

# **Directorate of Survey and Mapping (DSM), Namibia Digital Cadastral Information System**

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**Key words:** Cadastre, GIS, Swedesurvey, DSM, Survey, CIS

## **SUMMARY**

In recent years, cadastre systems have developed from manual inconsistent systems into automated systems that highly benefit from the advancements in the Geo-Information and Communication Technology (Geo-ICT). Such advancements led to the emergence of ArcCadastre, which is an internationally unique software for collecting, maintaining, processing and presenting geographic and cadastral information. Since ArcCadastre was launched in December 2002, it was implemented in many countries in Africa and the Middle East. In Namibia, ArcCadastre will be used to establish the Cadastral Information System for the Directorate of Survey and Mapping (DSM).

The Directorate of Survey and Mapping (DSM) in Namibia is the sole government agency responsible by laws and regulations to provide the up to date accurate cadastral and survey data to the community and citizens of Namibia.

SWEDESURVEY's system for DSM provides complete cadastral information management based on the concept of workflows and jobs. The Geodatabase contains a data model, where the spatial data resides with normalized attribute data in a database management system. The database management system will be used for the updating of urban and farm registers and plans, in cases of consolidation and subdivisions.

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## 1. INTRODUCTION

The cadastral concept has developed significantly over the past few decades. During this time these systems, whether developed from a land market or land taxation perspective, have increasingly played a multi-purpose role. Cadastre systems in early times were manual systems that were effort and time consuming to operate and maintain. Moreover, manual systems yielded inconsistency and the lack of integration and unity between the various sectors of cadastral agencies.

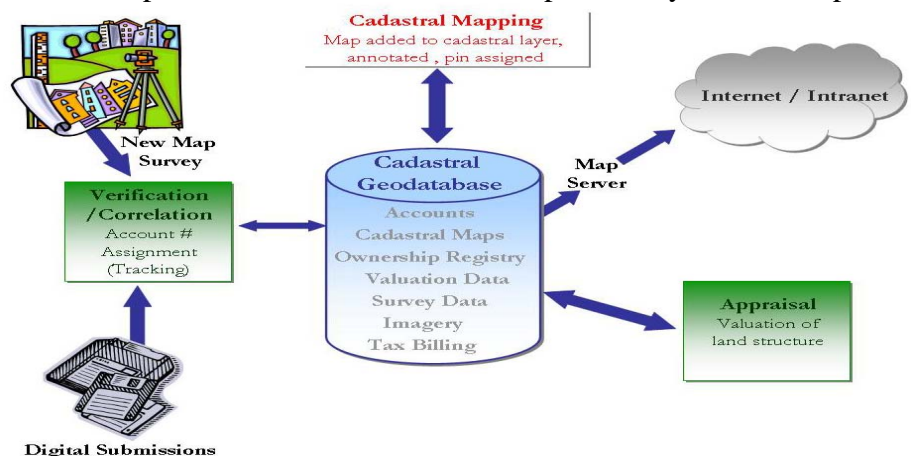
The increasing demand for accurate, easily accessible and up-to-date cadastral data has pressed forward the conversion of cadastral mapping registers from analogue to digital format. This process has been accelerated by the new possibilities of the Geo-ICT. Both theoretical and practical developments in ICT such as the ubiquitous communication (Internet), database management systems (DBMS), information system modeling such as the Unified Modeling Language (UML), geographic information systems (GIS) and global positioning systems (GPS), all automate and improve the quality, cost effectiveness, performance and maintainability of cadastral systems. As never before, most of the cadastral systems around the world are looking for technology to help them create efficient enterprise systems supporting cadastral organizations.

**CADASTRE** is defined as both 'Maps and Data' that define the possessory relationship between land & man.

Cadastral systems are mainly based on GIS for map creation and maintenance with a link to legal registration of ownership, and valuation.

Cadastral information is a fundamental requirement for security of land tenure, development of land market and credit markets.

It is also essential for the governance of the country, the formulation and implementation of land policies and land reforms and for planning of sustainable use of land and real property assets. Easy access to reliable and relevant land information is an important input in strengthening poor people's access to land and thus contributing to poverty reduction through



faster economic growth and more equal distribution of wealth in society. It is also a prerequisite for formulation and implementation of policies for environmental protection.

## **2. DIRECTORATE OF SURVEY AND MAPPING**

The Directorate of Survey and Mapping in Namibia is the national survey and mapping authority in Namibia providing professional services and advice to the government, parastatals, private companies and general public on all matters related to survey and mapping. DSM consists of three divisions, namely:

- Division of Mapping and GIS
- Division of Cadastral and Geodetic surveys
- Division of Planning, Marketing and Administration

### **2.1 Division of Cadastral and Geodetic Surveys**

The division of cadastral and geodetic surveys is responsible to maintain the integrity of the cadastre and for the examination and approval of all cadastral surveys and plans that are required to support the registration process. It is also responsible for providing up to date cadastral data to the public.

#### **2.1.1 The Current cadastral system**

The current cadastral system is a well-organised manual system. Rigorous quality control checks on all cadastral records are carried out at DSM. The volume of records has increased over the years and because of the increase in demand for land information, the current system will no longer be able to serve the needs of the clients. The system has therefore become inefficient giving rise to the following problems:

- Accessibility – There is only one office for the whole country. Not everyone has access. Paging through the pages makes the speed of data access very slow;
- Security – there is no effective control of who has access to the data
- Data recovery - there is no back-up system in place
- Delay in registration process – It takes approximately 6 months from lodging of surveys for approval to the approval stage
- Insufficient information - some plans dated from the colonial era have insufficient information and some are out dated
- Lack of human resources – not enough qualified staff
- Storage space is a problem as the number of data volumes increases
- Durability of the papers reduces, wear and tear of analogue documents
- Distribution process is very slow

### 3. DIGITAL CADASTRAL INFORMATION SYSTEM PROJECT

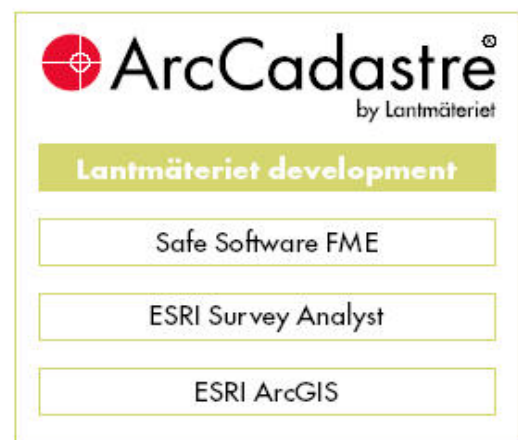
#### 3.1 Project overview

The overall objective of the project is the establishment of a Digital Cadastral Information System in order to improve access, quality and usefulness of cadastral information in Namibia. Due to the problems experienced with the current manual system the division of Land information decided to develop and implement a digital Cadastral Information System (CIS) as a means of improving the current manual system. The project commenced in March 2005 and will be completed at the end of February 2008. The digital cadastral information system is being developed by Swedesurvey AB and Quality Standards Information Technology (QSIT), and will provide complete cadastral information management based on the concept of workflows and jobs. The geodatabase contains a data model, where the spatial data resides with normalized attribute data in a database management system. The database management system will be used for the updating of urban and farm registers and plans, in cases of consolidations and subdivisions.

It became essential to build specialized advanced software that is written specifically to manage cadastral business. Lantmäteriet (National Land Survey of Sweden), Leica Geosystems and ESRI have joined forces to develop ArcCadastre for providing the software solution for capturing, maintaining and managing survey data and cadastral information.

ArcCadastre has been built on the latest, proven high technology platforms that are available within the respective technological fields:

- **ArcGIS from ESRI**  
ArcGIS is the GIS engine that has been used as the base for the development of ArcCadastre.
- **ArcGIS Survey Analyst from ESRI**  
Survey Analyst from ESRI is used for survey and computation functionality.
- **FME (Feature Manipulation Engine)**  
FME objects from Safe Software are used for import and export to and from various data formats. FME is the world's most complete data format converter.



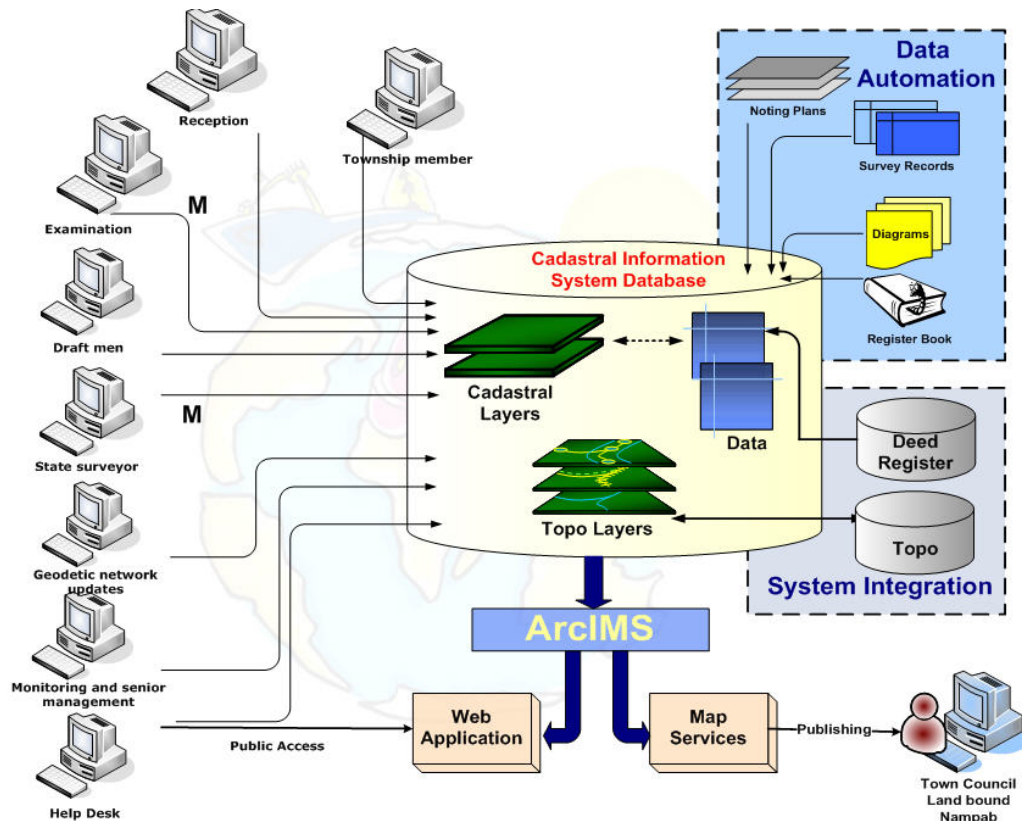
Localization is supported with ArcCadastre. It is delivered with a localization tool kit supporting country customization for the specific country to ensure that the software is presented in the same language as that of the user, hence providing ease of use. It can also be implemented through a distributed system or a centralized system, depending on environment requirements.

### 3.2 Project Objectives

To create a computerized version of all cadastral parcel data, which is currently in analogue format, in order to facilitate easier management and access of cadastral information to the public in any part of Namibia.

- To develop and implement a cadastral information system
- To capture, convert and load existing cadastral information into the new database
- To develop applications for the cadastral functionalities; ArcCadastrre is the chosen software that will provide the common platform for the users working with spatial data processing.
- To enable DSM's clients to view the topographic and cadastral data seamlessly in one map view.
- To enable the administrative and managerial users to monitor activities; a light GIS application will be developed to support all their functional requirements and empowering the application with the spatial data visualizing.
- The allow mapping users to continue to use their current software products and applications to support their functional requirements in the new system.
- To develop an Internet application to provide access to public users to cadastral information from any part of Namibia.

### 3.3 System Architecture



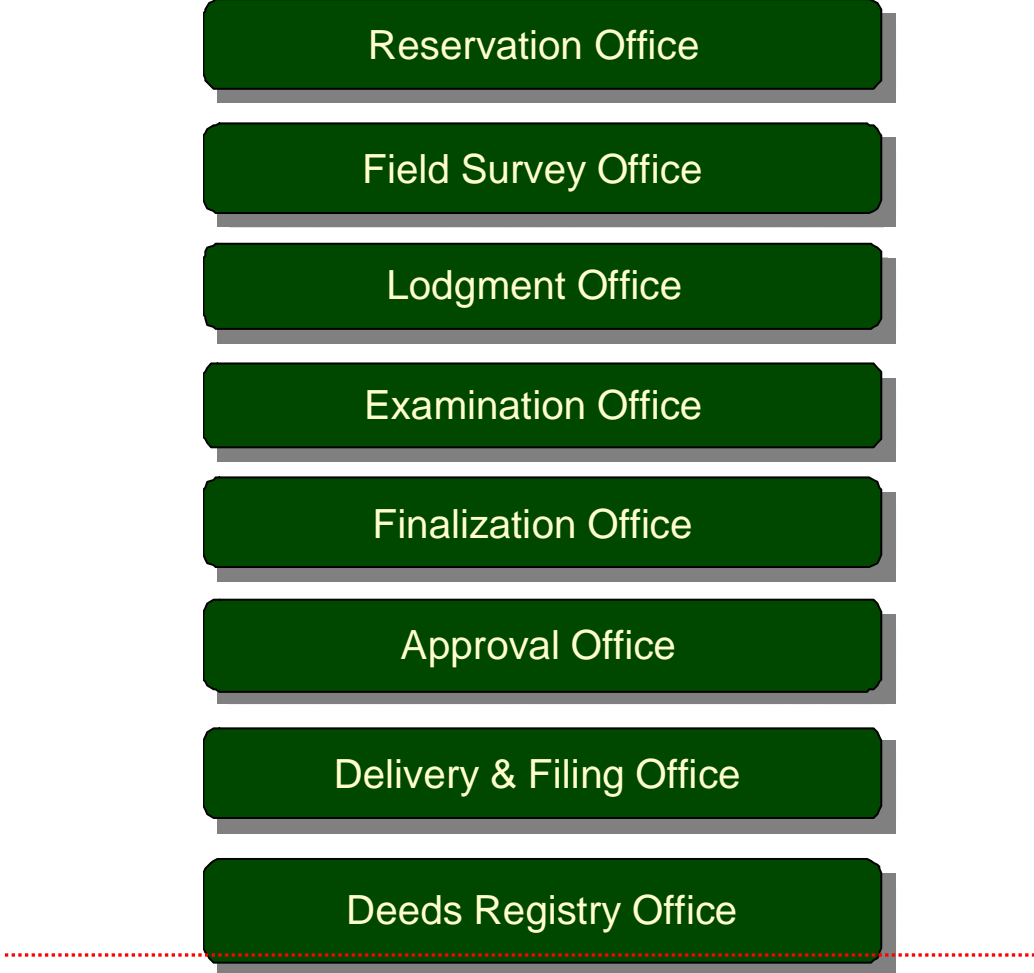
The project will be implemented through a Central architecture, where each entire section has access to the same database with different privileges.

As shown in the system layout figure, DSM will host unified cadastral databases where land properties tabular and geographic data will be stored in an enterprise edition of Oracle 9i.

Each DSM section will have access to land properties geographic and tabular database stored in a Unified Cadastral Database (UCD) based on an enterprise Geodatabase built on Oracle Enterprise edition with ArcSDE 9.1. ArcCadastre 2 will be utilized for performing cadastral operations through workflow and job concept, while the senior management application will be implemented as a light GIS application for monitoring various activities taking place in the office. This system will be used to allow future integration between the regional offices and the deeds registry to DSM's Cadastral system.

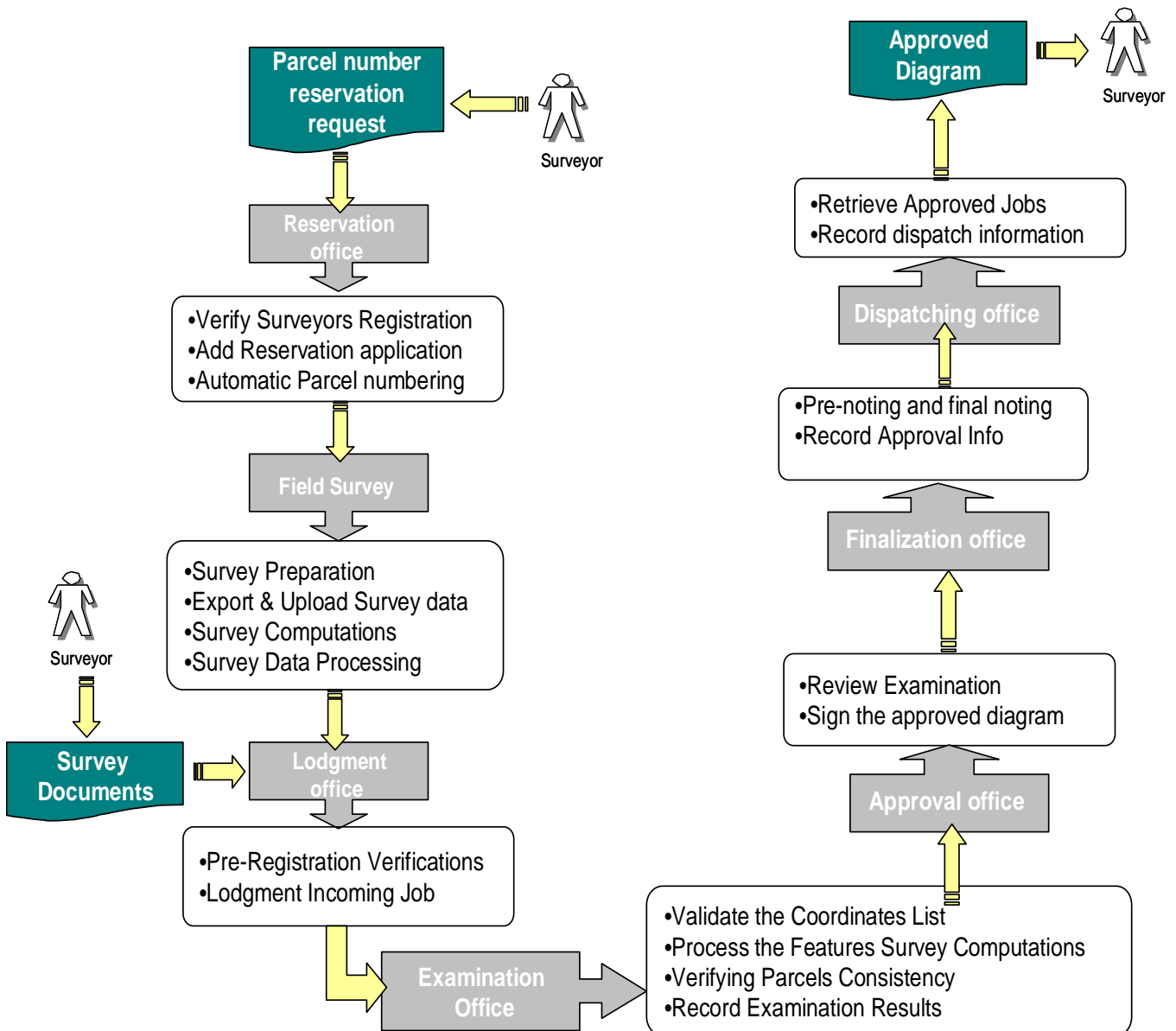
### 3.4 Business Environment

The project will integrate and connect the seven internal existing sections at DSM and the Deeds Registry office, these sections, are shown in the following figure:



- Reservation Office  
It is a board responsible for the reservation of parcel and general plan numbers according to request from surveyors
- Field Survey Office  
Field Survey Office is responsible for surveying of State lands and Survey of Geodetic Control Stations.
- Lodgment Office  
Lodgment office is responsible for recording incoming jobs and assigning job number, survey records no., diagram no. and DSM no. into the system.
- Examination Office  
Examination Office is responsible for examining and validating the proposed land survey within the survey records as well as the disposal process
- Finalization Office  
Finalization Office is responsible for updating the office maps with a pencil (Pre-noting) and doing the final Noting which is registering the temporary updates with an ink pen on the map.
- Approval Office  
Approval office is responsible for approving examination and diagrams.
- Delivery & Filing Office  
The Delivery & Filing Office is responsible for Archiving the survey records after updating the office maps, filing the survey records and indexing the diagrams in the strong room.
- Deeds Registry Office  
The Deeds Registry office is the agency responsible for the legal transactions by conducting the following:
  - Registration of the title deeds as per the approved diagrams & approved general plans from DSM.
  - Sending the registration data of the newly registered title deed to DSM.

### 3.5 System workflow





### **3.6 Project Modules**

Various modules are required to serve the different needs of the Directorate. The main modules to be developed are as follows:

#### **(i) Capture Cadastre Data**

This module contains all the functions that provide the means for capturing existing cadastre data to populate the new Geodatabase. These functions are:

- Capture Townships data
- Capture Registration Divisions data
- Capture Administrative Divisions data
- Capture Erven data
- Capture Farms data
- Capture Farms Portions data
- Capture Servitude data
- Capture Geodetic Stations data
- Capture Reference Marks data
- Capture Beacons data
- Capture State Land Areas
- Capture Township Extensions
- Capture Land Surveyor data
- Capture Roads data

#### **(ii) Cadastre Process Automation Module**

This Module contains all the required functions for automating the daily cadastre process within DSM. These functions are:

- Parcel Number Reservation
- Job Field Survey
- Job Lodgment
- Job Noting
- Job Examination
- Job Approval
- Job Dispatching
- Job Monitoring
- Job Registration
- Job Queuing
- Job Administration
- History Tracking
- Query/Search
- Reports
- Map View

### **(iii) Retrieve Information from Deeds Module**

This Module contains all the required functions for integration with the deeds registry system and provides the means for electronic data exchange.

- Retrieve Information from Deeds
- Provide Information to Deeds

### **(iv) Integration to Topographic Section Module**

This Module contains all the required functions for integration with the Topographic division GeoDatabase and provides the means of electronic data exchange. These functions are:

- Retrieve Topographic Dataset
- Provide Cadastre dataset

### **(v) Dissemination of information Module**

This Module contains the required functions for supporting the dissemination of cadastre information through an interactive spatially enabled website. The Module contains two functions:

- Dissemination for Surveyors
- Dissemination for Directorate of Valuation and Estate Management

## **4. PROJECT BENEFITS**

Once the project objectives have been achieved a number of benefits are expected to influence not only DSM, but also the society. Benefits to the society are based on the contribution to the economic development of Namibia through more effective decision making processes at all levels ensuring sustainable land management. The project will also benefit the society by providing increased security. Benefits that directly affect DSM include:

- Profits: A digital database makes it possible to create specific and standardized products in a more efficient way at a lower cost in accordance with client requirements, which could attract more customers and hence increase the income.
- Customer Satisfaction: Faster delivery measured by the reduction of time for the delivery of cadastral services and products via a digital environment. The new system will be capable to speed up data processing, data analysis and data output to increase the quality of the products.
- Improved Office Environment: The digital storing media takes less space than the analogue environment of storing. This can enable the improvement of office environment and working conditions, as well as reduce the need for office space.
- Preservation of Historical Records: Historical records can be preserved for future generations, as the use of analogue documents decreases.
- Getting More Support from the Government: The proposed nation wide cadastral system provides transparency on information and quick access to it, which can have

an economic effect and motivate the land market. It is expected that DSM could play a more important role as the government institution responsible for land information.

## 5. CONCLUSION

By this project DSM aims at the development and implementation of a **Digital Cadastral Information System** for Namibia. The system shall maintain and process the digital cadastre data sets and support the automation of DSM's cadastral processes. The system will provide the means for DSM staff to capture existing cadastral data in order to populate the database.

At the end of the project, the system will allow DSM to overcome the drawbacks of the old system and ensure accurate and up-to-date digital cadastral data as well as integrating to the database of the Division of Mapping and GIS and the Deeds registry system.

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