Discourse on access barriers to public sector geospatial information (PSGI) and the impact on the commercial sector’s ability to create value added products.

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Abstract

The public sector is the greatest producer of a wide range of public sector information (PSI) in any given country. Literature indicates that up to 80% of this information is spatial and is stored in a digital format. Access to PSI has significant economic and, subsequently, social welfare benefits to the people in any given country. The potential value of public sector geospatial information (PSGI) within a country’s economy can be derived from either selling the PSGI or providing it to the open market as a catalyst for the development of value-added products and services. Accessibility to PSI and, in particular, PSGI, is the greatest hindrance in optimising the potential economic opportunity.

Barriers exist that inhibit access and the free flow of PSGI to potential users. These access barriers can be internal, such as public sector information holder (PSIH) internal culture. Standardisation and internal operational procedures are often cited as barriers to accessing PSGI. Outward facing access barriers such as pricing policy receive considerable attention and are a prominent point of debate in international forums. Unfortunately, issues related to inter-organisational relationships (IOR), the lack of PSGI maintenance plans, metadata and transparencies of operating procedures are prevalent and exist in developed and developing countries alike, but do not receive the same level of attention.

The potential of deriving economic value from PSI and PSGI is evident from the prevalence of the topic in policy development worldwide. The European Union, Australia, USA and New Zealand, to name a few, have all introduced policy directed at facilitating access to PSI and PSGI. PSGI can provide the platform for innovative development of value-added products and services. The extent and impacts of these access barriers on the commercial sector’s ability to derive economic gain from PSGI is understated.

The economic value of PSI increases along the value chain as value-added products and services are developed from the PSI and PSGI. The availability of PSI and especially PSGI will induce the level of innovation in terms of value-added products and services that the commercial sector can offer. In a free market system this, in turn, will stimulate the level of innovation and variety of value-added products and services the market will invest in and will subsequently be available to end-users at a competitive price.

Keywords

public sector information (PSI), public sector geospatial information (PSGI)

Introduction

Public sector information (PSI) holds significant economic and, subsequently, social welfare benefits to the people in the country. The benefit of availing public sector geospatial information (PSGI) is a core theme in all spatial data infrastructure (SDI) initiatives worldwide. Over the past decade, new and reviewed SDI strategies have incorporated the commercial sector as a crucial contributor to economic growth in countries and regions. The commercial sector’s reliance on PSGI has been highlighted and prioritised for action.

The potential value of PSGI within a country’s economy can be derived from either selling the PSGI or providing it to the open market as a catalyst for the development of value-added products and services. Fig. 1. illustrates the interconnectivity of the different stakeholders associated with the PSGI value chain and illustrates the vertically integrated along the supply chain. The PSGI value chain is applicable to either one of the PSGI economy generating models described below. The premise in this model is that the flow is bidirectional and unobstructed.
In reality, stakeholders such as the commercial sector and end-users are confronted by a number of access barriers that inhibits the flow of PSGI and value-added products and services. Access barriers can be described as any restrictive measure or action implicit or explicit in nature on the side of the PSIH that inhibits the flow of PSGI downstream\(^1\). Access barriers to PSI and in particular PSGI is a popular theme in research literature. Different pricing models and their impact are by far the most prevalent and well-documented.

**Value chain principles**

There are six basic building blocks in a traditional spatial product value chain. Fig. 2 provides an overview of the components and illustrates the sequential nature of these activities\(^2\). The activities within the value chain can be divided into three main components. Firstly, the creation of the PSGI. Secondly, creation of value-added products and services and, finally, delivery to the end-user. Not all activities are performed or required in the development of a value-added product or service.

Firstly, the PSGI is created (and maintained) by the PSGIH or an entity which provides the service on its behalf. These activities are directed at informing the PSIH public good function. The value chain activities represent the collection, digitising and project-specific modelling practices. In modern SDI activities, an additional distribution activity can be incorporated.

Secondly, the commercial sector creates value-added products and services by performing additional modelling, integrating additional PSGI or incorporating additional attributes. The “packaging” and distribution of the value-added products and services is an essential component delivering the product. The sophistication and the level of innovation of the aforementioned activities will provide for product differentiation and economic potential.

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\(^1\) Access barriers definition Pollock, 2008; Vickery, 2011

\(^2\) Basic value chain model adapted from Loenen & Zevenbergen, 2010
Linked to components one and two described here is the delivery to the end-user. Unfortunately, the importance and value of this component are largely unrealised. This oversight is often recognised when the uptake of the products or service is not satisfactory. This scenario is applicable to commercially generated or custom products and services. But in a well-constructed product development cycle the economic value increases along the value chain if the potential product uptake is prioritised.

**Interconnectivity**

If PSGI is freely accessible, it can provide for the multi-dimensional integration of these datasets along the once linear value chain. Fig. 3 illustrates the potential derivatives of the different PSGI and associated products and services. The PSGIH still has the potential to deliver PSGI to the end-user. But the multiplier effect of integration of the different information products provides for innovation within the realms of value-added products and services. This increase will also have a positive impact on the level and extent of uptake of these value-added products and services.

**Economic value**

Economic value is generated through the different activities in the value chain and increases along the development chain based on additional enhancements to the PSGI. Fig. 4 illustrates this growth but also opens the question of when the economic value commenced. The debate surrounding the point at which a PSGI dataset has economic value formed the basis of countless arguments supporting the sale of PSGI and the associated prising policies.

PSI and in particular PSGI are very valuable commodities. For a long time, the PSGIH focused on deriving short term financial gain by selling the PSGI through a variety of pricing models. Recent literature compared the American and European approaches and policy frameworks to providing access to PSI and PSGI and established that the economic value derived further along the value chain through the commercial sector, provides substantially greater benefit to an economy in comparison to the initial funding derived from PSGI sales.
Access barriers

The vertical integration of PSGI into a product or a service to meet the demand of the end-users depends on the free or unobstructed flow of PSGI from the PSGIH downstream into the value chain. The potential obstruction that the commercial sector or end-users contend with can be ascribed to internal and external access barriers. These access barriers can be defined as any restrictive measure or action implicit or explicit in nature on the side of the PSIH.

Flow scenarios

There are a number of permutations of scenarios that present themselves based on these access barriers. For the purpose of this paper three different constraint categories can be identified. Fig. 5 illustrates the different flow scenarios associated with the constraint categories. The first constraint categories provides for a scenario where there is no flow of PSGI due to access barriers and PSGI does not reach the commercial sector or any end-users.

Within the second constraint categories there is limited flow of PSGI to the other components of the value chain. This is due to access barriers that restrict the dissemination of the information in its original format. In this scenario, there is limited uptake from the private sector and the development of value-added products and services are therefore inhibited. This scenario can lead to a withdrawal from the market by the commercial sector. Alternatively, a neoclassical
economic adaptation exists where the price of the product increases with demand. Thus the cost of closing the gap between the original states of the PSGI as captured and maintained by the PSGIH and the state of provision is recovered from the end-user.

The best case scenario would entail a free flow of PSGI to the commercial sector and end-users. In the case of end-users, there might not be a requirement to obtain the information by means of a value-added product at this point in time. This will change as the customer demand for a more specialised or customised product increases. This provides for a market opportunity for the commercial sector.

The commercial sector, on the other hand, can use the PSGI as a raw material to develop value-added products and services. This environment encourages research and development into new products and services. In a mature environment, this type of PSGI will lend itself to integration into complex interconnectivity of value chains.

Access barriers

A systematic review of international literature provided insight in to the following access barriers. The prevalence and impact differed from area to area with policy development, maturity of SDI activities and uptake of PSGI into commercial ventures being some of the greatest deciding factors. The level of economic development of the country or region was not the deciding factor as was evident from the American vs. European analysis.

The list of access barriers that the commercial sector and end-users alike contend with is described here. The list is not exhaustive by any means but does, however, provide insight into the main themes. The list is provided in alphabetic order with a high-level description.

Accessibility

Accessibility is a multi-facetted barrier which often links to other barriers such as policy, inter-organisational relationships (IOR), licensing agreements, etc. At the core of this barrier is the basic delineation of the level of accessibility associated with the dataset. The impartial accessibility of the majority of South African PSGI is unavailable to the broader spectrum of the potential user base.

Completeness

The completeness of a dataset in terms of spatial footprint (geometry) and descriptive attributes. The majority of these datasets are developed to inform specific projects and not necessarily to address the greater user base requirements.

Data formatting

Data transfer formats impact on the re-use of PSGIM. Open source platforms and standardisation of protocols can improve data interoperability between the PSGIH and the potential users of the PSGI.

Data formatting of PSGI does not seem to be a considerable constraint due to the following two reasons: Firstly, it is estimated that more than 70% of the GIS community in South Africa use the ESRI suite of products. Secondly, the remaining user-base software products all support data formats from the ESRI suite of products. The second constraint associated with data formatting resides in the conversion from CAD environments to GIS platforms and custom software modules are used for the generation of spatial data.

Data accuracy

The accuracy of the data in terms of position and attribute descriptions will impact on the perceived value of the data. PSGIH should provide a framework or standard against which the accuracy should be measured and a decision on usability can be made.

The accuracy of data being captured is often linked to the budget supporting the project. This is often the case where data is captured as a one-off input to a project and there is no or very little consideration for the long-term maintenance of the PSGI.

Data discovery portals

Data discovery portals refer to metadata repositories or data portals. These data discovery portals are closely linked to SDI initiatives (national or theme-based). The SDI Act makes provisions for the establishment and maintenance of a Metadata portal. The delivery of these portals has been severely constrained due to a number of causes relating to: funding, maintenance, support of metadata contributors and uptake from users. There are examples of successful regional metadata portals such as GEOSS.
Data maintenance

Data maintenance of PSGI against the entire data life cycle model. Such a life cycle model should, as a minimal requirement, address the following components: planning, sustainable funding, collecting, integration, publishing, data discovery and archiving. Some base datasets required to support national objectives such as the NDP are maintained by means of a formal process e.g. cadastral data (DRDLR), protected and conserved areas (DEA and provinces), and administrative boundaries (Demarcation Board).

Data quality

PSGI is a representation of a constantly changing reality. Integral to this constant change is the fact that there will always be a constant “inaccuracy”. A user’s perception of the quality of a dataset is often linked to the perception of its accuracy. The quality of a dataset resides in the users’ observed value associated with the task at hand. PSGIH that create PSGI as part of their public good duty should establish a data standard against which the PSGI can be evaluated. This will minimise the perceived risk associated with PSGI.

Licensing policies

Licensing policies inform the use of the PSGI by other governmental institutions, the public and commercial entities. Sometimes the licensing policies are linked to the sale of PSGI, but there are often no formal policies and the distribution is governed by personal agendas or IOR and informal SDI. Licensing policies associated with data are often undocumented or restrict the use of data outside the PSGIH domain or project areas.

The Committee for Spatial Information prescribed in the Custodianship Policy that “base data set custodians may not license data sets for exclusive use. However, in circumstances where a base data set custodian received a licensed date, the base date set custodian must comply with the requirements of such licenses.” (Section 9).

Metadata

Metadata is considered to be the biggest constraint associated with PSGI. The lack of up-to-date metadata describing the data holdings of PSIH is a severe constraint. Metadata builds capacity throughout the value chain by capacitating stakeholders to strategically approach new ventures through informed decisions pertaining to availability and usability. The unavailability of said metadata increases the transactional costs associated with the PSGI and eventually the value-added product.

The majority of datasets that are made available to users do not have meta-data. This is the case notwithstanding the SDI Act’s legal requirement to create and publish metadata and the availability of SANS 1878-1:2005 as a national standard. PSGI without metadata is one of the greatest constraints of the national metadata portal.

Organisational structures and autonomy

The traditional bureaucracy associated with the public sector is evident in the operations of PSIH across the world. Organisational structures should also be assessed against the physical representation within the different spheres of government, which adds to the complexity of providing PSGI and adds to the associated transaction costs.

PSGI is created over all spheres of government. Organisational structures and autonomy have become major constraints to the provision of national authoritative datasets. Often there are discrepancies in content, accuracy and duplication of the same data theme over the different spheres of government. The SDI Act Custodian policy makes provision for a base dataset co-ordinator who will have the mandate to facilitate the creation of policies and standards to inform the creation of PSGI to ensure the delivery of an authoritative source of PSGI.

Political context

Vertical and horizontal flow of information through the different spheres of the public sector and the prevalence of political alignment impact on PSGI provisioning.

Pricing policy

Trading fund entities’ policies on costing models are directed at benefiting the public sector. This approach jeopardises the commercial sector’s ability to enter the market by providing value-added products and services and stifles any growth in the free market system associated with the provision of products and services. There is a perceived bias in the PSGI provided in terms of the attributes that is maintained and the revisit time as the political agendas of the PSIH dictate its work plan.
Pricing policy is a major constraint associated with datasets such as mining data, soils, geology and deeds data, to name a few. These datasets are crucial reference datasets and the costs associated with accessing them have, in the majority of cases, led to substandard projects and severe impacts on strategic decision making.

Regulatory compliance

The compliance with regulations by PSIH and their commercial partners could lead to monopolisation of the PSGI. These practices are inherent in cost recovery policies and the PSGIH should be transparent in applying contracts for commercial partners.

Access to mining, geology and soils data (to name a few) is constrained by the monetisation of the distribution of these datasets by the PSGIH commercial partners. The data associated with these datasets is generated by PSIH as a public good but can only be accessed through a single source.

Standardised, transparent request procedures and response time

The standardisation of processes for the acquisition or request of PSGI is required to mitigate the perception of unwillingness of PSGIH to release the PSGI. There is perception of collusion or protecting self-interest by the PSIH that operates on a trading fund model or has a sole provider of PSGI. The response time by PSGIH to a request from the commercial sector impacts the potential uptake of the PSGI into value added products and services. Timely and scheduled delivery of PSGI will increase the value associated with datasets.

Technological considerations

Technological constrains on the side of the PSIH pertaining to technology platforms for data management and dissemination are often highlighted. Budget constraints and the lack of the required ICT skills on the side of the PSGIH exasperate this constraint. PPP can be used to address this constraint.

Usability

Usability of PSGI is defined in terms of its market value or the potential to derive market value of a value-added product or service generated from the PSGI. Usability requires a PSIH to consider external requirements when designing and maintaining PSGI. Literature identified a strong correlation between accessibility of data and the impression of usability.

Spatial Data Infrastructure (SDI)

SDI can be described as the integration of technology, people and policy as an enabling platform to promote access to the public and private sectors’ spatial data holdings. SDI initiatives can be the product of informal relationships between data producers, data users and data managers. Alternatively, the existence of an SDI can be the product of legislative and policy requirements.

The discovery and delivery of PSGI through integrated SDI platforms is reliant technological developments and infrastructure. The funding requirements to design, build and maintain an SDI initiative are high and remain a challenge regardless of the proven economic and social benefit. SDI initiatives can only continue if there is dedicated funding within a formal regulatory environment. The impact of SDIs and national spatial infrastructure (NSDI) has prevailed in current economic and technical literature since 2008 and highlights the crucial contribution to data democracy and economic growth.

SA legislation - SDI Act

The South African Spatial Data Infrastructure Act (Act 54 of 2003) was established as the national technical, institutional and policy framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial information. The co-ordinating body of the SDI Act is the Committee for Spatial Information (CSI). The main objectives of the SASDI are to:

- Facilitate the capture of spatial information through co-operation among organs of state.
- Promote effective management and maintenance of spatial information.
- Promote the use and sharing of spatial information in support of spatial planning, socio-economic development and related activities.
- Create an environment which facilitates co-ordination and co-operation among all stakeholders regarding access to spatial information.
• Eliminate duplication in the capturing of spatial information.
• Promote universal access to such information.
• Facilitate the protection of the copyright of the state in works relating to spatial information.

Custodianship

Section 2 of the SDI Act applies to data custodianship. Under the direction of the CSI the criteria for base data sets and custodianship was finalised. The data custodianship policy was drafted in terms of section 6 of the act to define the roles and responsibilities of the base data set custodians. The concept of base data set co-ordinators was introduced to address the disparate creation of PSGI over the different spheres of government and different PSGIH.

Impact

The overall impact of the access barriers described within the South African context has resulted in a geospatial industry that, in the majority of cases, specialised in delivering services opposed to creating value-added products. The products that are produced are normally deliverables associated with the service rendered. There are a few companies which have produced independent products such as cadastral data packages, land cover mapping and DTM products.

The commercial sector can position itself to derive substantial economic value from the creation of value-added products from available PSGI. Capital investment in research and development for potential products will be required. The economic potential cannot be realised without a significant culture shift in the provisioning of value-added products and services that require PSGI. The development of this growth opportunity is totally dependent on the PSIH prioritising accessibility to PSGI in its day-to-day operations and not approaching it as an ad-hoc task.

Way forward

The availability of PSI will induce the level of innovation in terms of value-added products and services the commercial sector can offer and the products and services end-users require. PSGI is important for economic growth of especially small economies through innovation of products and services. Information on potential development opportunities and new economic growth can only be realised if access is facilitated to the required PSGI. Developed opportunities have a duel benefit as it will create employment opportunities and additional tax revenue for the state.

The SASDI Act makes provision for the establishment of a metadata portal. Establishing the metadata portal will invariably change the face of PSGI accessibility. In addition, if the custodian prescript of the SDI Act and custodianship policy are implemented by PSGIH, the impact of access barriers will be dramatically reduced. A dedicated approach to PSGI policies in South Africa is required to ensure the pragmatic and sustainable delivery of a knowledge-based industry reliant on PSGI.

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