

A consideration for a conceptual partnership framework in building spatial data infrastructures in developing countries

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Key words: SDI, Partnerships, Institutions, Information Policy, Developing Countries

SUMMARY

This is a brief statement of the paper on Spatial Data Infrastructures (SDI) and partnerships in the context of developing countries. The concept of SDI started developing in the 1990s. Its real explosion was felt after the 1993 presidential order 12906 by the then United States of America President Clinton. It was held then that this concept was going to spread and grow across the countries of the world as it embraces geospatial information sharing across multiple organizations. In terms of word, the concept did spread but in terms of implementation coupled with growth it did not progress as anticipated particularly in developing countries. They have struggled with the implementation of this concept with African countries at the fore front. To understand the challenges faced by developing countries, this paper focuses on the aspect of partnerships. Partnerships are important aspects which SDI foundations should be built upon. This paper explores the SDI concept through its components and links it with the aspect of partnerships. In so doing an SDI Partnership framework is advanced which can be used by developing countries especially in Africa to pursue their SDI developments. This framework is premised on the aspect of institutional arrangements in respect to underlying behaviour, technical and information policy issues. The framework is envisaged to guide SDI adaptability analysis, modelling and design to meet a developing country's spatial data systems implementations. The usefulness and significance of the framework was tested by interfacing it with existing SDI assessments of African countries to prove that the proposed partnership framework can be useful to their development and growth.

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1.0 INTRODUCTION

A Spatial Data Infrastructure (SDI) is a conglomerate of geospatial technologies and institutions fused with multi-sectoral professional activity. If properly implemented and structured, it can play a leading role in supporting major government, business and private decision-making avenues (Lipeg, 2010, Mueller, 2010). This conglomeration of institutions together with various professions need to be kickstarted and founded on good working relations, which this paper refers to as partnerships. In the last 30 years the need for partnerships in geospatial data collection, processing and dissemination have been exposed by weaknesses such as duplication of effort, wastage of resources and a lack of policies and standards that enable functional partnerships to succeed. To address these challenges, politicians like the USA President in 1994 through an executive order 12906 and professionals like John McLaughlin in 1991 (GeoConnections, 2013) started looking at geospatial data as a resource that can be developed into an infrastructure to benefit all stakeholders and communities at large. This view has been emphasised by Crompvoets et al. (2008), who stressed that spatial information should be treated as a multi-stakeholder commodity meant to mutually benefit all those involved.

Activities which promote partnerships in the development of SDIs are its capabilities in spatial data sharing and exchange with the help of Information and Communication Technologies (ICT). For data sharing and exchange to happen effectively, sufficient collaborations and coordination need to be established. Partnerships in the development of SDIs can be controlled by an anchor structure such as an SDI committee or coordinating organisation. Examples of such structures are the USA Federal Geographic Data Committee (Williamson, Rajabifard, & Enemark, 2003) and the European INSPIRE (Craglia & Annoni, 2006; Lipeg & Modrijan, 2010).

Suggestions have been advanced early on regarding how developing countries could initiate their SDI (Bishop et al, 2003) and most started them towards the turn of the millennium. Meanwhile, SDI assessment regimes were established in western countries like the SDI Readiness Index (Fernandez, Lance, Buck, & Onsrud, 2005) and the INSPIRE State of Play method (Vandenbroucke, Janssen & Van Orshoven, 2008). These methods have recently been used to assess SDIs in developing countries particularly in Africa. Makanga and Smit (2010)

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based their assessment on the INSPIRE State of Play to assess 29 African countries, whilst Mawange, Maluku and Siriba (2016) used the SDI Readiness Index over 13 African countries. In both studies it has been revealed that SDI in Africa continues on an uphill struggle and its developments are rather slow. Moreover, they stressed that new ways need to be devised to aid SDI implementation in Africa. The foregoing has motivated investigation of the phenomenon, leading to the suggested conceptual SDI partnership framework that outline how the challenge can be addressed.

In an attempt to design a conceptual partnership framework for SDIs in developing countries, this paper acknowledges that SDIs have been described as ambiguous (Cromptvoets et al., 2008). Nonetheless, this study argues that to tackle issues of ambiguity, a country developing an SDI needs to have a robust partnerships model to address institutional arrangements, and relationships of involved communities. The role of partnerships in SDI development was captured by Rajabifard et al (2008, p14) by saying that “aspects identified in developing an SDI roadmap include the vision, the improvements required in terms of national capacity, the integration of different spatial datasets, the establishment of partnerships as well as the financial support for an SDI”. We have endeavoured to describe SDI based on its well-known components and reconciled them with partnerships in the process proposing a conceptual partnership framework. The parts of the proposed SDI conceptual partnership framework will be described in the context of developing countries’ SDIs assessments and a conclusion drawn.

2.0 SPATIAL DATA INFRASTRUCTURE AND COMPONENTS

A SDI is a term used to denote a collection of technologies, policies and institutional arrangements that facilitate the availability and access of spatial data and services. It provides a basis for spatial data discovery, evaluation and application for users and providers within all levels of government, the commercial sector, the non-profit sector, academia and citizens (Nebert, 2004). According to Lipeg (2010, p2), SDI development “is an on-going process leading towards spatially enabled societies and governments”. The SDI concept involves a complex digital environment that includes a wide range of spatial databases concerned with standards, institutional arrangements and technologies such as the World Wide Web (WWW). SDIs are created with efforts and aims of maximizing the use of spatial information available in many organizations. SDI components serve as a cornerstone to establishing consistency and structure in regards to documenting daily spatial data applications as well as building distributed networks to facilitate spatial data sharing (Onah, 2009). They include: a) Technical standards,

b) Access networks, c) Policies, d) Fundamental datasets and services, e) Institutional arrangements, and f) People (users and producers).

2.1 Technical Standards

The adoption of international standards like the Open Geospatial Consortium (OGC) specifications helps spatial data and services to be accessible to a variety of users (Janowicz et al, 2010). In addition, they make spatial data integration possible over a distributed environment. However, semantic interoperability still proves to be a challenge when sharing data in a distributed network. It involves the structure in which spatial data meaning and terminology are defined. A step towards semantic interoperability is on the foundation of good data practice. For example, it is necessary for organizations to standardize ways in which spatial data is defined and how metadata is structured for ease of integration with other data from different sources. Technical standards require partnerships tailored within the context of technology, engineering and computation viewpoints advanced by Hjelmager et al (2008).

2.2 Access Networks

The wide adoption of technological advancements like the Internet, Global Positioning Systems (GPS) units and smart mobile phones makes them suitable platforms for comprehensive collaborations in SDI environments (Rajabifard, Feeney and Williamson, 2003). The Internet provides a primary mechanism where stakeholders can interact using asynchronous and distributed networks (Vandenbroucke, Crompvoets, Vancauwenberghe, Dessers, Van Orshoven, 2009). However, developing countries face problems of slow Internet bandwidth. Spatial data can be large especially when it involves images. Therefore, ample consideration and investment has to be made in regard to increasing internet bandwidth which could be a deterrent to the SDI implementation. In addition, the widespread use of generalized GPS enabled devices like mobile phones and hand-held GPS units provide another opportunity where the community could contribute immensely to the initiative.

2.3 Policies

SDI policies should be backed by the highest office in a country for the successful implementation of the initiative. For example, the National Spatial Information Framework (NSIF) of South Africa is a success story for a developing country, because of the Spatial Information Bill of 2003, which paved way for the South African Spatial Data Infrastructure (SASDI) (Spatial Information Infrastructure Bill, 2003 Revised). The NSIF created the

necessary buy-in for other organizations to participate in the initiative and promoted the development of the country's SDI, which was later backed by the SDI Act implemented in 2006 (Onah, 2009). Influence from higher offices has long been experienced by developed countries. For example, in the US, the High-Performance Computing Act of 1991, paved way for the National Information Infrastructure Bill passed in December 1991, by the then Vice President, Al Gore. Advancement for such initiatives are possible when comprehensive cooperation, collaboration and coordination are in place.

2.4 Fundamental Datasets and Services

Fundamental datasets and services are the commodities of SDIs. They are accessed and processed in a distributed network to generate new information. Integrating spatial data from a well-structured system like SDI brings about a wider spectrum of applications as opposed to using uncoordinated datasets. Furthermore, as noted by Morebodi (2001) integrated information is of greater value to those who may not have the expertise to appropriately prepare it for their own use. The user base has expanded, is now more diverse and directly put pressure on a wide spectrum of geospatial data management processes, (Elwood, 2008). For various data sets to be integrated we need to have a robust geospatial data governance structure mandated to prescribe policies and standards. The governance structure should be secured through partnerships of the stakeholders.

2.5 Institutional arrangements

Institutions are platforms on which geospatial data are collected, collated and constructed into what is known as the SDI. Data is further shared, exchanged and distributed across a myriad of users. In early stages, these processes were informal and disjointed as described in Harvey and Tulloch (2006). These loose arrangements show lack of proper partnerships between institutions responsible for SDI. In developing countries this scenario has played itself out for a very long time and has been responsible for the many challenges experienced in SDI development. Examples of these can be drawn from the works of Maphale and Phalagae (2012); Makanga and Smit (2010); and Mawange, Maluku and Siriba (2016).

2.6 People (users and producers)

People are an important constituency in SDIs. This statement is relevant now and in future because technology and its advancement keep on releasing geospatial data sensors for use by everyone. This scenario has been articulated in Budhathoki, (Chip) Bruce, & Nedovic-Budic

(2008) who acknowledged the role of traditional producers of SDI but stressed that users are also transcending in to producers due to the many geospatial sensors and technological advances like Volunteered Geographic Information (VGI) (Coleman, 2010; Moreri, Fairbairn, James, 2016). This offers fertile ground for partnerships where processes can be streamlined to keep SDI developments progressive.

3.0 PARTNERSHIPS IN SDIs

3.1 What are Partnerships?

Partnerships aim to bring aspirations of sustainability to products and processes in innovative and collaborative ways. They can be understood in terms of Mclaughlin (2004) who defined them by saying that “partnerships represent an important mechanism for bringing government departments, local authorities and professional groups both within and between agencies, the private and the voluntary sector, those who deliver services and those who receive them to work together towards a common goal”. They occur at various levels ranging from within organisations, between organisations, locally, nationally and globally. Partnerships have been found to be very useful by encouraging new product developments in a number of industries (Dutta and Wiess, 1997; Ettlé and Pavlou, 2006). The aspect of ‘new product development’ is consistent with SDI and should help us to appreciate why SDIs need cooperation and partnerships as alluded to by Warnest, Rajabifard & Williamson (2003). Our appreciation should encourage us to realise the importance of conceptual framework that can help analyse SDI adaptability through partnerships.

For organizations in developing countries to have successful partnerships, they should think and act strategically about their information needs and the resources needed to deliver to a wider audience. As noted by Rajabifard et al. (2002) SDIs aim to provide an environment where stakeholders, both users and producers cooperate in cost efficient and cost-effective ways to better achieve organizational goals. Partnerships must not only inform SDI development processes, they must be functional enough to deliver the benefits associated with it. The emphasis here is that SDI concepts and partnerships need to be harmonized to develop national SDIs. Several scholars like Crompvoets et al. (2008) have summed up SDI concepts as ambiguous and for them to be understood better, cross-disciplinary research needs to be conducted. African scholars have also conducted overviews of SDI discourses for a number of African countries that talks to how various elements that lead to successful SDI partnerships and development can be exploited (Morebodi, 2001; Onah, 2009; Makanga and Smit 2010; Maphale and Phalagae 2012; Mawange, Maluku and Siriba 2016).

3.2 The Conceptual SDI Partnership

Looking back at the discussed SDI components it can be deduced that partnerships can be conceptualised on people and institutional arrangements. People are crucial for transaction processing and decision making. As Onah (2009) noted, all decisions require data and as it becomes more volatile, issues of data sharing, security, accuracy and access, make the need for defined relationships between people and data imminent. In SDI partnerships, it is necessary to facilitate the role of people and data governance for decision making and sustainable development of the initiative (Onah, 2009). Policies and institutional arrangements in an SDI environment are concerned with governance structures, data privacy and security, data sharing and cost recovery issues (Nebert, 2004). They make it possible for SDIs to meet their objectives and without them, activities like coordination, cooperation and data sharing cannot be achieved. For SDI investments to be a success, data services should be offered to a wide audience to exploit the data usage comprehensively. A healthy and responsible exploitation of the data would lead to self-sufficiency and awareness of what others do. In consideration of the SDI components discussed above a framework is constructed in figure 1 whereby partnership defines the bedrock for people and institutional interactions.

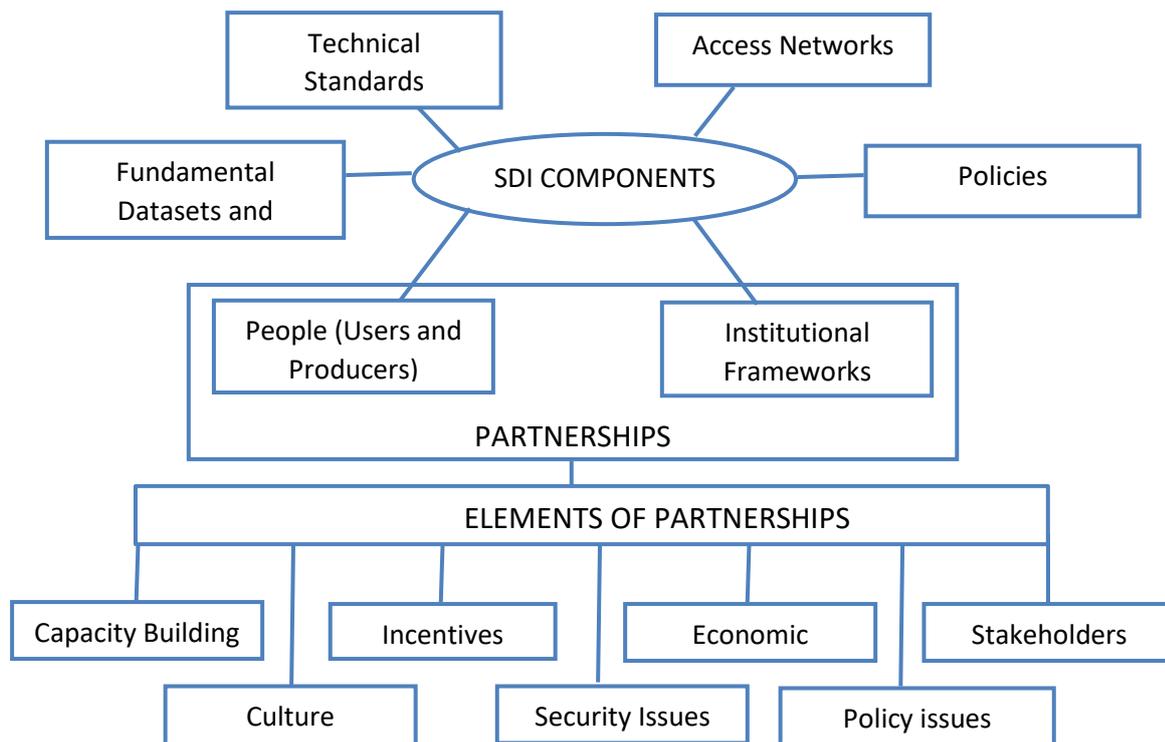


Figure 1: Conceptual Partnership for SDIs in Developing Countries

The illustration in figure 1 is meant to reveal that SDI partnerships can be premised on two SDI components, namely people and institutional frameworks as a linkage between other SDI components and various elements of system development. In that case, figure 1 highlight the importance of partnerships in building SDIs whereby roles could be identified in which stakeholders can partake for a successful SDI initiative.

3.3 Conceptual SDI Partnership Framework Explained

It is necessary for organizations in developing countries to acknowledge and recognize that there is value added in working with other institutions. Therefore, figure 1 was constructed by considering the six main components of SDI and then blocking the people and institutions together to be the main components on which partnerships are developable. A number of elements which can directly impact on partnerships were then identified as shown on figure 1

and they include; capacity building, culture, incentives, security issues, economic issues, policy issues and stakeholders.

Addressing the above elements should lead to effective partnerships. Effective partnerships take time, which requires all those involved to establish appropriate working frameworks from the start. The structures and processes of the partnerships evaluation as recommended by World Bank (1998) can be followed. The partnerships advocated can start from small steps at operational levels of organisations through management levels within an organization up to inter-organizational. The operational level could be involved in data production and dissemination, while the management level could monitor the operational level as well as for decision making and creating policies for conducive environments. It is important then to discuss the elements of the partnership framework within the context of underlying organisational behaviour, technical and information policy issues.

3.4 Elements of the Partnership Framework

3.4.1 Capacity Building for SDI

Capacity building in an SDI context refers to improvements in the ability of all stakeholders to perform appropriate tasks within the broad set of principles of an SDI initiative (Rajabifard and Williamson, 2004). It involves the creation and development of capacities and capabilities with efforts of solving problems on spatial information collection, management, sharing and dissemination. Capacity building does not only involve institutional assessments and development, it also includes individuals. This is where the importance of training in creating an enabling environment for SDI development is realized. Extensive training for a successful SDI is an essential and significant parameter of a functional partnership framework. In agreement, Williamson et al. (2003) stress that training requires a whole new way of thinking about sharing and exchanging spatial data assets, and creating optimum solutions that would benefit all partners.

According to Rajabifard (2002) there are different capacity building factors that are necessary for the success of SDI initiatives. These factors include technological capacity, human capacity and financial capacity. Some examples of capacity factors cited by Rajabifard and Williamson (2004) include: the level of awareness of stakeholders on values of SDIs; the state of infrastructure and communications; technological pressures; the economic and financial stability of each member nation (including the ability to cover participation expenses); the necessity for long term investment plans; regional market pressures (the state of regional

markets and proximity to other markets); the availability of resources (lack of funding, which could be a stimulus for building partnerships, hence there should be a stable source of funding); and the continued development of business processes.

Capacity building often focuses on staff development through formal education and training programs to meet the lack of qualified personnel in a project in the short term. However, Rajabifard and Williamson (2004) argue that capacity measures should be addressed in the wider context of developing and maintaining institutional infrastructures in a sustainable way. Moreover, businesses and decision makers should be made aware of the benefits of having such an infrastructure so that there could be investment and buy-in.

3.4.2 Culture

In the words of Kok and van Lonoen (2005) “SDI develops gradually”. This statement need to be embedded into the organizational cultures in SDIs of developing countries. Leadership of institutions need to be visionary about this gradual process. Institutional leaders need to understand that SDIs are better achieved with shared resources than as individuals working in silos. A culture that lacks the appreciation that more could be achieved as a collective, is common in developing countries. Furthermore, the lack of awareness amongst stakeholders on how they could effectively participate in the initiative is a stumbling block in many developing countries. In addition, most organizations are spatial data users and not producers. Users tend to concentrate on their organizational needs and lack the hindsight that their information when shared and integrated with others could bring value added products for the benefit of all. This is supported by Warnest et al (2003) who have indicated that “implementation of this type of infrastructure will be facilitated through better understanding

and awareness of the partnerships that support SDI”.

3.4.3 Information Policy Issues

SDIs involve organizations and people sharing fundamental datasets and services with each other (Rajabifard et al, 2003; Warnest et al, 2003; Hjelmager et al, 2008). However, with the absence of information policies, procedures and rules that govern and guide inter-organizational interaction, initiatives like SDIs may fail terribly. It is necessary for coordinating agencies to clearly address the issue of policies to all stakeholders involved. This is consistent with the SDI information viewpoint where policy is recognised as the starting point and a basis of shaping product specifications (Hjelmager et al, 2008). Policies should also inform the

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preparation of guiding principles for spatial data access, use and pricing models. Furthermore, they should include legal implications for wrongful handling of resources in the initiative, to curb abuse and encourage accountability. These policies if properly implemented, could facilitate easy and equitable access to spatial data and services. Policies should further emphasize on maximizing net benefits with less variations on data pricing and access policies between different stakeholders (Clarke et al., 2003). In a nutshell, stakeholders should develop policies that formalize and legally bind partnerships, clarify participants' roles and expectations, such that a conducive SDI development environment is achieved.

3.4.4 Economic factors

Developing countries are known to have budgetary constraints due to their low economic factors. As such, initiatives like SDIs are best suited to such environments because a pool of shared resources can provide more results at minimal cost for organizations involved. Unfortunately, this has not been the case in most African countries. The limited resources that developing countries have should be motivation towards efficient and effective data sharing efforts. In addition, there should be clear SDI directives and funding mechanisms, as these have proved to be detrimental in establishing successful initiatives in western countries like the USA and Canada. Such funding mechanisms can only be achieved if the limited resources are channelled to where they are most needed.

Developing countries tend to embrace proprietary software suites more than free and open source software suites (FOSS). They believe that proprietary suites have more support compared to FOSS. However, technological advancements like the Internet, GitHub (a Web-based development platform for FOSS), and question and answer websites (e.g. GIS Stack Exchange and Stack Overflow) have made it possible for FOSS development codes, strategies and documentation to be available to everyone. Current investments made by developing countries in proprietary software suites that are pricey and unsustainable, could be channelled into other resources like improved data collection tools. In addition, geoprocessing needs and adequate utilization of advanced software suites in developing countries are very low and these could be performed sufficiently by FOSS. Hence, the justification that ample resources are misplaced in tools that do not meet the needs of users. The adoption of standards in an SDI environment, could enable users and producers to share spatial data and resources regardless of the software suite used.

3.4.5 Security Issues

SDIs deal with many stakeholders in a distributed network. They involve the use of spatial data and resources from a variety of stakeholders with different needs and purposes like spatial analysis, optimum route analysis, geoprocessing and other decision-making activities. Therefore, it is essential that data and services in the initiative are produced by trusted and properly registered sources. Enforcing security within the SDI environment can also help attract more users and producers into the initiative over time. Sufficient security measures could further increase the integrity of the initiative, thus attract more organizations to it including late adopters. Other avenues to increase the integrity of the initiative include: a) upholding technical standards, b) conducting regular updates of spatial data and services, c) encouragement of partnerships for value added information, d) establishing proper monitoring and security measures to ensure that it is free from virus attacks and abuse, and e) ensuring that only registered users benefit the most from the initiative.

3.4.6 Incentives

Partnerships are meant to benefit all those involved, hence the need to identify areas where each participant may benefit from the initiative is imminent. For all stakeholders involved, a return on investments study should be conducted for each stakeholder to promote their buy-in. An example cited by Borzacchiello and Craglia (2013), is that organizational structures of each stakeholder could be inspected and in-depth case studies conducted to gather more information for better placement into the initiative. However, it should be noted that initiatives like SDIs may take longer for individual stakeholders to realize financial benefits, but added value products from utilizing spatial data from various sources may be achieved. Due to the complex nature of SDI partnerships, Rajabifard et al. (2002) suggest that they should be positioned such that they develop as the SDI progresses. The authors highlight that users and businesses should drive the development of SDIs, which in turn will lead to business systems relying on the infrastructure. Eventually the initiative could become an infrastructure of successive business systems (Rajabifard et al., 2002).

3.4.7 Stakeholders

Successful SDI implementations in developed countries have clear defined roles and responsibilities of stakeholders in their initiatives. They have a coordinating agency and leading organizations in each jurisdiction responsible for coordinating efforts in that area. Such an arrangement helps create an environment of accountability and trust between stakeholders. Furthermore, it increases stakeholder awareness of spatial data in the community where proper

communication channels can be used to disseminate it to other stakeholders to reduce duplication of effort.

Institutions can have their own systems that meet their own needs, but an infrastructure environment can only be achieved if they are made interoperable through agreed standards and technical specifications. This is where the significance and importance of partnerships come into place. It is necessary for member states to assess the impacts that each organization's investment may have in the infrastructure (Borzacchiello and Craglia, 2013). For example, conducting early impact assessment activities like that of INSPIRE in 2003-04 where a programme of activities was launched to practically verify cost and benefit assumptions of the initiative (Borzacchiello and Craglia, 2013). Rather than being theoretical in all aspects, some avenues within the infrastructure could be validated in such a manner at the initial implementation stages.

4.0 A CASE FOR AFRICAN COUNTRIES

Among developing nations, African countries have made their own efforts towards SDI and some levels of assessment have been carried based on Inspire State of Play method (Makanga and Smit 2010) and SDI Readiness Index (Mawange, Maluku and Siriba, 2016). In Makanga and Smit (2010) where 29 countries were assessed, several elements which are cornerstones to SDI development were found not to be satisfactory. These include; coordination, political support, funding and stakeholder participation. All these elements do bear the hallmarks of SDI partnerships which if sufficiently promoted and implemented, can produce positive results. Within a period of six years from Maknga and Smith assessment a SDI Readiness Index assessment was carried out by Mwange et al (2016) and the extracted results of the study, presented in tabular form are shown in Figure 2.

	Organisation	Informational	Human	Technology	Financial	SDI Index
Botswana	0.1357	0.2345	0.5244	0.6530	0.4665	0.3477
Ethiopia	0.5466	0.4000	0.3820	0.4340	0.3038	0.4058
Ghana	0.6459	0.6837	0.5537	0.5904	0.5673	0.6063
Kenya	0.5676	0.5500	0.5178	0.6148	0.5500	0.5592
Malawi	0.5960	0.6837	0.2668	0.3382	0.2030	0.3755
Nigeria	0.7468	0.6205	0.3742	0.5390	0.7274	0.5841
Rwanda	0.8411	0.6837	0.5263	0.5225	0.7274	0.6489
Senegal	1.0000	0.7714	0.5802	0.5729	0.6069	0.6893
South Africa	0.7114	0.7348	0.6039	0.6649	0.5130	0.6404
Tanzania	0.2802	0.2500	0.4158	0.4468	0.3038	0.3307
Zambia	0.5500	0.5500	0.4627	0.4517	0.5673	0.5140
Zimbabwe	0.2924	0.3708	0.4433	0.5664	0.1531	0.3342
Overall	0.5761	0.5444	0.4709	0.5329	0.4741	0.5030

Figure 2: Extract of SDI Readiness Index (Source: Mwange, Maluku and Siriba 2013)

The SDI readiness Index as depicted in Figure 2 indicate a minimum of 0.33 to a maximum of 0.69. These indices imply that more work needs to be done and this paper proposes partnerships that should be utilised to close gaps inhibiting SDI developments in these countries. From the presented results, organisations and informational elements indices are very low which could be attributed to weak institutional partnership arrangements to move SDI forward. The two examples of assessments carried in Africa by two different researchers using two different methods suggests strongly that partnerships could be a real problem in SDI development. Some countries like Botswana, Ethiopia, Kenya, Malawi, Nigeria, Rwanda, Senegal, South Africa, Tanzania and Zimbabwe are featuring in both assessments. It is a concern that some of these countries are still returning readiness indexes which are routinely described by Mwange et al (2013) as “a lot more work still needs to be done”.

5.0 CONCLUSION

Developing countries have in the past struggled to establish SDI initiatives because of issues that this paper has highlighted in the conceptual partnership framework outlined. This research argues that SDI implementations in developing countries can be as successful as those in developed nations. However, there are some aspects regarding partnerships that impede developing countries to establish successful SDI implementations. These failures are attributed to a lack of understanding and appreciation of how stakeholders can actively collaborate in partnerships for a successful initiative that benefits all parties. Therefore, this research has developed a conceptual framework that highlights an enabling platform where stakeholders can actively collaborate in the collection, sharing, storage and dissemination of spatial data. The conceptual framework highlights issues that developing countries should consider in their

efforts to building functional partnerships for successful SDI implementations. It is believed that the issues raised and suggestions outlined in this partnership framework could aid the implementation of a successful initiative. This paper has put forward a partnerships framework for consideration in SDI development and made relations to several assessments carried out on the African continent. Building spatial data through the power of the functional partnership framework can help address the following problems; Common geodetic reference framework, records linking, sharing and data exchange between stakeholders, removal or reduction of data inconsistencies, cumbersome data presentation and record keeping, lack of standards in spatial data handling, production of fit for purpose spatial data products and reduction of geo-information transaction costs. Future work will further investigate the proposed conceptual partnerships elements and actually test them in some African countries by basing then on the preceding mentioned problems.

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International Federation of Surveyors Article of the Month - April 2018

Lopang MAPHALE and Kealeboga Kaizer MORERI, Botswana

A consideration for a conceptual partnership framework in building spatial data infrastructures in developing countries

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