

A Strategy for Virtually Sharing of Geographic Information by Botswana National Mapping Agency

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Summary

National Mapping Agencies (NMAs) are internationally recognized as critical in collection, processing, modelling and distribution of geospatial data within home countries. Their roles are entrenched as main suppliers of base geospatial data sets. In Botswana, the prevailing NMA is known as Department of Surveys and Mapping (DSM) established under Botswana Land Survey Act CAP 33:01. This NMA, in 2004 responded to geospatial technological advancements through a wide scoped project dubbed Integrated Geographic information System (IGIS). This project was styled to have a number of modules relating to geodatabase development, digital archiving and geospatial information distribution. Its overarching purpose was to integrate cadastral, geodetic, and topographic databases within the NMA to facilitate the provision of geographic information and discoverability for cost-effective use within Botswana economy. Though some parts of this system have been developed, they are operational and available only internally within the NMA and are still not available for a wider access by external stakeholders through technological platforms. The unavailability of virtual access for external stakeholders' points to difficulty in sharing and exchange of the MNA's geospatial data and information in the midst of unfolding technological advancements and other sudden and explosive trends such as COVID-19. Through this paper, the intention is to explore the efforts made by Botswana Department of Surveys and Mapping (BDSM) in embracing geospatial technologies, deduce problems encountered and suggest the strategies that could be employed to successfully share and exchange geospatial information virtually in Botswana. The strategy is aimed at reflecting technological changes which have occurred, coupled with current concepts such as National Spatial Data Infrastructure (NSDI) which are critical in geospatial information sharing and exchange.

Key Words

Mapping Agency, Data Management, Geospatial Information, Content Management, Enterprise, Sharing and Exchange, Strategy

1.0 Introduction

Botswana National Mapping Agency (NMA), Department of Surveys and Mapping (DSM) is established under the auspices of country's Land Survey Act. Among its core mandate is to undertake and oversee cadastral land surveying; development of a robust geodetic referencing system; national mapping at all levels of scales; archiving of topographic and engineering

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surveys. With all intents and purposes DSM is the ultimate authority to underlying geospatial data, as such making the objective of sharing it mandatory.

According to Morebodi (2006a), to implement this mandate, this NMA has through the years made several attempts at establishing what it considered to be critical systems. Such systems include; Cadastral Information System (CIS); Cadastral Geodatabase Storage; Digital Archive System; and Cadastre Dissemination System (Morebodi, 2006b). The overarching motivation of Botswana NMA was to establish an Integrated Geographical Information System (IGIS) that could be accessed by stakeholders. The aim of the IGIS was to enable geospatial data sharing and exchange with its myriad stakeholders such as other governmental institutions, utility corporations, private geomatics practitioners, individuals of the public, the academic community and non-governmental community. To date this has not been achieved and according to the current DSM administration, two main problems seem to be major stumbling blocks. The two main problems are; (a) lack of operational National Spatial Data Infrastructure (NSDI) data sharing protocol; (b) information, once held at DSM is dispatched following set revenue generation requirements, bringing into question accessibility and affordability to the intended community.

Through this paper, the operational, tactical and strategic implementation of online sharing initiatives by Botswana NMA are identified with an objective of proposing a strategy. Several scholars opine that legal, policy, standards, institutions and data are usually responsible for difficulties associated with sharing and exchange of geographical information (Gelagay, 2017; Rajabifard, Binns, and Williamson, 2005). Despite all those difficulties, Rajabifard et al (2005) insists on a necessity for creating opportunities for geospatial data to be shared and made available for public good. The ideas of Rajabifard et al (2005) must be taken into consideration from all possible angles and the defining approach can be anchored on the frameworks of the concept strategy. Strategy is a concept in itself and it entails subjecting a number of processes to change that is rationally planned, guided as learning process, subjected to logical incrementalism and being responsive to emergent trends (Idenburg, 1993). Importantly, an organization in pursuit of such change needs to revisit its Enterprise Content Management (O'Callaghan and Smits, 2005). According to O'Callaghan and Smits (2005), Enterprise Content Management (ECM) is about rethinking and establishing of convergence of Data Management (DM) and Content Management (CM). DM concentrates on internal frameworks of file storage, file categorization, metadata services, collaboration services, workflow services, versioning services and access services, on the other hand CM addresses itself to collecting, management, and publication content to any outlet (O'Callaghan and Smits, 2005). Publication can be seen to be solutions to geospatial data sharing by DSM. That as it may, this paper is structured through this introduction followed by the method, reporting and analysis of results, strategy formulation, discussion, and a conclusion.

2.0 Method

The study is qualitative in nature and at best it can be viewed as a case study for Department of Surveys and Mapping (DSM) in Botswana regarding its migration processes in respond to

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technology and prevailing trends such as COVID-19. With an understanding that this is a case study of DSM, the research further utilized methods of document study, online presence searches and interviews to broaden the scope of the data collection and analysis processes.

The DSM is regarded as an authority in all surveying and mapping operations, products and functions in Botswana. On the other hand, technology has become ubiquitous and moved frontiers of surveying and mapping across all professional spheres. The current prevailing and explosive trends such as COVID-19 has made the requirement of geospatial information more pressing with the need to transact it virtually in view of COVID-19 associated protocols. That in itself brings with it a number of questions such as the continued relevance of DSM as the absolute authority to survey and mapping products. How does DSM collect, process and distribute information to other stakeholders within Botswana economy? What operational changes has DSM brought about in order to maintain its status and relevance in provision of surveying and mapping products? Does DSM have a tactical and Strategic route to devolve their services virtually and be able to supply them timeously on request?

Deep-seated answers to these questions are considered relevant to DSM and geospatial information stakeholders in Botswana and beyond. The question relating to strategy is considered more important to stakeholders as they seek to get quality products and services from DSM. For this reason, DSM was studied so as to review its organizational commencement in pursuit of geospatial data sharing strategy defined within a virtual environment. To achieve this feat, document study, online presence and interviews were done within DSM as stated below.

- In terms of document study, departmental brochure, publicly available documents and those department was willing to share were perused. Through their perusal, the element of geospatial information sharing was fished from the content as per the vision of DSM.
- In terms of the online presence, the Botswana Department of Surveys and Mapping was searched using its name on the internet. The results from this research were expected to return internet sites/portals, documents and any related content to DSM.
- Interviews were conducted with senior management at DSM to get their views on their geospatial information sharing especially in the context of the internet. interview led to acquisition of information about the history of how DSM have been conducting data sharing and exchange. In addition, it revealed the problems they encounter in relation to sharing geographic data on the web. Further to that, solutions to deal with the barriers that hinders the DSM to share data by the use of Internet were discussed.

From the above methods, data was collected which enabled an analytical framework. The analytical framework then fed into a proposition for a strategy of virtual data sharing by DSM.

3.0 Results and Analysis

The results are summarized in the subsections below numbered as 3.1 to 3.3. These results are reported and polished with some analytical viewpoints buttressing the narrative of data sharing.

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3.1 DSM and Internal Operations

Through interviews and documents analysis, DSM has a historical origin rooted in Vryburg City, with office transiting through Mahikeng City in the Republic of South Africa to Gaborone City in the present-day Botswana. DSM is a product of the 1959 Land Survey Act which is crafted following on the 1929 Land Survey of South Africa. DSM profess a number of operations in surveying and mapping which effectively provides survey and geospatial information products for Botswana. Currently, DSM has four (4) fundamental structural units being: Administration, Survey, Geoinformatics and Mapping Divisions. Three (3) of these units collect data and process it into information products which in essence could be called authoritative. During its years of operations, DSM has undertaken and saw development of the following:

- A robust cadastral land survey practice based on the dictates of the Land Survey Act
- Development of a geodetic datums which culminated into the Botswana Geodetic Referencing System 2002 (BNGRS02) based on Geodetic Referencing System 1980 (GRS80) ellipsoid which is World geodetic System 1984 (WGS84) compliant.
- Continuous Operating Reference Stations (CORS)
- Production of various mapping products
- Integrated Geographic Information System Project

Associated with the above, DSM envisaged and crafted its cadastral system architecture in the Figure 1 as way back as 2006.

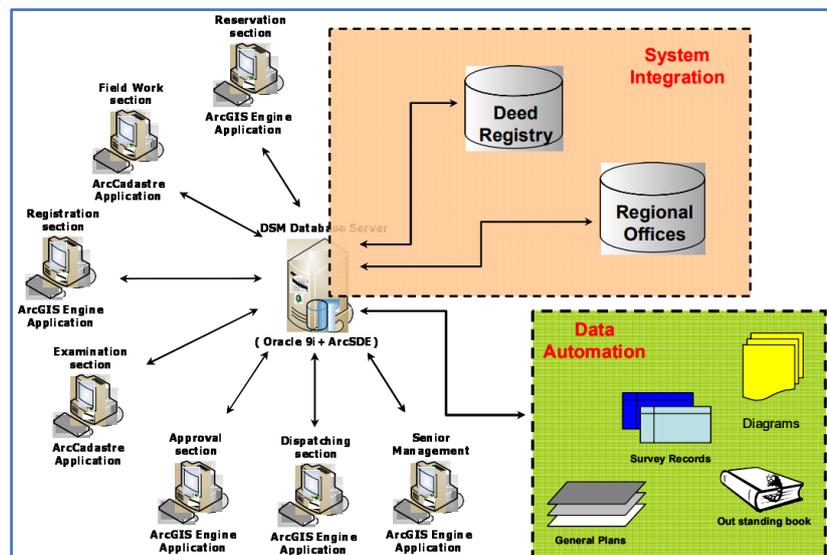


Figure 1: Botswana DSM Cadastral System Architecture (Morebodi, 2006b)

The above architecture indicates internal cadastral survey system with slight operational openings to the Deeds Registry Office as the only external stakeholder. Attempts have been made towards development and full implementation of this system, though it has not reached completion and operation yet.

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3.2 Web Presence

1. <https://www.gov.bw/land-management/land-survey-records-approval>: This particular site explains Department of Surveys and Mapping, its mandate and role in land administration in the context of registration and titling. Content on this site also reveal that the NMA is found at four main centres of Gaborone City, Francistown City, Selibe-Phikwe Town and Maun Village. The content provided further indicate that land records can only be submitted at the offices of Gaborone and Francistown. For a country of the size 582,000 Km², it implies long distances for other settlement centres to reach these places for services and products.
2. <https://www.gov.bw/land-management/maps-and-geospatial-data>: This site reveals various types of geospatial data that are shared from the DSM. In sharing of the data, what is coming out is that hard copy documents and digital files are purchasable from DSM. A price list Portable Document File (PDF) is attached on this site showing costs for various information sets such as map of whole country, tourist maps, Street maps, topographic maps, 50 Km series maps, constituency maps, line maps, digital map information products especially referring to elevation, hydrography, transportation, settlements, cadastre, geodetic points, orthophoto maps and administrative maps. Other information products include vegetation and land cover data and maps, atlas in hardcopy and digital form. From this site it is evident that information and products can be obtained by visiting DSM or making requests online. Products and information services are released to stakeholders who have been described as private individuals, government, non-governmental organizations (NGOs) and parastatals upon certified payment for the requirements. The greatest challenge to virtual transaction is that a stakeholder never comes to see the information they are acquiring until after purchase.

3.3 National Spatial Data Infrastructure Movement

Botswana NMA had vested a lot of trust on NSDI initiative as means to its data sharing. From the documents perused and interviews done with the Senior Management, NSDI has not been successful since the idea was initially hatched and housed under Department of Information Technology in 2002 as opined in Maphale (2019). In the recent times, the NMA is the main actor in rekindling the SDI fortunes of Botswana, but this does not seem to be bearing fruit. The NMA's unfruitful efforts can be traced back to 2009 after the initial NSDI effort failure (Maphale, 2019). The NMA is still consistent with its efforts to Botswana NSDI establishment as a means to its data sharing. Though BNSDI is acknowledged as a good effort if implemented, the NMA is encouraged to look at its own internal processes and strategies as a launching pad for virtual sharing of geospatial data and information. For that reason, it is opined here that, the NMA must look more internally and make it possible for its data to be shared virtually as a stepping stone towards Botswana NSDI. A strategy framework is therefore suggested in the next section as a way forward for Botswana NMA.

4.0 Strategic Framework

Coining a strategic framework for enterprises is critical to their operations, tactics and high-level execution of their mandates. Department of Surveys and Mapping (DSM) is a product of a statute and that in itself makes it accountable to the public of Botswana in its endeavors. DSM inter-alia work on the collection, processing and dissemination of geospatial data and in so doing must recognize the public good aspect in their mandate. Geospatial data must be shared with the public and as such appropriate platforms must be developed or established for that purpose. In light of that, we propose for DSM a Virtual Strategic Framework based on four fundamental parameters being: Data management, Content Management, Content Enterprise Management and Stakeholder Virtual Requirements as shown in Figure 2.

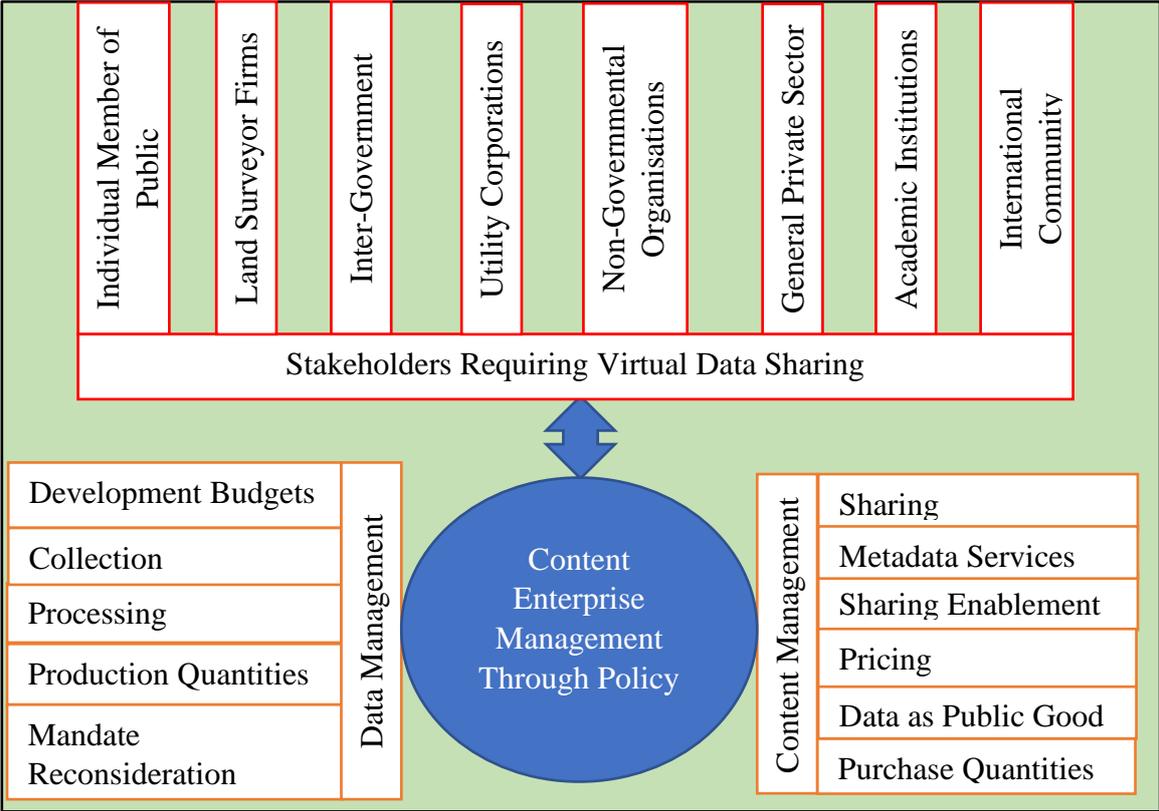


Figure 2: Proposition for Botswana Department of Surveys and Mapping Virtual Data Sharing Strategy

In consideration of this strategy, it is acknowledged that DSM has massive data under its management. This data has been developed into various information products which are shared as content with stakeholders. The sharing of content is largely practice based and it is without a properly constituted Enterprise Content Management (ECM) informed by policy. Such policy should be developed internally as a means to convergence between Data Management, Content Management within DSM and the Stakeholder Community. Proper mandates, planning and reporting on issues of ECM must be codified and followed. In implementing this strategy, it is recommended that a functional Enterprise Content Management Committee should be established within DSM under the NMA’s Administrative Division. The Committee should

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meet monthly to deliver on the mandate of sharing geospatial information content virtually and among its duties should be to: (a) Provide a tactical framework necessary for Enterprise Content Management at DSM; (b) Identify Fundamental Datasets that needs to be shared with the stakeholders on the basis of the volumes of demands; (c) To set up Metadata service for DSM content in line with International Standards Organisation published standards (d) To establish standards and guidelines on virtual access of DSM content by stakeholders. This strategy should not only be considered necessary but inevitable.

5.0 Discussion

Internally, DSM has a massive Data Management regime in place and has always moved towards innovative ideas on how to devolve their data from manual form through technological platforms. Despite that, DSM Web Presence can be characterized as negligible, apart from the informational pages shared under Subsection 3.2 above. With this acknowledgement in mind, it has to be noted that the current COVID-19 international dilemma is very instructive for nations to move towards the use of the modern technologies to hold meetings and to share data critical for decision-making. In that light, it is posited that Botswana NMA has a duty to respond and deliver on the fundamental data sets it holds virtually to its stakeholders. Hence the strategic virtual presence framework has been proposed as seen in Figure 2.

An Enterprise Content Management virtual strategy will enable a coordinated situational analysis and awareness within DSM. It will further enhance information-sharing approaches. This will in turn provide insights for decision-makers on the status of DSM content demand and the shape it has to take. In response, DSM should enhance support to mandates in terms of budgets and identification of new opportunities in pursuit of this strategy. It has to be realized that, this strategy would invoke inclusivity and commitment from stakeholders as virtual access would ensure reliable use, sharing or distribution of content. DSM is mainly mandated with geospatial data and content of the country; thus, it has to ensure security and authenticity of spatial data by being the main supplier of what is commonly termed authoritative data and content. As the main custodian of geospatial data and content, DSM has a duty to mitigate duplication of data acquisition and production especially in view of data quality regime. It is problematic for stakeholders to re-collect data, sometimes at a different level of accuracy to data already held at DSM. It is common knowledge that utilities and settlements intertwine in most cases, but there have been instances where some utilities have collected data at one (1) m accuracy and integrated with the one (1) centimetre accurate cadastral surveying data from DSM, which led to encroachments and confusion. DSM in the end experiences dilemmas of demanding and archiving that kind of data as the law prescribe in the Botswana Land Survey Act Section 42 Subsection 2.

DSM can learn from a few experiences regarding virtual presence from around the world. Rwanda and China are acknowledged here as countries which have experimented successfully with sharing their geospatial information content through simple to use web services. Rwanda through its NMA since 2009, has pursued development of what is called The Rwanda Meta Data Portal (Akinyemi and Kagoyire, 2010; Akinyemi and Uwayezu, 2011) following Services

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Oriented Architecture (SOA). China has also used SOA to implement a public GISWeb service platform (Zonghua, Mingjun and Wei, 2014). As such, following a well-crafted geospatial content virtual sharing framework, SOA platforms can be carefully studied and used to advance content sharing and accessibility by DSM. With this, a conclusion is drawn.

6.0 Conclusion

As elaborated through this paper, technology advancement and other debilitating trends such as COVID-19 have made it inevitable that DSM should pursue a rigorous virtual presence strategy. A strategy proposition has been put forward with Data Management, Content Management, Enterprise Content Management and Virtual Stakeholder Requirements as the main pillars. This strategy is meant to be internally looking in terms of inputs but externally focused in terms of outputs. To implement the strategy, DSM does not necessarily need to bring in new staff but rather to reconsider its internal operational, tactical and strategic endeavours. The strategy requires that a committee be established to develop and actively pursue the pillars of the strategy. This is done in recognition that the Data Management of DSM is quite advanced, but it requires to be augmented with a more structural approach to Content Management through convergence into an Enterprise Content Management that addresses the requirements of the stakeholders virtually.

7.0 Acknowledgement

Botswana Department of Surveys and Mapping is acknowledged for taking part in this study. The hope is that they will look at the strategy and draw some useful insights from it in pursuit of their mandate.

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