



**Uganda Bureau of Statistics**



**SOLVING  
COMPLEXITIES IN  
IMPLEMENTATION OF SDI  
IN  
UGANDA<sup>1</sup>**

***A case of Uganda Bureau of Statistics***

**By**

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## INTRODUCTION

This paper expounds the strategy undertaken by Uganda Bureau of Statistics (UBOS) within its corporate structure in an attempt to resolve the multifaceted Spatial Data Infrastructure (SDI) function in Uganda. While over the last ten years or beyond, bodies and scholars have written some 'notes' about the need for SDI in developing countries like Uganda, this had fallen on a hard complex of issues that circumference and entangle the vital mid ribs that skeletons the spatial data infrastructural body. The paper seeks to point out initiatives made by the bureau as an opportunity to be embraced by all geospatial users and producers both in Uganda and globally over. Geospatial data in Uganda has been a real 'monster' that has mistreated anybody bothered about having informed decision making based on geo-referenced data, information and policy evidences in Uganda.

The main task of UBOS as defined by its (Act of Parliament on June 11, 1998) mandate is "to provide high quality central statistical information services on social, environmental, and economic conditions of the country". To fulfil this task modern tools and structures are needed to capture, process, analyse and disseminate the statistical information in a spatial context. The international practice shows that Geographic Information Systems are among most effective tools to coordinate the statistical data capturing, processing, analysis and dissemination, and support decision-making process at all levels of management.

In 2004, UBOS confirmed to the commitment of GIS in Uganda by adopting a comprehensive GIS policy which states: **'We define GIS as a key strategic tool to improve our services and meet the aims and objectives defined in our corporate plan. We are fully committed to coordinate our efforts with other GIS stakeholders in Uganda to build a spatial data infrastructure that can improve the performance of our services'**. Therefore, GIS application has been embraced by the Bureau as a corporate function critical in statistical data capture and production processes, which is in line with UBOS' mandate.

Since the bureau's adoption of this position, it has been in the forefront of mitigating the constraints affecting management of SDI which have largely included: lack of written doctrines in structures, lack of policy, lack of integration mechanisms with other data collection routines, lack of visions, lack of strategy on adoption of SDI decree, and lack of consensus on SDI component roles, GIS awareness, budget pitfalls like divided budgets / departments, training and education costs, time spent by participants = money, data costs, and HW/SW costs.

This paper therefore addresses the most important factors influencing SDI in Uganda and the initiatives being pursued by UBOS, in the area of Geospatial Data, Policy, Technology, Standards, Organizational framework and Resources / Partnerships.

## DECREE ON SPATIAL DATA INFRASTRUCTURE<sup>3</sup>

The Government of Uganda views land and geographic information as an infrastructure, with the same rationale and characteristics as roads, communications and other infrastructure. Uganda shall have the spatial data infrastructure needed to support their economic growth, and their social and environmental interests, backed by national standards, guidelines, and policies on community access to that data.

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<sup>3</sup> Formulated under DESIGN AND DEVELOPMENT OF GEOGRAPHIC INFORMATION SYSTEM, project consultancy: Uganda EFMP II/PHRD/00/05-GIS, 2001

Everyone can collect the spatial information that they need at the national, regional and local level, but this leads to costly duplication of data and inconsistency. It also results in data that cannot be integrated with other data and used as a basis for spatial modelling and analysis to produce value added information. In other words, excessive costs, inefficiencies, confusion and decision making based on poor information. The Government of Uganda believes that this country does not have the resources to waste on such duplicated efforts.

Therefore the implicated organisations should reach agreement on what fundamental datasets are required in the national interest, to what standards they should be collected and maintained, which agencies should have custodianship of those data, and what the national priorities are for collection of those data. The implicated organisations shall establish a Spatial Data Infrastructure Committee,

and commit to:

Institutional cooperation that provides mechanisms for sharing experience, technology transfer and coordination of the development of the national fundamental datasets;

Use of common technical standards, including a common geodetic reference frame, so that data from numerous databases can be brought together to create new products and solve new problems, both nationally and locally

Adoption of common policies on data access, pricing, privacy, confidentiality and custodianship;

Implementation of inter-governmental agreements on data sharing of Key Data Sets

Contribution to freely accessible directory of available datasets containing descriptions and administrative information that accords with agreed standards for metadata.

Within one year ('2002-'03) of the issue of this decree each of the institutions should have accomplished their geospatial documentation and defined their contribution to the National Key Data Set, to the coordinating body. This is yet to be a reality, and its our vision to see happen, when we still serve in the public offices.

## **UBOS GIS POLICY, NIMES AND ORGANIZATIONAL FRAMEWORK<sup>4</sup>**

The development of SDI/GIS capacity at UBOS is well correlated with the UBOS mandate and shall be considered as one of the most important measures towards the achievement of UBOS strategic goal and objectives. The capability of UBOS to process, analyse and disseminate the geo-referenced statistical information will contribute to achievement of the strategic objective of coordination, improve the statistic data use and reduce the overlapping of data capturing efforts, increase the efficiency of statistical information processing and products development, and improve the statistical information availability and dissemination for information users and society.

The Poverty Eradication Action Plan (PEAP) provides a national vision and overall goals for the economic and social transformation of Uganda in the medium term. The improvement of mechanisms of public services delivery and improvement of efficiency and equity in public expenditures are the central elements to the achievement of the PEAP objectives.

GIS should be one of the most important instruments used by UBOS in the PEAP monitoring process for data collection, processing and analysis. Besides the importance of highlighting the overall poverty and the living conditions it is important to highlight the differences and similarities in poverty between different parts of the country. In this aspect, GIS gives the means to efficiently analyse the geographical differences and similarities and to visualise them in a way understood by almost everyone.

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<sup>4</sup> GIS Capacity Development for Uganda Bureau of Statistics, Final Report 2004

It is evident that for UBOS to fulfil its main task "to provide high quality central statistical information services on social, environmental, and economic conditions of the country" it will heavily depend on other institutions to produce, exchange and update data in a standardized and orderly manner. The success of UBOS does in other words depend on the existence of a National Data Infrastructure and institutional arrangements for exchange and dissemination of data. There being no initiatives in Uganda specific to the SDI, other than the recent initiative related to Monitoring and Evaluation (National Integrated Monitoring and Evaluation Strategy or NIMES) under Prime Ministers office, whose 4 main goals are formulated as to:

- Ensure key stakeholders' articulate data and information needs;
  - Bring greater coordination to M&E initiatives in Uganda by providing mechanisms which align the existing M&E initiatives with these data and information needs;
  - Ensure that a sound evidence-base is available to inform decision making on the national policy frameworks such as the PEAP;
  - Enhance M&E capacity In Uganda,
- and based on the evaluation of user demands and assessment of the existing SDI/GIS capacity nationwide and UBOS' institutional position in Uganda within the field of GIS,

UBOS adopted the following policy guidelines:

- To be a definite main GIS Stakeholder with particular responsibility to integrate spatial data from different GIS Stakeholders for the purpose of statistics
- To coordinate activities related to geo-spatial statistics by defining, coding, maintaining and make available spatial objects for statistical purposes. (e.g. public delivery services, administrative boundaries and enumeration areas)
- As a center of excellence for integrating spatial data and statistics in Uganda UBOS shall offer competent service within this area to relevant users.
- Bi-lateral agreements shall support access to data and unobstructed utilization of available spatial data in publishing of statistics.
- The NIMES initiative represent an excellent window of opportunity for developing the GIS in UBOS in line with a National Strategy, and development within UBOS shall be directed at supporting and taking advantage of NIMES.

## **GIS AWARENESS, UTILIZATION AND THE NEED FOR SPATIAL DATA**

The public sector of Uganda is definitely in the process of adopting GIS in their work operations. Within the institutions defined as Main Focus and Supporting, there are about 60 GIS or related software packages in use and some 75 professional institutions directly related to GIS and Mapping. Looking at the Main Focus Institutions only, which primarily are users and not providers of GIS information, the number of GIS and related systems count about 20, and the professionals directly involved about 35. UBOS has 7 GIS software packages, 25 GIS trained users, 6 GIS operators and 1 GIS Specialists.

Most found GIS applications use GIS as a graphic interface for tabular data viewing and as a background for other data. The potential for using GIS in more advanced analysis and modelling is little, although UBOS has integrated methodologies using GIS and Statistical tools in its recently disseminated Poverty Analysis and Mapping (1999 Poverty Maps). This may be due to lack of "intelligence" in existing data, and lack of GIS knowledge, which the Bureau has committed itself to handle by migrating its file-based geospatial layers into geoprocessing environment using ArcGIS 9.x in the third quarter of 2005 and

training its staff in advanced geospatial analysis and geodatabase construction at ESRI GIS Learning Center, Redlands, USA June-Aug 2005).

GIS awareness can be said to be rather high, the very fact that GIS is recognised, as a key area for improving the efficiency in the public administration is a clear indication of this. Even if detailed GIS knowledge is often lacking in the user environment, we have a rather large number of people that realise that adding a geographic dimension to their information may improve the performance. If funding was not a very serious constraint to the initiatives, meetings with public and organization's administrators would achieve more elaboration of 'best practises and successes' in their fields of business. The little noticeable awareness has been achieved through printed thematic maps, illustrative charts and posters using GIS tools displayed during dissemination workshops of major national reports.

## RESOURCES/PARTNERSHIPS

As highlighted in its GIS policy, UBOS has initiated joint spatial data collection, cleaning and data handling, analysis and dissemination functions with other both government and non-government agencies and individuals. The related activities with the respective organization have been highlighted in italics blue print.

### The Main Focus Institutions are:

- Ministry of Education and Sports
  - Education Planning Department *[UBOS has finished a joint School mapping prog]*
- Ministry of Health
  - Community Health Department *[UBOS offers geo-information services, public health sector surveys]*
  - Health Planning Department *[UBOS has had two meetings to harmonize health facility datasets]*
  - Health Infrastructure Division
  - National Disease Control Department
- Ministry of Water, Lands and Environment
  - Directorate of Water Development, Sector Planning and Quality Assurance, MIS/GIS-lab *[UBOS jointly collaborated in 2002 Census Mapping, to share data]*
  - Directorate of Water Development, Water Resources Management Department
  - National Water and Sewerage Corporation (NWSC)

### The Supporting Institutions are:

- Ministry of Finance, Planning and Economic Development
  - Uganda Bureau of Statistics *[UBOS is here]*
- Ministry of Water, Lands and Environment
  - Lands and Surveys Department, Directorate of Lands and Environment *[UBOS undertook 2002 Census mapping/geospatial data collection under quality assurance expert from Lands and Surveys to ascertain acceptable Spatial Data Standard]*
  - National Biomass Study Forest Department *[UBOS is currently documenting MOU for data sharing and joint data collection, have good spatial data corroboration]*
- Ministry of Local Government *[UBOS worked with MoLG, closely throughout the 2002 Census geospatial data capture, more joint data collection are planned in ten districts for 2006]*

- Ministry of Works, Housing and Communication *[UBOS with other stakeholders have had a workshop or cooperation, no report was disseminated by Works (the host), we following on the matter]*

#### **Other Peripheral Institutions are:**

- Ministry of Education and Sports
  - Remote Sensing and GIS Lab Institute of Environment and Natural Resources Makerere University *[UBOS has exchanged MOU which are not yet officiated, do share expertise and data on adhoc terms for training purposes]*
  - National Biodiversity Data Bank, Institute of Environment and Natural Resource Makerere University
- Ministry of Water, Lands and Environment
  - Information and Monitoring, NEMA
  - Natural Resources Management and Conservation Project Forest Department
  - Department of Physical Planning *[UBOS offers goe-information services in the upcoming small towns planning]*
  - Geography Department Faculty of Arts, Makerere University *[UBOS offers goe-information for students and training]*

The initiatives above need to be harmonized into a said working and coordinating body through a number of workshops of producers/producers, users/producers and users/users to reach a consensus, in order to fine-tune the modalities of the SDI decree, coding systems, data collection, data needs/ quality/ detail/ coverage and frequency that UBOS has adopted from the SDI recommendations as documented in the 'Design and Development of GIS' report.

During 2002 Census Mapping/Geo-spatial data collection, Ugandan Government together with partners in development including UNFPA, World Bank, NORAD, and South Africa offered financial, expertise and material support to the 2002 Census preparation, enumeration and post-enumeration cartographic activities, worth over 3billion UgShs. The Geo-Information Services Section under the Bureau is now fully functional GIS infrastructure, with Intergratable data sets with the rest of the National Statistical Datasets. The current budget allocation to the GIS/Poverty Mapping component is 0.5% of the total budget for the Bureau for 2005-2006 (8.8bUgShs). This therefore, reflects the big financial gap that still exists towards implementing the generation of the national key data sets by the end of year, regardless of the commitment to see the tasks completed.

#### **STANDARDS AND GEOSPATIAL DATA SPECIFICATIONS<sup>5</sup>**

The importance of geographic information to support decision-making and management of growing national, regional, and global issues was cited as critical at the 1992 Rio Summit, and by a special session of the United Nations General Assembly assembled in 1997 to appraise the implementation of the Agenda 21.

However, information is an expensive resource, and for this reason the establishment of appropriate infrastructures (i.e. Spatial Data Infrastructure or SDI) that support information discovery, access, and common use of this information in the decision-making process is very important for economic growth of any country. The establishment of Spatial Data Infrastructure means the implementation of policies, standards, technology and development of human resources necessary to acquire process, store, distribute, and improve utilisation of geographic data. In all cases a link-descriptive attribute shall be given.

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<sup>5</sup> DESIGN AND DEVELOPMENT OF GEOGRAPHIC INFORMATION SYSTEM, project consultancy: Uganda EFMP II/PHRD/00/05-GIS, 2001

The specifications were developed in accordance with the recommendations of Open GIS Consortium and in the harmony with the tendency and ideology of ISO/TC211 "Geographic information-Feature Cataloguing Methodology" developing standard.

A dataset, that can be regarded as an associated of another dataset (i.e. one data set that contains the socio-economic data about an administrative area and suppose to be integrated with spatial data set of administrative units), shall contain the same unit identification that contains the spatial data set. UBOS has developed unique 'geocodes' as they are called that uniquely identifies all administrative areas from national down to village level for 2002 geospatial data set.

Due to the need for trends analysis, the Geo-Information Services plans to 'geocode' all the previous datasets backwards through 1990, 80 and 70, if funds permit for the 1st quarter of 2006.

To enable the definition of the spatial relations to the features the spatial referencing of all Basic geographic data within the territory of Uganda is done in one national coordinate system based on horizontal and vertical control survey network.

The coordinates of objects are given as geographic coordinates (latitude, longitude) or as Cartesian plane coordinates (X and Y) in Universal Transverse Mercator Cartographic projection.

The following parameters of reference system have been adopted

ELLIPSOID:	Clarke 1880 (modif.)
HORIZONTAL DATUM:	New Arc (1960)
Origin:	Blomfontein (South Africa)
VERTICAL DATUM	Mean sea level
Origin	Mombassa (Kenya)
Measurement units	Meters
PROJECTION:	Universal Transverse Mercator
Grid:	UTM, Zone 36
Meridian of origin:	33 degree East of Greenwich
Latitude of origin:	Equator
False coordinates of origin:	500,000 m Easting 10,000,000 m Northing

If any other co-ordinate system is used (i.e. WGS84) the mathematical relationships between either of the above-mentioned co-ordinate systems and the coordinate system used, must be defined and the direct transformation between coordinate systems must be trivial procedure for the user. In all cases the coordinate systems must be based on the reference ellipsoid.

The transformation parameters from/to national coordinate system to World Geodetic System WGS84 shall be provided.

The resolution of coordinates should be given to one significant digit more than the order of the positional accuracy for that data. UBOS used the above recommendation of specification in undertaking the 2002 Census Mapping/geospatial data collection, and other detailed subsection data exchange specs to facilitate data sharing as the main objective.

## **FUTURE SDI ACTIVITIES**

- Establish a Spatial Data Infrastructure Committee under NIMES.
- Establish a Standardisation Committee for Spatial Data Infrastructure including Metadata.

- Establish a Co-Financing Committee for Acquisition of Spatial Data and Maps.
- Establish GIS capability in local government district planning units for data updating and utilization for planning.
- Establish a Permanent Spatial Data Infrastructure Coordination Unit.
- Launch Activities for Initial Conformance and Exchange Operation.
- Establish a permanent linkage with the proposed National Land Information System.
- Impose the Rules and Conditions of Ugandan Spatial Data Infrastructure to all Future Donor Funded Project
- Adopt the Principle of Free Exchange of Key Spatial Data Sets.

## **CHALLENGES STILL IN THE WAY**

- Geo-spatial analysis and statistical data spatial modelling capacity in the bureau (2 staff to GIS Analysis level);
- Resources for upgrading of equipment needed to carry out GIS services like WFS like ArcIMS (1 license);
- Resources for new software to carry out basic GIS services especially in the migrating phase from file-based datasets to geodatabases, ArcSDE (1 license);
- New statistical products for public use (2002 poverty maps, Census Atlas, Meta Data, national key data sets)
- Data availability for research community (shape layers for roads, administrative units, census enumeration areas)
- Data delivery on time and in the formats suitable for different stakeholders;
- Resources for conducting and coordinating workshops and consultative meetings with other stakeholders in adoption of SDI guidelines

## **CONCLUSION**

With the initial strategy of an elaborate UBOS GIS policy, present willingness from staff and support from administration, SDI process in Uganda is likely to benefit tremendously fast from the 'poles' that have been planted in the right positions. We attribute our success to the continued support from well wishers and partner's in development like NORAD, WB, DFID, UNFPA and fellow sister institutions in geospatial environment, an NSDI in Uganda will sooner than later be a reality.