Evaluating Access to Spatial Data and Information in Rwanda

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Abstract

Access to spatial data is of growing interest to practitioners and society as the use of geospatial technology pervades all fields and all sectors of the economy can use the same information in different applications. There is the need to find means of data access that is appropriate to a given context. This study targeted 35 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. Majority of the organizations give out data free to users on request whereas 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.

Keywords: Geospatial Information, Public sector information, Spatial data infrastructure, spatial data access, spatial data sharing, Rwanda

1 INTRODUCTION

Geospatial Information (GI) is becoming more important everyday at all levels of society as it has a central role in supporting economies, improving business effectiveness in the private sector, enabling more efficient governments and increasing citizens' quality of life (Genovese et al. 2009). As virtually everyone is a user of GI, the same information can be used by all segments of society - citizens, businesses, and public bodies - usually for different intentions. 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. In a broader sense, the term GI includes the spatial data and services used in providing it (Poplin 2010). Therefore, there is the debate on how society accesses spatial data (SD) and assigns values to spatial products. Despite their importance, assessing the value of digital GI products, services and infrastructures is particularly complex due to its specific characteristics as a non-standard economic good and the nature of the market itself (Krek and Frank 2000, Krek 2006). Spatial data forms a substantial component of public sector information (PSI), which already is recognized as a valuable national resource. This is because a greater proportion of the decisions regarding resource management and the 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 the distribution and use of the information 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 producing spatial data, using existing data in GI applications results in reduced cost for mounting projects. The value of data increases when used (National Research Council – NRC 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 to which the information may be applied. 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 spatial data production is changing worldwide. To better capture the changing landscape, it is crucial to note the changing role of government agencies. Traditionally, governments produced and disseminated spatial data. This role, particularly those of national mapping agencies, has changed dramatically in the past 10-15 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 perspective. The reasons for sharing public information have remained the same, but it is the imperatives and business needs that have become the new focus (see McDougall 2009).

With this in mind, many countries are developing Spatial Data Infrastructures (SDIs) to improve access and sharing of spatial data. SDIs are designed to facilitate spatial data provision, accessibility, maintenance and use of spatial information. They aim to provide efficient infrastructures for data sharing and exchange, enabling the users to acquire the data with less effort than normally would be required and to use spatial information in their decision-making processes (Poplin 2010). SDI has a huge potential to ensure standardization, harmonization and integration of information across agencies and reduce duplication of efforts and cost in spatial data collection, processing, management and access (Williamson et al. 2003, Crompvoets et al. 2008). SDIs promise to provide an enabling platform to facilitate the sharing and integration of spatial datasets (Mohammadi et al. 2009).

Sharing of spatial data is critical to the development of comprehensive and inclusive SDIs. 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), behavioural 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 data sharing (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 the academia is essential to facilitate SDS in order to form the information infrastructure required to support Rwanda in its quest to become a knowledge based society. Sharing of data is more often about people and organizations than the data itself. According to Budhathoki and Nedović-Budić (2007, pp.10), in data sharing, nontechnical interoperability (or soft interoperability) is more challenging than the technical issues. The technical issues of SDS are well studied and largely resolved, but institutional and

individual behavior aspects are less well 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 operating at regional, national and local levels cooperate. A survey was conducted within 35 organizations with specific target at those directly involved in any aspect of spatial data collection, management, dissemination and use. Key areas examined are data access conditions and restrictions. The paper outline is as follows: a brief background is given about recent SDI related initiatives in Rwanda and the methodology utilized. Under results and discussion, data access conditions and types of restrictions imposed on spatial data usage by producers were presented. Lastly, users' willingness to pay for spatial data is examined. This 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.

2 BACKGROUND

Data discovery and access are necessary steps in SDI use (Budhathoki and Nedović-Budić 2007). These are facilitated through metadata catalogues (Craglia and Masser 2002, Smith et al. 2004, Craig 2005). In 2009, the Rwanda Metadata Portal was developed as a web catalogue service (see Akinyemi and Kagoyire 2010). It is meant to ease the discovery of existing spatial data on Rwanda through metadata search. Prior to this, there has never been an inventory of what spatial datasets are available.

Now that the discovery of spatial data is greatly enhanced, it is still a challenge for users to access existing data on Rwanda. This is because no spatial data sharing policy exist in most organizations in Rwanda. In the absence of policy, it is difficult to properly respond to users' requests. Thus, it is imperative to facilitate the development of a national spatial data policy to cater for SDS in Rwanda. The need to involve key players, share experiences and encourage the formation of new partnerships is well recognized as SDIs evolve in different parts of the world (Masser 2005, Schram et al. 2008, Cetl and Ivić 2009). Building an effective NSDI requires a well-coordinated effort among a broad array of public and private sector data providers and users. Upon closer examination of the efforts targeted at establishing SDI in Rwanda, something grossly lacking that need to be particularly promoted is multi-stakeholder involvement in the NSDI. Stakeholder effort in SDI implementation is also required in developing and adopting common contents and standards to facilitate different organizations to make their data available using the same agreed specifications to the benefit of all (see Bulens et al. 2009).

3 METHODOLOGY

3.1 Objectives

The main objectives of this study are to:

- Identify the conditions of access to spatial data in Rwanda
- Identify the types of restrictions on spatial data usage
- Examine user's willingness to pay for spatial data

3.2 Survey Statistics

Thirty-five organizations using spatial technologies and data were surveyed (see Tables 1 and 2). The data indicate that of all the types of organizations surveyed, public agencies owned by the government are in the majority (63%) and most of these organizations operate solely in Rwanda as area of their jurisdiction. This makes the sample very representative of the desired pool of spatial data stakeholders' in Rwanda. Both tables imply that in Rwanda, spatial data provision and usage occurs predominantly in national public institutions.

Status of organizations	Number of organizations	Percentage
Public	22	63
Semi-public	1	3
Private/consultants	7	20
Non-governmental	1	3
Academic & research	4	11
Total	35	100

Table 1: Organizations surveyed

Area of operation	Number of organizations	Percentage
Regional (Africa-wide)	3	9
Sub-regional	4	11
National	22	63
District	5	14
Local	1	3
Total	35	100

Table 2: Area of organizational operation

3.3 Survey Method and Analysis

The purposive sampling method was used to determine the number of organizations to survey. We specifically targeted persons directly engaged in spatial data collection, management, dissemination and use within their respective organizations. Questionnaires (structured and open-ended questions) were administered by interviewing the respondents. This meant that the organization was visited and face-to-face contact had with the respondent. Each question is read out to the respondent and the interviewer records. Having face-to-face contact is a costly and time-consuming technique to use but it ensured that all questions were well understood and answered by the respondent. The method was adopted to guarantee very high quality of the results obtained. The research uses simple interpretative techniques such as percentages and cross-tabulations to analyze the data obtained.

4.0 RESULTS AND DISCUSSION

4.1 Access to Spatial Data

Access to spatial data can be broadly classified into two, namely: restricted and unrestricted access. Organizations that freely give out data account for 62%, whereas the remaining 38%

restrict access to data. The first category implies that majority do not impose any form of restrictions on their data. For the second category of restricted data, 14% of the organizations restrict access to data for some users (i.e. data is given free only to public entities, academic and research institutions but not to private entities), whereas 24% do not make data available for external uses (see Figure 1).

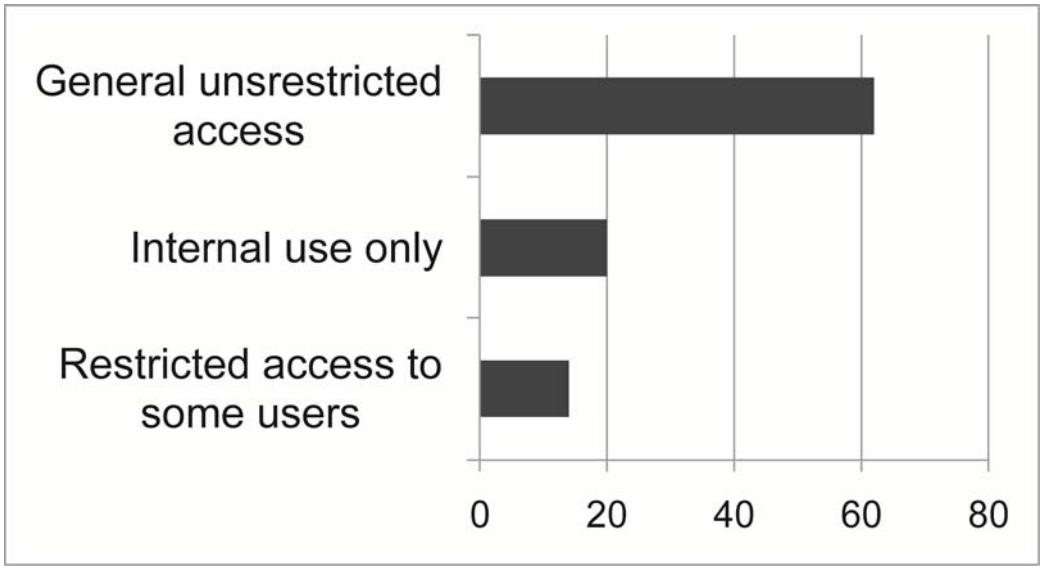

Figure 1: Spatial data access in Rwanda

This implies that spatial data are only for internal use and so cannot be shared with other organizations. It seems quite wasteful if data produced with public funds cannot be accessed for justifiable purposes outside the organizations producing them. Van Loenen (2006, 2009) identified accepted restrictions to include information concerning national security, trade secrets and information relating to an individual's privacy. This situation shows the complexity of spatial data sharing as there are publicly funded organizations which cannot readily cooperate to share resources or information with other users (see Onsrud and Rushton 1995).

The reality is that it is easier for individual public sector agencies to work within their sphere of influence than outside of it. Historical bureaucratic structures carry with them a significant organizational inertia which is reinforced by departmental silo structures, traditional public service systems and an increasingly complex legislative framework that is difficult to change. It must be pointed out that the development of data sharing cultures is important to successful implementation of geoinformation technologies (Onsrud and Craglia 2003, McDougall 2009). The NRC (1997) advocates for full and open access to scientific data, which should be adopted as the international norm for the exchange of scientific data derived from publicly funded research.

4.2 Restrictions on Spatial Data Usage

Examining the types of restrictions on data usage, six percent (6%) of the organizations with restrictions on data usage allow no redistribution, three percent (3%) allow no modification of data, whereas the majority (31%) of these organizations insist that the data must only be used for the purpose for which it was initially provided to the user (see Table 3). The latter implies

that though a user already received the said dataset initially for a specific purpose, it is not permitted to reuse the data for another purpose other than that for which it was initially given.

Restriction on data usage	**Organizations**
No redistribution	6%
No modification of data	3%
Data are to be used for the purpose are provided	31%

Table 3: Types of restriction on spatial data usage

Despite these restrictions on data usage, there is no enforcement mechanism in place. This is partly due to additional cost data producing organizations must incur to police data infringement. The near-absence of data sharing policy in most organizations make enforcement unattainable.

4.3 Willingness to Pay for Data

In the light of the preceding, users' willingness to pay for spatial data was further examined. Results reveal that 51% of the organizations are not ready to pay to use spatial data produced by others; whereas 34% are willing to pay to have access to data, 9% were neutral (yes and no) on the issue of payment and the remaining six percent (6%) gave no response (see Figure 2).

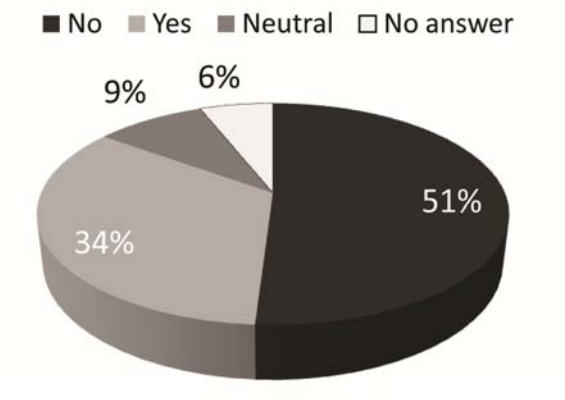

Figure 2: Willingness to pay for spatial data

By cross-tabulating the responses received to the question, *Are you willing to pay for data?* with the status of 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 3). 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. This view is important to note as the system of production in Rwanda at present is best described as mandate driven because different organizations produce spatial datasets relating to their domain. Example are the digital soil database of Rwanda of 2000/2006 at a scale of 1/50000 produced by the Ministry of Agriculture and Livestock Resources, forest cover maps produced in 2007 by the Ministry of Natural Resources, Rwanda trade datasets produced by the Ministry of Trade and Industry comprising of information about trading centers, days of operation, major products.

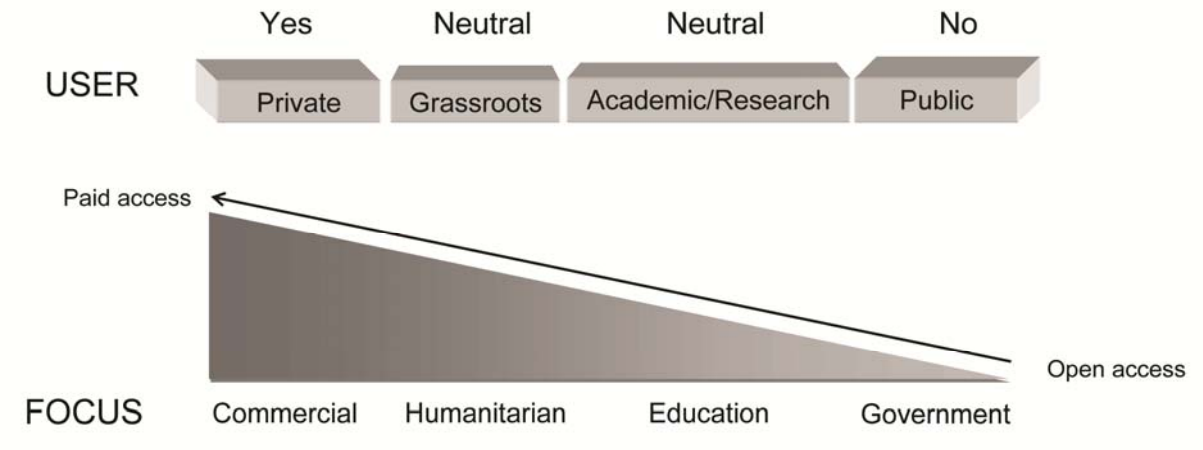

Figure 3: Users perspectives and implications on payment for spatial data

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 themselves. Clearly, the opinion of the public users and the private users of spatial data are at extremes (*No* - not willing, cannot pay; Y*es* - 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* group that fall in between the two extremes. Examples of such users are academics/research institutions and grassroots organizations such as non-governmental organizations - NGOs. This neutral group is tilted towards 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, user's willingness to pay for spatial data in Rwanda vary between organizations, depending on whether their focus is more commercial, humanitarian, 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 the development and maintenance of datasets. This approach relies on the principle that organizations have to generate income from the collection, creation and maintenance of the spatial datasets. The cost of collection, maintenance and dissemination of spatial data and information is covered through the sale of spatial data or information (de Montalvo 2003b). The price of spatial information dissemination may also include a return on investment (van Loenen 2009). Compared to the free access approach, the paid access approach implies that

spatial data are shared at a higher price than the cost of their reproduction and dissemination. There may be use restrictions which are often imposed through contracts and licenses. This approach may also be associated with competition between spatial data producers (public or private organizations) towards the provision of spatial data to users (Onsrud and Rushton 1995). Moreover, spatial 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 spatial data, products and services in most European countries as cost recovery, whereby organizations expect to at least cover their initial investment by charging a fee (Cetl and Ivić 2009).

Since the situation of SDS in the Rwandan context is no exception to the open versus paid data access debate, it might be helpful to reconsider the value and costs of spatial 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 as 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.

4.4 Conditions of Spatial Data Access

The conditions of access to spatial data were examined as these touch on the issue of payment for data from the perspectives of the data producers (see Figure 4).

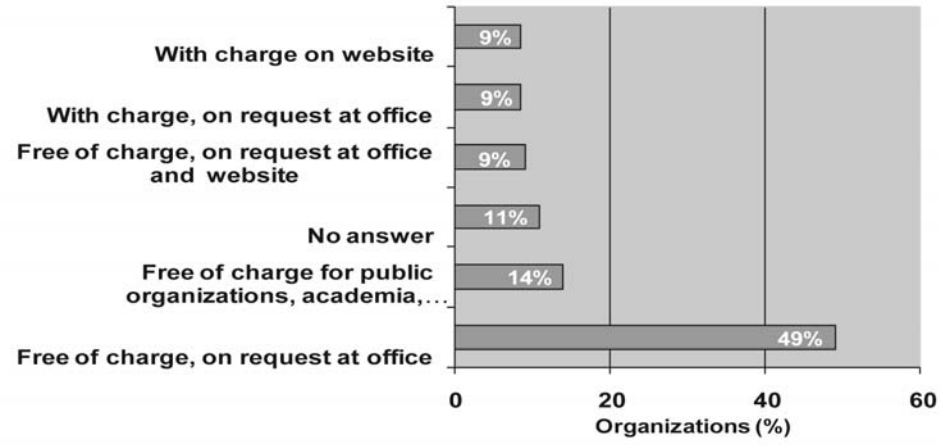

Figure 4: Spatial data access conditions in Rwanda

Figure 4 gives a breakdown of the access conditions to spatial datasets in general. When official requests are made at the office, 49% of the organizations producing spatial data give it free of charge to all categories of users. Some organizations (14%) only make data available free to public, academic and research users, whereas private users such as consulting firms and telecommunication firms will have to pay for datasets. Nine percent

(9%) will charge for data on their websites only, whereas another nine percent (9%) will charge for data whether requested in their office or downloaded from their website.

Some data producers differentiate between users when granting access to spatial data. It is interesting to note that this finding is in line with several studies that show access to spatial data differing according to the type of user. Looking at the categories of users identified earlier, it must be emphasized that the present conditions of access as regards grassroots organizations is not really clear as that of other users. 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). Taking into cognizance the spatial data needs of this group of users is important as the composition of grassroots groups are varied such as local level nonprofit agencies, voluntary associations and NGOs.

Studies reveal that grassroots data access is shaped by political and institutional structures, relationships and cultures. In many cases, grassroots groups are not afforded a formally recognized role in local governance, but function more as adjuncts to local government. Thus, government data stewards may refuse to release data to them; or these groups may be excluded by existing data sharing and usage policies, cost structures or data standards (Leitner et al. 2000, Ghose and Huxhold 2002, Elwood and Ghose 2004, Elwood 2006, Elwood 2007). Also, relating to meeting grassroots groups' spatial data needs, studies have further shown that grassroots groups' strategies and priorities are often different from those of government actors, leading to a mismatch between grassroots data needs and data that are made available by different tiers of government. Local government data may fail to represent the perceptions and priorities of grassroots groups, articulate spatial attributes in vocabularies unfamiliar to this category of users, or rely on semantic systems for describing spatial conditions that differ significantly from those of grassroots groups (Rundstrom 1995, Elmes et al. 2004). Data may not be available at a scale or resolution that is meaningful for the very small service areas typical of grassroots groups. Or, these groups may need attributes that are not available from existing public sources (Ghose and Huxhold 2002, Elwood and Leitner 2003, Warren 2004). It is important to recognize the grassroots groups and to consider their needs for spatial data when formulating the SDS policy in Rwanda.

5 CONCLUSION

Gaining access to existing data requires sharing between spatial data producers and users. This study evaluates the context of and the basis for spatial data sharing in Rwanda. With the costliness of producing spatial data, there are benefits in facilitating access to existing data and encouraging their re-use. We sought to identify the conditions for accessing spatial data by users and the various types of restrictions imposed on data usage by producers. The results reveal that more than half the organizations surveyed give out data free to users on request. But in the absence of policy, it is difficult for them to know how to properly attend to user request in a consistent manner. Some organizations restrict access to data for some categories of users. Still others produce data solely for internal uses, 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 the nation's security, measures ought to be put in place to determine who has access and for what purpose in an atmosphere of transparency. Otherwise, this practice ought to be discouraged as it is wasteful of public funds.

The willingness of users to pay for spatial data was also examined and the different categories of spatial data users in Rwanda had to be identified. These user categories are the public users, private users, grassroots groups and the academia. The willingness to pay for spatial data varies between organizations and it depends on whether the organization's focus is more commercial or not. It was found 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. To better meet the needs of all users, clearly, the spatial data sharing policy to be developed for Rwanda must seek to strike a healthy balance between making data freely accessible and the use of paid access.

ABOUT THE AUTHOR

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figure1.tif: Spatial data access in Rwanda

figure2.tif: Willingness to pay for spatial data

figure3.tif: Users perspectives and implications on payment for spatial data

figure4.tif: Spatial data access conditions in Rwanda