

Evaluating Access to Spatial Data Information in Rwanda

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Abstract: *Access to spatial data is of growing interest to practitioners and society for the use of geospatial technology pervades all fields, and all sectors of the economy can use the same information in different applications. Means of data access appropriate to any given context must be found. This study targeted organizations active in spatial data collection, management, dissemination, and use. It examines their willingness to cooperate in sharing spatial data in Rwanda. Key areas covered are the conditions of data access and restrictions to data usage as well as the willingness of users to pay for spatial data. A majority of the organizations give out data free to users on request, while others restrict access to data for some categories of users. Private-sector users are more willing to pay for spatial data. This study captures producers' and users' perspectives to spatial data access. Also, it reveals the situation of spatial data sharing in a developing-country context where explicit policies to cater to such activities are absent.*

INTRODUCTION

Geospatial information (GI) is becoming more important every day at all levels of society for it plays a central role in supporting economies, improving business effectiveness in the private sector, enabling more efficient governmental operations, and increasing citizens' quality of life (Genovese et al. 2009). In a broader sense, the term *GI* includes geospatial data and the services used in providing the data (Poplin 2010). The fact that GI and analysis lie at the heart of nearly all major international peace, global health, and economic development problems is recognized (United Nations–UN 2011). Virtually everyone uses GI, so the same information can be used by all segments of society—citizens, businesses, and public bodies—usually for different reasons. Kelly et al. (1995) noted that GI is increasingly valuable for making decisions and solving problems in economic development, environmental management, emergency response, and public health and safety.

There is the debate on how society accesses geospatial data and assigns values to products. Despite their importance, assessing the value of digital GI products, services, and infrastructures is particularly complex because of their specific characteristics as nonstandard economic goods and the nature of the market itself (Krek and Frank 2000, Krek 2006). Geospatial data forms a substantial component of public-sector information (PSI), which already is recognized as a valuable national resource, for a greater proportion of decisions regarding resource management and provision of public services are spatial in nature (Yawson et al. 2010). The economic benefits accruable to the state from such information are maximized by increasing its distribution and use through inexpensive mechanisms (OECD 2001, Eckardt 2008). Williamson et al. (2006) rightly noted that the ability of society to meet sustainable development objectives is a complex and temporal process involving multiple stakeholders. It requires data to be accessed and shared as information that is accurate, well maintained, and sufficiently reliable for use by a spatially literate society.

Spatial data sharing (SDS) is commonly advocated on the basis that there are tangible benefits through improved efficiencies (Azad and Wiggins 1995). With the costliness of data production, using existing data in applications reduces cost. Data value increases when used (National Research Council 1997, McDougall 2009). Onsrud and Rushton (1995) argue that the value and utility of GI comes from its use, and the more it is used, the greater becomes society's ability to evaluate and address the wide range of pressing problems. Another perspective to SDS is the need to create connections among widely dispersed databases (Calkins and Weatherbe 1995). With the democratization of mapping, the model of data production is changing, with the most crucial changes appearing in the role of the national mapping agencies (NMAs). Traditionally, governments produced and disseminated spatial data. These roles, particularly those of NMAs, have changed dramatically in the past 10 to 15 years. Map production and service-based agencies have been downsized and their operations outsourced to private enterprises. The focus of governments is far more business oriented and budget driven in contrast to the traditional public-good and service perspectives. The reasons for sharing public information have remained the same, but it is the imperatives and business needs that have become the new focus (McDougall 2009).

Spatial data infrastructures (SDIs) are being developed because of the huge potential to ensure standardization, harmonization, and integration of information across agencies and to reduce duplication of efforts in spatial data production (Williamson et al. 2003, Cromptvoets et al. 2008). SDIs provide an enabling platform to facilitate SDS (Mohammadi et al. 2009). Much work has already been done on developing aspects of SDS, e.g., approaches to SDS—social-network analysis approach (Omran and Etten 2007, Omran 2007), behavioral approach (de Montalvo 2003a); SDS issues—GI transaction costs (Poplin 2010), spatial data integration (Mohammadi et al. 2009), SDS modelling (Omran et al. 2007); geoportals (Maguire and Longley 2005, Akinyemi

and Kagoyire 2010); SDI readiness index (Fernández et al. 2005, 2008; Crompvoets et al. 2009); SDS context—local government (Harvey and Tulloch 2006); SDS country setting—Rwanda (Schilling et al. 2006), South Africa (de Montalvo 2001), UK (Askew et al. 2005, Beaumont et al. 2005), Denmark (Jarmbæk 2009), Lesotho (Letsie 2008).

In Rwanda, many types of spatial datasets are produced by different ministries, but there is no systematic way of access. Furthermore, available datasets are in various formats, making data integration difficult and time-consuming. Consequently, cooperation between the private and public sectors as well as academia is essential to facilitate SDS to form the information infrastructure required to support Rwanda in its quest to become a knowledge-based society. SDS is more often about people and organizations than about the data itself. According to Budhathoki and Nedović-Budić (2007: 10), nontechnical interoperability is more challenging than are technical issues in SDS. The technical issues of SDS are well studied and largely resolved, but institutional and individual behavior aspects are less understood and require more attention (Harvey and Tulloch 2006).

As a basis for deriving appropriate mechanisms for spatial data access in Rwanda, this study examines how organizations cooperate. The survey targeted organizations involved in spatial data production and use, focusing on data-access conditions and restrictions. The paper outline is: a background about SDI initiatives in Rwanda, methodology, results on data-access conditions, types of restrictions on data usage, willingness of users to pay for data, and implications of findings. The study contributes to ongoing efforts in SDI research by improving our understanding of the institutional structures that shape spatial data access in a developing-world context.

BACKGROUND

Many developing countries seriously lack the institutional capacity to harness the enormous potential of geospatial information technologies (GITs) and to build a sustainable national infrastructure to facilitate data access and usage (UN 2011). Countries rarely have explicit policies or guidelines regulating spatial data production, access, and use. Users rarely know what datasets are available or where and how to access data. On the global scene, efforts to combat challenges to data access include the Global Geospatial Information Management initiative under the United Nations Economic and Social Council. The aim is to encourage international cooperation and establish best practices on the use of geospatial data. A global platform is needed for all countries to discuss issues such as standardization of GI and applications to enable the sharing of data and services across borders (UN 2011). To contribute to this need, the African Action Plan on Geospatial Information Management is about to be finalized and implemented by African countries in collaboration with the UN Economic Commission for Africa and African Union Commission (see <http://www.uneca.org/istp>).

No doubt, the lack of effective mechanism to exchange data and information among government, private-sector, and

nongovernmental organizations (NGOs) remains a significant impediment to the more effective and efficient use of geospatial products and services (Pinto and Onsrud 1995, Elwood 2007). With this in mind, many countries are developing SDIs to improve data access and sharing. SDIs are designed to facilitate provision, accessibility, maintenance, and use of spatial data. They aim to provide efficient infrastructures to enable users to acquire spatial data for use in their decision-making processes with less effort than normally would be required (Poplin 2010).

National SDIs are important in facilitating access to and use of geospatial data in support of decision making. For Rwanda to establish its SDI, it needs to involve key players, share experiences, and encourage new partnerships. Such partnerships are well recognized as SDIs evolve in different parts of the world (Masser 2005, Schram et al. 2008, Cetl and Ivić 2009). A series of SDI-related events have occurred in Rwanda, the first being the national workshop in 2006 to kick-start the NSDI process. The workshop was organized by the Center for GIS at the National University of Rwanda (CGIS-NUR) in collaboration with the National Institute of Statistics of Rwanda (NISR), Presidential Office and Human Resources and Institutional Capacity Development Agency (now the Public Sector Capacity Building Secretariat). In 2009, a Web catalog service, Rwanda Metadata Portal (RMP), was developed to ease the discovery of existing spatial data on Rwanda. These efforts raised awareness about the need for NSDI in Rwanda and helped to initiate the implementation process (Akinyemi and Kagoyire 2010).

Prior to RMP's development, no inventory of available spatial datasets existed. Now that the discovery of spatial data is greatly enhanced, it is still a challenge for users to access existing data for most organizations lack explicit policies for data sharing. Also, there is no national geospatial policy. In the absence of policies, users experience difficulty in accessing data and data producers cannot properly respond to user requests. Thus, it is imperative to facilitate the development of policies to cater to SDS. This is crucial in most developing countries where explicit policies for such activities often do not exist. The foregoing necessitated conducting a survey to assess the current situation of SDS in Rwanda, the results of which are described in this paper. The circumstances of spatial data production and exchange are described within the context of different arrangements. With policies lacking, Rwanda's case is typical of many developing countries. Data discovery and data access are necessary steps in SDI use (Budhathoki and Nedović-Budić 2007).

METHODOLOGY

Objectives

The study objectives are to:

- Identify the conditions of access to spatial data,
- Identify the types of restrictions on spatial data usage, and
- Examine willingness of users to pay for spatial data.

SURVEY METHOD

A purposive sampling method was used to determine the number of organizations to survey. This is defined as sampling conducted that is based on judgment. Only organizations using GITs were eligible and the sample was drawn from this pool of organizations. Only these organizations were likely to have and could provide the needed information for this survey. Specifically, only persons directly engaged in producing and using spatial data within an organization were targeted. Questionnaires containing structured and open-ended questions were administered by interviewing the respondents face-to-face. The interviewer read each question and recorded each response. Having face-to-face contact with the respondents was a costly and time-consuming technique, but it ensured that all questions were well understood and answered to obtain very high-quality results.

SURVEY STATISTICS

The geospatial industry in Rwanda is still in its infancy and organizations producing and/or using geospatial data are few. Thirty-eight organizations were targeted and 34 organizations (90 percent), mostly public agencies, eventually were surveyed (see Tables 1 and 2). Of the four organizations not surveyed, three did not refuse per se but were excluded from the survey because of their long approval procedure. Most of these organizations are in the private sector, working in the telecommunications industry. The status and functions of organizations that responded are shown in Table 1. This sample is very representative of the desired pool of spatial data stakeholders and the results provide substantive insights into the contexts of data access and practices of data sharing in Rwanda (Akinyemi and Uwayezu 2011).

It is evident from Table 2 that most of these organizations operate solely in Rwanda. In summary, spatial data provision and usage occurs predominantly in national public institutions.

SURVEY ITEMS AND ANALYSIS

In drawing up the survey instrument, questions were in two broad sections, namely, Part I, identification, and Part II, specific questions. For identification, personal/company name and status were requested. Interestingly, this was not a limitation in filling questionnaires or granting interviews for the survey was conducted face-to-face. There was really no point making the questionnaire completely anonymous for organizations using GITs are few and everyone seems to know who does what. Questions in Part II focused on the types of geospatial data exchanged and users, conditions of access, types of restrictions, as well as the willingness of users to pay for spatial data among others (the questionnaire is available at http://memberservices.gsdi.org/files/?artifact_id=809). No questions were unanswered, which is attributable to the face-to-face interview method used. In data analysis, simple interpretative techniques such as percentages and cross-tabulations are utilized.

Table 1. Sectors and functions of the organizations surveyed

Status of Organizations (Number/%)	Functions of Organizations (Number/%)
Public (23/66)	Environment (6/18)
	Information (2/6)
	Land (6/18)
	Utilities (2/6)
	Administration (2/6)
	Agriculture (2/6)
	Health (1/3)
	Statistics (1/3)
	Transportation (1/3)
	Telecommunication (1/3)
Private Sector/Consultants	Commerce (5/15)
Nongovernmental (NGO)	NGO (1/3)
Academic and Research	Education/Research (4/12)

Table 2. Area of organizational operation

Area of Operation	Number of Organizations	Percentage
Regional (Africa-wide)	3	9
Subregional	4	11
National	21	63
District	5	14
Local	1	3
Total	34	100

RESULTS

Regarding the types of spatial datasets exchanged, administrative boundaries accounted for 25 percent of responses; topographic maps, 15 percent; orthophotos, 14 percent; sociodemographic data, 11 percent; road data and satellite images, 8 percent respectively; land use, 5 percent; bathymetry of Lake Kivu, 3 percent; accessibility to services, meteorological data, and soil maps, 1 percent, respectively. The main producers of these datasets as identified in the survey were NISR, producing 40 percent of all datasets shared; Rwanda Natural Resources Authority (RNRA, former National Land Center), 39 percent; and CGIS-NUR, 15 percent. Other organizations combined supplied 6 percent (Akinyemi and Uwayezu 2011).

CONDITIONS OF ACCESS TO GEOSPATIAL DATA

The conditions of access to data were examined from the perspectives of data producers. A breakdown of these access conditions to datasets are shown in Figure 1. When official requests are made at the organization's office, 49 percent of data producers give data free of charge to all categories of users. Fourteen percent of organizations only make data available free to public, academic, and research users, while private organizations will have to pay for datasets. Nine percent will charge for data downloaded from their

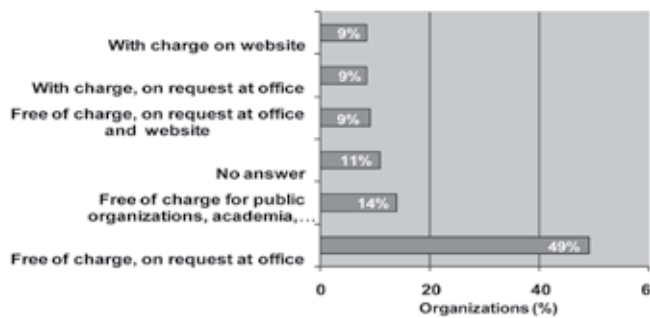


Figure 1. Geospatial data access conditions in Rwanda

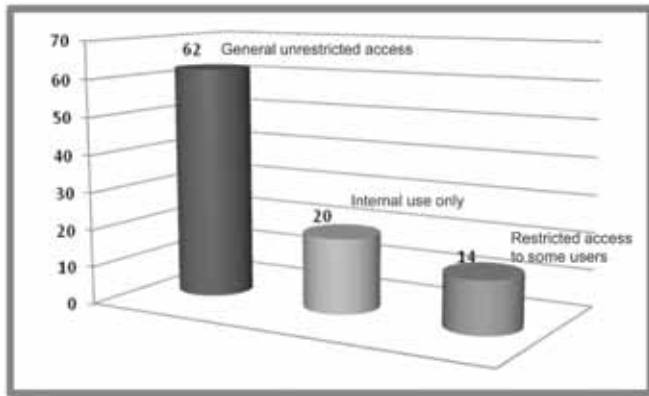


Figure 2. Geospatial data access in Rwanda

Table 3. Types of restriction on spatial data usage

Restriction on Data Usage	Organizations (%)
No redistribution	6
No modification of data	3
Data are to be used for the purpose for which they are provided	31

Web sites, while another 9 percent will charge for data whether requested in the office or on the Web site.

It is interesting to note that some data producers in Rwanda already differentiate between users when granting access to spatial data. Looking at the categories of users identified earlier, it must be emphasized that the present conditions of access regarding grassroots organizations is not really as clear as that of other users. Taking into cognizance the spatial data needs of this group of users is important for the composition of grassroots groups are varied, such as local-level nonprofit agencies, voluntary associations, and NGOs. They are neither private users such as consulting firms nor academic users. They do mostly humanitarian work. It is important to note that a growing number of grassroots organizations are beginning to use geospatial data and technologies in local planning, problem solving, and service delivery (Elwood 2007).

Studies reveal that grassroots data access is shaped by political and institutional structures, relationships, and cultures. In many cases, grassroots groups are not afforded formal recognition in local governance but function more as adjuncts to local-level government. Thus, government data stewards may refuse to release

data to them, or these groups may be excluded by existing SDS policies, cost structures, or data standards (Leitner et al. 2000, Elwood and Ghose 2004, Elwood 2006, Elwood 2007). It is important to recognize grassroots groups and to consider their needs for spatial data when formulating SDS policies in Rwanda.

RESTRICTIONS ON DATA USAGE

Relating the foregoing to restrictions on data access and usage by users, two broad classes emerge, namely, restricted and unrestricted access. Organizations that freely give out data account for 62 percent of respondents, while the remaining 38 percent restrict access to data. The first category implies that no form of restriction is imposed on data. For the second category of restricted data, 14 percent of organizations restrict access to data for private users, while 20 percent make data available only for internal use (see Figure 2). This latter category implies that data cannot be available for external use and so cannot be shared with other organizations.

Examining the types of restrictions on data usage, 6 percent of surveyed organizations with restrictions on data usage allow no redistribution to third parties, 3 percent disallow modifying data, while 31 percent of these organizations insist that data must only be used for the purpose for which it was initially provided to the user (see Table 3).

The latter category implies that although a user already has the dataset, the user is not permitted to reuse the data for another purpose other than that for which it was initially given. Examples of datasets having restrictions to their usage are orthophotos, which must not be redistributed; socioeconomic, demographic datasets from censuses and household surveys, however, have no restrictions for they are available online for free download. Despite these restrictions on data usage, there is no explicit enforcement mechanism in place, partly because of the additional cost data producers must incur to police infringement. The near absence of data-sharing policies in most organizations makes enforcement impracticable.

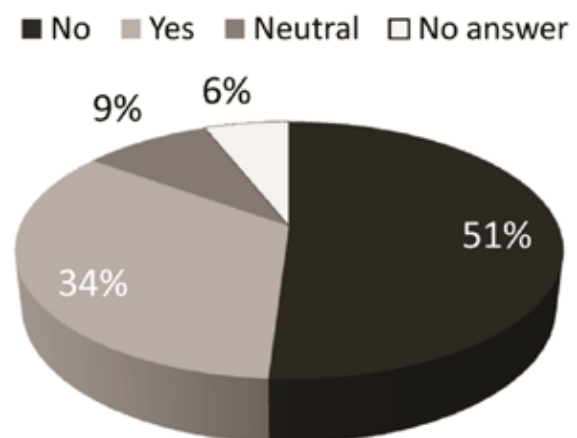


Figure 3. Willingness to pay for spatial data

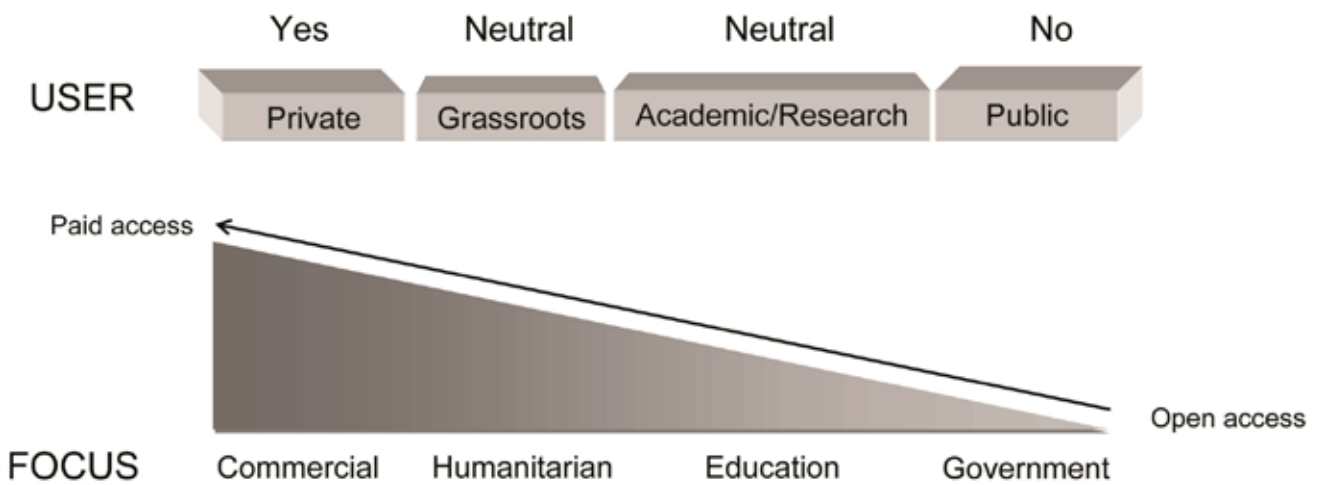


Figure 4. Users' perspectives and implications on payment for spatial data

WILLINGNESS TO PAY FOR DATA

In the light of the preceding information, the willingness of users to pay for spatial data was further examined. Results reveal that 51 percent of organizations are not ready to pay to use spatial data produced by others, while 34 percent are willing to pay to have access to data, 9 percent were neutral (yes and no) on the issue of payment, and the remaining 6 percent gave no response (see Figure 3).

By cross-tabulating the responses received to the question, "Are you willing to pay for data?" with the status of the organization, a definite pattern emerges. Based on the perspectives of spatial data users, there is the "yes" group, the "no" group, and the "neutral" group (see Figure 4). Those organizations in the "no" group that are not prepared to pay for spatial data are public institutions (public users in the extreme right-hand side). The reasoning is that other public institutions also need data they produce. This group favors free, unrestricted spatial data access. Moreover, they assume their mandate is of national interest and they should get data free.

Those organizations in the "yes" group that are willing to pay for spatial data are mostly private organizations (private users, e.g., private consulting organizations). If the data quality is assured and meets their requirements, they would rather pay for the data than go to the field to collect the data themselves. Clearly, the opinion of the public users and the private users of spatial data are at extremes ("no"—not willing, cannot pay; "yes"—willing, can pay). The perspectives of these two groups of users equate to open access and paid access to spatial data, respectively. It is equally important to capture the users in the "no" and "yes" groups that fall in between the two extremes. Examples of such users are academics/research institutions and grassroots organizations such as NGOs. This neutral group is tilted toward not paying, but when having the data is absolutely essential to doing their work and there is no other way to get it except to pay, then they

consider paying. Consequently, the willingness of users to pay for spatial data in Rwanda varies between organizations, depending on whether their focus is more commercial, humanitarian, or educational, or mandated by government.

Open access and paid access are common models used for spatial data access and sharing. The former makes spatial data available to all users, at no cost or at a price not exceeding the cost of reproduction and distribution (e.g., printing cost) with few restrictions on use (de Montalvo 2003b). The latter focuses on making profits from the sale of spatial data to support data development and maintenance. This approach relies on the principle that organizations have to generate income from datasets. The cost of collection, maintenance, and dissemination of spatial data and information is covered through the sale of geospatial data (de Montalvo 2003b). The price of spatial information dissemination also may include a return on investment (van Loenen 2009). Compared to the free-access approach, the paid-access approach implies that data are shared at a higher price than the cost of their reproduction and dissemination. There may be use restrictions that often are imposed through contracts and licenses. This approach also may be associated with competition between spatial data producers (public or private organizations) toward the provision of data to users (Onsrud and Rushton 1995). Moreover, data is seen as a visible commodity that can be distributed, bought, and sold (Sieber 2007). For example, the main criterion for defining policy on prices of geospatial data, products, and services in most European countries is cost recovery, while organizations expect to at least cover their initial investments by charging fees (Cetl and Ivić 2009).

DISCUSSION

Because of the awareness of the benefits of using GITs in tackling development issues in Rwanda, the need for current, reliable data is increasing. This, in turn, is driving the need to create a national infrastructure to ensure existing data are accessible to users. Tull-

och and Harvey (2005), citing the case of the United States, noted that there is a variety of state and federal laws governing public organizations, while constantly changing markets govern commercial distribution. Initially, access to data was allowed largely under ad hoc arrangements, but as GIS institutions continue to grow, more organizations are developing policies and practices that formalize the ways in which their geospatial data can be used and disseminated. Organizations in Rwanda rarely have explicit policies or guidelines regulating how their data is accessed and used. Taking the issue of responding to user requests for data for instance, the survey found that organizations often do not know what is right to do. They often say no to requests because it is much easier to say no and be on the safe side.

Views as regards the willingness of users to pay for geospatial data differed depending on whether a user is commercial, humanitarian, educational, or governmental in orientation. Organizations such as those in health or agriculture, whose operations are assumed to be of national interest, believe that they should have free access to data. This view is important to note for the system of geospatial data production in Rwanda is best described as mandate driven because different organizations produce datasets relating to their domain. Examples are the NISR producing socioeconomic, demographic data and administrative boundaries (the latter in collaboration with Ministry of Local Government). The Rwanda Natural Resources Authority (RNRA) produces mostly fundamental datasets such as orthophotos (0.25 m) with about 97 percent national coverage, land-parcel boundaries (scale 1:2,000 for rural and 1:1,000 for urban), national land use and development master plan (1:2,500), and topographic maps. The digital soil database of Rwanda (1:50,000) was produced by the Ministry of Agriculture and Livestock Resources in 2000/2006. The Ministry of Natural Resources in 2007 produced forest cover maps (1:40,000); the Ministry of Trade and Industry produced trade datasets comprised of trading centers, days of operation, among others. Access to these available data still is very poor because of the lack of policies (Akinyemi and Kagoyire 2010).

An ongoing debate—to which the results of this survey contribute—is the issue of open (free) versus paid access to spatial data. From an economic standpoint, that is, looking at the huge cost incurred in producing spatial data, the tendency among government institutions is to recover the cost or, better still, to generate profits. Regarding the sale of spatial data, instances of commercial distribution of spatial data are very minimal. Some public institutions, such as the RNRA, give out some data for a fee, for example, the orthophotos. Where a memorandum of understanding with an organization exists, there could be an agreement to give datasets free, based on mutual benefits. Regarding environmental datasets such as wetlands, it is believed that the Rwanda Environmental Management Authority (REMA) should give out this information for free because environment is a crosscutting issue. For example, all wetlands in Rwanda are protected from being developed by law for these are fragile ecosystems. The more users have access to environmental datasets, the less the possibility of infringement. Thus, the destruction of

these fragile ecosystems by developers is better avoided and the consequent cost of policing to identify and prosecute offenders is drastically reduced.

Results further reveal that apart from those organizations that give data free or on payment of a fee, some organizations do not give data at all to external users, implying that data is created solely for use within the organization. It seems quite wasteful if data is available but cannot be reused outside organizations producing them. For publicly funded data, this situation is not acceptable except if refusal is justifiable. Van Loenen (2006, 2009) identified accepted restrictions to include information concerning national security, trade secrets, and information relating to an individual's privacy. Our results show that the majority of organizations creating data only for internal uses are private consulting firms. This is because they bore the cost of data production and they need to have competitive advantage over competitors in the marketplace. It must be pointed out that the development of data-sharing cultures is important to the successful implementation of GITs (Onsrud and Craglia 2003, McDougall 2009).

This situation shows the complexity of SDS in the Rwandan context. It might be helpful to reconsider the value and costs of geospatial data, services, and products and to take into account the purpose of use to determine data access. Janssen et al. (2009) argue that while the debate on open access and cost recovery is important, it must be recognized that the arguments that are used in the debate are sometimes too generalized in nature for they fail to take into account the fact that different situations might call for different measures. Such a difference that is often disregarded lies in the purpose for which the data is used. For example, spatial data can be used by public bodies for performing their public tasks, by the private sector for creating commercial products, or by citizens for participating in their national democracy or holding their government accountable (see Akinyemi and Uwayezu 2011).

Realizing there is no straightforward solution to resolving the issue of spatial data access in Rwanda, the most pressing question now is “How best can SDS be improved in the present circumstances, seeing there are no policies to explicitly cater to such activities?” It is proposed to develop initial agreements on sharing to support data access and usage between stakeholders (data producers—public or private—and users). Although these agreements will most likely mirror the various ad hoc arrangements currently existing, they should be more formalized to make the process less vague and informal. Efforts should be well coordinated among the broad array of public and private-sector data providers and users. Akinyemi and Uwayezu (2011) found that data-sharing modalities in Rwanda are very informal, with friendship, goodwill, and the propensity of organizations to share being the major considerations influencing decisions to share data. Something grossly lacking at present that needs to be particularly promoted is multistakeholder involvement in establishing SDI in Rwanda. Stakeholder involvement is required in developing and adopting common contents and standards, for example. This will facilitate different organizations making their data available using the same agreed-on specifications to the benefit of all (Bulens et

al. 2009). The development of geospatial standards to facilitate SDS is essential.

Lessons learned are as follows:

Development of formalized and enhanced SDS arrangements. Currently, the three big spatial data providers in Rwanda are all government institutions. Because data access is one of the greatest challenges to GIT adoption in Rwanda, it is imperative for the RNRA (the government institution in charge of Geo-ICT) to develop good relationships with these key institutions and to coordinate the process to achieve collaborative sharing of existing data.

Developing spatial data and sharing policies to facilitate use of common data standards. The absence of policies is seen by respondents as the main impediment to SDS in Rwanda.

Development of a shared warehouse of data/information. This must be very user-friendly and producers are allowed to retain data ownership. Differences in levels of user know-how must be catered to. It is increasingly important that users without spatial analytical skills can use the services provided.

CONCLUSION

Geospatial data use requires sharing between data producers and users. This study evaluates the context of spatial data sharing in Rwanda. With the costliness of producing spatial data, there are benefits in facilitating access to existing data and encouraging reuse. Conditions for data access and the various types of restrictions imposed on data usage by producers were identified. Results reveal that more than half the organizations surveyed give out data free to users on request. Some organizations restrict access to data for some categories of users, especially private organizations. Still others produce data solely for internal use, implying that no external use of such data is permitted. When data are of a very sensitive nature, such as can be used to undermine national security, measures must be put in place to determine who has access to data and for what use in an atmosphere of transparency. Otherwise, the practice of using data only within the organization ought to be discouraged for it is wasteful.

The willingness of users to pay for spatial data also was examined and the different categories of spatial data users in Rwanda were identified. These user categories are the public users, private users, grassroots groups, and academia. The willingness to pay for spatial data varied between organizations and depends on whether the organization's focus is more commercial or not. Most government institutions believe that they should have free access to data from other organizations for their operations are of national interest. Results reveal that those willing to pay for spatial data are mostly from the private sector. The present conditions for spatial data access in Rwanda do not take cognizance of all categories of data users, particularly the grassroots organizations. Further research work is needed to ascertain the kind of data-access arrangements to meet the requirements of grassroots groups, such as NGOs, whose operations are humanitarian in nature.

To better meet user needs, there is the urgent need for explicit policies to cater to various activities in the production and use of spatial data to facilitate sharing. In the absence of policies, it is difficult for organizations to know how to properly attend to user requests in a consistent manner. Rwanda must seek to strike a healthy balance between making data freely accessible and the use of paid options for data access.

About the Author

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