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Country Report of Namibia *

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Country Report on the development and innovations of the Namibian National Geospatial Information System

By

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Introduction

The Republic of Namibia is situated in the southwest of the African continent and covers an area of 834,295 square kilometers. It shares long borders with Angola in the north, with Botswana in the east, and with South Africa in the south. It also shares relatively short borders with Zimbabwe and Zambia in the north-east.

Namibia's natural boundaries are formed by the Kunene, Kavango, and Zambezi rivers in the north, the Orange river in the south and the South Atlantic ocean in the west. The main geographical features of Namibia are the Namib desert in the west, the Kalahari desert in the east. Situated between them the central plateau, on which the capital Windhoek is situated. Towards the north, grassland savannahs are the main feature. The population of about 2 million people mainly live in the capital and in the northern regions close to the border with Angola.

Economic development

The economy of Namibia is largely based on agriculture, fishery, mining and tourism. A national 25-yr development plan (Vision 2030) is currently in operation, detailed into 5-year National development plans (NDP's). The main objective is to create a politically stable, economically prospering, industrialised state by 2030.

Current urgent issues on the political agenda include the unemployment rate, the limited access to land resources, the limited food security, the inadequate education levels, the effects of global warming (flooding, drought) and the extreme differences in per capita income. Most of these items have a geospatial dimension, and require reliable geospatial information to support policy making and – implementation at national- and local levels. The Directorate of Survey and mapping plays a key role in this regard.

The Directorate of Survey and Mapping (DSM) is a directorate under the Ministry of Lands and Resettlement. The DSM is the Namibia's National Survey and Mapping Organization. Statutorily, its role is defined under the Land Survey Act, 1993 (Act 33 of 1993) which came into effect in June 1994.

The official mandate of the Directorate of Survey and Mapping (DSM) is essentially, to collect, maintain, process and disseminate geospatial information in support of national need. This is in addition to developing policies and advising Government on matters related to

survey, mapping and geographic information. Survey, Mapping and Geographical Information Systems (GIS) provide tools to promote economic development, improve our stewardship of natural resources and protect our environment.

The development and provision of geospatial information have featured prominently in the three National Development Plans (NDP). Capacity building was one of the main thrusts of the DSM activities in the NDP 1. The DSM realised early enough that for it to fulfil its statutory role as national survey and mapping organization, it needs to build the requisite competencies and skills required.

Development of DSM Capacity to fulfil its statutory role as national survey and mapping organization.

The capability of the DSM to maintain and revise the national map series, extend the geodetic networks and to provide up-to-date geographic information to users has been severely affected by the limited capacity. This was principally due to the historical antecedents. Before independence, most principal functions of the DSM were performed from South Africa. At independence, therefore, the capacity of the DSM to transform itself from a provincial organization to a national survey and mapping organisation was very limited. To compound matters, the modest skilled personnel that sustained the provincial office were recalled to South Africa at independence, thereby leaving the DSM with very limited capacity to fulfil its national mandate.

The Government of Namibia (GRN), knowing fully well the importance of a functional Mapping Organization within the context of the national development process, and, with the aim of addressing this serious problem, commissioned a number of consultancies to address the problem. One of them was done in cooperation with the Australian (AUSAID) consultants. One of the by-products of this study was the Strategic Plan 2000. This document is primarily geared towards human resources development and the restructuring of the Directorate of Survey and Mapping.

The implementation of the recommendations of the Strategic Plan 2000 commenced in 1998. The long-term goal of the GRN is to build enough capacity at the DSM to such a level that the DSM can fulfil its statutory obligations and at the same time generate enough money to meet its running cost.

As a step towards developing local competence, the DSM embarked on a number of training programmes spanning from university, polytechnics and short courses in different institutions.

Development and Maintenance of a Geospatial Database.

Faced with a demand for digital data, the DSM started to work on the development of digital databases for use in various planning processes and the creation of geographical and land information systems. Modern technology to improve its efficiency and to enable it give prompt response to changing user needs were acquired.

In 1996, a systematic coverage of Namibia with aerial photographs at the scale 1:80 000 was initiated. This programme was completed in 1998.

The digital conversion of existing topographical maps at the scales 1:50 000, 1:250 000 and 1:1 000 000 commenced during NDP I. Also commenced was the digital map revision of topographical maps at the scales of 1:50 000 and 1:250 000.

For the 1:50 000 topographic maps, the revision of Kavango maps was commenced in 1996. This project was initiated through a cooperation between the Government of the Republic of Namibia (GRN) and the Government of Luxembourg. The Kavango region was used as a pilot project.

Prior to this exercise, there was no capacity to revise the topographic maps in Namibia. Hence, the topographic maps were more than 20 years out of date. The pilot project was therefore designed to create the capacity to revise maps in Namibia by providing training and equipment for this exercise. The Kavango project was concluded in December 1998. To fine tune the methodology used and consolidate the confidence of the staff trained for this exercise, the GRN and the Government of Luxembourg agreed to extend the pilot project to the Caprivi region. This exercise was concluded by the third quarter of 2000. The DSM, thereafter, during the NDP II replicated the process in the other 11 regions of Namibia. For the 1:250 000 topographic maps, the digital data capture and revision of the whole of Namibia has been completed.

Proposals for the Second National Development Plan (NDP2)

The gains made during the NDP 1 were consolidated during NDP 2. The overarching thrust was to ensure the availability of up-to-date topographic and other geospatial information of national scope in line with evolving trend and demand that is fit for purpose at prices that would enhance cost recovery and equity and to promote the use of this information to enhance national development.

Namibia has a complete national coverage of the topographic map series at the scales of 1:50 000 and 1:250 000. The problem, before NDP2, was that most of the maps were more than twenty years out of date and they were mainly in hard copies. Presently, the 1:250 000 topographical maps for Namibia have been revised and are in digital format. The revision was completed in 2006. The content is less than ten years old. For the 1:50 000 scale, about one third of the country has been revised and now reflect conditions that are less than ten years old. The programme during NDP 2 is described below.

Digital topographic map updating (1:50 000)

The topographic map series covering six regions, Kavango, Caprivi, Omusati, Oshana, Ohangwena, Oshikoto and parts of Karas were revised at the scale of 1:50000. This represents about 50% regional coverage or about one-third of the land mass. For all the areas covered, there exists also the corresponding cartographic database. The database of the revised maps is in GIS format and includes the metadata.

Development of new Products.

The revised digital topographic maps were used to generate more products that could be beneficial to a larger society and not just the professional. During NDP 2, the DSM developed national tourism maps, regional tourism maps, regional topographic maps and 1: 1 million administrative map from the revised maps. The regional topographic maps has each region represented on one map sheet as opposed to many sheets, and in addition to the topographic features, highlight some salient and peculiar features of that region. The regional

tourism maps concentrate on highlighting the tourist potentials of each region. The national tourism map was produced in collaboration with the Namibia Tourism Board (NTB).

The availability of revised map at 1:250 000 scale is important for most regional planning. Being also available in digital format increases its usefulness for planning. The optimum agricultural economic unit is usually determined at this scale. The availability of the revised maps at this scale means that other users like Ministry of Agricultural, Land Use Planners, Geologists, Engineers, Planners could overlay their own data on these maps without having to do further transformations. They will also be confident that the base map they are using reflects the reality on the ground. The Geological Surveys also uses maps at this scale as the base map for their geological and geophysical maps.

Capacity to provide data in most formats.

As a national mapping agency that provides the base maps for other users, it is important that we are able to service as many users as possible, if not all. We have therefore during the course of this period, acquired the software and skills to convert our data to as many potentially useful formats as we foresee from current demands and existing literature.

Development of cartographic databases.

Establishment of a cartographic database is a logical step in conforming to the trend in the industry. Maps are usually not printed directly from the GIS database. Some cartographic editing needs to be applied before the maps can be printed. Depending on the use and scale of a map, some features in the GIS database may be omitted, generalized or simplified in generating a cartographic database for that particular map.

The production of a cartographic database has enabled us to print on demand and also offer our clients an a la carte menu of maps. Just like one goes to a restaurant and chooses from a variety of dishes, our customers can also make similar choices. Additionally, our customers, can, unlike a typical restaurant ask for what is not on the menu. Quite often a user may only be interested in, for example, contours, rivers and infrastructure, but he/she has to be inundated with all other unnecessary features. Having a cartographic database means that customers pay for only what they need. One other advantage of the cartographic database is that we could avoid wastage of money by doing offset printing for only those maps that are high in demand, thereby saving money and storage space. Presently, there are thousands of maps that have been gathering dust due to low demand.

Technology has made it possible to use one GIS database to generate multiple cartographic databases. Previously, for each scale, one had to produce two databases. With this possibility, the 1:50 000 GIS database would be used to produce other smaller scaled maps, thereby reducing cost and logistical problem significantly.

Present Status of Geospatial Information Management

Namibia is determined not only to provide its citizens and residents with a faithful record of its land marks, natural and man made features, but to preserve these records for generations to come. These records, we capture, in the form of maps, aerial images and cadastral information.

The Ministry of Lands and Resettlement (MLR) is responsible for the management of Namibia's national geospatial datasets relating to topographical information, cadastral information, deeds registration, communal land registration, land valuation, and land taxation. The MLR is also responsible for contributing to land policy development and implementation of the national land reform policies. This way, the MLR is also an important user of its' own geospatial datasets.

In support of the NSDI, Namibia embarked on a systematic revision of the topographic maps. Namibia has full coverage at the scales of 1 in 50 000 and 1 in 250 000. Full colour digital aerial images of sub-meter resolution exist for the northern part of Namibia. A full coverage is expected in the next two years. Namibia has developed a Unique Parcel Identifier, which, when implemented, will assist in the sharing of information between government agencies and across national boundaries.

In 2005 the Ministry identified the strategic need for implementation of digital land information systems as a means to improve service delivery and process efficiency. 'Excellent systems' were to be provided to the users of cadastral information, deeds information, communal land information, the land valuation process and the land taxation process. It was recognized that interoperability of parcel data was essential for sharing and combining these MLR datasets, and that huge leaps forward could be made in terms of process efficiency, product quality, information consistency and, ultimately, service delivery. For this reason, Unique Parcel Identification (UPI) method was designed, and is currently being developed. Systems defined before 2007 (like the deeds registration system and the cadastral system) will be retrofitted with the UPI, while systems defined after 2007 already accommodate the UPI.

The UPI will be published for all spatial data stakeholders in Namibia to use, or implement at a moment convenient to them, using a UPI integration point facility. An important feature of this UPI integration point will be the historical parcel database allowing easy reference to parcel mutations data. Assigning the UPI to all of Namibia's estimated 16 000 commercial farm parcels, and approximately 160 000 urban parcels, will be completed around mid-2012, while an estimated 500 000 communal land parcels will be processed by the end of 2014. The new statistics- based mass appraisal land valuation system will provide its' first fully automated valuation roll in 2012, after which the land tax system will allow fully automated collection and reconciliation of all resultant taxations.

The new UPI integration point will allow further integration of the cadastral- and deeds registration systems eliminating the need for maintaining overlapping manually administered copies of datasets.

Currently information planning within the Ministry is under review, especially focusing on the provision of business-wide consistent reporting for monitoring and evaluation reporting, and land management information provision across all units and all sites. The UPI implementation will surely pay off here, as it ultimately will for all stakeholders in Namibian spatial data provision.

Upgrading and maintenance of geodetic network.

Namibia has approximately 2600 Trigonometrical Beacons, which form the basis of the current geodetic network. These are mostly situated in the commercial farming areas, and therefore, do not have adequate density to cater for the development needs of Namibia. These

beacons, also, are not convenient to fully take advantage of the global navigational satellite systems.

Namibia has therefore, embarked on a programme to upgrade the current geodetic infrastructure.

To this end, the Directorate of Survey and Mapping has completed an observation campaign of Namibia's Zero Order Network. This Network consists of a total of 22 accessible monuments with coordinates given in the ITRF, epoch 2005.0. To date, Namibia has built 79 first order beacons and another 50 are planned for this financial year. To further support, the development of geospatial applications, a feasibility study for the establishing of continuously Operating reference stations is underway.

Namibia Land Information System

The development of a digital cadastral system received significant attention during the second and third National Development Plans. This project will upgrade the recording and mapping of property boundaries and Registration of Deeds through development of databases and computerization of processes. The workflow process will also be automated.

Namibia is in the process of developing e-governance. Land reform, being an important programme of government will have to be geospatially enabled. The starting point for bringing the land sector into modern economy is the reorganisation of discrete data obtainable on the land parcel in a manner that would facilitate the adoption of service-oriented approaches to producing information. The most important revolution in land administration is the development of an integrated digital management system - database management system (DBMS) that adopts geographic information system/land information system (GIS/LIS), to synthesise the spatial details and the attribute information (including incidental bundles of right) over any piece of land in a central compact database. LIS was born out of the need to enthrone a regime of easy and transparent access to land and land records as well as create and authenticate legitimate title to land. Until it is implemented, all land administration and registration process will be manual, slow and cumbersome. It currently takes many months to process and register any title document to land.

The primary aim of LIS is to provide on-line, real-time service to all stakeholders from every part of the country and indeed the world as well as generate revenue for the government using digital LIS. LIS provides a flexible system for recording and administering land information against the hitherto manual system. The first step after the system structure was developed was the digitisation of the cadastral maps. The available maps came in analogue form, requiring that they be converted by digitisation, geo-referencing and transformation to be able to get them in their relative geographic locations on the Namibian map. The attribute data were thereafter captured including the scanning of all the relevant documents relating to the landed property. These data are currently residing on different work stations awaiting the implementation of the system.

The volume of cadastral records has increased over the years. There are currently an estimated 16 000 commercial farm parcels and 160 000 urban parcels in Namibia. In addition there are an estimated 500 000 informal parcels that need to be recognised and given adequate legal protection.

To expand the application of spatial data generated by the Directorate of Survey and Mapping, Ministry of Lands and Resettlement (MLR) has engaged the Ministry of Health and Social Services and the Namibian Police in developing applications in the areas of Health Facility Mapping and Geopolicing. These tools are useful for planning, facility management and resource allocation.

A policy on the Namibian Spatial Data Infrastructure (NSDI) has been developed under the coordination of the National Planning Commission. The purpose of this policy is to guide the collection, processing, integrating, storing, distribution, and improved access and utilisation of spatial data and services in Namibia.

SDIs must be based on a medium - long term strategy and coordinated to maximize investment in data collection, integration and maintenance. Presently, in Namibia, the two primary datasets were developed to serve different purposes and are usually managed separately, thereby creating inconsistency. This separation is inefficient and uneconomical and could hamper the implementation of sustainable development. A separate development and maintenance of the cadastral and topographical systems would involve duplications with attendant escalation of costs on data collection and maintenance. The datasets should be configured into a multi-purpose database to serve wide ranging applications that could include poverty reduction measures, pro-poor interventions, HIV and AIDS and Gender profiling. This thought informed the concept used in the design of the digital cadastral system at the DSM. The architecture for the DSM's system is shown in figure 1 below.

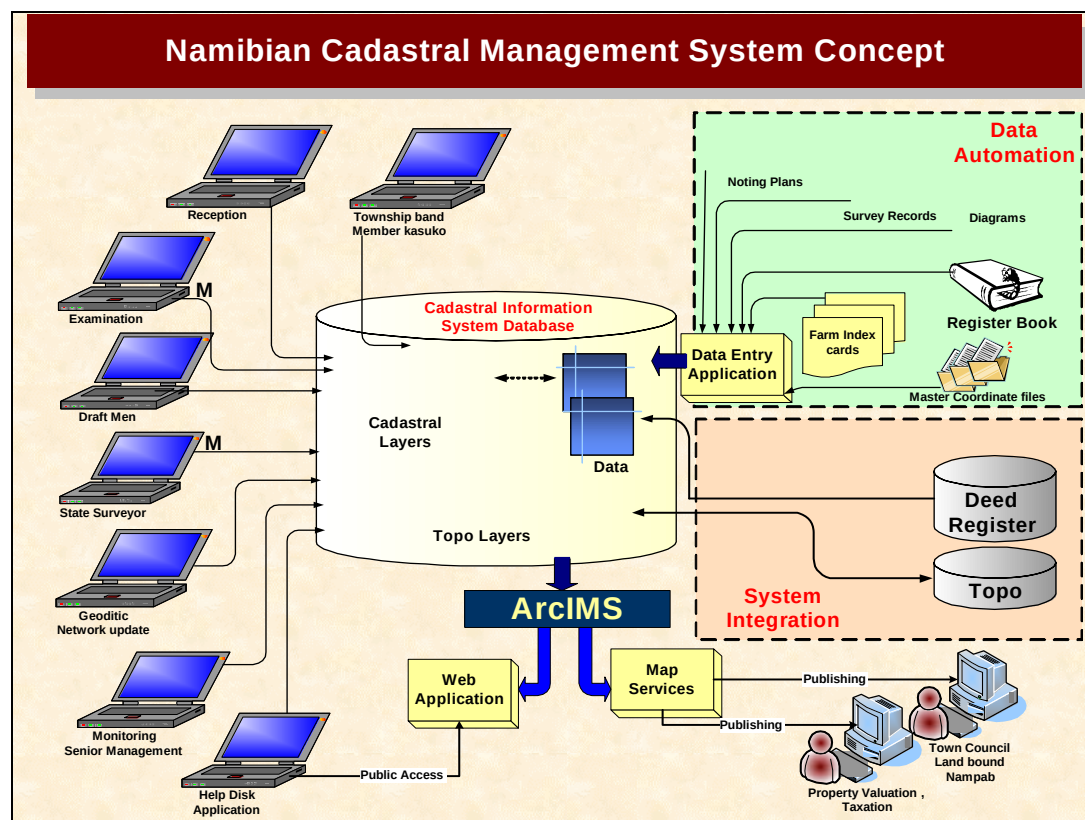


Figure 1: Namibian Cadastral management System Concept

Institutional framework for Namibian national spatial data management

The current trend internationally, is to improve access to available spatial data, promote its use and reuse, and ensure that additional investment in spatial information collection and management results in an ever-growing, readily available and useable pool of spatial information. To this end, there has been significant evolution in the approaches taken to implement and support frameworks for spatial data use and access, especially applications utilizing the benefits of product-based approaches, and those emphasizing the communication process (process-based). These approaches formed the bedrock of the strategies used for the National Spatial Data Infrastructure (NSDI) within NDP3.

Key organizations tasked with the management of national spatial data are the national Planning Commission, NPC, various ministries and the private sector including registered private land surveyors and registered attorneys qualified to carry out conveyancing activities. Additionally, many government agencies, public administration bodies and private sector organisations have set up geospatially enabled administrations to support their core businesses.

A profound lack of and reliable statistics and data interoperability problems led to the establishment of a National Statistics Agency (NSA), including a Committee for Spatial Data. Creation of spatial data interoperability has, however, always been an important issue inside the Ministry of Land's strategic information planning. All information system development from 2007 onwards has been converging towards the use of a unified parcel reference system as the core element creating national spatial data interoperability.

The National Spatial Data Infrastructure and the Committee for Spatial Data

Within the framework of the Statistics Act (Act No 9 of 2011), the National Spatial Data Infrastructure (NSDI) is established as the national technical and institutional framework to coordinate and facilitate the capture, management, maintenance, integration, distribution and use of spatial data. The main approach will be that of acting as a clearing house, i.e. central publishing of metadata on nationally available spatial data sets.

It was agreed that the NPC would be the 'institutional home' of NSDI, although practically 'housed' inside National Statistical Agency (NSA), a government agency functioning under the currently approved Statistics Act.

Relating to NSDI, the main activities of NSA will consist of Clearinghouse and Helpdesk services, Information provision and Public Relations, publications- and report editing, library- and documentation services, and provision of the NSDI Secretariat for the Committee for Spatial Data.

While NSA is tasked to coordinate NSDI within the government, the Committee for Spatial data will be established as the advisory body for NSA, and thus an important coordinating mechanism for all NSDI-related activities inside Namibia

In addition to its' advisory role the Committee must facilitate, promote and safeguard conditions for efficient collection, management, distribution and use of spatial data by promoting awareness of its' activities and of the importance of spatial data for effective governance, planning and decision making. The Surveyor-General will be the Chairman of the committee, but the NSDI itself will be administered by the Statistician General.

Future proposals

Web based mapping.

The use of digital geographic information has often been limited to those who have access to appropriate GIS software. With web mapping, any person with a computer running a web browser can, using a catalogue, locate a dataset of interest and view it over the web. It is no longer absolutely necessary for one to acquire own data set and own software before one can enjoy the infinite possibilities inherent in spatial information. Quite often, merely being able to view geospatial data in the form of a map, may be all that is required in order to plan or make a decision. This greatly increases the number of potential users of geospatial data, as this group is no longer limited to those who have the relevant GIS software and expertise to be able to manipulate digital geospatial datasets. Those who have experimented with Google Earth have never failed to marvel at what could be achieved using spatial data that is easily accessible.

The Open Geospatial Consortium (OGC) has contributed significantly in the definition of specifications for web mapping interfaces. Many software products are available to publish geospatial data in the form of maps through the Web. A significant contribution of OGC has been to define specifications for web mapping interfaces. This has opened the way for the visual overlay of geographic information residing on different servers. These possibilities would be explored and exploited in publishing Namibian spatial data on the web for wider accessibility.