THE NEED FOR SPATIAL DATA INFRASTRUCTURE FOR SUSTAINABLE DEVELOPMENT IN TANZANIA

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ABSTRACT

This paper explores the use of spatial data in Tanzania, it underscores the reasons for lagging in the establishment of National Spatial Data Infrastructure. Using documentary analysis, strategically designed interviews, and questionnaires; data were collected from the spatial data user community in Tanzania.

Goal and objectives:
The main objective of the research was to examine the challenges hindering establishment of an NSDI in Tanzania. The specific objectives were to examine how geospatial data is managed in Tanzania and to identify factors that hinder collaboration in geospatial data collection, sharing and dissemination.

Methodology:
There are two basic approaches to research as found in (Kothari, 2004), these are; quantitative and qualitative approaches. However, a mixed-method that combines quantitative and qualitative methods of collecting data which is also known as triangulation has been used in research and can be found in works of literature. The choice between the three types considers the research purpose and objectives to be achieved

Results and findings :
Upon simple analysis of the data, the following were the findings: Firstly, it has been revealed that spatial data is not well managed, reused nor shared. Secondly, there are difficulties in the availability and accessibility of spatial data. Thirdly, lack of coordination and collaboration in spatial data collection, management, and sharing. Coordination and collaboration is a necessity for the country to fully and effectively utilize the huge spatial data scattered in various organizations, The country should use its national IT infrastructure, namely; the National Internet Data Centre and eGovernment Agency to create a common gateway for spatial data discovery and sharing. Finally, all stakeholders should be fully involved to establish NSDI for the benefit of the country's sustainable economic development.

Keywords:
Spatial Data Infrastructure, Spatial Data, Geospatial Governance, Spatial enablement

1. INTRODUCTION

Spatial Data Infrastructure (SDI) is becoming a necessary resource, just like other infrastructures such as road networks and electrical systems. SDI continues to be on the agenda at national and international forums like the UN, which signifies its importance and advocate nations to actively work towards ensuring proper management of spatial data. Recent milestones include the three frameworks developed and released by the United Nations, namely, Strategic Framework on Geospatial Information and Services for Disasters, Global Statistical Geospatial Framework, and the Integrated Geospatial Information Framework. All these provide a basis and guide for developing, integrating and strengthening geospatial information management.

1.1 Main argument

The interest in this study is to enable the decision making authorities in Tanzania to become aware of SDI and how important it is for national development. It has always been discussed in various research as in (Johansson, 2006) and other government strategies on the need for SDI in the country, these can be seen in two government programs such as the Tanzania Statistical Master Plan (TSMP) 2009/10- 2013/14 (URT, 2010), and the Strategic Planning for the implementation of the land laws (SPILL) (URT, 2005). Generally, it is agreeable that there is a lack of awareness on SDI in Tanzania, especially at the highest levels in decision-making officials, notably at ministerial level and chief executives of government agencies and other government technocrats. Hence, the need to explore and understand in detail what are the reasons behind the lagging behind of embracing SDI in Tanzania.

1.2 Problem statement

Location information is important for the orderly organization of data, information, and processes in government operations, hence, the government must be spatially-enabled. This concept is termed geo-enablement. It is now a global agenda to ensure that spatial data and information is used by governments for the effective decision-making process. This follows global initiatives such as the Sustainable Development Goals (SDGs), and spatial data can greatly contribute toward the implementation of SDGs. Sustainable development can be achieved through the creation and provision of services linked to a location at all decision making levels in the central and local governments. The government should ensure data and services are easily and readily accessible, accurate, well-maintained, and sufficiently reliable. The society must also be able to use the data regardless of their level of education.

Readily available, accurate, and timely digital geospatial data is indispensable for the progressive development of the country on key economic, infrastructure, environmental, and societal issues, which depend on location information (geospatial data). All sectors and stakeholders of development (government, private sectors, and individuals) require some type of geospatial data for their undertakings. Henceforward, availability, management, and governance of geospatial information are imperative for the country's sustainable development. However, Tanzania is lagging, there is no government-backed mechanism or framework and sufficient awareness for users, providers, and managers of geospatial data on how to work in partnership to build National Spatial Data

Infrastructure (NSDI). There are problems in the availability, access, and sharing of geospatial data in government institutions (agencies, independent departments, and government corporations), and in the private sector. Therefore, the main problem is that: There is no National Spatial Data Infrastructure (NSDI) nor any clue that the government is in a process to formally develop NSDI for economic and sustainable development for the benefit of the country.

1.3 Research objective

The main objective of the research was to examine the challenges hindering establishment of an NSDI in Tanzania.

The specific objectives were to:

  i.   To examine how geospatial data is managed in Tanzania;
  ii. To identify factors that hinder collaboration in geospatial data collection, sharing and dissemination

Research questions

The study addressed the following research questions:
  i.   How is spatial data managed in Tanzania?
  ii.   Why are there so many obstacles in spatial data accessibility both in government and private sector?
  iii. What are the impediments for the establishment of National Spatial Data Infrastructure in Tanzania?

2. LITERATURE REVIEW

Spatial data plays a vital role in economic development, whether natural resource management or socio-economic development. Spatial Data Infrastructures (SDIs) facilitate access, sharing, and dissemination of spatial data necessary for evidenced decision-making processes of the future (Okuku, Bregt, & Grus, 2014)The importance of SDI for national development has led to the formation of National Spatial Data Infrastructures (NSDI) in many countries across the world. Thus, NSDI is instigated in many countries to better manage and use spatial datasets for informed decision-making processes.

There are many definitions of SDI, this paper adopts a definition by Tonchovska, Stanley, and Martino (2012) who defined SDI "as a framework of policies, institutional arrangements, technologies, data, and people that enable the sharing and effective usage of geographic information. SDI allows information to be integrated from a variety of disciplines for a variety of uses"

The importance of SDI has increased in recent days where major decisions and resolutions have been passed. Three geospatial frameworks have been adopted by the United Nations through its Committee of Experts. The adopted frameworks are the strategic framework on geospatial information and services for disasters (UN-GGIM, 2018), global statistics geospatial frameworks (UN EG-ISGI, 2017), and the integrated geospatial information framework (UN GGIM & World Bank, 2018). In Africa, the African Union has endorsed an action plan called "Geospatial information for sustainable development in Africa: African Acton Plan on Global Geospatial Information Management

2016-2030 (Economic Commission for Africa, 2017). All these make geospatial data management a matter of priority which a country like Tanzania should not ignore.

Sustainable development requires effective integration of economic, social, political, and resource management factors into decision-making; these require the availability of geospatial data. Accurate and timely availability of geospatial data can assist to speed up sustainable development decision making. Geospatial data infrastructures (GDIs) are the inter-sectorial, cross-domain, inter-departmental consensus-making mechanisms by which a nation can manage its geospatial data assets (Luriault & Taylor, 2007). This cannot be achieved if there is no coordination and sharing of geospatial resources among providers and users. Development planning such as road construction, environmental and physical planning, agriculture, forest, and mining explorations all depend on geospatial data. Therefore, good governance of geospatial data is important for the sustainable development of a country, and this type of geospatial governance is lacking in Tanzania.

3. METHODOLOGY

3.1 Research Approach

There are two basic approaches to research as found in (Kothari, 2004), these are; quantitative and qualitative approaches. However, a mixed-method that combines quantitative and qualitative methods of collecting data which is also known as triangulation has been used in research and can be found in works of literature, see (Johnson, Onwuegbuzie, Tucker, & Icenogle, 2014). The choice between the three types considers the research purpose and objectives to be achieved.

3.2 Adopted research approach

This research was exploratory and descriptive, thus, it was mainly qualitative. It was advantageous to adopt a qualitative approach to study spatial data infrastructure in Tanzania to get users' and producers' perceptions of how best to manage, share, and utilize geospatial data. The reason for using this methodology was the need to comprehend the context of the study, and the researcher being part of the study process to answer the research questions. The choice of the approach was also influenced by fact that spatial data infrastructure is not yet in place, therefore, the perceptions of respondents in combination with other collected data sources needed to be interpreted instead of being predetermined.

3.3 The research methods

Research methods are about the tools and resources used for data collection, and the tools and techniques applied for data analysis. There are various methods for facilitating the data collection process. These include interviews, questionnaires, document analysis, observations, and Focus Group Discussions (FGDs) (Lancaster, 2005)However, the choice of data collection instruments is determined by the nature of the information needs intended to achieve the objective of the study and data sources. This study used the following research methods: 1.) documentary analysis, 2.) interviews, and 3.) Focus group discussions, as the main research methods to assist in reaching the research main objective and specific objectives.

3.3.1 Documentary analysis

Documentary analysis is one of the research methods in qualitative research; it is one of the most effective ways of collecting data about an issue to be studied (Mogalakwe, 2006). Much qualitative research use documentary analysis to collect data as acknowledged in Owen (2014). Document analysis is a systematic procedure for reviewing documents both printed and electronic materials and is often used in combination with other research methods (Bowen, 2009). This is because documents provide additional research data in which information resulting from documents can be valuable additions to a knowledge base.

This research used documentary analysis, which enabled the collection of information about patterns and perceptions of the issues in SDI in Tanzania. It provided a means of tracking history, change, and development of geospatial governance. Documents studied and reviewed include research reports, published papers, and government reports from within and outside Tanzania. The list of reviewed documents is presented in Table 1 below.

Table 1: The list of reviewed documents in the documentary analysis (Source: Author's compilation)

S/N	Document Name	Year	Source
1	Tanzania e-Government Strategy	2013	President's Office, Public service Management (Tanzania e-Government Agency)
2	Strategic Planning for Implementation of the Land Laws	2005	Ministry of Land Housing and Human Settlements Development
4	National Information and Communication Technology Policy	2003 & 2016	Ministry of Works, Transport and Communication
5	NSDI – A look at the National Spatial Dimension in Tanzania	2003	Dr. Furaha N. Lugoe
6	Challenges and Issues in Surveying and Mapping of Tanzania Land	2008	Dr. Furaha N. Lugoe
7	Tanzania Development Vision 2025	1999	Ministry of Finance (Planning Commission)
8	Tanzania Mini-Tiger Plan 2020	2004	Ministry of Finance (Planning Commission)
9	Tanzania Statistical Master Plan 2009/10 – 2013/14	2009	National Bureau of Statistics
10	Tanzania Five Year Development Plan 2011/12 – 2015/16	2011	Ministry of Finance and Planning
11	UN Global e-Government Surveys, 2005, 2008, 2010, 2012, 2014, 2016, 2018	2005, 2008, 2010, 2012, 2014. 2015, 2016, 2018	United Nations (Economic and Social Council Division))
12	The Global Information Technology Reports, 2012, 2013, 2014, 2015	2012, 2013, 2014 & 2015	World Economic Forum (WEF)
13	Measuring the Information Society Report 2014 & 2015	2014 & 2015	International Telecommunication Union (ITU)
14	National Strategy for Growth and Poverty Reduction (NSGRP) I & II	2005 2010	Ministry of Finance and Economic Affairs

3.3.2 Interviews

The interview is an important method of generating information in qualitative research. A combination of face-to-face interviews and written questionnaires were used to gather relevant information relating to spatial data infrastructure in Tanzania. Many people from government institutions and individual experts from the private sector were selected to participate in the

interview. Guided questions were used to gather information from respondents. A questionnaire is a research instrument consisting of a series of questions for gathering information from respondents. Two modes of questionnaire administration were applied these are:

i. Face-to-face interview: where questions were orally presented to interviewees,
ii. Paper and online questionnaires: where questions were presented on paper and the same were presented online using an online survey tool called "Survey Planet".

These techniques of information gathering were not aimed at getting quantitative data for analytical analysis but to get insights and explore information from respondents, which have been very useful for the study. The research questionnaire was prepared and designed for online distribution to anonymous respondents. The questionnaire was prepared in such a way that each of the four research questions was aligned to one or more questions on the questionnaire.

3.3.3 Focus Group Discussions

A Focus group is a method of data collection whereby a researcher convenes a small group of people having similar attributes, experiences, or "focus" and leads the group in a non-directive manner. The objective is to get insights and perspectives of the people in the group with as minimal influence by the researcher as possible (Yin, 2009). One FGD meeting comprising of ten (10) participants was organized; participants were drawn from the following institutions; the National Bureau of Statistics (NBS), Surveys and Mapping Division (SMD), Tanzania Communications Regulatory Authority (TCRA), and Local Government Authority, private companies and the academia.

4. ANALYSIS AND RESULTS

4.1 How data was analyzed

Both primary and secondary data were collected and analyzed based on the type of method used in its collection. The content analysis method was used to analyze textual data by applying open coding which is done by disassembling texts and differentiating dissimilar themes and concepts found in the data. Data collected from the online survey tool was analyzed by the tool itself, especially the closed-based questions. SurveyPlanet web tool offers the means to create an online questionnaire, collect the responses, and analyze the results. The researcher assembled all responses for each open-ended question and filtered multiple responses with similar responses.

4.2 Results

This study was qualitative in its entirety, the administered questionnaires were meant to provide insights into users' perspectives on the status of spatial data infrastructure in Tanzania. The analyses presented here were not meant to measure the quantitative aspect or to test any hypothesis but to help answer the research questions, and ultimately fulfill the highlighted main research objective, the results of analyzed data are presented in this section.

4.2.1 Classification of responses

The total response from an online questionnaire was 50, 30 responses from the paper-based questionnaire, and 20 face-to-face interviews. A response came from respondents who work in government MDAs, private companies, and NGOs. The information collected in part A, questions 1 through 4 (see Appendix 2) was intended to know who they are respondents, the type of organizations, the type of work they are doing, and their designations. Respondents' names and designations were optional to allow anonymity. Responses from MDAs were 64%, private companies

14%, and NGOs 22%. Part B of the questionnaire was about issues of SDI, E-Government, and G-Government of which in question one majority of respondents work in organizations, which produce or collect geospatial data and this account to 89% of all respondents while 11% worked in organizations not related to either spatial data collection or its use.
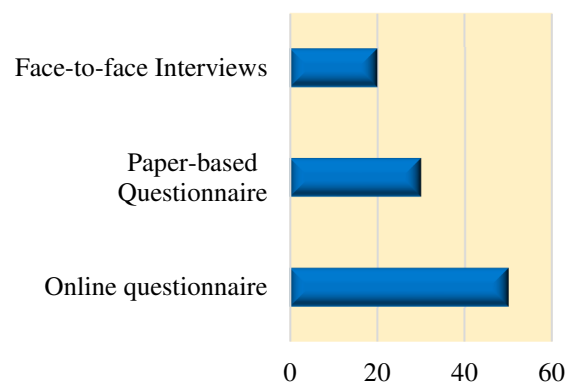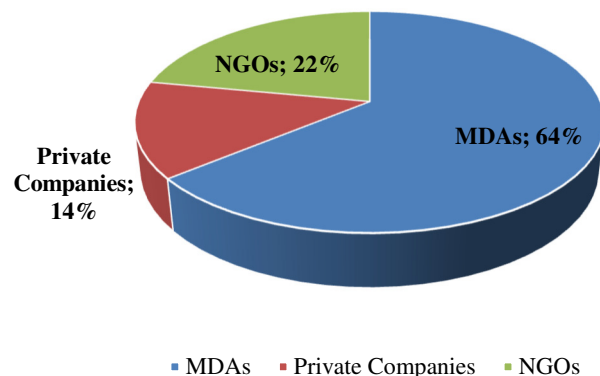

Figure 1: Categories and number of respondents

Figure 2: Respondents' organizations

4.2.2 Areas of concerns

The study also sought to get users' experience on data acquisition, this aimed at providing an understanding of where users get data for their internal use. It has been shown that 32% of users acquire geospatial data through internal arrangements; they collect geospatial data themselves for their internal use only. Outsourcing of spatial data accounts for 21%, as data users outsource and or purchase data from data collectors, producers, vendors/sellers. Those who obtain data through sharing within institutions account for 22% while 24% get data from open data portals that share data free of charge and 1% did not disclose their source of data. The government, private companies, and NGOs commonly use the outsourcing option due to limited capability in terms of equipment and techno-know-how in data acquisition and processing, therefore, data producers are usually

contracted to do the tasks or purchase the already collected raw data or value-added data from
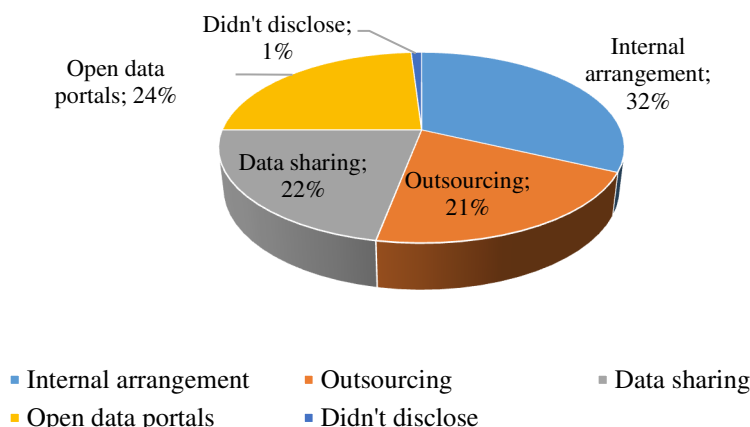
Figure 3: Sources of spatial data

producers' archives.

4.2.3 Status of spatial data governance in Tanzania

In general, the study has found that there is no national framework of governance of geospatial data resources. The information collected from face-to-face interviewees has revealed that the following features characterize the status of geospatial data in Tanzania:

    i.   Spatial data is inconsistent and not well managed nor reused,

    ii.   There are no geospatial data standards and many data lacks metadata,

    iii.   Difficulties in spatial data discovery, availability from data custodian; and where there is a possibility of accessing the data there are unnecessary bureaucratic procedures to obtain the data.

Many reasons are contributing to this, which include (i). Misunderstanding of the importance of incorporating metadata information in the collected spatial data; (ii). Inexistence of a vibrant national institution to oversee geospatial resources (iii). Lack of policy framework to guide data exchanges and interoperability, (iv). There is no proper data ownership and in many cases individuals, not the institution's data. Data generated or collected by the donor-funded project, once they phase out, all the data are either lost or are possessed by individuals who sometimes use them as their private property.

4.2.4 Geodata sharing

The most impending issue in geospatial governance in Tanzania is data sharing, it has been revealed in the study that there are departments under the same ministry that cannot share data within themselves. The study has shown that 48% of data collectors are willing to share what they collect with other users, and 45% are willing, but with some restrictions or conditions, and 7% are not ready to share data with other users as seen in Figure 4.5.
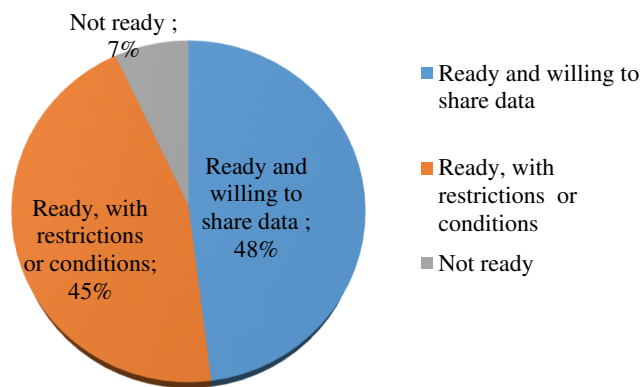
Figure 4: Status of geospatial data sharing

There are genuine reasons why some organizations are reluctant to data sharing and exchange. Some argue that for security purposes, and to avoid misuse and abuse of the data, there is a need to impose some restrictions on users. Some private companies are doing business, hence cannot make their data freely available. The issues of copyright and intellectual property is another legal barrier to data sharing.

4.2.5 Impediments to geospatial governance realization in Tanzania

Initiating and implementing geospatial governance framework is not an easy task; some challenges have always been hindering the success of its implementation. In this study, it was very important to know from users and producers the hindrances for Tanzania in instigating and implementing SDI. Below are the reasons for the barriers to SDI implementation in Tanzania.

  i. Lack of awareness, knowledge on spatial data and appreciation of geospatial technologies at the higher decision making level;
  ii. Lack of financial resources;
  iii. Political issues which face out scientific matters;
  iv. Lack of Government commitment and support for the establishment of NSDI in the country.

5.   DISCUSSION AND CONCLUSION
5.1   Discussion

This section briefly presents the discussion about the outcome of the study in the subsequent subsections, the discussion focuses on the three issues, namely; the status of geospatial governance in Tanzania, data sharing and collaboration and barriers to SDI implementation.

5.1.1 Status of geospatial governance in Tanzania

Several organizations do collect geospatial data in Tanzania; these include government MDAs, private companies, NGOs, and academic & research institutions, without forgetting many donor-funded projects. The country has a massive amount of geospatial data at its disposal, which when

properly used will be of great economic benefit and for sustainable development. However, there is no common platform for geospatial data discovery and associated metadata.

The fact that each organization collects its data has created a duplication of interoperable datasets with varying degrees of quality, accuracy, completeness, and standards. This type of inconsistent datasets is advantageous to users who may want to integrated data from multiple sources. Standards are one of the important elements in the national geospatial framework and can only be instituted if there is a coordinating body to set and create a common ground for all spatial data producers and users. There is a great need of having a national clearinghouse and metadata portal for easy of data discoverability, accessibility, and availability from diverse data producers and other data sources.

5.1.2 Data dissemination and collaboration

The reuse of data, sharing, and collaboration with other users is a common practice in the geospatial community around the world; however, this is less practiced in Tanzania. Whereas some data producers are willing and ready to share data freely, others see it differently; that there must be some restrictions because not all data can be free by 100%. Other producers do not support the idea positively due to the business nature of their enterprises. The call for guidelines and policies for data sharing and reuse is inevitable in this case. There is also an issue of privacy, security, copyrights that are of great concern to data producers and owners. On the other hand, geospatial data is a business, those who invest their resources in the acquisition of geospatial data anticipate a return on investment, they expect to gain and get some profit out the data they collect through sales. Non-existent of legal frameworks (laws, policies, and guidelines) makes it difficult for data producers to share their valuable spatial data with other users. This calls for the establishment of coordinating body, to coordinate and oversee all geospatial data activities countrywide.

5.1.3 Obstacles to SDI Implementation

It appears that most of the government executives are lacking knowledge and awareness on the importance of NSDI while there are experts in government mapping division and other agencies like SMD and NBS who can be used to sensitize other executives on the benefits of NSDI. The private sector and academia can also do the same in different fora or through organized meetings with a government official whose ministries are responsible for data collection.

The government may take a long time to start supporting NSDI activities due to massive investment and associated costs. It is understood that the MLHHSD has implemented the Strategic Plan for the Implementation of the Land Laws (SPILL), and the establishment of national spatial data infrastructure was one of the proposed programs to be implemented but has never been implemented. The Integrated Land Management Information System (ILMIS) is input to NSDI. However, implementing ILMIS in isolation of the NSDI framework (i.e. Policy, laws and institutions, and other guidelines) can be a problem for future national SDI in terms of standards and interoperability issues.

5.2 Conclusion

The paper has presented a descriptive analysis of the collected data from respondents and other sources on the need for geospatial governance. The information has broadened the existing knowledge of different viewpoints from data producers and users, and challenges facing the geospatial community in terms of data sharing, the analyzed information revealed and make it significant on the need for establishing a geospatial governance framework, which is the National Spatial Data Infrastructure. The country has a massive amount of geospatial data at its disposal, which when properly used will be of great economic benefit and for sustainable development. However, most of the prospective users have no idea of where to get spatial data because of the lack of discovery platforms. There is no common platform that users can search and discover the availability of spatial data and associated metadata. There is a great need of having a national clearinghouse and metadata portal for easy data discoverability, accessibility, and availability from diverse data producers and other data sources.

The call for guidelines and policies for data sharing and reuse is inevitable in this technological era. Non-existent of legal frameworks (laws, policies, and guidelines) makes it difficult for data producers to share their valuable spatial data with other users. This calls for the establishment of an institutional framework, to coordinate, create, and oversee all geospatial activities countrywide, thus, the need for the national spatial data infrastructure for the economic and sustainable development of the country is and must be on the national agenda.

REFERENCES

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal, 9*(2), 27-40.

Economic Commission for Africa. (2017). *Geospatial information for sustainable development in Africa: African Action Plan on Global Geospatal Informaton Management 2016-2030*. Addis Ababa: Economic Commission for Africa.

Johansson, J. (2006). *Improving access to geographic information: Exploring the National Spatial Data Infrastructure Initiative in Tanzania.* (BA Dissertation), Umeå University, Umeå University.

Johnson, R. B., Onwuegbuzie, A. J., Tucker, S. A., & Icenogle, M. L. (2014). Conducting Mixed Methods Research: Using Dialectical Pluralism and Social Psychological Strategies. In Patricia Leavy (Ed.), *The Oxford Handbook of Qualitative Research* (pp. 557-578). Oxfford, United Kingdom: Oxford University Press.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd Revised ed.). New Delhi: New Age International (P) Ltd.

Lancaster, G. (2005). *Research Methods in Management: A concise introduction to research in management and business consultancy*. New York: Elsevier Butterworth-Heinemann.

Luriault, T. P., & Taylor, D. R. F. (2007). Geospatial Data Infrastructure for Sustainable Development of East Timor In H. Onsrud (Ed.), Research and Theory in Advancing Spatial Data Infrastructure Concepts. Redlands,CA: ESRI Press.

Mogalakwe, M. (2006). The Use of Documentary Research Methods in Social Research. *African Sociological Review, 10*(1), 221-230. Retrieved from http://www.codesria.org/IMG/pdf/Research_Report_-_Monageng_Mogalakwe.pdf

Okuku, J., Bregt, A., & Grus, L. (2014). Assessing the Development of Kenya National Spatial Data Infrastructure (KNSDI). *South African Journal of Geomatics, 3*(1), 95-112.

Tonchovska, R., Stanley, V., & Martino, S. D. (2012). Spatial Data Infrastructure and INSPIRE. *Knowledge Brief, 55*(September). doi:http://hdl.handle.net/10986/17082

UN-GGIM. (2018). *Strategic Framework on Geospatial Information and Services for Disasters.* Retrieved from http://ggim.un.org/documents/UN-GGIM_Strategic_Framework_Disasters_final.pdf

UN EG-ISGI. (2017). *Global Statistical Geospatial Framework: Linking Statistics and Place.* Retrieved from http://ggim.un.org/meetings/GGIM-committee/8th-Session/documents/Global-Statistical-Geospatial-Framework-July-2018.pdf

UN GGIM, & World Bank. (2018). *Integrated Geospatial Information Framework: a strategic guide to develop and strengthen national geospatial information management.* Retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/Part%201-IGIF-Overarching-Strategic-Framework-24July2018-1.pdf

URT. (2005). *Strategic Planning for the Implementation of the Land Laws (SPILL). Main Consultancy Report.* Dar es Salaam: Ministry of Lands and Human Settlements Development.

URT. (2010). *Tanzania Statistical Master Plan 2009/10- 2013/14* Dar es Salaam: Government of Tanzania Retrieved from http://www.nbs.go.tz/takwimu/tsmp/TSMP_Doc_Aug2010.pdf.

Yin, R. (2009). *Case Study Research: Design and Methods* (4 ed.). London: Sage Publications.

KEY TERMS AND DEFINITIONS

1. **Spatial Data Infrastructure (SDI)** is a framework of policies, institutional arrangements, technologies, data, and people that enables the sharing, integration and effective usage of geographic information from a variety of disciplines for a variety of uses

2. **Spatial Data** are data that have a location component which is usually represented using geographic coordinates, that means data are connected to place in the earth.

3. **Geospatial Governance** is the governance process, which involve the use of geo-information and communication technologies in the process of decision making

4. **Spatial enablement** is the ability to add location to all information and use spatial information for informed decision making