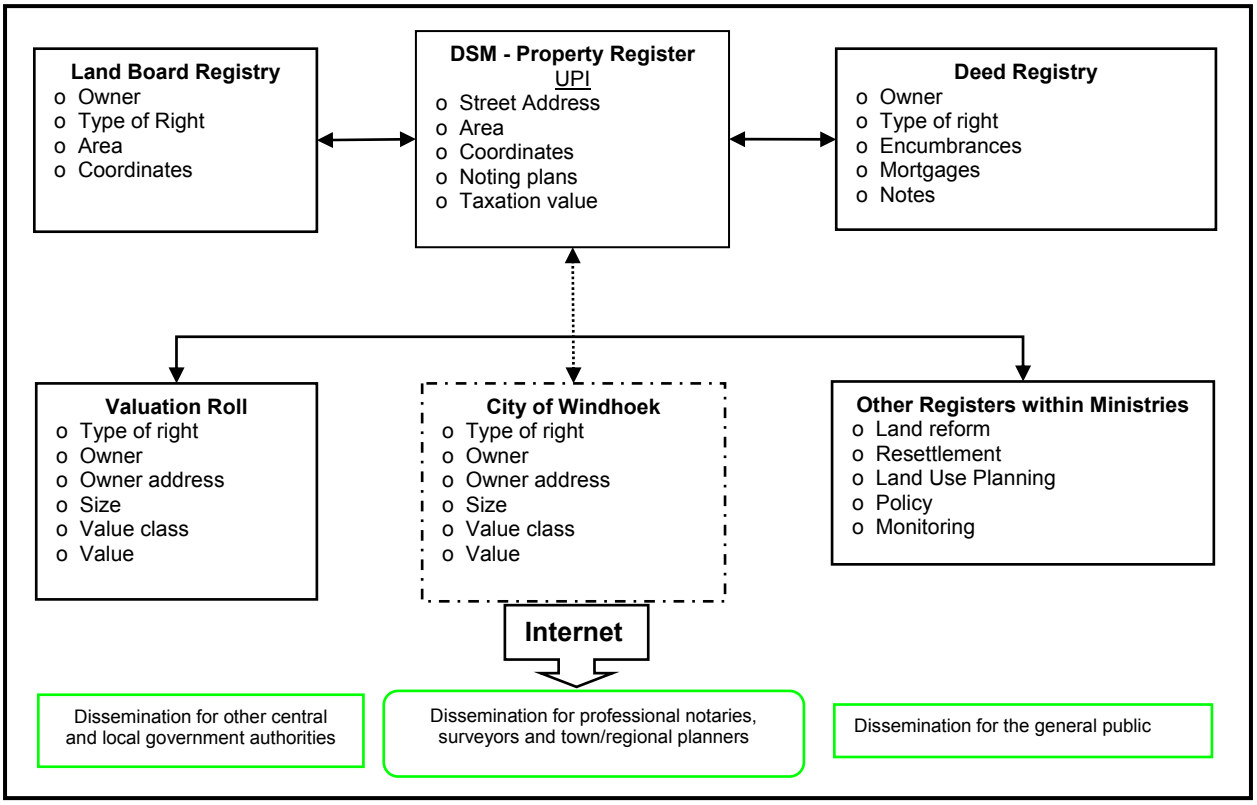

Figure 2.5: FLTS Functional exchange between stakeholders

The Swedesurvey AB feasibility study progress presentation took place on the 28th of April 2006 to introduce the Namibian Land Information System (NLIS) after consulted by the SGO of the Ministry of Lands and Resettlement. It was recommended that the DSM should be designated as the hub for establishment of the LIS, further agreements of formalizing the structure of Urban Planning Information (UPI), data sharing between directorates and other agencies (figure 2.5) should be finalized and real property register law should be established. At this presentation, the Geomatics Division represented the CoW. Figure 2.6 below shows all the agencies involved.

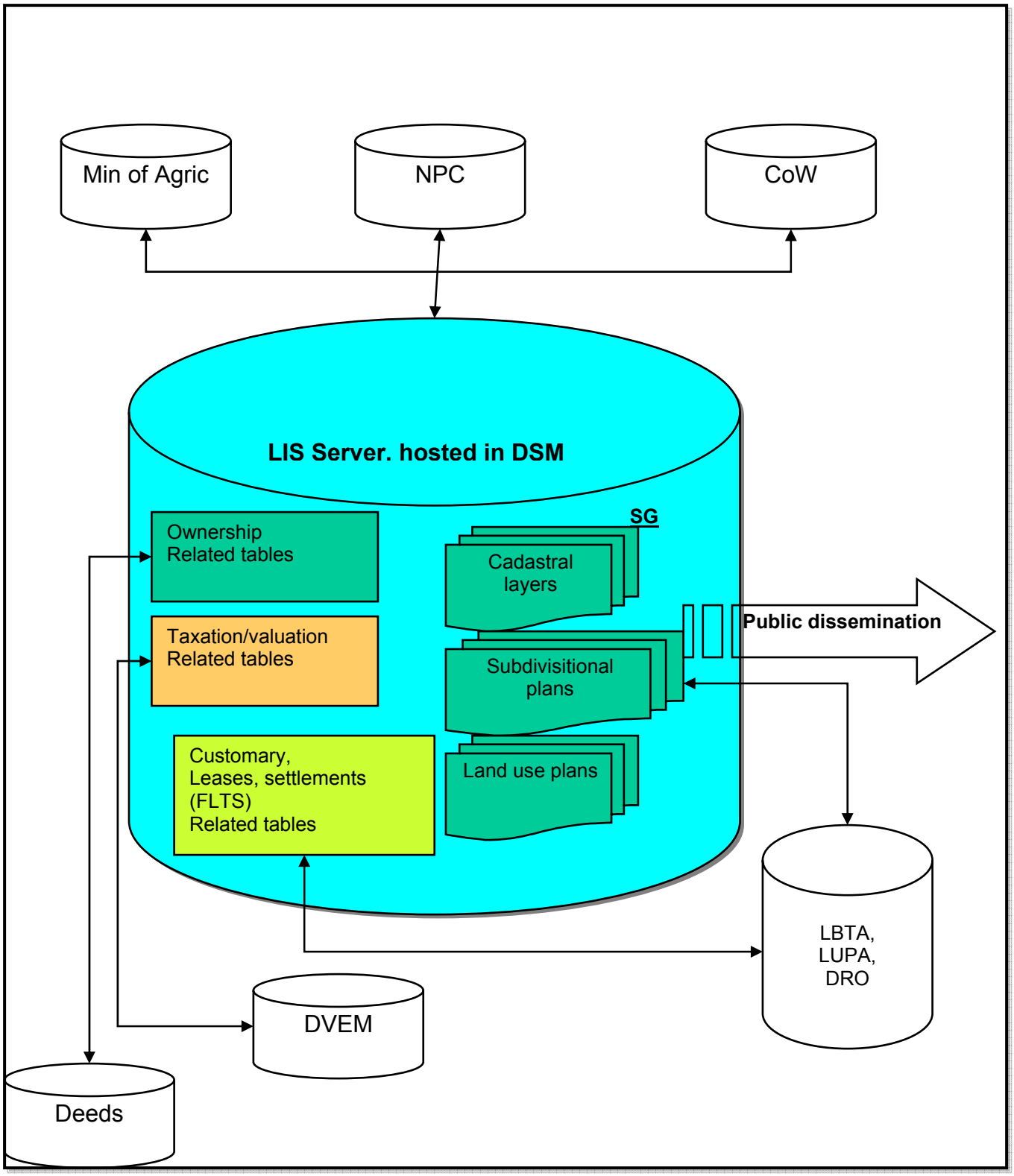

Figure 2.6: FLTS Technical integration of stakeholders

Spatial data management challenges in a multi-institutional context are mainly caused by lack of policies and infrastructure for data exchange and sharing, although the demand for this was identified and even acknowledged by some institutions, it caused inter-organizational decision-making problems (Merson, 2004, p. 87). The problem of unclear organizational mandates makes it difficult to set up a cooperation framework in which the responsibilities are being clearly defined based on the functional characteristics of an organization.

The lack of organized co-operation between large group of spatial data producers and users, and lack of requirements analysis for facilitation of information detection, sharing, exchange, creates a situation in which avoidance of data redundancy is impossible. Merson (2004, p.88) states this very clearly 'there are no policies on digital data copyrights, no policies for digital exchange and data sharing'. With regards to political issue, the FLTS project would be secured, due to the growing interest of high level ministry officials in the land administration related to poverty alleviation and informal settlement upgrading.

2.5.5 Land Information and LIS General Overview

One of the important considerations in implementing a Land Information System (LIS) is that it must be located in such a way that the people have access to all kinds of services and information delivery required for land management. A local LIS normally contains local databases (or registers) in digital form that relates to spatial and non-spatial (or descriptive) components (Tuladhar, 2005a, 2005b, p.7). In order to find the contents of databases, the users or stakeholders are consulted and analyzed in terms of service required and financial availability. In the starting phase, the system may be simple with minimum services and data, and later on it is upgraded in stepwise approach.

As an example, the spatial component may contain the following information:

- Spatial units of outer boundaries – tenure units, customary areas, family parcels, individual parcel which could be represented by geometry (either graphical polygons or points including topology);
- These spatial units must have unique identifiers in a standard form; and
- Locations of spatial units are always referred to national geodetic reference system (Tuladhar, 2005c, p.7).

Similarly non-spatial (descriptive) components may contain the following information:

- Links to spatial unit through unique identifier,
- Register of tenure rights and right holders – chief/head of the group/village, family head, individuals, and
- Agreement/evidences on how tenure rights are brought to right holders (Tuladhar, 2005b, p.7).

According to Robinson (2003, p.2), an information system can technically be defined as a set of interrelated components that collect, process, store and distribute information to support decision making and control in an organization. In addition to supporting decision-making, coordination and control, information systems may also help managers and workers analyze problems, visualize complex subjects, and create new products. Information systems perform three main duties:

- Data collection
- Data processing
- Information output (feedback)

Robinson (2003, p.20) states that the system boundary is one of the principles that concern itself with system structure and behavior. It defines the components that make up the system. Anything outside the system boundary is known as the system environment. The system boundary is dictated by the goals, which in some cases are stipulated by legislation. As the Flexible Land Tenure Act dictates the land tenure registration process at City of Windhoek, then these dictate the system boundary. The system consists of people, processes and information technology. The role of computer systems is to support people in their work by using technology to provide ways to collect and use information and to support their work processes (Robinson 2003, p.20).

2.6 Principles of Database Management Systems

2.6.1 Introduction

This section deals with the definition of a database, its functions, description a brief explanation of a file versus Database Management Systems (DBMS) and the reasons for using DBMS.

2.6.2 Database Definition

A database is a set of related data stored in a structured manner. *Note* that some text use “data base” to refer to non-computerized sets of data, reserving the word “database” to mean sets of related data held in a computer.

A computerized database is defined as ‘a collection of interrelated data stored together with controlled redundancy to serve one or more applications; the data are stored so that they are independent of programs which use the data; a common controlled approach is used to add new data, modify and retrieving existing data within the database’ (Longley et al. 2001, p. 13). On the other hand we have a Database Management System (DBMS), which is a pool of shared facilities used to access and maintain a database. A DBMS acts as an interface between end users, application programs and the database. It

allocates storage, provides security and handles all the traditional demands of file processing (Longley et al. 2001, p. 13). Application programs extract data from a database via the DBMS.

2.6.3 Functions of A DBMS

Rich (2004, p.12) considers a Multi-user Database Management System as a very large integrated collection of data that models real world enterprise. The enterprise is entities and relations. Entities e.g. parcel unit and parcel owner, and relationship e.g. Hangula is taking parcel unit 22. A Database Management System (DBMS) is software packages designed to store and manage databases.
Broad functions of a DBMS adopted from Longley et al. (2001, p. 14) are as follow:

Creating, modifying and deleting data structures: Any DBMS must have a way of creating the field definitions, record and file structures needed to receive an organization's data.
Adding, updating, and deleting records: Having established a data-structure, the DBMS must be able to populate the database by importing data records, either from existing external files, or via keyboard input.
Extracting information from data: There must be mechanisms by which information can be retrieved from the database in formats which will be appropriate to decision takers. It should be possible to query individual records, sort records into required orders, summarize data statistically, produce report tables, and possibly produce graphs. It should be possible to export data into other systems.
Maintaining data security and integrity through DBMS software provide means of limiting access to particular data and of ensuring that the data held in the database is internally consistent.
Application building: In addition to maintaining the database, most DBMS software will include a programming language, or will be compatible with an existing language such as C, Pascal, and COBOL, which will allow applications programs to be written which can access the database through the DBMS.
Multi-user Data Sharing: Many users will need to access a database at the same time, so DBMS must have the ability to serve data to many users.

DBMS software provides a set of tools that database designers can use to meet particular requirements. As with any set of tools, the quality of the end product depends upon the skill of the person using the tools. The skill of the database analyst is to use DBMS software tools to design a database that efficiently meets client specifications (Longley et al. 2001, p. 15).

2.6.4 Why Use DBMS?

Rich (2004, p.7) argues that an application must stage large datasets between main memory and secondary storage (e.g., buffering, page-orientated access, 32-bit addressing, etc.) it should offer special

code for different queries, it must protect data from inconsistency due to multiple concurrent users, it must perform crash recovery and finally it must offer security and access control. Rich (2004, p.14) pointed out that a Database Management System (DBMS) offer data independence, reduce application development time, it provides data integrity and security, it offers uniform data administration, it provides concurrent access and recovery from crashes.

2.7 Context of GIS in FLTS

2.7.1 Introduction

This section deals with the definition of GIS, its components, the roles, benefits and the need of a GIS in FLTS projects. Briefly, critically explained and described also are the sources of spatial data, data input methods and data quality issues.

2.7.2 Definition of GIS

It is evidently proven that GIS is difficult to define. Definitions of GIS are likely to change quickly as technology and applications develop further (Heywood et al. 1998, p.11). This is proven to be true, in the sense that definitions vary according to the background of the person who is giving it; some people define GIS in their line of duty and vice versa. For this research the definition of GIS is viewed as a tool from the theory point of view in academic's real situation into practical stage of GIS operations for FLTS.

The term 'Geographical Information Systems' describes a technology, Geographical Information Science (GIS) is the term used more nowadays, meaning that GIS is more than a system which can process much data. They offer functions for collecting, storing, processing, and retrieval of spatial data. Below is a definition very much inline with this research and an early definition of GIS:

'A system for capturing, storing, checking, manipulating, analyzing and displaying data which are spatially referenced to the earth' (Petch 1999, p.1)

This is essentially a techno centric definition. It focuses on what the technology does, not why it does it or what the role and context of the technology are. A spatial component makes it Geographical. Much data from different sources, different suppliers from different hardware platforms, combined, analyzed together and interpreted make it (new) Information. The whole of activities and means to provide users with the geographic information needed to carry out tasks and to take decisions in the context of spatial problems. In summary, the GIS should be able to edit the geo-referenced data, spatial data analysis and modeling.

2.7.3 Components of A GIS

The definition of GIS provided in section 2.7.2 above is expressed as a centre of the components of GIS (Figure 2.7) as a field of study. Looking first at the main aims of this centre we can then brainstorm this into five components (Petch, 1999, p.4), which are:

- Technology
- Data
- Organizations
- Methods
- Body of ideas

It is known and believed that without the above, there are no GIS and GIS cannot exist without a part of it, it operates like a human being, whereby if a human being looses almost half of his or her skin, he or she dies. This application applies to the operation of GIS that it cannot operate or exist without people.

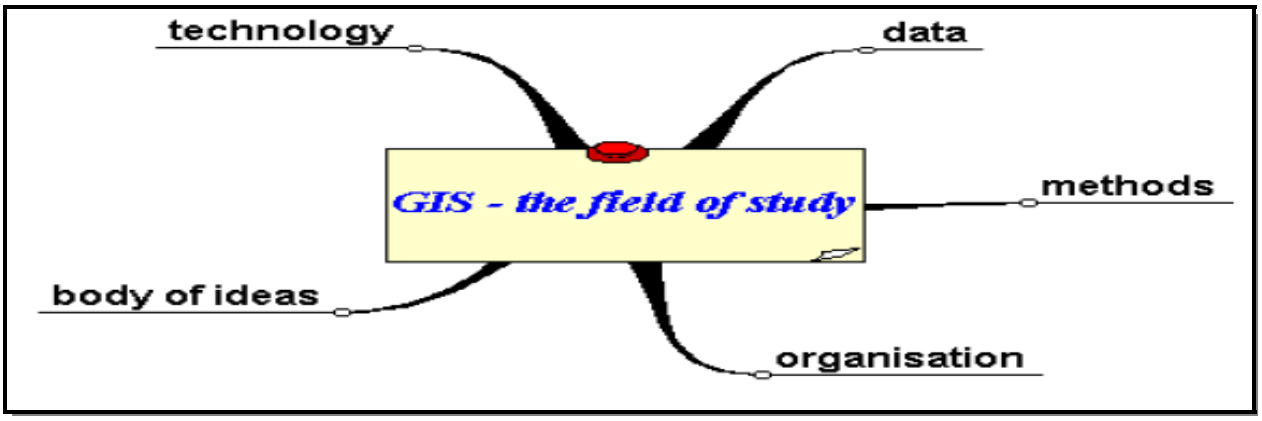

Figure 2.7: Components of GIS (Source: Adopted from Petch, 1999, p.1)

GIS can be viewed as a software package, the components being the various tools used to enter, manipulate, analyze and output data. Since GIS cannot operate in isolation from an application area, which has its own tradition ideas and procedures, attention therefore will be given at the components of GIS in detail as outlined and illustrated above in figure 2.7 which are argued that each deserves conscious consideration.

First among the GIS components there is the **technology** of GIS, which is the software and hardware. The software part of this technology is initially a set of software process at the core of which is a set of algorithms for accessing, presenting, analyzing and synthesizing data with reference to their spatial and non-spatial attributes. Linked to these programs are others for data management, for extraction from databases, for visualizing data and for undertaking other tasks such as importing and exporting

techniques. Networks (intranets, the Internet) and distributed systems are a very important part of this technology in GIS (Petch, 1999, p.1), this are further explained in detail in this research.

The hardware part of the technology is centered on the computer platform and has peripheral devices related to input and output. These include conventional read devices such as floppy disks, compact discs (CDs), etc that allow file transfer, as well as network devices, together with output devices such as printers. In addition there are specific devices widely used in GIS applications for input and output of maps to and from analogue formats (Petch, 1999, p.1), this are explained further in section 2.7.6 of sources of spatial data below.

The second main element of a GIS is **data**. All information systems are based on data and rules for using data in some form or other. The main components of the data part of the system (figure 2.7) are inputs, spatial and other forms of databases, data maintenance systems and quality assurance systems (Petch, 1999, p.1). This initially means at this level, GIS is now beginning to include not only technological entities but also human systems.

The third component of GIS is the set of **methods**. They are neither hardware, nor software, and certainly not specific to people. They are independent procedures or rules for undertaking the various tasks involved in the design, creation and operation of GIS. A method contains the logic for a procedure and the specification for the actions. There are methods for spatial analysis, for data manipulation, for database design, for user needs analysis, for map interpretation and the list go on and on. Each activity has a method. And the method is what determines the meaning or quality of the outcomes of that action. Method is the key to everything in GIS operations (Petch, 1999, p.2).

The next part of the GIS is the **organization**. Any information system can only work in the context of an organization. The organization consists of many complex and subtle parts but we will consider it here to consist of a set of business objectives, a set of business processes, management, operators and the general overarching component, people. Particular sub-components of the management, operators and people are those concerned with system design, implementation and monitoring since they have a particularly important role in defining what a GIS is (Petch, 1999, p.2).

Finally, there is the **body of ideas**, which lie behind the use of GIS. They include areas of engineering concerned with computing including mathematics and physics that lie behind the computer hardware systems. Behind software systems are bodies of knowledge concerned with geomatics, data processing, databases, spatial analysis and in any applications area bodies of theory such as from agriculture, ecology, sociology, transportation and endlessly on. Behind organizational issues are theories of management, systems design, business economics, sociology, psychology, psychophysics and ergonomics. Methods stand on bodies of theory from every conceivable branch of science, sociology,

management and commerce (Petch, 1999, p.2). In combining these components together and of course in GIS technological way, the output should be a successful GIS with different roles, and should increase efficiency at workplace like the City of Windhoek.

2.7.4 FLTS GIS Linkages and Dependencies

FLTS is a land management tool that is making land possible to access, provide, manage and monitor. Managing land in a local authority boundary is the response to enquiries from various stakeholders such as the public, banks, notaries, line ministries of government, private organisation (Namibia Housing Action Group, Shack Dwellers Federation of Namibia, etc) and private individuals, which is overseen by the local authorities in Namibia. There is accurate information on addresses of properties (block erven) and on the matters relating to land such as land surveying, town planning, planning consents, pollution control ordinances, and strategic plans and so on.

The key issue in creating a GIS here is in producing an information system, which accurately reflects the business process. The focus of interest in this situation is the analysis and design procedure. This is about defining clearly and fully what the users of the system need and then translating these into system requirements and system specifications. These specifications are met through a system (including database) design process so that a computerised system truly reflects what the business and the operators need and want, and the customers get what they want easily and quickly (Petch, 1999, p.3). The GIS functions such as buffer operations, overlay operations, database integrations, importing and exporting of spatial data operations, flow models, etc are the key existing functions that links FLTS to GIS.

In each area the five components are present and each is essential. The focus of interest, activity and investment depends, however, on the problem in hand. In other words the critical element depends on the application. In one case it is theoretical background, in another on interpretation, in another on design. Each application has its own focus. What is important to understand is that this focus has to be recognised and addressed. There are no rules. Only experience and common sense can guide us to identify the focus of our endeavor (Petch, 1999, p.3).

2.7.5 FLTS Project Spatial Model

The spatial data model component is very important for spatial data representation in a computer system as it informs the computer on the kind of visualization it should adopt for display in GIS view window. A user chooses whether to use raster data models or vector model as per problem area. Choosing a spatial data

model is very important fundamental in mapping science as each of the two models available offers different spatial analysis power.

In FLTS project, the spatial data model adopted is the vector model because data for vector maps will be held in a database. Vector point data such as parcel boundaries; feature information such as parcel erf number and attribute data such as erf owner, ID numbers, etc are held within a database table which can be populated by normal file transfer. Other data for raster maps generated by some form of keyboard entry or automatic process of data entry such as direct entry from a GPS will be used, but in most cases this will be converted into vector files.

Some of the reason to the choose of vector spatial data model is that it has a compact data structure, efficient encoding of topology useful for FLTS projects, efficient network analysis, accurate map output which is good for the repetition of the organization, less computer storage space which save space and it is more preferable for digitizing.

2.7.6 Sources of Spatial Data

There are a number of sources of spatial and attribute data, including maps, census and survey data, aerial photographs, satellite images, soft data and Global Positioning Systems (GPS), which have additional special characteristics into the GIS areas, some of these data sources are generally used and will be applicable for FLTS at City of Windhoek.

Data are costly and we have limited resources available. Data may take time to collect; yet we have deadlines to meet. In building a GIS, therefore, we need to become adept at finding and obtaining data, and we often need to be both imaginative and flexible in the sources we use. One of the main reasons for the success of GIS has been their ability to bring together different data sets. It is this which allows them to generate new levels of information, and thus to provide new insight. It is this, which provides the 'added value' from using GIS (Longley et al. 2001, p.1).

Currently, satellite navigation systems (survey data) is the main source of the FLTS cadastral data, the collection of survey data is costly and time-consuming but it is very accurate in locating survey points on the ground, this mostly is done using Global Positioning Systems (GPS). In recent years, GPS have become relatively cheaply available, which is why is the most favorable to the use in FLTS project at the City of Windhoek. The technology is nevertheless not entirely foolproof, and positional errors may occur for a number of reasons, including errors in the satellite clock, the receiver, atmospheric interference, human errors (setting on a wrong control point or typing wrong coordinates) and signal reflection from features on the ground.

Whilst maps and remotely sensed imagery usually satisfy many of the City of Windhoek's needs in spatial data, they are relatively limited sources of the attribute data, which are needed for GIS. Some attribute information may be provided in the map legends or accompanying memoirs, some may be derived from the map symbols and text e.g. contour heights, place names, etc *(*Longley et al. 2001, p.1). The most usable one in upgrading when designing layout plans at City of Windhoek is aerial photographs - like maps - are analogue documents. Other sources are sometimes used but on a very limited scale, because of poor reliability of results or product of this data sources.

2.7.7 Data Input and Editing

Normally, of course, data would be entered into a GIS before being structured. Without data a GIS will not produce output. Spatial data can be obtained from many different sources in different formats, and can be input to GIS using a number of different methods, see figure 2.8 below for a data stream.

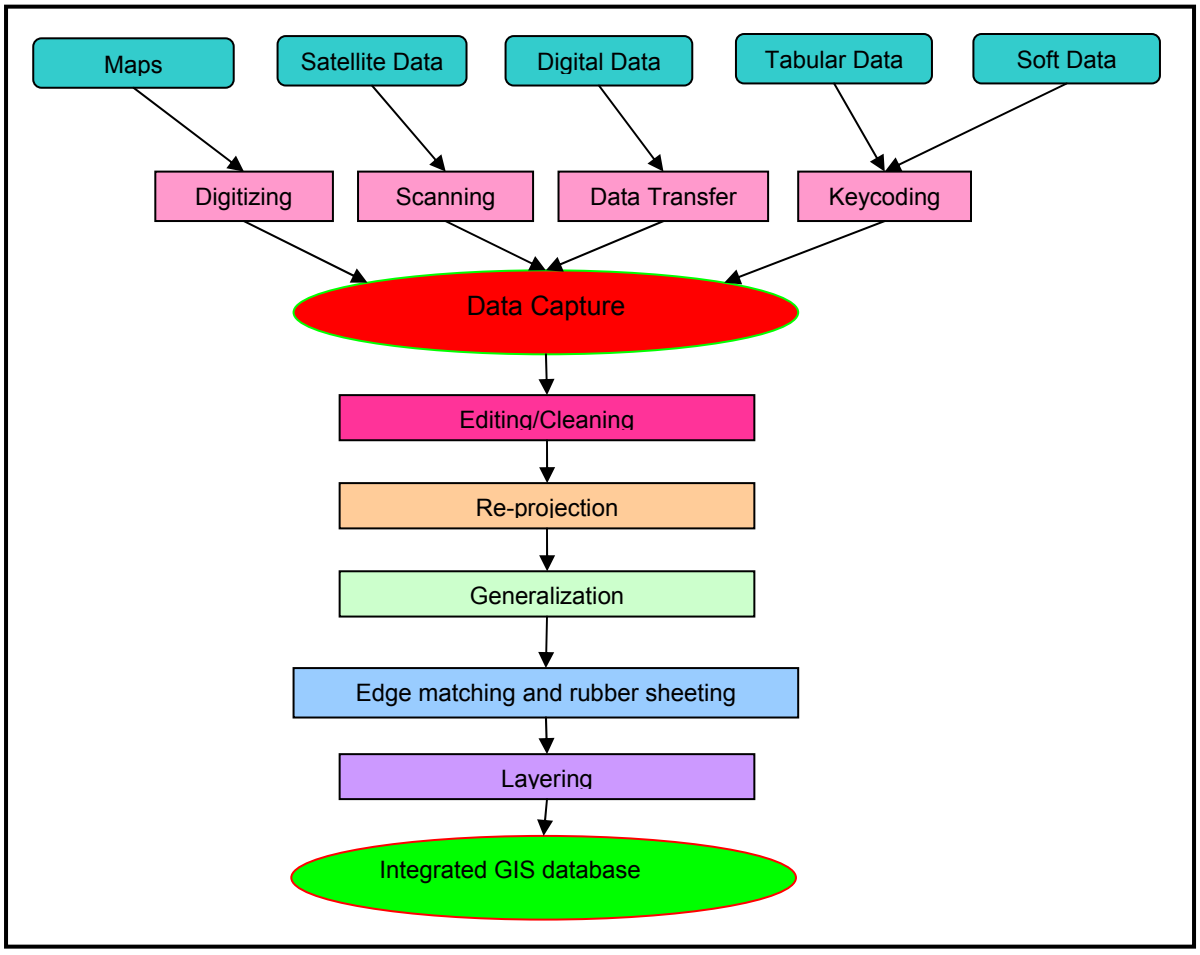

Figure 2.8: The data stream (Heywood et al. 1998, p90)

Data in analogue or digital format need to be encoded to be compatible with the GIS being used. All data in analogue form need to be converted to digital form before they can be input into GIS. Four methods are widely used: keyboard entry, manual digitizing, automatic digitizing and scanning.

Keyboard entry may be appropriate for tabular data, or for small numbers of co-ordinate pairs read from a paper map source or pocket GPS. Digitizing is widely used for the encoding of paper maps and data from interpreted air photographs. Scanning represents a faster encoding method for the data sources, although the results, digital data may require considerable before analysis is possible. Spatial data may be collected in digital form and transferred from the devices such as GPS receivers, total stations (electronic distance-metering theodolites), and data loggers attached to all manner of scientific monitoring equipment. This process is called electronic data transfer; all that is required is download cable and data communications software for a user to download the data to a file on their computer.

During encoding a range of errors can be introduced. During keyboard encoding it is easy for an operator to make a typing mistake; during digitizing an operator may encode the wrong lines; and folds and strains can easily be scanned and mistaken for real geographical features, conversion of data between formats required by different packages may lead to loss of data. Errors in attribute data are relatively easy to spot and may be identified using manual comparison with the original data. Errors in spatial data are often more difficult to identify and correct than errors in attribute data. These errors take many forms, depending on the data model (vector or raster) and the method of data capture.

Data derived from maps drawn on different projections will need to be converted to a common projection system before they can be combined or analyzed. If not re-projected (figure 2.8) data derived from a source map drawn using one projection will not plot in the same location as data derived from another source map using a different projection system.

When a study area extends across two or more map sheets small differences or mismatches between adjacent map sheets may need to be resolved. Normally, each map sheet would be digitized separately and then the adjacent sheets joined after editing, re-projection, transformation and generalization.

2.7.8 Data Quality Issues

The computing adage ‘Garbage In, Garbage Out’ (GIGO) recognizes that if you put poor quality data into your program, you will output poor quality results. This applies to GIS since the results of analysis are only as good as the data put into the GIS in the first place. Error can be introduced at every stage of the data stream. Sources of error are, however, not limited to this process of data capture and integration,

exclusive to conceptual reality stage (Heywood et al. 1998). If an error is already present in the source data and further errors arise during manipulation, output and use of the data in a GIS will both have errors.

There are varieties of errors in GIS; the main two types of errors in FLTS projects that we need to be aware of are positional error and attribute error. Other types of error are important but will usually be manifested in either of the two main types. According to Redman (1996, p.1) the case for improving data quality is pervasive, poor data quality is costly and data quality can be improved. It should therefore be remembered that errors in the application can entirely be limited and that all geodata are subject to errors. Errors propagate at all stages of GIS usage. We therefore need to consider carefully problems associated with error at all stages of GIS usage if we are to maintain confidence in our output. Poor data quality impacts on the success of the organization like the City of Windhoek.

2.7.9 The Role of GIS at City of Windhoek

The overall role of GIS in FLTS is to manage geodata and non-spatial data, to make the data available as resource on GIS and, therefore, ensure its continued existence and make it available to a much wider client base. To mention a few, here are the roles of this GIS, and are aiming to provide:

- A desktop GIS tool that allow exploration of the FLTS data;
- A set of maps that displays the FLTS data graphically on GIS;
- Within FLTS GIS can also be used to digitize location data; primarily the locations of health facilities, community water points, and schools. These locations can be digitized using GIS software from scanned images. Other spatial data, such as road networks, drainage and topography can also be extracted from scanned images in the same way;
- To provide an integration of spatial data management of environment, land use planning for the capture, storage, manipulation, management and mapping of relevant data;
- Developments in computerization and IT can allow GIS to cover almost all of the cadastral data application area in Windhoek for FLTS projects;
- Standardization of parcel, block erven data, land tenure and new products of digitization are very much relevant to success of GIS in FLTS projects.

With relevant to the roles that the GIS can offer when implemented wisely, the roles also aim to contribute by benefiting the City of Windhoek in their intended project, which are discussed below.

2.7.10 Benefits and the Need of GIS at City of Windhoek

A well-designed GIS has the capability to provide quick and easy access to large volumes of data. It can select information by area and by theme to merge one data set with another, to analyze spatial

characteristics of data, to search for particular features, to update quickly, cheaply and access. According to Aditi (2002, p.11) the general benefits that a well-designed and successful GIS would offer are mostly very potential benefits to the organization, and this can include:

- Opportunity to reduce sets of manual maps held and associated storage costs, e.g. capturing all the FLTS paper maps into the GIS for efficiency analysis and query services;
- Faster and more extensive access to geographical information throughout the organization, e.g. when new developmental projects comes along, the data are easy to access in digital format and easy analyze for such development;
- Improved of analysis e.g. of areas, distances, patterns, etc,
- Better communication of information to public officers, e.g. the public can have the information via electronic or can view and query to meet their needs;
- Improved quality of services to the client, e.g. when fire occurs within the boundaries of Windhoek it is easy for emergence services to query the street and parcel number for location purpose;
- Better targeting and coordination of services within the organization and beyond, e.g. the block erven of FLTS can be analyzed for possible community toilets at the radiuses of 50m using GIS.

The benefits of GIS are like their roles, a variety of them exists and mostly depends on the project and interlink with various situations. In addition to the role and the benefits of the GIS at City of Windhoek, there is the need for a GIS tool to help in the following areas:

Improve management of organization and resources through integration are one of the needs for GIS. A GIS can link data sets together through by common location data i.e. such as addresses, which helps departments, divisions and agencies to share their data. By creating a shared database, like the one existing in the City of Windhoek, one department benefits from the work of another at once and can be used many times (Aditi, 2002, p.9).

According to Aditi (2002, p.9) GIS is not only an automated decision making system but also a tool to query, analyze, and map data **support of the decision process**. Therefore, an old adage “better information leads to better decisions” is a true say for GIS. GIS can provide powerful FLTS information not just how things are, but how they will be in the future based on changes that are applied. GIS in FLTS is therefore about modeling and mapping the world for better decision-making**.**

Making maps with GIS is much more flexible than traditional manual automated cartography approaches. GIS creates maps from data pulled from databases. Existing paper maps can be digitized and translated into the GIS as well. A GIS-based cartographic database can be both continuous and scale free. Map

products can be created centered on any location, at any scale, showing selected information symbolized effectively to highlight specific characteristics (Aditi, 2002, p.9).

2.8 City of Windhoek's Tasks and Responsibility in GIS and FLTS

2.8.1 Introduction

This section deals with the set situation of GIS in FLTS at the City of Windhoek; it reviews the vision and mission of the City of Windhoek including the GIS objectives. It further explains and describes the positioning of the GIS at City of Windhoek and lastly providing the tasks of the City of Windhoek in FLTS currently.

2.8.2 City of Windhoek's Vision and Mission

The City of Windhoek (CoW) has set for the community a Vision, which states "We commit ourselves to make Windhoek a vibrant, economic and technological centre of excellence in Africa in order to enhance the quality of life of all our people".

As Mission Statement, the City of Windhoek is committed to:

- Render affordable, efficient and effective services to their customers through the optimal use of resources, technology and financial and environmental practices.
- Recruit, train, develop and retrain a highly motivated work force.

Value Statement

The City of Windhoek upholds the WINDHOEK values:

Winning Team
Innovation
Networking
Diversity and Equity
Honesty and Integrity
Open Communication
Efficient and Effective
Knowledgeable

Geomatics Division is positioned in the Department of Planning, Urbanization and Environment, the ninth Department on figure 2.10 below on the City of Windhoek's Organogram together with the other seven

Divisions. The Division is entirely a small division of 10 employees as outlined on figure 2.9 below on Geomatics Division's organizational structure.

The City of Windhoek's Geomatics Division under the vision, missions and value statement, it is committed in rendering the efficient and effective services of "cartography, GIS and draughting (land surveying maps compilations)", the basic geographical data are created and maintained and available for further analysis and evolving urban design. The following are the activities that the Division is held responsible for in this area:

- City maps production,
- GIS data capture and processing,
- Layout draughting (land surveying map compilation),
- Topological surveys and GIS data capture by land survey.

The above are the Information Systems (IS) Strategy, which are the statement of the information needs of the City of Windhoek, i.e. a demand statement. Its production involves an input from IT professionals as it strongly reflects the requirement for Information Systems as perceived by the business managers (Reeve, 1996, p.15).

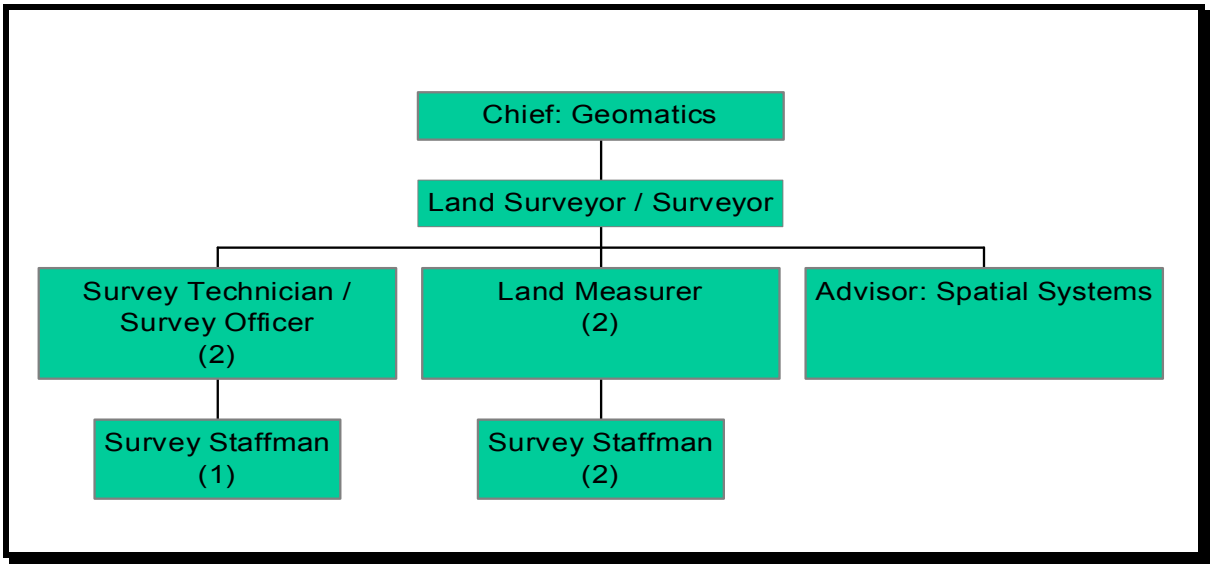

Figure 2.9: Geomatics division's organization structure (Adapted from: City of Windhoek)

All the technical support to the "Urban Management" and the "Urban Planning" processes is provided by this division, through networking, as well as carrying out surveys and geographical work of their own and on behalf of other department/divisions on cost recovery bases.

The City of Windhoek's Geomatics Division's overall objectives of its GIS are as follow:

- Stimulate the development of core base of geo-referenced data and related standards that include base map of features,
- Promote the development (standardization and sharing) of data and economic activities in ways that can be readily geo-referenced to the base map,
- Generate clearer rules regarding the ownership and exchange of data to ensure continued internal access to data, and
- Develop the organizational infrastructure needed to build this information, infrastructure in a way that connects effectively to internal personnel and practices.

These are the Information Technology (IT) Strategy, which are the statement of how the City of Windhoek intends to meet the needs expressed in its IS strategy. The IT Strategy is a supply document, detailing the software and hardware requirement, and is primarily the province of the IT specialists (Reeve, 1996, p.16). On top of that SWOT analysis developed as a tool for strategic thinking, which stands for Strengths, Weaknesses, Opportunities and Threats, these being the broad headings which managers developing a strategy or considering an investment should review. Strengths and Weaknesses relate primarily to internal (Reeve, 1996, p.16), and current issues and it is outlined in chapter 4 below.

2.8.3 City of Windhoek's Tasks and Responsibility to FLTS

The main task of the City of Windhoek in the implementation of the Flexible Land Tenure System (FLTS) projects is holding responsibility of the planning, allocation of land, surveying, layout designing, informal settlement land invasion enforcement and registration processes; thereof keep the records such as maps (both paper and digital formats) and survey records as geo information providers.

The City of Windhoek, in its effort to contribute to the upgrading of the informal settlements under the new land tenure system aimed for poor people in maintaining, managing, processing the demarcations of land for the informal settlers, it has employed qualified land measurers to undertake this challenge and to provide efficient and effective land demarcation services within the City of Windhoek's informal areas for good quality information and help to cater for good demarcation services of the City of Windhoek's land.

Beside the above, the City of Windhoek has also established an Informal Settlement Committee (ISC), see in table 2.1 below) which includes members from different level of responsibilities of work and tasks such as planning, technical, GIS, finance, top management, political and housing and urban management area.

Table 2.1: Representative of the ISC of City of Windhoek

Divisions	***Title of Representatives***	***Responsibilities***

City Council (Government of Namibia)	One Councilor	Help to advice both the committee and other councilors on the targeted project upgrading and on improving health situation of the informal settlements in accordance to the councilors of the City of Windhoek's needs.
Regional Council (Government of Namibia)	One Regional Council	Help in advising the committee on the needs identified within the informal settlement areas in accordance to the developmental needs of such area.
Sustainable Development Division	Town planner and Town Planning Technician	Advice the committee on sustainable city planning and management of the urbanization process.
Housing and Properties Division	Control Officer: fixed assents & leasehold, Officer: housing & settlement and Control Officer: residential & resettlement.	Advice the committee on sale and lease of city land, access to housing and finance for low-income residence.
Geomatics Division	Land Measurer	Advice the committee on surveying, mapping and Geographical Information Systems (GIS) of the informal settlements and FLTS which is being provided in an environmentally manner.
Community Development Division	Project Co-ordinator: Community Development and Senior Community Development Officer (settlement)	Advice the committee with residents' participation in the identification of needs and implementation of projects to seek to address community needs.
Finance Department	Revenue Collection, Electricity and Water officers, etc	Advice the committee on advising and managing of municipal accounts, provision and maintenance of basic electricity and water.
City Police Division	Law enforcement officer	Advice the committee on crime prevention and crime control within the geographical boundaries of the city and maintenance of law enforcement in the city.

The City of Windhoek has so far started acquiring FLTS data into the archive, some of the cadastral data are now been stored into the archive, others are digitally managed, but are not geographically analyzed into a GIS environment.

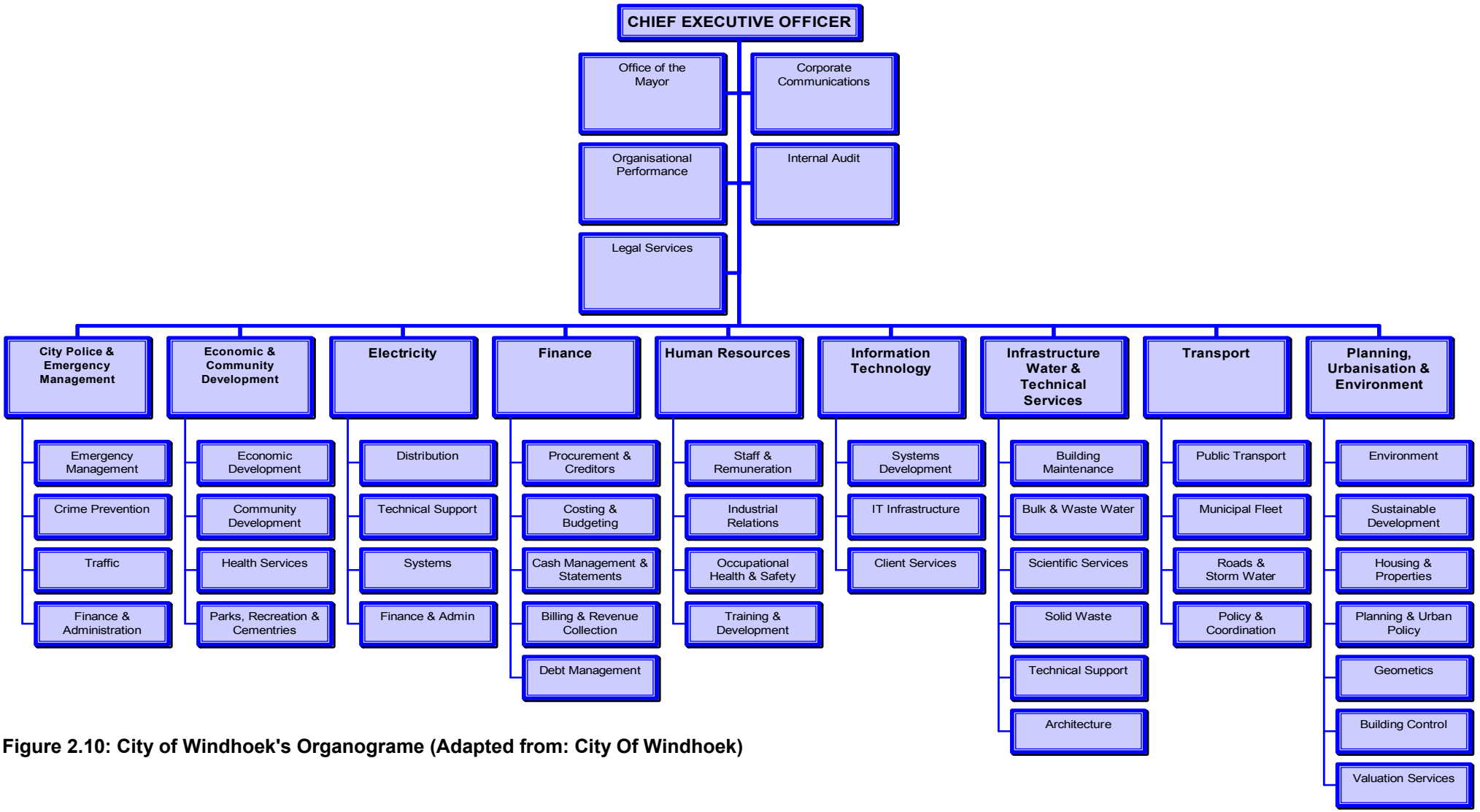

Figure 2.10: City of Windhoek's Organogram (Adapted from: City Of Windhoek)

Understanding of tasks and workflow is not that completed because representatives such as those from Sustainable Development, Geomatics and Housing & Properties Divisions are from the Department of Planning, Urbanization and Environment as seen on figure 2.10 above. Whilst Community Development Division is under the Department of Economic & Community Development and City Police are under City Police and Emergency Management. The Department of Information Technology is an independent one and has a very close relationship with the Division of Geomatics due to the CAD/GIS technology implemented by the Division of Geomatics and managed by both parties. The tasks of the ISC are mostly set by the Department of Planning, Urbanization & Environment because they deal directly with informal settlement communities in their daily tasks. Currently, the entire City of Windhoek and other organizations depend to Geomatics Division for maps and other mapping projects on cost recovery bases.

The standards of handling informal settlements and low-income people's needs are set by the Informal Settlement Committee (ISC), and it liaisons itself with line ministries and other stakeholders. The ISC was established in 2003 by the City of Windhoek's management committee in terms of section 26 (1) of the Local Authorities Act, 1992 (Act 23 of 1992) to co-ordinate the improvement of living conditions in the informal settlements and advice Management Committee and Council accordingly.

This was also established in order to provide the transparent way of handling individual poor people's complaints, the ISC seats or meet once a month. The committee is also a useful implementation team in the dealings of FLTS activities in Windhoek.

2.8.4 City of Windhoek's Tasks and Responsibility to FLTS' GIS

The GIS to be used in "Flexible Land Tenure Projects" will be a tool managed and implemented at City of Windhoek's Geomatics' Division. Block erven and its plots and other geodata will be captured, mapped and managed on new separate GIS software called ArcGIS. The maps will carry all the spatial and attribute entities necessary for recognition as flexible land tenure schemes. This was agreed during the consultation meeting and intensive presentation of the need for a GIS in FLTS applications held between the City of Windhoek's Geomatics Division and Geo-Business Solution, a GIS consulting company which also presented the capabilities of Autodesk Map 3D 2007 existing in the City of Windhoek with comparison to that of the ArcGIS proposed by the Geomatics Division. The detailed explanation to the choice of ArcGIS is outlined in chapter 4 of section 4.3.4 of results to OPAFITS C+ concept on the subsection agreement.

Currently in the entire Namibia there is no corporate database or register with different organizations or ministries existing. The responsibility of land administration including the managing of cadastral data is entirely to the local authorities themselves, like the City of Windhoek. It is for that reason that the City of Windhoek is finding it important in upgrading its tools and system of land administration to accommodate

FLTS potential spatial and non-spatial data. The Geomatics Division will timely monitor the way the LPO and other private land practitioners of FLTS are carrying out the activities of spatial data compilations. This in the end allows the data to be captured on the City of Windhoek's GIS.

The data to be captured on GIS is of good quality, and this is made sure by the Geomatics Division's land surveyors who first check the quality contents and recommend for approval for the survey to be carried out, after the survey the final layout is prepared and is brought for approval to the City of Windhoek before it goes to the Surveyor General's Office (SGO) for final approval.

3. Research Methodology

3.1 Introduction

This chapter examines the methods/tools used in collecting data and sources of data for this research, and presents also reasons for selecting these methods. The chapter begins by introducing the data collection techniques, details of the interview techniques, and lastly the development of an LIS and GIS approach.

3.2 Data Acquisition Techniques

3.2.1 Introduction

This section deals with the data acquisition techniques used in gathering the data for the study area and the met contents of data sets. It therefore starts by introducing the study area identification technique and field visit, followed by the research data set requirements and lastly by the digital layout map acquisition techniques used.

3.2.2 Identification of Study Area

As a first step, the exact geometrical extent of the study area had to be defined. As it is envisaged that the City of Windhoek will use the results for upgrading, information dissemination and planning of the informal settlements, the site was visited together with a planning official from the City of Windhoek, who pointed out the boundaries of the settlement (erf 3378, Otjomuise Township) concerned. The boundaries were roughly surveyed by handheld GPS, the coordinates of which were then used to identify the study area on digital cadastral map (Autodesk Map 3D 2006, supported by Munsys 9.3 applications format) of the study area.

3.2.3 Research Data Sets Requirements

The data requirement was determined on the study area data to the importance of the data for this research (the use of GIS for flexible land tenure system). The FLTS cadastral data model has been designed to support the Division of Geomatics' cadastral data maintenance requirements. The model represents current cadastral status but not necessarily current title. Other major issues considered were methodologies based on a target ESRI geodatabase implementation to reflect the requirements of this technology.

Spatial, attribute and population data for the study area with comparison to other townships (see figure 3.1 below) will be managed by the GIS and are available.

More data sets were needed to fulfill the tasks for completing the research. After site visit, collection of the secondary data for all the FLTS in Windhoek was carried out as follows:

Acquisition of layout plans and other maps, either in digital or hard copy format, were acquired from individuals, private companies, institutions and town planning consultants who carried out such FLTS layout designing tasks, these always contains block erven with internal erven (plots).

Acquisition of records of all the cadastral information of the existing block erven was acquired from the Surveyor General's Office (SGO). Other related information were acquired from the organizations and individuals who carried out the land survey, this include coordinates on general plans and diagrams.

Other block erven information outside the study area was also necessary for collection and storage, which was available within the City of Windhoek. Figure 3.1 below defines the data sets requirements. Locations of community toilets, community water points and other sewer data were collected from the field through manually delineating them on a hard copy map, and then geo referenced into ArcView. This data are important in the context of FLTS because at the Starter title level, the community will be sharing these services at an earlier stage at a walking distance within the block area. It is also important for the upgrading of the informal settlement areas to the FLTS standard.

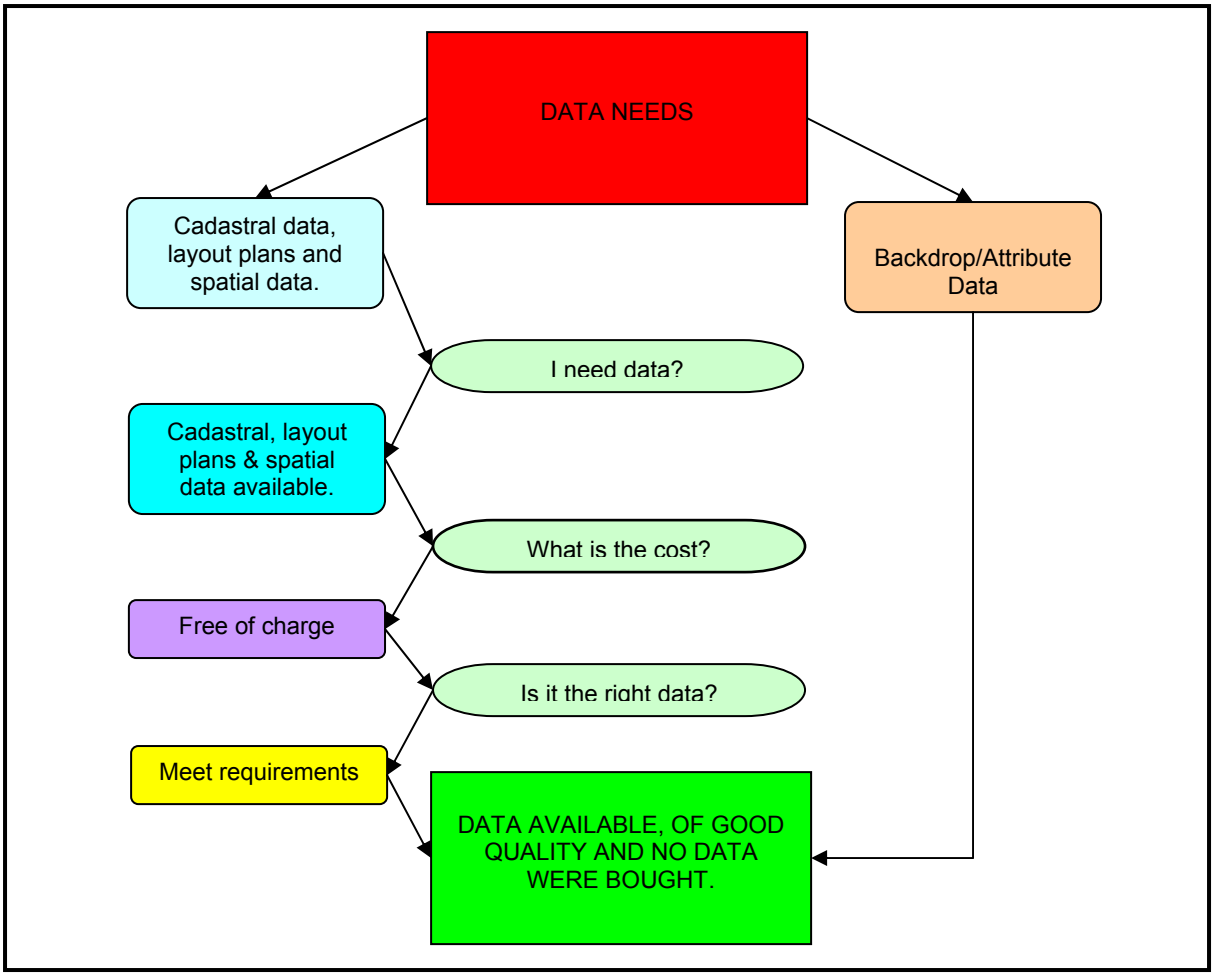

Figure 3.1: The data definition process

Except for the data sets outlined in figure 3.1 above, for use in spatial operations, "backdrop data" were also needed. Such data are:

- Erven numbers of parent erven (block erven),
- Internal erven numbers (plot numbers),
- Townships & extensions,
- Registration division,
- Tenure rights,
- Saving groups names,
- Plots holders names and addresses,
- Titles holders (City of Windhoek categories), and
- FLTS Title.

Cadastral data, Layout plan, attribute data and backdrop data were available and were adequate for the purpose of this thesis. Other data such as household data were acquired from Namibia Housing Action

Group (NHAG); an organization involved in a process of formalization of low-income people in the country and Shack Dwellers Federation of Namibia (SDFN) an organization with group of saving groups (schemes) affiliated to them.

3.2.4 Importing, Exporting and Cartographic Techniques

A layout plan of the study area (erf 3378, Otjomuise Township, Windhoek) was available; it was imported into ArcView. Saving it as DXF file format in Autodesk 3D map software and then selecting extensions that supports DXF file in ArcView did see through the entire process of having this layout in ArcView. Other new data entities like toilet points, water points, etc were created as new features as there appear in the GIS mapping project. Other new operations were also done in ArcView during data analysis.

A basic understanding of map projections, coordinate systems, and map compilation was required before the location data could be digitized. Transverse Mercator projection and Clarke 1866 Spheroid at a central meridian of -17, and reference latitude of 22 with scale factor of 1 was used in ArcView GIS for the mapping project. The project was fortunate in that the location data were drawn from a single map sheet. It was therefore not necessary to combine and integrate location data from map sources of differing scales and ages, otherwise a higher level of understanding of cartography would have been important.

Geographical Information Science (GIS) became important in geo-referencing location of new features but basic cartographic issues such as the placement of labels, symbolization, and generalization still required attention on a daily basis of operation.

3.3 Interview Techniques

3.3.1 Introduction

This section defines and explains the focus group techniques used to acquire the information and share the group's views on introducing GIS for FLTS projects at City of Windhoek. It briefly explains the purpose of the focus group with the date it was carried out, and further explains the contents of the interview and lastly outlining the success of the contributed work before this research.

3.3.2 Focus Group Definition and Background

The Australian Government (2004, p.1) defines a focus group as a structured discussion with an expert group of users, they further outline the purpose of a focus group as a tool that brings together the attitudes, beliefs, perceptions, preferences and experiences of different consumers. A focus group is an

effective method to use group dynamics to obtain a large amount of material in a short period, and evaluate different concepts and explore new ideas of a GIS tool in land administration.

In addition, Marczak & Sewell (1990, p.1) explains that a focus group is typically 7-10 people who are unfamiliar with each other. These participants are selected because they have certain characteristics in common that relate to the topic of the focus group. Marczak & Sewell further ague that the groups of over twelve have often proven to be too big while fewer than four have shown that not enough total experiences exist.

The base for this interview is the views of others, technical aspects and site inspections on informal settlement block erven for the geodata verification and techniques of GIS for FLTS in order to verify the focus group interview results. The observation done by myself through few informal settlement block erven within the City Boundary was carried out in July 2006, whilst, cartographic maps are included in this thesis to motivate the need, capability, benefits and efficiency of GIS in FLTS as a pilot study.

Before the focused group interview was carried out, two of the City of Windhoek staff members knew some interview content. To get the focused group interview content structured, some colleagues of the City of Windhoek played a role in contributing to the presentation content. Before the focused group interview content was presented to the focused group, the content draft was first tested to few City of Windhoek staff members in order to get an understanding of the whole interview structure.

The pilot presentation to the focused group (Appendix B to C and the accompanied digital files) told the implementation team that GIS could be supportive in performing some major tasks for FLTS. Integrating many data from different software and sources into a GIS, and different departments and divisions is one of the tasks.

3.3.3 Focus Group Interview Technique

The focused group interview presentation was held on the 23rd of August 2006. The time between then and now, June 2007, is a relatively long time. The discrepancy in time is particular important given the rapid take up of GIS. Many respondents agreed and understand the need of involving flexible land tenure data into the GIS world soon.

The sample for this interview includes all the implementation team from areas of IT, Geomatics, Housing & Properties, Sustainable Development and Community Development of City of Windhoek, see attendees list in annexure B. The team was a total of ten people, excluding one top management who was on leave; two middle management level members from the Department of Planning, Urbanization & Environment,

with the rest as technicians, first and middle management level members we present. The questions were raised out to and from the group during the presentation; answers and recommendations were provided and tackled straight away with the focus group members, including the opinions via voting on number of GIS issues (Annexure C). The invitation notice was addressed to "GIS and FLTS Implementation teams" (Annexure A). The invitation notice was addressed to specific staff members via e-mail. Invitations we sent to all the FLTS, Informal Settlement Committee (ISC) members and GIS implementation team members.

3.3.4 Interview Contents

The focused group interview technique was mainly focusing on three main parts. Several questions were answered and discussed during the presentation aimed at answering both the objectives of this study and the hypothesis as set out in chapter 1.

In section one of the focus group discussions, the benefits of using GIS for FLTS were outlined. This was followed by an open discussion with the focused group members to rank and determine high benefits for using GIS in handling FLTS data. The evaluation process was done through voting with results recorded on flip charts (Annexure C).

Issues covering other factors that influence the use of GIS in FLTS and its outputs were covered. This were also discussed in the interview content of 'the use of GIS in administering FLTS data' and ranked to test the group's understanding on the use of GIS through voting.

The concept OPAFIT C+ was another interview content covered in the interview. It stands for Organization, People, Agreements, Finance, Information, Technology and Communication; in short it is used to illustrate the tools behind the GIS, which makes the GIS successfully in intended projects. Issues covering comments on the OPAFIT C+ and other relevant issues of FLTS were also discussed during the focused group interview presentation. The OPAFIT C model was used in order to gain all the required information on the implementation of a GIS/LIS database within the City of Windhoek.

A chance was given to the team to add their views and opinions on the current 'hard copy (archive)' of FLTS data at Geomatics Division and on any additional comments or remarks, the results of this discussion are presented in chapter four below.

3.3.5 Contributed Work

This research and others like Bayer 2000 and Robinson 2003 are very useful for the Namibian local authorities and the world at large, in improving land administration activities. Nevertheless beside a focus group interviews involving ten (10) members of technicians, first, middle and top management of the implementation team from City of Windhoek, Bayer (2000a, 2000b) and Robinson (2003) carried out some researches before. Bayer was the first researcher to work on Flexible Land Tenure System (FLTS) in Namibia; he researched for “Information system design for PC based Land Information System (LIS) of Local Property Office in Namibia within the context of the "Flexible Urban Land Tenure bill of 1999". His research was reviewed as part of the whole initiation phase of FLTS. Whilst Robinson (2003, p.0) emphasizes on “Development of an Operational Plan and LIS for the proposed Local Property Offices in Namibia”, which also played a big role in drafting the Flexible Land Tenure Bill of 2006; waiting for parliament debate soon.

3.4 The Development of an LIS and GIS Approach

3.4.1 Introduction

This section describes the techniques of LIS and GIS technical approach to the development and designing the prototype used to demonstrate the capabilities of GIS in FLTS. It starts by elaborating the aim and background of the LIS and GIS model, followed by setting situation on the presentation of the pilot study.

3.4.2 The Aim of the LIS/GIS Prototype

A pilot project intended to demonstrate capabilities of GIS in general. A pilot project was useful because it demonstrated to potential users and management what GIS in FLTS can do for them. Employees who are directly involved, gain experience. The relation with the present technical infrastructure can be identified. Basic assumptions can be tested. The usefulness of all the data can be tested. Requirements like training and support can be identified.

The aim of the LIS/GIS pilot approach was for the team to gain experience, building technical infrastructure, insight in own data registrations, and the use of standards and usefulness of external data; whilst, to construct a small group of focused group employees who will be working on small feasible and pilot of GIS and LIS products available. Only two workstations are required for managing the database and GIS for FLTS and are available. A cadastral base map data was internally available, containing all the informal settlements layouts and a highly useful map of cadastral data, it is useful because the background of data can be determined from there i.e. one can easily determine the land surveyor or a private company which carried out that specific area’s survey work. This is an ideal map to start with; it will make early deliverables possible. The results

therefore aim at increase of knowledge of the basic understanding of GIS to the group, decision-making as to accept or not accept the GIS for FLTS and realisation of some GIS products by the focused group members. The results also aim to demonstrate what GIS in FLTS can do for users and managers.

3.4.3 LIS and GIS Model Technique

Well-designed and maintained GIS and LIS database approach was presented to the focus group to motivate the capabilities and benefits of the GIS in the usage for managing FLTS data.

Robinson (2003) a graduate with ITC (International Institute for Geo-Information Science and Earth Observation) from 2001 – 2003 focused his Masters research on the Development of an Operational Plan and Land Information System for the proposed Local Property Offices (LPO) in Namibia. His research although more concerned with proposed Local Property Offices (LPO) for the implementation of the Draft Flexible Land Tenure in the entire Namibia; it shares a common interest with this research on the basis of developing of a non-expensive and effective Land Information System (LIS) to support the land information and land registration process.

Robinson's research proposed the use of Microsoft Access, as a standard database for the envisaged Local Property Offices (LPO) and the reason for this is that, Microsoft Office of which Microsoft Access forms part, is readily available and affordable. Therefore, this research also used Microsoft Access to convert the manual FLTS tenure register to a digital format. However, the choice of whether to develop the database in MS Access or conventional database packages will be borne by the Divisions of Geomatics and Housing and Properties at City of Windhoek given the way forward presented in this research. ArcView GIS was used for cadastral spatial data part of data administration and analysis.

3.4.4 Pilot Presentation and Discussions Technique

Presentation of GIS/LIS prototype and discussion with the technical and management implementation team of FLTS projects held on the 23rd of August 2006 saw its green light. Beside the scheduled issues, discussions included new issues of successful implementation of a database; such as:

- Adopting of the database and modify it to suit more household data,
- Communication with other relevant Divisions to be done either through the available communication ways i.e. email, telephone, office visit, etc,
- Data exchanges and consultations within the City of Windhoek, and
- To continue researching for tangible technique of handling other spatial data like FLTS data.

The results of all the questions during the focused group interview presentation were answered by a 'Score Card' technique. In case of optional questions, each member of the team was given a chance to select his own choice, whilst, in case of open questions, all the questions were answered through different techniques of responding and answering and finally reaching agreement as analyzed in chapter 4 below.

Three techniques of responding to questions were applicable during the focus group discussion; one was through ranking factors that influence the use of GIS in FLTS projects, the next one was where members has to raise their hands to NO and YES question and lastly through commentary during the discussion. Chapter 4 below outlines in detail the entire focus group results.

4. Analysis and Results

4.1 Introduction

This chapter provides the results of the set objectives in chapter one. It also presents the discussions and personal communication results made during the time of researching. It begins with the results on flexible land tenure in Windhoek, followed by the focus group interview results; LIS/GIS approach results and lastly the general GIS analysis based on a SWOT analysis with the advantages and disadvantages of GIS.

The extent and relative importance of the geographical information varies between the projects, but taken together they present an opportunity to investigate how maps and geographical information can be presented on GIS in a variety of different contexts (GIS can integrate data from these different disciplines). A key aim of this research is to achieve solutions in handling and presenting spatial data and attribute data of FLTS at City of Windhoek. A number of FLTS issues are included in this chapter, mainly to prove the progress of the entire FLTS projects in the City of Windhoek.

4.2 Results on Flexible Land Tenure in Windhoek

4.2.1 Introduction

This section explains, elaborates and describes the results on the state and progress of the flexible land tenure system in Windhoek. Issues such as availability of land for FLTS projects, the standards set for acquiring the FLTS from other stakeholders and subsequently the memorandum of understanding that is put in place between the Local Property Office (LPO) when established and the City of Windhoek as also discussed. The results on stakeholders' approach to FLTS currently in Windhoek is explained and described here. Other results on how FLTS data are managed currently and FLTS land demarcation techniques in the City of Windhoek and other local authorities in Namibia are also explained.

4.2.2 Flexible Land Tenure State in Windhoek

Currently, about 47-block erven are made available and are recognized for flexible land tenure projects (figure 4.1) with possible upgrading. 10-block erven are purchased by saving groups, 8 are individual leasehold, 18 are group lease agreements and lastly 11 are earmarked for resettlement on FLTS standards.

Over 50 saving group schemes or more exist in the City of Windhoek. Saving group schemes refers to a group of organized people in a community who comes together and starts saving money in a common account for the purpose of purchasing a portion of land they are occupying, or an alternative portion of land from the City of Windhoek. The monthly contribution towards the scheme is not fixed and it all depends on the income level of the member. In most cases the contribution is about ± N$50.00 monthly (about ± € 7.00) as mentioned earlier.

In figure 4.1 below, it can be seen that flexible land tenure exists in all the five townships of the northern part of Windhoek city. Havana township, a 100% informal settlement area is currently under major upgrading process of basic services such as water, electricity, sewer etc, this is budgeted for by the City of Windhoek and clearly explained in chapter 2 above.

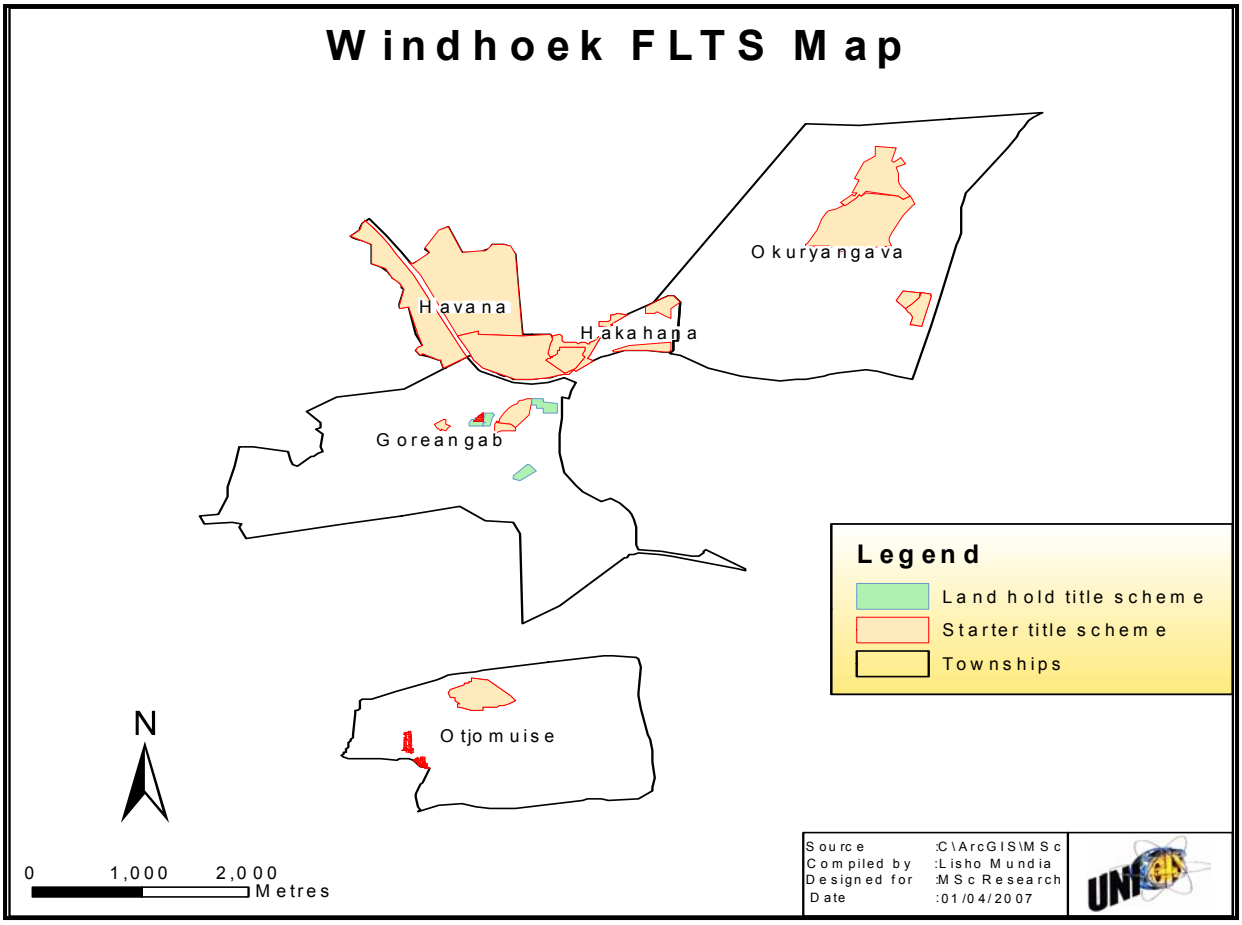

Figure 4.1: Windhoek flexible land tenure system map

Land hold tenure titles practically existed before in this low income townships (figure 4.1), because this are the land bought by saving groups of the Shack Dwellers Federation of Namibia (SDFN) and Namibia Housing Action Group (NHAG) who provided low-income houses on this land in the past ±7 year for the

poor people who saved money in order to buyer the land from the City of Windhoek. Whilst, starter title are new development of demarcated land, well planned and continued been planned in catering for low-income groups currently saving in order to afford the land on starter title in future. The initially stage of starter title and land hold title is to make them legally recognized nationally.

There are ±10 block erven settled under the saving groups in Windhoek city alone. These are believed to suit well with the FLTS requirements, and are been provided with basic services such as water, street access, community toilets, and basic electricity. Their land is well demarcated and suits the needs of all the FLTS under both starter title scheme and subsequently upgrading to land hold title scheme.

4.2.3 FLTS Set Standards at City of Windhoek

Flexible land tenure layout plans is acquired from individuals, organizations, private practitioners, and institutions that are carrying out demarcations and any other task of flexible land tenure projects. Currently, the City of Windhoek has made sure that the future acquisition of all the FLTS layouts be done thorough by setting standards that all the flexible land tenure layout maps be approved by the City of Windhoek before any surveying ground work begin. These standards are in line with the land survey act, including the process model between the City of Windhoek, LPO and the clients of FLTS.

Once the Local Property Office (LPO) that deals fully with FLTS is set, it will also have to get approval from the City of Windhoek for the final layouts to be approved and put in place before the survey starts. This was agreed upon on the meeting of “Memorandum of Understanding between the City of Windhoek and the Ministry of Land and Resettlement for the Local Property Office (LPO)” to be established soon see figure 4.2 below for the process model of FLTS application. ‘All the layout plans and flexible tenure plans also known as Land Hold (LH) plans (figure 4.2) will have to be approved by Local Authority (LA) in this case is the City of Windhoek before any survey starts and that the Local Property Office (LPO) can at anytime seek advice on any issues related to surveying or map composition of such FLTS’ (C P Jendrissek 2006, pers comm., 23 May). The standards of the FLTS block erf layout that the City of Windhoek will recognize are outlined in table 4.1 below.

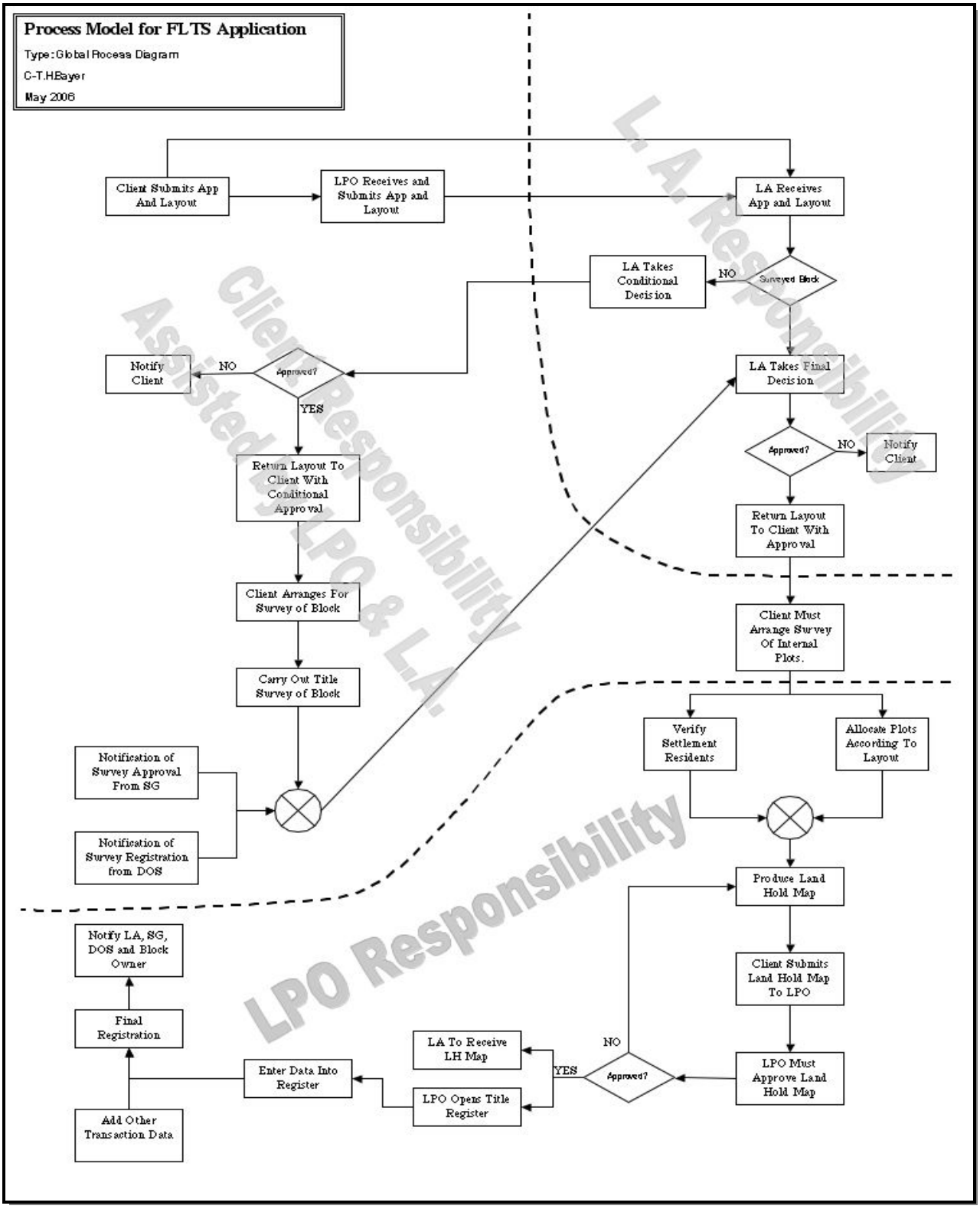

Figure 4.2: Process model for FLTS application (Source: Adapted from Bayer, 2006, p.7)

During the meeting between the Ministry of Lands and Resettlement (MRL) and the City of Windhoek (CoW) held on the 12 May 2006, the two parties recognized the importance of institutional cooperation and exchanges in support of the Flexible Land Tenure Project for the purpose of land reform aimed at promoting poverty alleviation, sustainable development and integrated land management in Namibia. In support of the National Development Strategies and Vision 2030, the MLR has embarked on the process of establishing and staffing Land Rights Offices (LRO) and the CoW is engaged in the process of formalizing informal settlements in the Windhoek local authority areas through the principles of the flexible land tenure system.

Although the agreement of memorandum of understanding is still not yet legally agreed upon, it was mutually agreed that applications for the registration of land under the proposed FLTS would be submitted to, processed and approved by the CoW as per the current procedure in place at the CoW (Bayer, 2006). The parties agree that the LRO will be responsible for the registration and the safeguarding of the rights awarded under the FLTS. Furthermore the LRO will assume the responsibility for drafting and/or verifying the accuracy and completeness of the land hold plans (figure 4.2) with regard to the spatial location and layout and ensuring correspondence with the list of settlement residents provided by the savings scheme on the application to the CoW (Bayer, 2006). The LRO also agrees to provide the relevant information, including a copy of all land hold plans, on every newly registered transaction under the FLTS to the CoW within one week of registration.

Table 4.1: Standards for FLTS layout plans

Contents	Description Of Standards
Erf Size	The Erf shall not be less than 150m² per household and 300m² per two household (optional).
Units per block Erf (size limit)	Only a minimum of 30 and maximum of 100 units per block erf in a group are allowed.
Demarcation	Only a land measurer under the supervision of registered land surveyor, survey technician and a land surveyor registered with Surveyor's Registration Council of Namibia (SURCON) can carryout the demarcation.
Layout Drafting	The layouts can only be prepared by anyone in the land surveying and town planning industry that carries out such task. Final approval to be done by the City of Windhoek.
GIS Issues (City of Windhoek only)	The data will be imported or mapped on GIS immediately after approval of final layout.

Drafting of layout plans and a demarcation tasks has proven to be too expensive for the low-income earners, the fees paid to private surveyors and town planners are proven to be much more than they can afford.

Therefore, the City of Windhoek has resolved that the tasks of drafting of layout plans and demarcations of block erven be done by the City of Windhoek itself, and the costs be accumulated into property costs in order to eliminate high costs paid at once to private organization. However, saving groups, individual and group members are still welcome to appoint their own private land survey practitioners to do their work and get it approved by the City of Windhoek.

4.2.4 Stakeholders' Approach to FLTS in Windhoek and Other Region

The City of Windhoek has adopted the 'Development Upgrading Strategy' (DUS) to address the management of urban development and informal settlement upgrading. This strategy aims at establishing guidelines by proposing different development options based on affordability of the client and also proposes guidelines for informal settlement upgrading and management. The stakeholders in the land development and upgrading process are also identified.

Apart from the City of Windhoek and the Government of Namibia, there are at present only two main Non Governmental Organizations involved in self-help housing development; the Namibia Housing Action Group (NHAG) and Shack Dwellers Federation of Namibia (SDFN) have a number of saving schemes affiliated to them. The two NGO's broadly follow the same guidelines similar to those used by the City of Windhoek and as such the City of Windhoek works closely with them in the implementation of the self-help group' strategy.

The strategy urges the establishment of a land bank in order to speed up the allocation of land to the self-help housing groups. This land bank would contain information of portions of land and erven owned by the City of Windhoek that could be developed for residential purposes by these groups. This also allows for in-fill residential development, as vacant land within existing townships will also be listed. The City of Windhoek will determine the feasibility of developing these erven in terms of natural conditions and probable development costs as well as potential erf yield. The City of Windhoek' Sustainable Development Division have undertaken to provide planning layout designs at no costs to the groups in a bid to demonstrate the Division's social responsibility to the poor.

The two non-governmental organizations (Namibia Housing Action Group and Shack Dwellers Federation of Namibia) have been doing FLTS projects in the Otjozondjupa Region in the town of Otjiwarongo and the Kavango Region in the town of Rundu in the past with the help of the Polytechnic of Namibia's Land Management Department students, and are currently busy in Caprivi region in Katima Mulilo. The Government development supporting company called Luxemburg Development is now also sponsoring huge upgrading projects in the towns of Katima Mulilo and Rundu and they are not sure whether they will go for FLTS approach, or for formal title (full free hold, with general plan and township establishment).

4.2.5 Managing of Cadastral Data

The City of Windhoek, like any other local authority in the world, is faced with the challenge of supplying timely and reliable data to its clients. These data sets are looked at as strategic resource for development and business. The computerized multi-purpose cadastre of the City of Windhoek is a relatively new concept. It has the potential to provide many benefits across all sections of the communities by acquiring updated information of their parcels at quick service and to the City of Windhoek's employees itself, such benefits of this cadastre are:

- Ability to query data by the City of Windhoek and external parties, suburb, town name or geographic search criteria,
- Ability to handle zonings, densities and land use separate from land parcels,
- Ability to link addresses to parcels, and
- Efficient cadastral capture tools to construct data by coordinates.

Therefore it is important that the benefits are widely promoted both to top management of the City of Windhoek who are responsible for the allocation of resources and to the users of land and property related information. Figure 4.3 shows the land use map of the FLTS Otjomuise of erf 3378 block. The City of Windhoek's top management are aware of technology growth, change and its need, the attitude of the top management of the City of Windhoek and the people towards cadastre are quite generous and they always require productivity of work with this new technology. Implementation of land use maps for FLTS project is a good idea because the City of Windhoek can have a good tool for monitoring activities happening in their land.

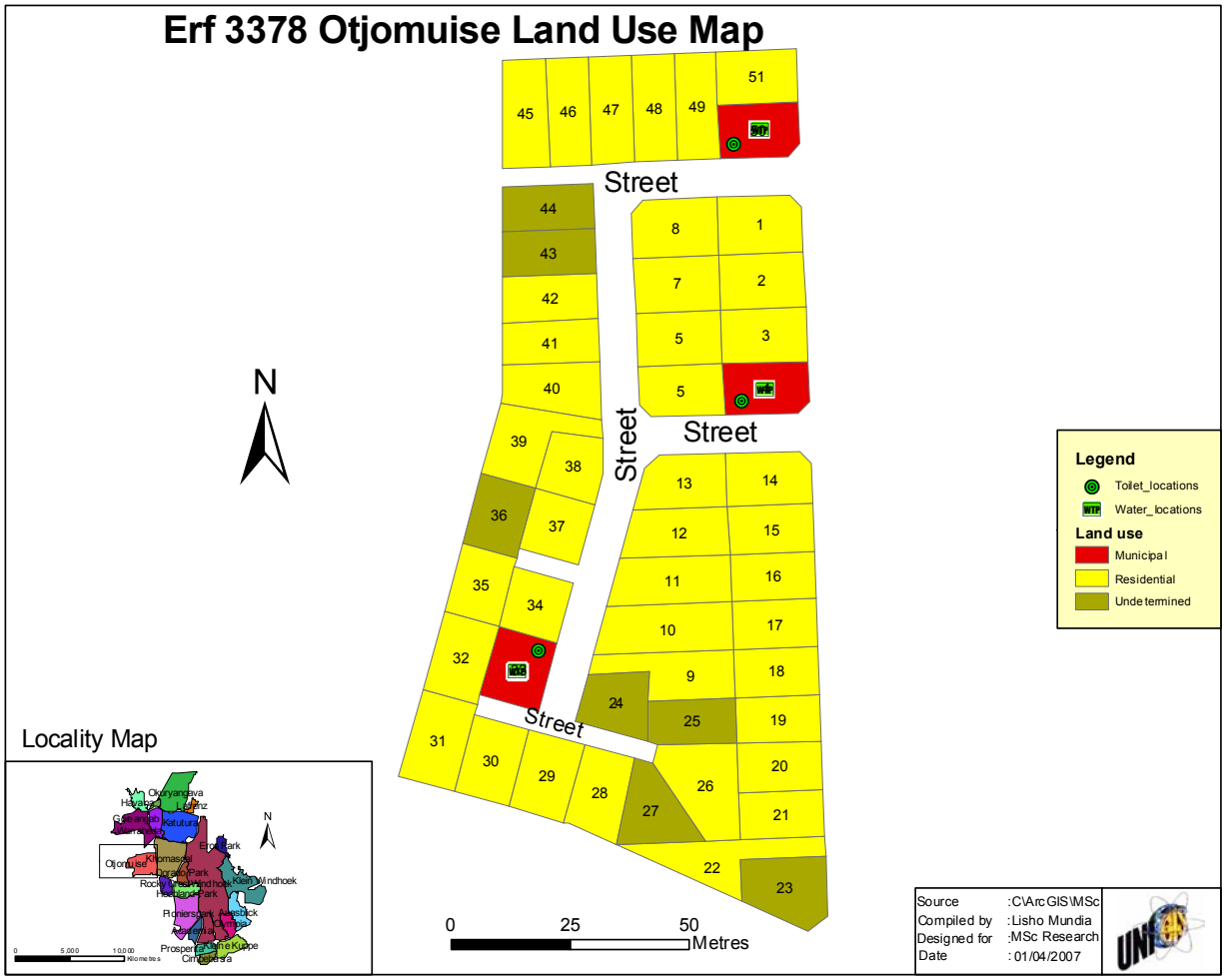

Figure 4.3: FLTS land use map

In order to ensure the efficient productivity and use of cadastral data and other geographical data for FLTS, suitable techniques and organizational arrangements for information dissemination has been put in place at City of Windhoek. The City of Windhoek's Geomatics Division's customer care front desk has recently opened an archive of hard copy map and digital data formats of all FLTS cadastral data that were carried out in the past few years. Data of interest can be checked for content, quality, price and conditions of delivery, which can further be analyzed to suit the clients' needs as seen in figure 4.3 above.

Collection of all the FLTS data from various organizations, institutions and individual has already started as mentioned earlier. Almost 80% of the FLTS data are now available at the City of Windhoek' Geomatics Division, this was a very difficult task because of different sources, some data are still been checked for contents and quality. All the FLTS data both digital and hard copies will be available immediately after approval of final layout. Whist, discussions for data to be available on separate GIS software, which was already tested with few FLTS block erven on ArcGIS, has seen its green light. All other digital FLTS data were acquired from the City of Windhoek's Sustainable Development Division in AutoCAD format.

The data will also be collected, stored, maintained and updated cost-effectively and efficiently through getting a final digital and hard copy immediately after approval of such layout by the City of Windhoek. Data will be registered only once, kept up to date in one place (Geomatics' Archive), whilst the electronic vision will be imported into GIS, cleaned and offered for public use. These will however, require several separate technical, organizational, and financial measures; this then answers the questions of many GIS experts within the Windhoek City and enthusiasts individuals who keeps asking what the City of Windhoek is doing with the FLTS data. Questions such as 'is there anything the City of Windhoek is doing with the FLTS data at the moment? (T C Bayer 2006, pers comm., 20 February 2006) will be eliminated by the GIS results in flexible land tenure projects.

4.2.6 FLTS Demarcation Issues

The demarcation of FLTS block erven will be carried out in accordance with the Namibian land survey act (act no. 33 of 1993: land survey act) by any registered land measurer, survey technician and a land surveyor. The Act was promulgated in 1993, to regulate the survey of land and to provide for matters connected therewith, in the Republic of Namibia, based on the Land Survey Act No. 9 of 1927. At present, any one who qualifies to carryout the survey and demarcation of the FLTS can do it with no objections to his or her work (Government of Namibia, 1993).

Before one starts with the demarcation/surveying on an upgrading area of the FLTS; in situ (area where people are already living), a meeting need to be held with the community involved to inform them of the project and also involve them where necessary. The community needs to be educated on how to manage beacons (pegs) and on cheap demarcation techniques, in case beacons are removed. The process of conducting a community meeting usually is through by conducting a short meeting with the community leader of that block erf first, the community leader then calls a meeting with their members together with the land surveyor involved. This procedure is normal a norm in Namibia's informal settlement upgrading as part of adjudication process, it aims mainly to solve land dispute within the block, for example if the land surveyor detect that the shack house is situated in the street access, he or she has to know who to approach and be known to such community member.

In an informal settlement, under the flexible land tenure bill, demarcation using tapes for internal erven demarcation is acceptable, because the schemes (saving group) only own a block which is registered at the Surveyor General's Office (SGO) and is first surveyed by a professional land surveyor. Although using a tape measure the survey will be accepted and it is also cheaper than using professional land surveyor with their expensive instruments, the City of Windhoek recommend the modern technological surveying equipments like GPS and total stations for their work in order to have good quality results.

4.3 Focus Group Interview Results

4.3.1 Introduction

This section provides the results on GIS and LIS for FLTS, explaining the attribute and cadastral data capturing results. The application contents in land administration projects of GIS for FLTS results and proposed and ranked by the focus group is also explained here including cadastral and attributes mapping. The results on the OPAFIT C+ concepts are explained and lastly the results on comments from the focus group interview.

To realize the focus group's contents, a presentation of a pilot study done with the City of Windhoek's data was presented to the group as an introduction to discussion and questions. This was done because the group composed of members who could not understand much about GIS. During the discussion the group mainly the middle and top management strongly agreed to seriously bring the FLTS data into GIS, and gave positive recommendations on the usefulness of the FLTS data. These are outlined in this chapter below.

4.3.2 GIS and LIS for Flexible Land Tenure System

Since the main objective of the research is to evaluate the use of GIS in handling FLTS data, the focus group interview was therefore carried out within the City of Windhoek with the implementation teams of FLTS and GIS. This was to allow inter-divisional information sharing and determine the reason for a GIS as to the reasons outlined in figure 4.4 below. The database will be managed by the Geomatics division, whilst, some land information data will be entered into the database by the Division of Housing & Properties.

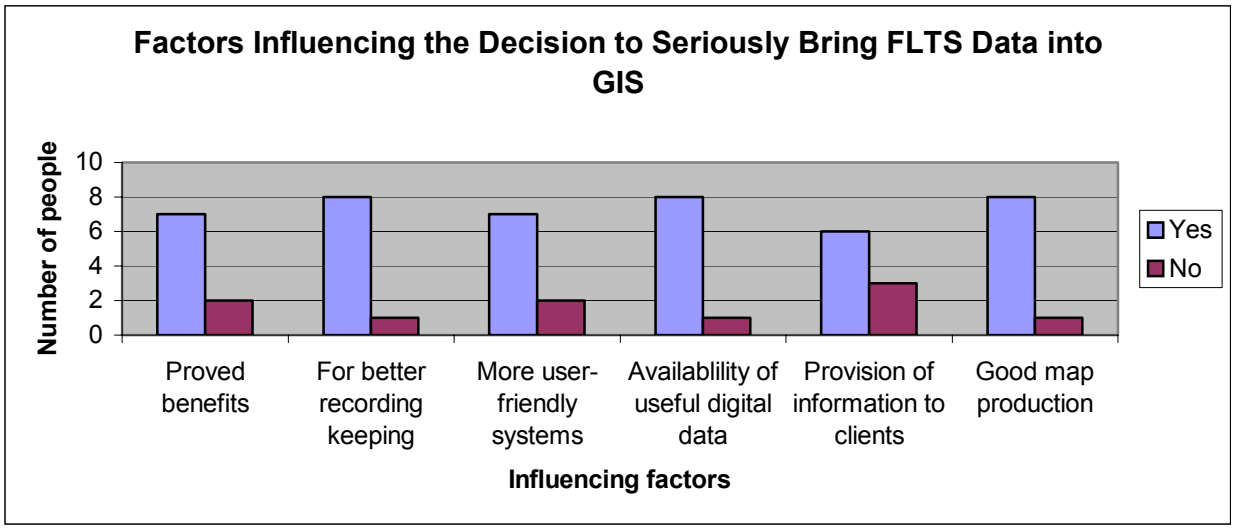

Figure 4.4: Factors influencing decision to bring FLTS into GIS system

The factors that influence decision to seriously bring FLTS data into GIS system as outline in figure 4.4 above were ranked on a YES/NO questions during the focused group interview. The questions followed after the presentation on the capabilities, needs and usefulness of GIS in FLTS. Out of nine participants of the focused group's interview, *proven benefits* yielded seven positive votes with two of NO. Whilst, in the category *of provision of information to the clients*, the team understands the importance of the information captured into GIS but could not understand the need for such provision that made them relax to vote for provision of this information to clients. These were middle management level team members, who could not understand the need for provision of information to clients, see their comments in section 4.3.5 of this chapter in table 4.2 below. No outside members from the City of Windhoek were involved because this is the tool for the City of Windhoek only. The GIS consulting company was involved at the technical part; this is explained in this chapter below in section 4.3.4 under agreement.

The capturing of attribute data (land information) is the responsibility of the Division of Housing & Properties of the City of Windhoek which is already in position of all the household data. This data will be captured into the Microsoft Access database or any new database agreed upon in future. Such data will include unit (plot) owner's details, sex, ID numbers, FLTS title, tenure rights, saving group names, land use, date of settlement, etc.

The Division of Housing & Properties is mainly responsible for allocating land to relevant clients after the Division of Geomatics is done with the surveying of such land. The Division of Housing and Properties are the main brain of tenure rights to the allocated land (figure 4.7). Thus, the agreement for them being responsible for capturing the above data cannot be viewed as a new task. These are the data available

within this Division, and are acquired in various ways such as through deed of sales, lease agreements and surveys.

On the other hand, Geomatics Division of the City of Windhoek as a Division responsible for mapping, surveying and managing all cadastral data in the boundaries of Windhoek city, will be responsible for managing the FLTS database and the capturing of all the cadastral data into the database and on GIS. The data includes - registration division, township, erf number, unique unit number, and plot sizes.

The relationship between these four main Divisions of the City of Windhoek namely Sustainable Development Division, Housing and Properties, IT and Geomatics is very much essential. This is mainly because of the integrations in work operations and Divisional needs. These parties are both in support of the GIS in FLTS projects and their work is very much overlapping to one another see figure 4.7 below.

Having said about the relationship of the Divisions directly involved and elaborating more with figure 4.7 below, it will be understood that plot sizes will be calculated in the GIS from the layout plans prepared by the Division of Sustainable Development and other data will all form a base for linking the Microsoft Access Database with GIS database and subsequently joining them for data storing, managing and further analysis. Information of GIS and Microsoft Access database can be analyzed and compiled in forms of maps, graphs, charts, etc to make tangible and geographically readable output like the map seen in figure 4.5 below. This can help in decision-making process, future planning of land allocation and in progress reporting to the top management. Figure 4.5 shows a map service by a GIS. It shows a 50m buffer of toilets points which can be used on deciding whether more toilets are needed in the area at 50m radiuses or less.

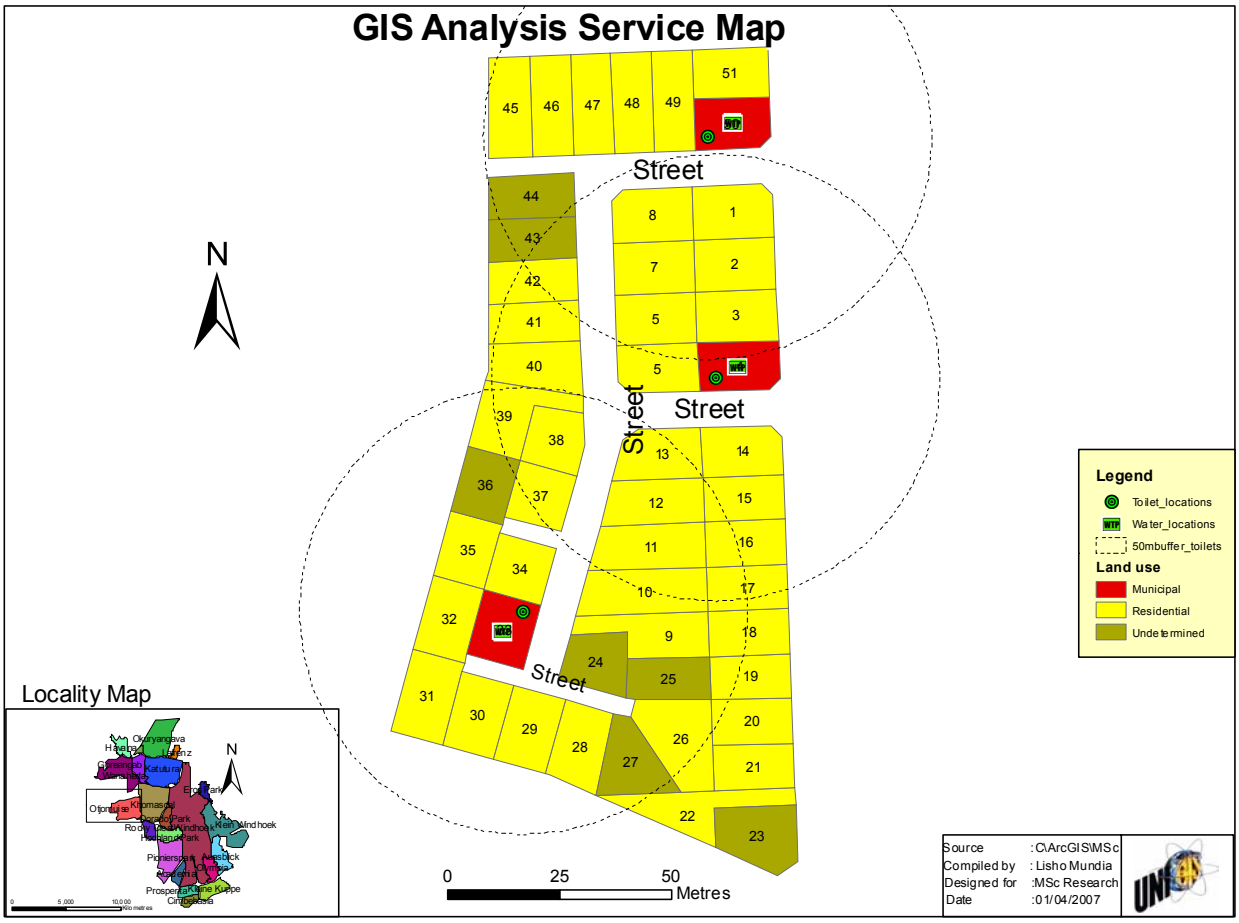

Figure 4.5: GIS analysis map

The map in figure 4.5 above is the map from the integration of a Microsoft access database (land information data), captured by Housing & Properties Division and that of the Arc View GIS attribute table, captured by Geomatics division. The importance behind the whole integration of the two attribute data is that attribute data can tangibly be represented geographically. Whilst, some information such as household data manually encoded into a database are also reflected in the output.

4.3.3 Applications Contents of GIS for FLTS

The mapping of attribute data will form the base task of the Division of Geomatics in the City of Windhoek. This will be done once the Division of Housing & Properties has updated the database with all the attribute data, through communication. Different map outputs will be produced from this attributes to support the decision making process of different Divisions at City of Windhoek.

Any map referred to as a cadastral map will include entities such as street names, parcel boundaries, dimensions, north arrow, date produced and erven numbers. This will be designed to reflect the cadastral

information. The Division of Geomatics will be responsible for mapping of all cadastral map of the City of Windhoek as it is currently doing the same task. The legality work of land registration and allocation is the responsibilities of Housing & Property Division.

All the digital attribute and cadastral information will be managed by the Division of Geomatics for different applications of any land administration project within the City of Windhoek. Figure 4.6 below shows the factors that influence the use of GIS in FLTS data perceived to be common and were supported by the focus group members by means of voting after the presentation of a pilot. Whilst, all the involved Divisions have the responsibility to see to the implementation and maintenance of the entire project tools by making use of this GIS tool for their decision making and planning process.

The results in figure 4.6 below, clearly indicates the need of a GIS in administering the FLTS data because of the 100% votes it has acquired from the focus group. The category of front desk and information, land parcel and cadastral data both got votes of 100%. These results indicate also the potentiality of FLTS data as useful for dissemination to both the public and other stakeholders like surveyors, town planners, etc.

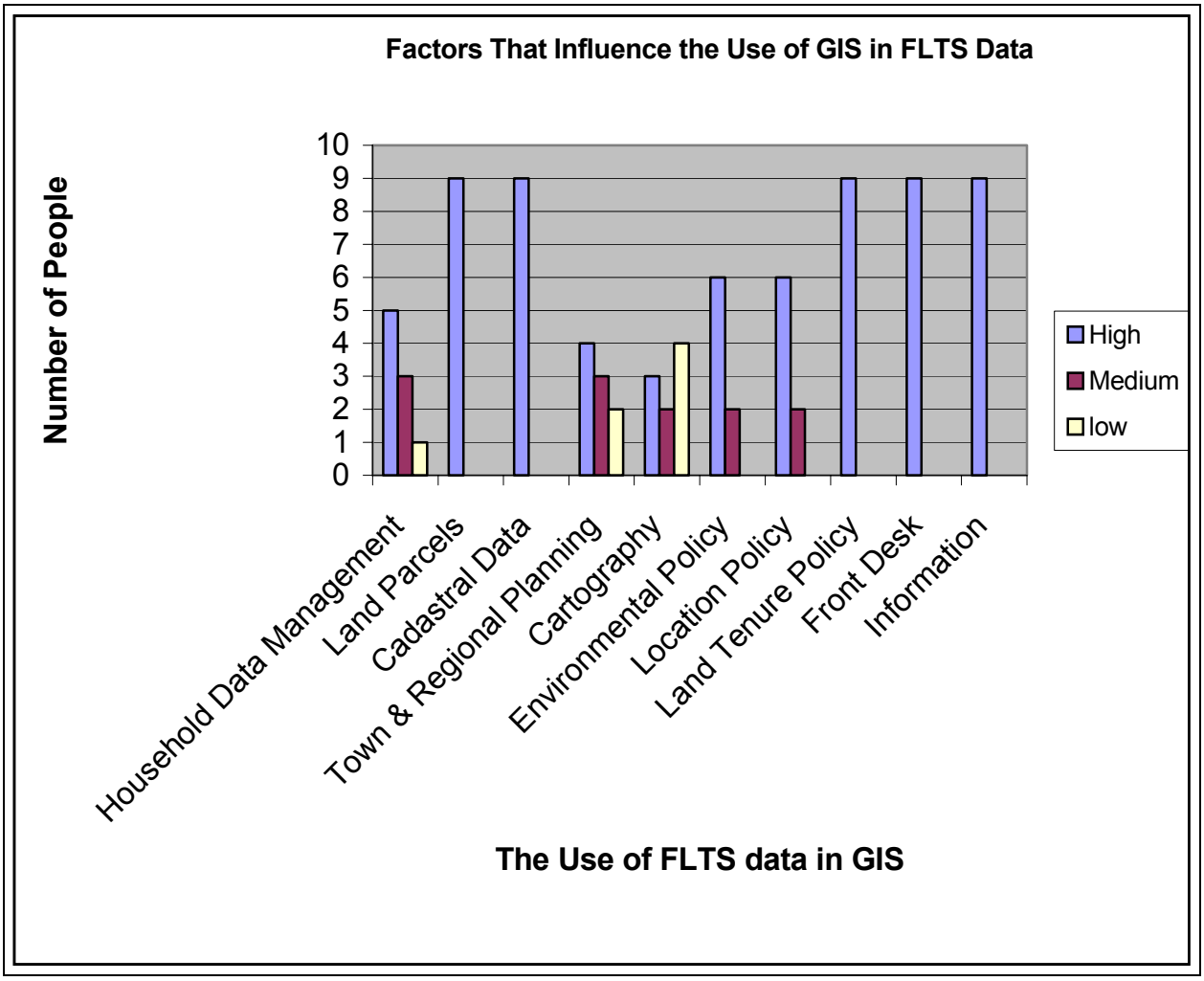

Figure 4.6: Other application contents of GIS for FLTS

The FLTS data will mainly focus on the above uses and any other required analytical reports by the top management. Since the focus group was composed of technical teams, top and middle managements and few GIS specialist and technicians, the team therefore didn't see the need in cartography and it is the only one ranked low among all the possible uses in figure 4.6 above. The category of cartography was later seen as an important one after varies explanation of its importance, such as the availability of Windhoek map on internet.

Hard copies of cadastral information (e.g. layout plans) are filed by the Geomatics Division. Whilst, Housing & Properties Division have the responsibility to file hard copies of agreements (lease, title deeds, etc). Digital data are mainly for easy access for information dissemination, data analysis, reporting and helps in decision-making process for future city developments which will be available at Geomatics Division.

4.3.4 Results on OPAFIT C+ Concept

Introduction

A main characteristic of land tenure is that it reflects a social relationship regarding rights to land, which means that in a certain jurisdiction the relationship between people and land is recognized as a legal valid one either formal or non-formal (Lemmen et al. 2004, p.2). The success of GIS requires a recognized organization, the people working in that organization with set agreements, finance available for the project, information as a component and the technology to keep it running smoothly with good communication.

For this research the OPAFIT C+ concept was used for discussion of the future success of FLTS GIS project during the focused group interview, the concept with its results is summarized below on its letters as headings.

Organization

Organizations like the City of Windhoek are now increasingly confronted with rapid developments in technology, a technology push: internet, (geo) databases, modelling standards, open systems, GIS, as well as a growing demand for new services, a market pull: e-governance, sustainable development, electronic conveyance, integration of public data and systems (Lemmen et al. 2004, p.2). Organisation of GIS in FLTS project exists, which is the City of Windhoek.

As Sieber (2000, p.16) have concluded, successful implementation of a GIS in local governments including the City of Windhoek, depends on a number of well-documented factors, such as:

- Evaluation of user needs;
- GIS as a vital component of the official organization' strategy
- Long-term upper management commitment to the project;
- Sufficient allocation of resources;
- Adequate staffing;
- Timely and sufficient training;
- Someone, called a "GIS champion (professional)," who will shepherd the project from acquisition to use; and
- Organizational communication or diffusion to smooth the transition to full utilization.

Sieber (2000, p.16) further pointed out that "clearly, management plays a key role in achieving GIS adoption." "In addition to commitment to the system and the securing of resources, implementation depends on the upper echelon's ability to articulate organizational goals for the GIS, including management of possibly conflicting departmental goals." This is clearly the same procedures at City of Windhoek because enthusiastic individual employees identify the need for a tool, and then present its role,

capabilities and benefits of such a tool to their line managers for possible recommendations and advice on a detailed research.

The management is divided into two levels; the primary user level and the secondary level all containing the centralised aspect of the management, (e.g. Geomatics division). Another subdivision is the divisions into technical, data and application management, which also include the Division of Geomatics, Information Technology (IT) Department, Housing & Properties Division and Sustainable Development Division. Figure 2.5 and 2.6 in chapter 2 indicates the brief explanation of other outside organisations involved in the FLTS project. On the paragraph people below, there is attention for knowledge and education.

The most important part in all the management affairs is mutual communication. The user organisation consist of main Divisions and mostly four roles are important - (see figure 4.7 below for divisional responsibilities in the FLTS projects) the end users, application administrator and GIS administrator. It is not possible to combine roles into one person because of different responsibilities; roles are divided to various Divisions as shown in figure 4.7 below.

To help elaborate more on the roles played by these Divisions, an overlap diagram of figure 4.7 illustrates the tasks and responsibilities of each Division. Firstly, the Division of Housing and Properties under its broad responsibilities determine the block erf (erven) for availability to the low-income people. Once the land is available and agreed upon after necessary consultation and pre feasibility studies by the Division of Housing and Properties, then the Division of Sustainable Development under the request from Housing and Properties Division carries out a planning process (including detailed feasibility study, designing of technical aspects of services, etc) and design a layout plan outlining details of parcel boundaries, street access, services such as community toilets and water point's locations. Thirdly, the Division of Geomatics under the request from the either the Division of Housing and Properties, Sustainable Development or from the Informal Settlement Committee (ISC) carries out the demarcation of this block erf by using the layout plan prepared by the Division of Sustainable Development through cleaning it to the land surveyor's needs. Lastly, the block erf is imported into the City of Windhoek townships map via IT's GIS/CAD administrator.

The process of recognizing a block of land for flexible land tenure system is the Division of Housing and Properties' responsibility but it gets its final approval from the Informal Settlements Committee (ISC) for such recognition. The ISC are the driver of the low-income land within the City of Windhoek's boundaries.

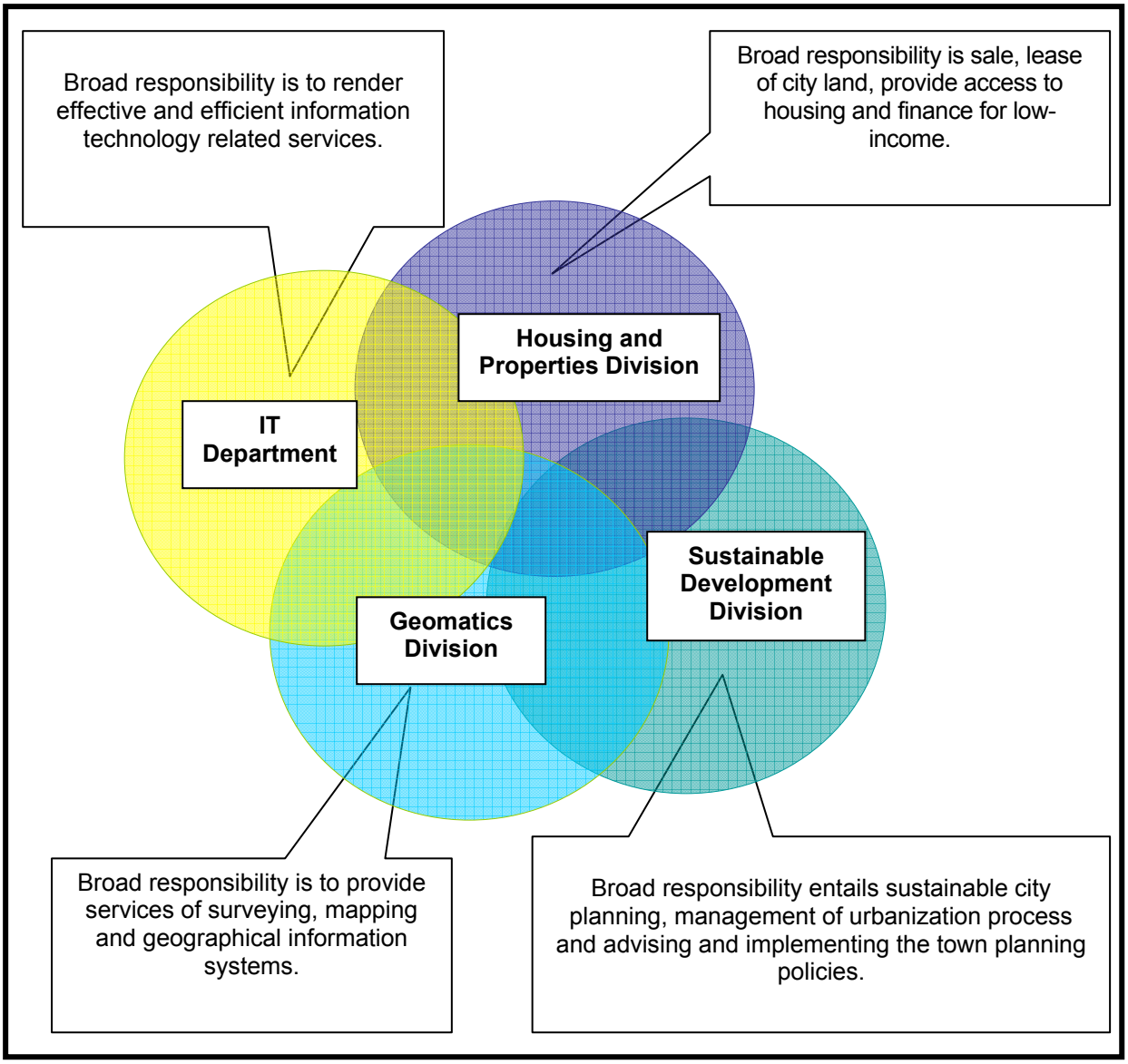

Figure 4.7: City of Windhoek technical divisional responsibilities in FLTS

The diagram of figure 4.7 above is used to show areas of overlap between elements of functions. The responsibilities of this four Divisions overlaps, and are very much working hand in hand in dealing with the FLTS issues. The Geomatics Division however, its work is mostly in surveying, mapping and GIS, mostly it also work on the advisory level of spatial issues such as advising the client who require advise on erven boundaries, dimension, servitudes, etc. Geomatics Division and the Information Technology Department of the City of Windhoek have a very much close relationship also due to the GIS/CAD technology they use.

The IT helpdesk is the central part of the technical management. The technical management is responsible for the correct working of the technical infrastructure. Users and application administrators get in touch with the helpdesk when there are technical problems e.g. disturbance of printers and plotters, authorisation

problem on network directories, problems with data communication. The helpdesk brings in the technical specialists e.g. network/system manager, automation-office expert, who are the IT department in case of this project it is CAD/GIS administrator and are available.

People

The GIS database administrator (DBA), who is agreed to be a CAD/GIS Administrator of the IT Department, is responsible for the technical management of the database and its GIS, with important aspects like authorisation, consistence and integrity, back up and recovery. The database administrator supports users with complex queries. DBA will liaison himself with the Geomatics Division's Chief Geomatics of the City of Windhoek and he also manages metadata as well. For the data co-ordination part the DBA makes agreements with users and data administrators. The agreements are set down in a data dictionary.

Training of the employees is an investment in the people and also an investment in the future of GIS and LIS for FLTS projects. The introduction of GIS causes new tasks like a highly specialised and trained DBA to manage the GIS database and IT related tasks. In practice it is possible that one person fills-in more tasks. The relation between the tasks is that, the GIS will cut short the long time spent on the pen and paper recording method. The following tasks need attention:

- GIS and LIS user,
- Land Information administrator,
- Database administration,
- Technical administration.

The GIS and LIS for FLTS project application management are new at the City of Windhoek. The filling in of these tasks is necessary and forms the base for successful use and co-operation. Fortunately, all the tasks are filled, and the new system will reduce their time frame on their everyday tasks.

Agreements

The agreements are an important aspect of an information infrastructure. Because of the cooperation between four divisions, agreements are even essential. There was already attention for some agreements on the data infrastructure and the technical infrastructure. Agreements such as that of installation of ArcGIS, setting up of Spatial Data Engine (SDE) which can operate as a client application on top of a wide range of mainstream Relational Database Management Systems (RDBMS) together with oracle database were agreed upon with the company called Geo-Business Solution. This is an external GIS Consulting Company; chapter five of figure 5.1 below outlines the proposed setup. These choose was made based on the Division of Geomatics' needs considering the entire City of Windhoek's needs too. One main reason was because the existing Autodesk Map 3D 2006, supported by Munsys 9.3 applications was automated and cannot create shape files for FLTS and other projects, either compatible for external clients.

The Distributing Database of ArcGIS is Spatial Data Engine (SDE) simply because the existing Oracle Corporate database cannot fully support the ArcGIS operations without SDE (figure 5.1). This thesis can only be an exploration. Some examples of significant agreements made during the focus group discussions and before are:

- Tasks, responsibilities, competence and substitution,
- Rules, standard procedures,
- Guidelines for creating, collecting, exchanging and using data, and
- Backup, archiving.

Finance

The project is fully budgeted by the Division of Geomatics and the funds are already available and were approved during the council meeting of budget approval for the year 2006/2007. Currently the GIS project is still at its pilot stage and the costs remain confidential until after the pilot has been approved. This is in accordance with the City of Windhoek's financial policy. However, this research can only reveal the estimation costs of the project, which was also reviewed by the manager for Geomatics Division and the CAD/GIS Manager.

Components	Costs
Central Components	
1. Autodesk map 3D	N$ 234,490.00
Components Per Workstation	
1. ArcGIS (ArcView 9.2) for five users with one year subscription	N$ 71,040.00
2. Spatial analyst (optional)	Budgeted
3. ARCSDE for Oracle RDBMS (Dual CPU) SDE (Spatial Data Engine) SDE (Spatial Data Engine)	N$ 92,075.00
Maintenance as from the 2nd year of Operation	
1. ArcGIS (ArcView 9.2) Annual primary subscription fee as from second year + secondary fee per software license	N$ 6,564.00
2. Spatial analyst (optional)	Budgeted
3. ARCSDE for Oracle RDBMS (Dual CPU) SDE (Spatial Data Engine)	N$ 6,564.00
4. Customization for ARCSDE to comply with City of Windhoek RDBMS (for 160hours)	N$ 40,500.00
Adjustments workstation	
Upgrade 64 Mb 600	Internal costs

21 inch Monitor	Internal costs
Education	
GIS training (ArcGIS)	N$ 3500, per group of 5 employees

The City of Windhoek is one of the local authorities that depend on the cost recovery based projects on its service provisions and it does not receive any budgetary fund from the government. Therefore, the top management advised that the cost budgeted for the GIS software and other items remain un-detailed to any other outside individual and institution, until the project is officially in its operational stage. It is for this reason that costs are estimation to indicate that the project is budgeted.

Information

Information is power. In GIS, usually they are types of information such as attribute and spatial. More attention is given to very useful information for the FLTS project which is explained below.

Cadastral maps; cadastral modelling is considered as a basic tool facilitating appropriate system development and re-engineering and in addition it forms the basis for meaningful communication between different (parts of the) systems (Lemmen et al. 2004, p.5). The cadastral map is very important for the entire FLTS GIS pilot and has many possibilities for use. This will be the responsibility of the Geomatics in provision of this information into the system and finally to both internal and external users.

Land information; the land information is very important for the entire FLTS GIS project and has many possibilities for use too. The household data and their background are useful for future planning and development.

Thematic maps; there are many widely used thematic maps at City of Windhoek. Examples of thematic maps are land use, low-income saving group, informal areas, soils, subsoil's, height maps, townships maps, etc.

Topographical data; the topographical maps are very valuable for the FLTS GIS and LIS pilot study, especially as background. The quality of the maps of the topographical service of the City of Windhoek is high. The core database can constitute the standard basis for the exchange of spatial data with some adjustments (simplification).

Technology

Some of the technical parts are already presented in agreements section above. The GIS specialist of Geomatics Division disposes of professional GIS tools (ArcGIS, conversion tools, and ArcView extensions). The database will be modified and managed. Several technical components (e.g. colour laser printer, big A0 and all size scanners, A0 colour plotter) are available.

For the quantity, the addition is technically not very complicated. The networks are connected by means of the suitable network protocol. The servers are present and the workstations are suitable.

Communication

Communication will be based on individuals involved, and the results will be presented to the Informal Settlement Committee (ISC) once in a month. The City of Windhoek's communication channels remains through emails and telephone, with the office consultation open to all the clients and colleagues on open door policy. The team reviewed this during the focus group discussions.

4.3.5 Focus Group's Comments and FLTS Archive

During the focus group discussions, it was revealed by the team that hard copies are very useful in cases where the network server is down. Besides the group's feeling, the hard copies are legally managed after survey has been done and prove to the Geomatics' land surveyors that the work has been carried out and is registered, and it is in accordance with the land survey act. Table 4.2 below shows few personal comments made by enthusiastic member of the focus group during the discussions of the need for a GIS tool in handling and managing FLTS data.

Table 4.2: Focus group's comments	
1.	It's good that we have a database now, because we can start capturing all the land information data and later integrate it into GIS and subsequently into a corporate database.
2.	The entire data is very useful for planning purpose, and this can be integrated with other data sets like population data.
3.	I am very much impressed to see such a system for storing and analyzing important data like this because this data are piled as cabinet files and are time consuming to find and analyze. I strongly believe we need this system in the City of Windhoek.
4.	For Geomatics Division, we have budgeted ArcGIS to be used for both FLTS projects and other projects. This will be made final soon after few consultations; all the necessary entities of the software and workstations are budgeted. We also have good personnel and good support from the top management.

Like the Chief Geomatics has said, "the objective of GIS in FLTS project at the City of Windhoek is to have a successful GIS tool similar to the existing one. This in return will include the standardizing of all the work process of data capturing; even if it mean starting small like we are starting it now (C E Jendrissek 2006, pers comm.., 22 August)".

The FLTS archive situated in the office of the Geomatics Division is open to the public for copies of this geometrics information (maps). These are information keep in the separate cabinets from those of the freehold land tenure and others. With the current development of house scheme for low-income people most of the building designer entrepreneurs are using this archive on a daily basis.

4.4 GIS and LIS Approach Results

4.4.1 Introduction

In this section the results of GIS map presentation are presented, including the Microsoft Access database results interlinked with ArcView database.

A pilot study of FLTS was carried out on Erf 3378, located in Otjomuise Township in Windhoek. The survey was carried out in accordance with the supplied informal layout. The calculations and draughting (land surveying maps compilation) was done in CAD with the final layout imported into GIS (ArcGIS).

4.4.1 Achievements on GIS/LIS Pilot Approach

A pilot study on the use of GIS for handling FLTS data was presented to the focus group before discussions commenced. The presentation helped by achieving the set objectives in the following areas:

- Helped the group in understanding the use of GIS in handling FLTS data,
- Helped to demonstrate the applicability of GIS to the managers and potential users,
- Helped in taking the first careful step towards digital data storage,
- Helped in testing data of other divisions (usability, conversion, loading),
- Helped in demonstrating the flexibility of GIS in producing cadastral maps, land use maps, etc,
- Helped on getting insight in technical and organisational consequence, and
- Helped on getting insight in tangible and intangible benefits of GIS.

These were archived successfully in a sense that the focus group appreciated the entire presentation. It helped getting the group members into focus of the purpose of the entire interview also.

4.4.2 GIS Maps Standard

The maps of FLTS will all adopt the existing mapping standards and zoning schemes existing in the City of Windhoek. The maps presented to the focus group mainly to prove one of the capabilities and role of GIS in FLTS were also on this standard. The color annotation is used as fill-in to allow good visualization. The approach was also considered for the map in figure 4.3 above. These standards are explained as follow:

Existing Zones: All the exiting zones are filled with different colors representing different zones on a Land Use Zoning scheme of the City of Windhoek, yellow as residential land, red as municipal land and many others. The approach was considered as alternative to map the FLTS maps as such in order to keep consistency.
FLTS data as Shape files: The maps will be brought into GIS as shape file for FLTS, thus it will be easily recognized with the normal existing zone maps. The erf sizes, erf owner and other attribute data will all be available in the attribute tables with information of each erf from a Microsoft Access database.

4.4.3 Proposed FLTS Database Solution

The FLTS database in figure 4.9 and its interface in figure 4.10 are used currently as a base for collecting and storing all the data available on hard copies with Housing & Properties Division. It is temporary located on the network folder of Informal Settlement Committee (ISC) and it is accessible via a password known to involved users.

There was no existing database for handling FLTS data. It was difficult for one to have all the FLTS attribute data available into a database. However, a default Arc View GIS attribute table was edited with addition of attribute field information and linked with the Microsoft access database and subsequently joined. This was used to add and modify all the necessary fields into one attribute table as data gathered during consultations and focus group discussions with relevant Divisions for necessary database fields in a Microsoft Access database (figure 4.9).

The Entity-Attribute-Relationships of the proposed land information system in figure 4.8 below indicates that the FLTS trial table is the main brain of the entire database. The mapping of attributes is a choice distinct done by choosing the entities of the cartographer's interest. The relationship of this database to that of the Deeds Registrar in the Directorate of Survey and Mapping (DSM)'s office is that registration division (regdiv) and townships tables has the common characteristics. This makes it easy for the City of Windhoek to export or import data of their interest. In case where a land holder is upgraded to freehold title, the data will be exported to a historical file or an archive. This will apply to new people entering either by marriage, inheritance on (erven) plot units which were previously located.

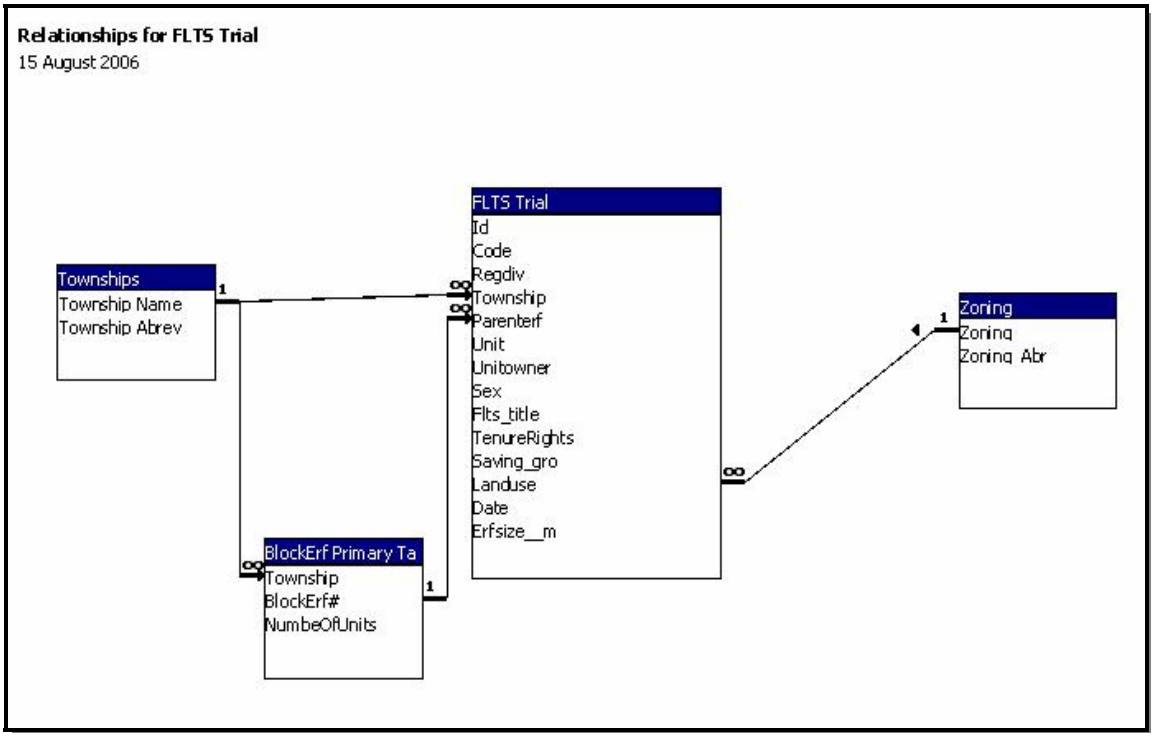

Figure 4.8: The Entity-Attribute-Relationship of the proposed solution

The database relationships in the above figure shows that townships table, blockErf primary table and zoning table's relationships are all 1: M to that of FLTS trail.

The fields in the Microsoft Access database seen in figure 4.9 below only allows the entry of information for the erf number recognized and registered for FLTS purpose. In return, this will eliminates forgery. The entire fields of the Microsoft Access database were made compulsory to have information entered into each field because of the potentiality and usefulness of this information. This was in accordance with the request from the implementation team. As seen in the database 'FLTS main registration form' below, registration division, township, sex, tenure rights and land use zonings are made as selective options. Registration division can only be 'K' for Windhoek as recognized by the Surveyor General in Namibia. Only five townships in Windhoek where FLTS erven can be implemented and recognized, sex on the other hand can only be male or female and cannot be a combination of both. Options 0 and none will mean that the parcel unit is vacant or its for the City of Windhoek, the tenure rights can vary from individual leasing, group leasing, group purchased, etc. Whilst, the zoning can vary to at least more than five options within a bock erf, thus all the zonings are made available as optional in the database.

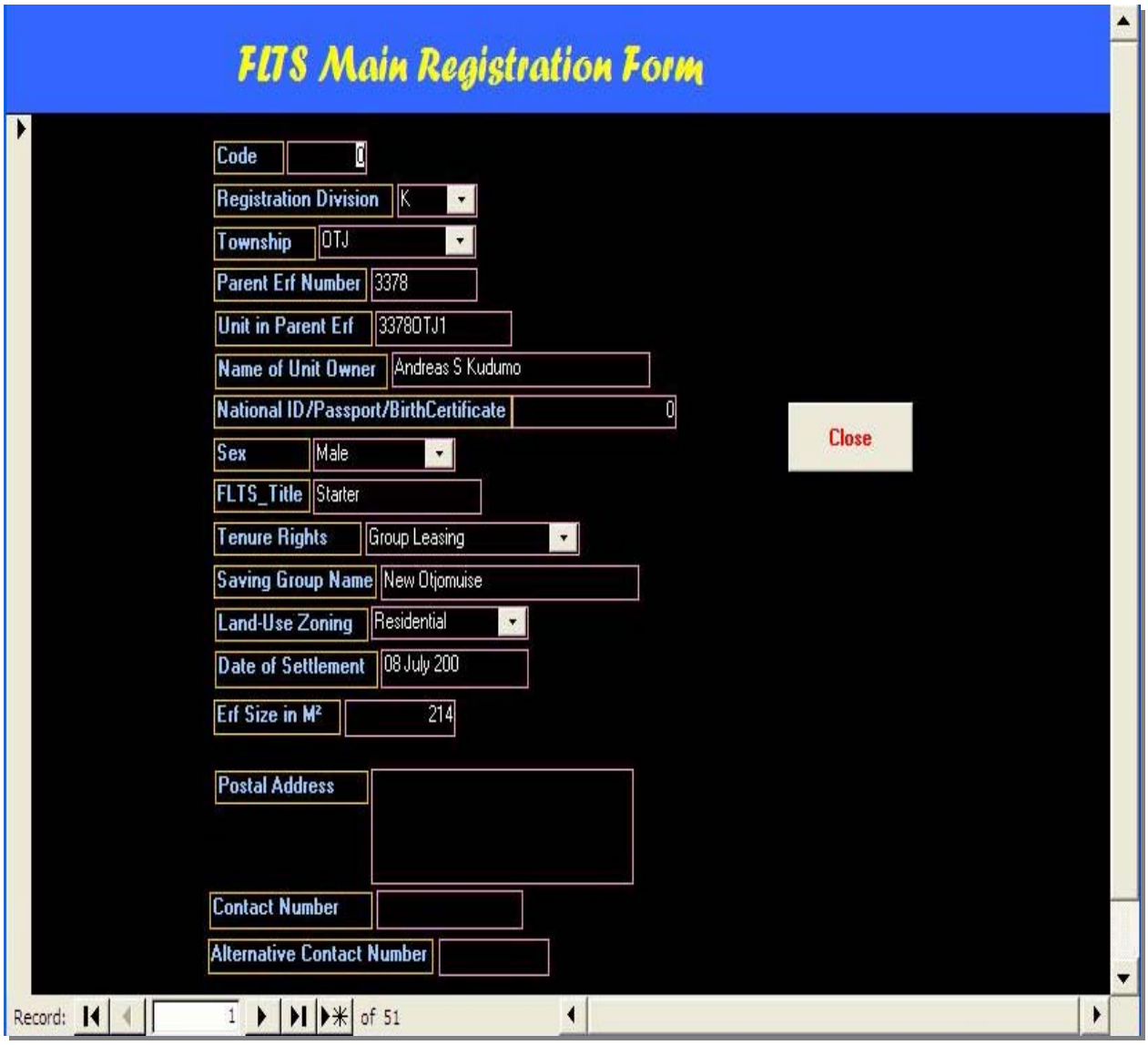

Figure 4.9: FLTS main register database

Beside the maps been mapped with different color annotations representing and indicating that it is FLTS information maps with starter title and land hold title scheme map, the attribute tables will carry information of each block erf, like saving group names. This will help in future for example, to identify 'who occupies block erf number 324, etc as seen in figure 4.9 above.

Besides having the saving group names to each household head, the team resolved that the key data for future reference be made compulsory in the database. Such data includes block erf numbers, unit numbers, saving group names, ownership details, land uses and tenure rights.

However, during the focused group interview the team decided to review the Microsoft Access database before been implemented. This came due to potentiality of some field (i.e. ID number of owner, contact number, box, etc,) of data not included and believed to be valuable.

Figure 4.10: FLTS database interface

Figure 4.10 above shows the Microsoft Access database interfaces or commonly known as 'Switch Board'. Its contents include all the directions to the table by simply clicking on the register of your interest. It is subdivided into two section, namely core registers and feeder to main registers. In core registers, one is allowed to enter, edit and view the contents of the main information for the entire database; it also allows closing and going back to the interface once you are done. Whilst, feeders to the main register are simply the registers that can also be found in the core register, it is simple for specification of what kind of data one would like to enter into the database, it also allows going back to the interface.

Because of the need for good quality data for the FLTS access database, consideration of error detection and correction in the case of a producer and user are adopted from Redman. Redman (1996, in Longley et al. 2001, p.14) identified several possible methods, interestingly and adopted one is the laissez faire approach, which is a form of error detection and correction. Users and others detect the errors and the producer tries to correct them, often while in contact with the user. In this case error rates and total costs are the highest.

The much known and commonly used method of error detection and correction identified also by Redman (1996, in Longley et al. 2001, p.14) is data edits. In a well-designed database like the FLTS access

database, it is possible and very much common to do data edits as computerized routines which verify whether data values and their representation satisfy predetermined constraints. They can be very simple or quite sophisticated but somehow require proper attention. Data edits may be applied to an entire database or as a screen or filter within a process or information chain. In the latter case, they can be used to control and improve process performance or to make a process less error prone.

It is stressed that issues of data quality and error are of paramount concern in all successful applications of GIS technology, which is very much considered as a fact to the GIS projects at the City of Windhoek.

4.5 General GIS Analysis

4.5.1 Introduction

In this section, the SWOT analysis, the advantages and disadvantages of GIS for flexible land tenure system are outlined and explained. The SWOT analysis was determined from the observation of tasks in different work environments within the City of Windhoek

Today many organizations are moving land information into Geographic Information Systems (GIS). Adopting GIS techniques for FLTS data can advance broader social purposes. For example, handling the communities' data digitally can benefits the community at large because this information can be provided to other community members from the City of Windhoek via the GIS technology, by making more effective public decisions and by using natural resources in a more optimal way. Other example could be that with GIS tool, you can determine the number of community water points required at the radius of 50m in a block erf of two hectare by simply applying buffer to the existing toilets. GIS systems provide tools that support many types of record keeping, analysis and decision-making. GIS has the capabilities of handling the land information better and geo-reference them to their spatial location digitally.

4.5.2 GIS SWOT Analysis

The GIS without proper management and maintenance is easily predicted to its failure and may not be a lasting GIS. Every tool introduced in the organization either replacing the existing one, a new tool, addition to the existing system, etc should be analyzed by its strengths, opportunities, weaknesses and threats (table 4.3) within and outside the organization. Failure to that may result in planning to fail.

Outlining the advantages and disadvantages of the system is also a very smart move before implementing such a system. The idea is to know indeed the capability, the good, the bad and the need for such a system in the organization.

Table 4.3: GIS SWOT analysis	
STRENGTHS	WEAKNESSES
○ Competent staff (good in-house knowledge), ○ Good office facilities and equipment, ○ Data capture for others (good information), ○ Integration and strong acceptance within Information Systems, ○ Good support skills & attitudes, ○ Provision of quick services, ○ Improve operations, management of labor resources and facilities, ○ Efficient facilities for utilities monitoring, good data management and other utilities activities.	○ Few GIS experts within the organization, ○ GIS software programs are expensive, ○ Compatibility problems, ○ Tendency to accept requests (overload), ○ Data capturing for other divisions ties up resources, ○ Errors and long process in data collection and transfer into new software, and ○ No GIS technical Committee (meetings).
OPPORTUNITIES	THREATS
○ Geographical information can be organized and managed, ○ Geographical information gathered from different databases can be distributed, ○ Mergers, joint ventures or strategic alliances, ○ Good team spirit, ○ Intranet and Internet development for GIS viewing & querying, ○ New software (ArcView, ArcGIS), ○ Positive attitude towards GIS (expectations), ○ Good internal communication,	○ Hire expensive consultants to train staff, ○ New software may outdate expensive software, ○ Delayed software upgrades, ○ Insufficient support from other sections (e.g. Storm water, Electricity), ○ Inadequate software support (Computer Foundation, GIS Business Solutions).

The SWOT analysis like the advantages and disadvantages below, it initially also highlights the OPAFIT C+ concepts in its contents because it explains the strengths and the opportunities of the organization of which the organization is in hands of people where as people have to make agreements in order to have a secure GIS systems, on the other hand the organization have to budget (finance) for the GIS projects for it to see the future, information is there and it need to be managed successfully with good technology for handling it and of course with good communication set in place. This SWOT analysis has based its strengths and opportunities within the City of Windhoek, while its weaknesses and threats are of the outside parties and few inside. It should also be remembered that, although GIS software are expensive, there is cost recovery in a long run.

4.5.3 Advantages and Disadvantages of GIS

Evolving GIS in the managing and mapping FLTS' geographical entities will help in lots of ways such as determining the need of land for other low-income people, open spaces, business land etc through GIS analysis techniques and will benefit huge number of industries and agencies such as consulting town planning companies to help in planning, design, engineer, build and maintain information infrastructures through the use of digital available data. Common industry users of GIS will be on the advantage side of getting the digital maps of FLTS projects and geo-reference their area of interest i.e. the crime prevention will acquire this maps for mapping of high crime activities areas for efficiency operations, for new recruits orientations etc,

Although GIS has advantages, it does also have the disadvantages; some of the advantages and disadvantages of GIS in FLTS are outlined below and might also reflect in table 4.3 above.

The SWOT analysis aid and the OPAFIT C+ concept, they all cover issues of organization that the advantages and disadvantages highlighted such as the employees involved, the set introductory to agreements with consultants of GIS as expensive, finance for equipments, data etc, and they all reflect the technology of integrating large amount of data and communication to other parties. Initially, they are different management tools of over viewing capabilities, strengths, weaknesses, opportunities, threats, efficiency, effectively, resources, etc.

Advantages

- Can manage larger amounts of data,
- Can cover large study areas (the entire Namibia if necessary),
- Can suitably select any sub-study area,
- Can survive with infinite and recurrent edits and changes,
- More forceful and resistant to damage,
- Faster and more efficient,
- Requires less person time and money,
- Good geographical features representation and mapping,
- It improves operations in both management, resources and facilities management,
- It can be really automated on the net (www) for possible clients, educator, researchers, communities, students etc,
- The communities, educators, students and researchers can download the data or browse the net and that can suffice,
- It is a very useful tool for researchers and good for information dissemination to clients,
- Help in keeping track of the historical land use.

Disadvantages

- Software are expensive,
- Long process in data capturing at the beginning,
- Expensive equipments for collecting data i.e. GPS,
- High number of geographical entities; too much work.

GIS tool, like the LIS, it also recover its cost in a long run of operations. Looking at this advantages and disadvantages above with relation to the City of Windhoek's Geomatics Division's situation of only 10 employees handling large amount of work to meet the city resident's needs; one should consider the fact of having a GIS to alleviate high costs in recruiting other staff members on board than on acquiring tools to improve the current situation.

It should also be remembered that all GIS processes can be undertaken manually. Before GIS, analysis procedures would have been manually undertaken using transparent overlays or run through very slow and cumbersome machines with far less power than the machines of today but due to the pressure in service provision and technology demand the need for a GIS technology is required. The important advantage of GIS here therefore is that all the functionality for working with multiple sets of geographic information are grouped and automated within one piece of software.

5. Discussion of Results

5.1 Introduction

This chapter deals with the discussion of the achieved and unachieved results. It begins by discussing the results of FLTS at City of Windhoek, followed by the GIS and LIS approach in FLTS results, the need, role, benefits and capabilities of GIS, focus group interview results, GIS SWOT analysis and lastly the general future and predictions of GIS.

The main objectives of the research itself explored the true values of the investigation, and resulted to have a bigger yield in benefiting both the public and the organization. This is because land administration for FLTS data will be secured and so does the public's need for having updated information. In my view and according to Fourie and Nino-Fluck (1999, p.3) it is proven that the success of GIS in FLTS projects lies firstly on review of the cadastral and Land Information Systems (LIS) in Africa, that decision makers should presently obtain sufficient information from these systems to make informed decisions. This is so because most African countries and many other developing countries do not have an LIS as a management tool. LIS and GIS systems either don't exist, or have lapsed, or are seen as too expensive (Fourie and Nino-Fluck 1999, p.3). This is proven to be partly true in the case of the City of Windhoek; it was found that the data is there but no tools to manage these data because the managers believed that GIS is expensive.

5.2 Flexible Land Tenure at City of Windhoek

The City of Windhoek's Geomatics Division - as a Division responsible for surveying, GIS and mapping - is very much aware of the importance to manage and store the flexible land tenure system data. Currently, all the land allocation of Windhoek's informal settlements is allocated on the standard of the flexible land tenure bill. This is done to avoid future restructuring of services, planning process and land surveying when the flexible land tenure act is fully gazetted and implemented.

The City of Windhoek is now re-designing the data management of its informal settlement under the FLTS bill. This research is part of such restructuring investigation tool and implementation therefore. It has further eliminated the demarcation of its settlement land of its clients from been demarcated with measuring tape to modern technological surveying instrument i.e. GPS and total stations.

5.3 GIS and LIS Approach for FLTS

Land administration should be less bureaucratic, simpler, cheaper and more transparent according to many global reports. This is mainly the reason why GIS for FLTS projects was modified to have a separate Microsoft Access database because it is less bureaucratic, simpler, cheaper and more transparent.

The FLTS GIS project is also a call for Namibian's vision 2030 of living in a technological nation of Information Communication Technology (ICT). According to Van der Molen and Lemmen (2004, p.4), 'there might be a need to redefine the role and importance of technology in realizing the worlds' objectives'. Most probably low cost approaches require high technology. Fortunately the City of Windhoek's middle and top management are very much aware of technology growth and change, with the capabilities and need for adoption and acceptance of good and useful technology. Table 5.1 below briefly outlines and explains the results of the set hypothesis outlines in chapter 1 above.

Table 5.1: Summary of hypothesis results
The capability of ArcGIS is much powerful and can help in much complicated tasks of spatial analysis, planning process and decision making than Autodesk Map 3D. Good FLTS spatial data is one of the key to consider the use of GIS, whilst, finance is a major key to the project.
The use of the focus group involving managers and the presentation of the prototype helped in promoting the need for the GIS system at City of Windhoek.
Enthusiasm and experience is the key to all the process of mobilizing the City of Windhoek to adopt the use of GIS in FLTS projects.
Understanding, experience and enthusiasm in GIS techniques to the users and involved managers at City of Windhoek can be improved through training and education.

The GIS and LIS for FLTS project was accepted, as seen in table 5.1 above for hypothesis results. This was because of its proven capabilities and benefits that was presented to the focused group; as Kaufmann (2001, p.5) have said 'with Information Technology (IT) it is possible to link land objects directly with the information needed for registration'.

5.4 The Need, Role, Benefits and Capabilities of GIS

The use of GIS in FLTS is highly required, because of the existence of spatial data and high spatial data sharing within the City of Windhoek. All the relevant Departments and Divisions within the City of Windhoek will either use or produce the information for self and public use.

The good quality outputs of the prototype of GIS in FLTS proved that the use of GIS in FLTS is suitable in managing and analyzing spatial data. Some maps, graphs and attribute tables produced in this research are a clear indication of the suitability of GIS for the use in FLTS at City of Windhoek. This brought the adoption of the Microsoft Access prototype database as a base to start capturing the data that is provided in chapter four of section 4.4.3 of FLTS database as an example.

5.5 Focus Group Interview

As Van der Molen and Lemmen (2004, p.5) has said 'many leaders of land administration organization are kept away from strategic issues and are too busy with daily problems they experience in service delivery. However, leadership is necessary to develop the future, in accordance with clearly set requirements by their organizations'. During the focus group interview for the prototype of GIS and LIS for FLTS, all the manager involved were invited to attend, which gave the green light to seriously bring GIS in FLTS projects at City of Windhoek.

The group strongly recommended that there is a need for a GIS tool in order to integrate many data. It believes that the data is useful for planning and good for integration with other data sets like population data. The group agrees to the addition of a GIS for managing FLTS projects to the existing Autodesk Map 3D. The decision on the type of final software was in the hands of the Division of Geomatics. The reasons behind such a decision are explained in chapter 4 above under section 4.3.4 of results on OPAFIT C+ concepts under agreements. Briefly, the Geomatics Division after consultations with IT Department of the City of Windhoek and a consulting GIS Company, decided adding ArcGIS to the existing tool as shown in figure 5.1 below with its necessary entities.

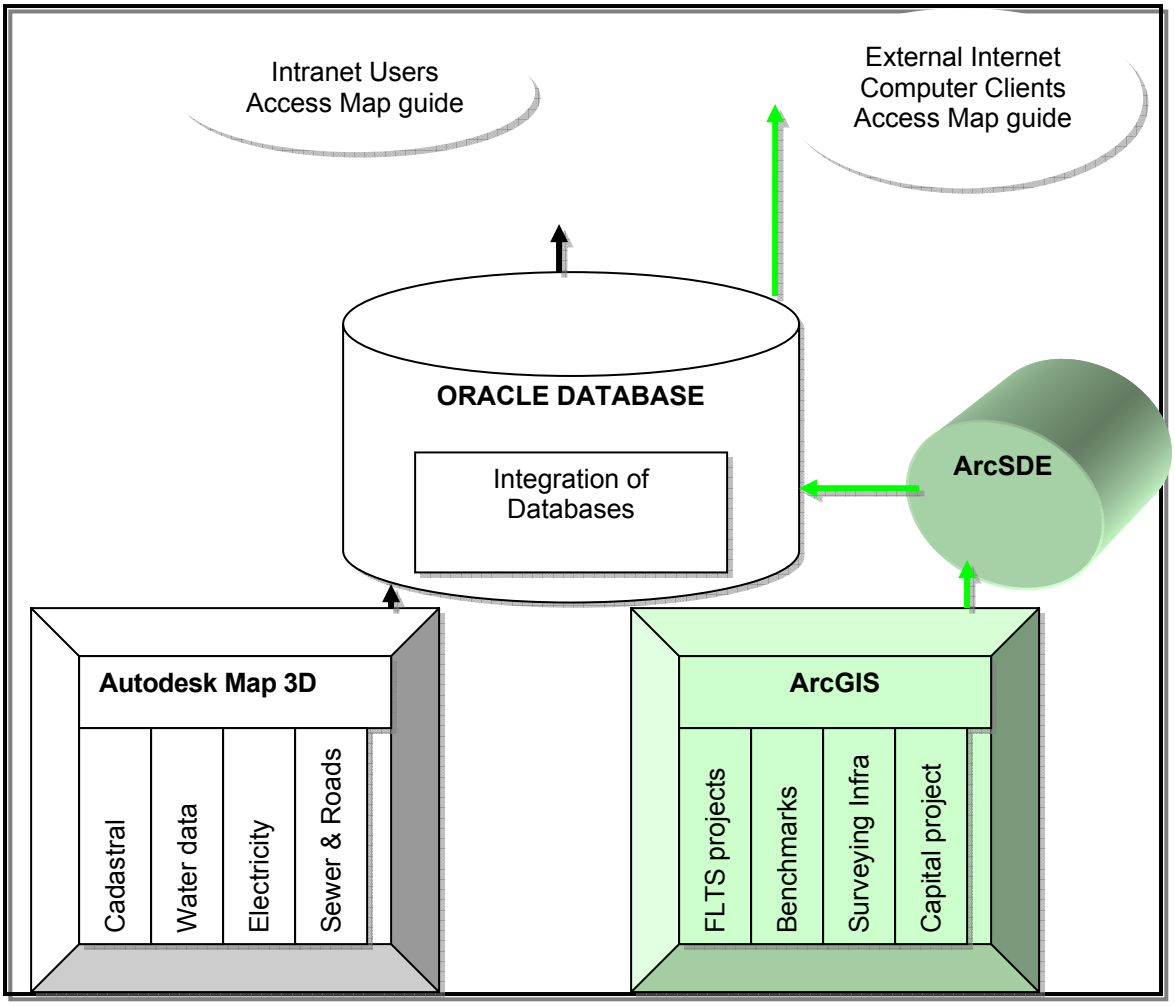

Figure 5.1: Existing and Proposed GIS system at City of Windhoek

GIS has become a wide management information system at the City of Windhoek. Most top and middle managers understand and are aware of how technology is growing and the need for such technology therefore. The need for a new software (ArcGIS) shown in figure 5.1, it shows a new proposed ArcGIS with SDE for data exchange, database writing and reading; whilst, Autodesk Map 3D, oracle database, intranet and internet systems exist.

In developing and transitional countries the traditional methods can be carried on. Today over six year after the 90s, one cannot find any cadastre project in the world where information technology is not involved. As Kaufmann (2001, p.6) has said 'IT makes work easier, it works with digital data and provides the ability to model objects of the real and legal world'.

5.6 GIS SWOT Analysis

The existing Autodesk Map 3D and munsys gave a great chance of motivating the capabilities and advantages of the use of GIS in FLTS projects, because the current munsys cannot handle the FLTS data and does not have any FLTS data managed by this system. A focus group interview and organizational observation done within work environments of the City of Windhoek gave a good guide in analyzing a good GIS SWOT analysis, which is dominated by strengths and good opportunities.
As it can be seen in chapter four, the advantages of the use of GIS in FLTS projects overpower the disadvantages due to a high need of the GIS tool and poor land administration tool for FLTS projects.

5.7 General Future and Predictions of GIS

Making predictions for a field changing and developing so rapidly as GIS is very difficult. We need to 'future proof' a new system, and make sure that it will last and at least be upgraded when the next set of technological developments comes along. Some of the well-known techniques for justifying investment in new technology such as cost-benefit analysis involve an element of crystal ball gazing. Costs and benefits are predicted to justify a project, despite the fact that the benefits may never actually be achieved.

Using the huge amount of data we present some exciting opportunities and challenges for the future. Heywood et al. (1998, p.263) cites the example of an Internet site that shows real-time maps of traffic conditions. Human (the richer, the lower-income and the poor) and organizational issues are not going to go away, data are one commodity we are not going to go short of in coming years, as long as land is needed; in fact we are more likely to drown in it. The need for tools to handle geographical data effectively and reliability is growing ever greater (Heywood et al. 1998, p.261). The tools we use to handle geographical data in the future are likely to be different. Software agents, which search the Internet on topics in which you are interested, are being developed (Heywood et al. 1998, p.263). Computers and Internet will be available and affordable, from developed countries to developing countries, whilst, GIS and IT will merge as one field of study.

The range of views of GIS has increased over the last few years in response to the expansion of the market for GIS and the applications to which it has applied. In nowadays, most of the predictions of GIS future made five to ten years has improved i.e. data model development has improved, new analysis exists, good quality assurance, multimedia support, GIS and GPS data exchange techniques exists, tools for 3D visualizing exists and has improved, GIS is now in developing countries, existence of cheap digitizing techniques, good flexible and affordable education like the UNIGIS and other universities. Heywood et al. (1998, p.260) perhaps rather rashly, suggested that by the end of the century everyone in the developed world would use GIS everyday for routine operations.

6. Conclusion

Considering the rapid growth of urban informal settlements, the cost of traditional mapping processes, and the information requirements for planning and management of informal settlements, GIS is the only valuable tool for handling spatial data for the effective upgrading and formalization of informal settlements to FLTS.

However, the GIS software to be used in managing and analysis of the FLTS at City of Windhoek was lately been decided to be ArcGIS. It was evidently proven in the focus group interview's analyzed results that GIS is highly required in managing and analyzing the FLTS data.

Even though the City of Windhoek has Autodesk Map 3D running with munsys in place, introducing a GIS for managing FLTS at City of Windhoek is a complicated job. It does not only consist of building databases, hardware requirements and purchasing software, but it consist also of people and their jobs, work flows, organizational matters, and especially what is it the organization wants to do with the information system. People involved need to be aware of this process, agreements with external organizations and internal divisions are entered into, finance to run the project need to be budgeted and made available, information has to be available clearly to all the involved people, technology should be of good quality with good communication to the involved stakeholders.

One of the tools of City of Windhoek put in the first phase of investigating the internal organization for the need of GIS before subsequently implement the founded GIS strategy, was the foundation laid for the GIS through conducting personal consultations in offices at City of Windhoek, conducting focus group interview, observing existing work processes and analyzing work flow, this determined the demand for GIS, and how the user (both the outside users and the City of Windhoek users) sees this upcoming information system. How the user sees this information system has to do with the point of view of looking at the system. The demand for information is different for a financial department than for a technical department. It should be noted that management people require other information than people in the field, thus clarity is of crucial important to management.

Reliable Land Information System (LIS) is a prerequisite for effective and efficient decision making. The City of Windhoek has put considerable efforts in upgrading its LIS during the past 10 years. Immediate attentions are necessary to develop a structured strategic planning and analysis of system requirements. New technologies require a champion (professional), and GIS for FLTS projects is no exception. This person promotes the system to others in the organization and lobbies for needed resources. The most important qualifications for this position are enthusiasm and the ability to get the attention of decision makers.

7. Recommendations

The use of GIS in Flexible Land Tenure System (FLTS) at City of Windhoek and in the entire Namibia has been under consideration since 90s. The Polytechnic of Namibia has had GIS courses since mid 90 in the context and for the purpose of local land management. A counted number of documentation and researches inline with this research topic (specifically on flexible land tenure system) has proven to exist, but very few related technical report papers on GIS in flexible land tenure exist on the net.

In general, local authorities with the responsibility of land administration in Namibia seem not to know that simple tools for performing the tasks will make the organization more efficient, effective and cost benefits involved in the use of these tools. GIS tools are one of those tools.

My recommendation therefore is that since land administration activity managed with the right tools like the GIS system on the one hand deals with huge amounts of data, which moreover are of a very dynamic nature, and on the other hand requires a continuous system maintenance process; the role of information technology is of strategic importance and it needs further researching.

I further recommend the need to research on the need of GIS in other local authorities for FLTS project implementation in Namibia and other countries. Issues of managing land policies and land management for the poor etc need to be researched as to how there can be managed by GIS technology. This is due to the value and the poor way the FLTS data are perceived currently by local authorities in Namibia. FLTS are looked at as data that can simply be management using a pen and paper method.

Lastly, there is a need of a tool that focuses on GIS in relation to formalization of informal settlements in order to provide secure tenure. Three examples of situations where GIS can be used in unplanned settlements are:

1) Inventory of existing informal settlements and land suitable for new residential areas for low-income groups for planning purposes,
2) Inventory for the purpose of formalizing land tenure, and
3) Inventory for the purpose of resettlement of areas, which have to be evicted.

This research will benefit much to future researches of almost similar contents through the tangible theory and practice applied in this area of study, while the success of it will open doors for other local authorities like the Otjiwarongo and Rundu Town Councils in the country to seriously bring GIS for FLTS data management, land administration projects and others perceived to be GIS projects.

Glossary

Adjudication: the process whereby the ownership and rights in land are officially determined.

Attribute: data associated with a spatial or non-spatial entity.

Block erf is a piece of land on which a land hold title scheme or a starter title scheme is established.

Boundary: either the physical objects-marking the limits of a property or an imaginary line or surface marking the division between two estates. Also used to describe the division between features with different administrative, legal, land-use, topographic, etc., characteristics

Buffering: the process of creating areas of calculated distance from a feature

Cadastral map: a map showing the boundaries of land parcels, often buildings on land, the parcel identifier, sometimes references to boundary corner monumentation. Cadastral maps may also show limited topographic features.

Cadastral surveying: the surveying and mapping of land parcel boundaries in support of a country's land administration or land registration system.

Cadastre: a type of land information system that records land parcels. The term includes:

- Juridical cadastre: a register of ownership of parcels of land;
- Fiscal cadastre: a register of properties recording their value;
- Land-use cadastre: a register of land use;
- Multi-purpose cadastre: a register including many attributes of land parcels

Common law: the unwritten law based originally on common customs and precedent but now administered by the courts

Coordinate: a measurement of distance and direction from a pre-selected origin

Coordinate system: A system that allows a position to be located in two-dimensional space. It has an origin, two axes and a unit of measurement.

Database: a storage system of linked tables

Demarcation: the marking-out of the boundaries of each land parcel on the ground.

Digital mapping: the processes of acquiring, transforming, manipulating and presenting spatial data held in digital form.

Fixed boundary: the legal boundary of a land parcel where the precise line has been agreed and recorded

Freehold: a free tenure, distinct from leasehold, in which the owner has the maximum rights permissible within the tenure system

Fundamental spatial data sets: spatial data for which there is a justified need for national consistency by multiple users in order for those users to meet their objectives. A fundamental dataset may comprise a number of compatible databases maintained by custodians in several jurisdictions.

Geographic Information System (GIS): 'A system for capturing, storing, checking, manipulating, analyzing and displaying data which are spatially referenced to the earth'

Global Positioning System (GPS): a system for fixing positions on the surface of the Earth by measuring the ranges to a special set of satellites orbiting the Earth

Information: any data processed, organized or classified into categories to serve a useful purpose. It can be presented in voice, digital, printed, pictorial, image, and graphical or numerical formats.

Internet: an international network of dispersed local and regional computer networks used predominantly for sharing information and resources.

Intranet: a private network inside a company or organization that uses the same kinds of software that one would find on the public Internet, but that is only for internal use.

Land: the surface of the Earth, the materials beneath, the air above and all things fixed to the soil.

Land Administration: the processes of determining, recording and disseminating information about the tenure, value and use of land when implementing land management policies

Land hold title: This links the person to the parcel that he owns. The title owner is issued with an individual certificate in respect of his erf.

Land Information System (LIS): a system for acquiring, processing, storing and distributing information about land.

Land management: the activities associated with the management of land as a resource from both an environmental and an economic perspective

Land parcel: an area of land under homogeneous property rights and unique ownership.

Land tenure: the manner of holding rights in and occupying land.

Land value: the worth of a property, determined in a variety of ways which gives rise to different estimates of the value

Metadata: is a structured summary of information that describes the data (data about data).

Polygon: a vector graphic figure that represents an area

Projection: formula to transform 3D spherical shape of earth onto a 2D surface

Raster: representation as a regular grid of cells

Spatial: anything dealing with the concept of space. In a geographical context, deals with distribution on surface of the earth

Starter Title: A starter title is the link between a group and a block. However, ever member of the group receives a holder's copy of the certificate.

Tenure: the way in which the rights, restrictions and responsibilities that people have with respect to the land are held. The cadastre may record different forms of land tenure such as ownership, leasehold, and different types of common, communal or customary land tenure.

Vector: representation in the form of points, lines and polygons by coordinates

World Wide Web (WWW): the WWW is a system that allows users to access resources stored on computers worldwide via the Internet. (WWW is frequently used incorrectly when referring to "The Internet").

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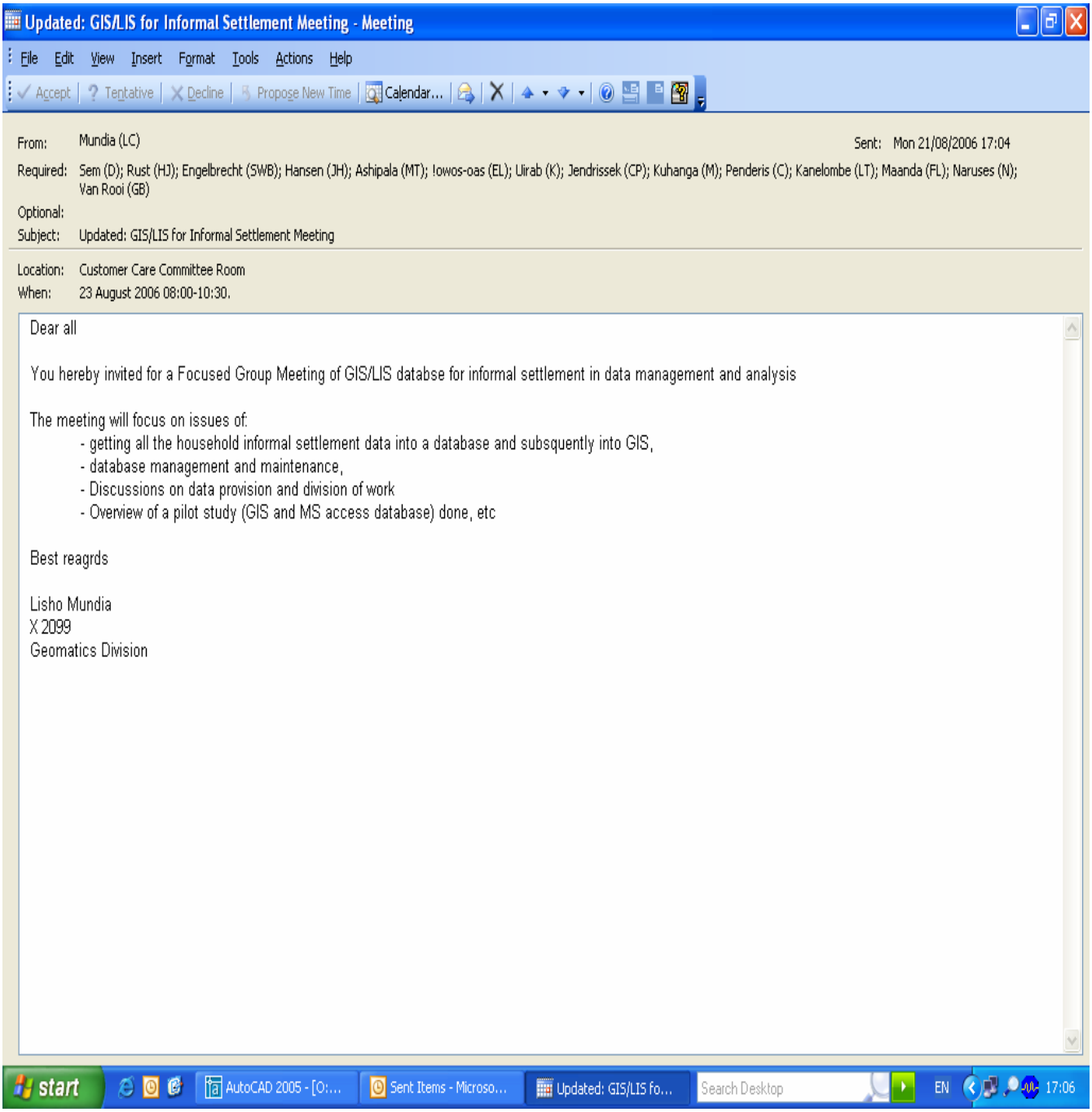
Annexures

1. Focus Group Interview Data

Annexure A: Invitation for a Focus Group Meeting Discussion



Annexure B: Focused Group's Attendance List

Informal Settlement (FLTS) GIS/LIS Presentation

Date: 23 August 2006

Focused Group Attendance List

Surnames & Initials	Department/Division	User ID	Ext Number
Kotjinjo EN	Geomatics	ENK	2101
S R [illegible]	Comm Dev		3150
[illegible]	[illegible]	[illegible]	3308
[illegible]	Comm Dev	OWO	2732
J H Hanson	Properties	JHH	3310
Hamuteta P.	Properties	Prh	3311
[illegible] K	H & P	[illegible]	3305
L [illegible]	H&P	KJK	3315
[illegible]	Geomatics	cje	2341
I. [illegible]	[illegible]	[illegible]	2398

Annexure C: Focused Group's Responds To Questions

1. The Use Of GIS In Administering Flexible Land Tenure System (FLTS) Data

FACTORS THAT INFLUENCE THE USE OF FLTS DATA IN GIS

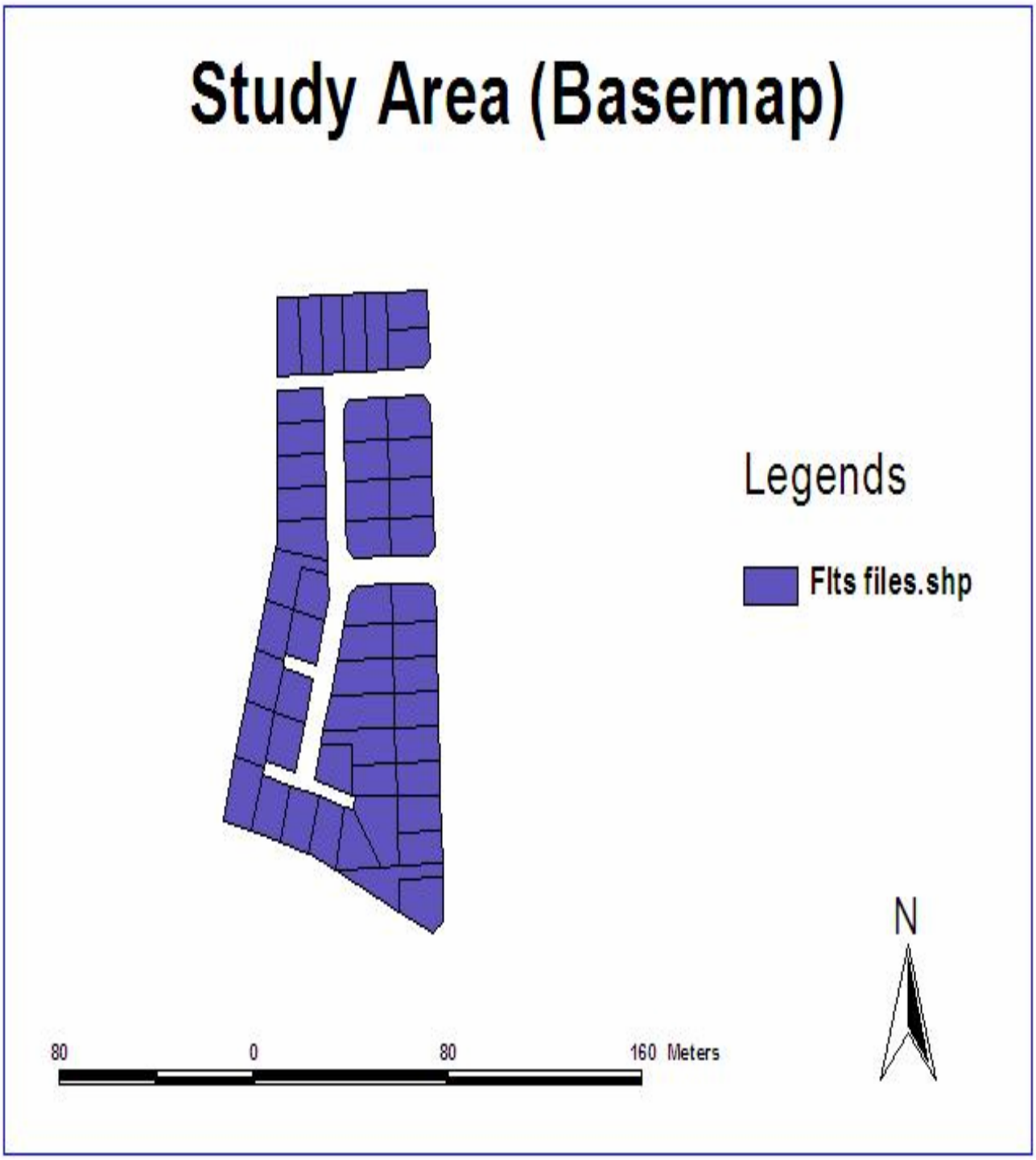
	1. Registration					2. Policy			3. Others	
Ranks										
	Household Data Management	*Land Parcels*	*Cadastral Data*	*Town & Regional Planning*	*Cartography*	*Environmental Policy*	*Location Policy*	*Land Tenure Policy*	Front Desk	Information
High	5	9	9	4	3	6	6	9	9	9
Medium	3	0	0	3	2	2	2	0	0	0
Low	1	0	0	2	4	0	0	0	0	0
Total	**9**	**9**	**9**	**9**	**9**	**8**	**8**	**9**	**9**	**9**

2. GIS For Flexible Land Tenure System (FLTS)

Factors	Optional Answers	
	Yes	No
Proved benefits	7	2
For better recording keeping	8	1
More user-friendly systems	7	2
Availability of useful digital data	8	1
Provision of information to clients	6	3
Good map production	8	1
Total	**44**	**10**

2. Study Area Map

Annexure A: Original Map of Erf 3378, Otjomuise, Windhoek



3. Windhoek Informal Settlements Base Map2002