Cooper AK, Eloff C & Schmitz PMU, 16 August 2010. *Draft position paper on CSI and SASDI*. Submitted by the CSIR to the Committee for Spatial Information (CSI).

# Committee for Spatial Information (CSI)
# Draft position paper on CSI and SASDI

*16 August 2010*

## 1. Background

One of the distinguishing characteristics of the use of geospatial data is that the same, common, base data sets are used by many different users for many diverse applications. Hence, there is a growing need to share and organise geospatial data across different disciplines and organisations, which has resulted in the development and implementation of spatial data infrastructures (SDIs) and of the theory and notions behind them.

An SDI is an evolving concept about facilitating and coordinating the exchange and sharing of geospatial data and services between stakeholders from different levels in the spatial data community. An SDI is more than just the technology of a geographical information system (GIS): it is generally considered to be the collection of policies, institutional arrangements and technologies that facilitates the availability of, and access to, geospatial data. It provides a basis for geospatial data discovery, evaluation, retrieval and application for a variety of users and providers.

The Spatial Data Infrastructure Act, No 54 of 2003, established the *South African Spatial Data Infrastructure (SASDI)* and the *Committee for Spatial Information (CSI)* to achieve the objectives of the SASDI. The CSI met for the first time on 21 June 2010. Unfortunately, there is a lack of experts on SDIs on the CSI. Indeed, there are very few people in South Africa who really understand SDIs, and the implications of the SASDI.

A lot of effort is being put into understanding and implementing SDIs and other types of data infrastructures around the world, and the CSI should exploit their learning and outputs for the SASDI. There is also a large body of literature already published on SDIs. Examples of these data infrastructure initiatives include:

- The European Union's Directive establishing the *Infrastructure for Spatial Information in the European Community (INSPIRE)*. INSPIRE is based on the SDIs of the 27 Member States of the European Union – it does not replace them. INSPIRE has 34 geospatial data themes, with technical Implementing Rules (IR) for the likes of metadata, data specifications, network services, data and service sharing, and monitoring and reporting. The key motivation for INSPIRE is to enable policy-making across boundaries, which requires seamless geospatial data sets, sharing data across levels, and making data easy to find. Supporting this is an older European Directive, on the re-use of public sector information (PSI).
- The United States of America's *Data.gov* web portal to increase public access to high value, machine readable data sets generated by the Federal Government. It aims to increase the ability of the public to find, download and use easily data sets, providing

metadata (descriptions of the data sets), tools such as a geo viewer and data mining, and the ability to create mashups. Its purpose is to promote participatory democracy.

- The United States of America's *Geospatial One-Stop*, or *geodata.gov*. Similar to Data.gov, but limited to geospatial data and including data sets from non-governmental organisations. It is a public gateway to facilitate communication, sharing geospatial data and resources, and to enhance government efficiency and improve citizen services.
- The Canadian *GeoConnections* programme, which includes the geoportal, the *Canadian Geospatial Data Infrastructure (CGDI)*. It aims at improving Canadians' quality of life by enhancing decision making, through making geospatial information available to decision-makers and by working with partners. The CGDI links to other national, regional and thematic portals in Canada.
- The *European Strategy Forum on Research Infrastructures (ESFRI)*. ESFRI promotes the scientific integration of Europe through competitive and open access to high quality research infrastructures. It supports policy-making and facilitates multilateral initiatives. It includes physical infrastructure as well as data portals, such as for genomics. An example of a relevant ESFRI project is the Council of European Social Science Data Archives (CESSDA).
- The *Global Spatial Data Infrastructure Association (GSDI)*. While GSDI is not building an SDI itself, it promotes international cooperation to support developing SDIs, through communication, networking, capacity building, education, research and facilitating partnerships. For example, its conference is the premier SDI-related conference internationally. At the next one, GSDI 12 in Singapore, 19-22 October 2010, the World Bank will host a workshop to explore the need for a pragmatic how-to guide for implementing and maintaining SDIs that would explicitly address the needs of developing countries. GSDI has also produced the SDI Cookbook.

Nevertheless, research needs to be done on the peculiarities of an SDI in the South African environment. Unfortunately, it is very easy for an SDI to fail.

## 2. Purpose of the CSI and the SASDI

The writing of position papers was proposed because it is not clear exactly what the purpose of the CSI and the SASDI should be, and these position papers will be used to help clarify the issues for the CSI, in the lead-up to the next CSI meeting, scheduled for 22 September 2010. The following issues need to be addressed:

1) **Strategy and framework**
   a) The SASDI is not an end in itself. It should support effectively and efficiently, participatory democracy, service delivery and sustainable development in South Africa to improve the quality of life of all.
   b) The SASDI does not replace existing geoportals – indeed, it encourages the development of geoportals by all of the national and provincial departments,

and by all local authorities. The SASDI will provide a one-stop portal for data discovery and evaluation, but it will not interfere with existing data sharing relationships (otherwise, it will engender resistance).

c) There is much competition already to the SASDI, such as from virtual globes (eg: Google Earth) and open data repositories (eg: OpenStreetMap and Tracks4Africa). Hence, the SASDI has to offer a valid value-proposition to justify its existence. The SASDI must also cooperate with other geoportals, to reduce costs and improve data quality and availability.

d) Clarity is needed on the roles and responsibilities of all the stakeholders in the SASDI, including data providers, users and the Directorate: National Spatial Information Framework (NSIF), which is scheduled to provide the secretarial and administrative support for the SASDI.

e) The CSI needs to establish sub-committees that will meet more frequently than the CSI does and that should do much of the work assigned to the CSI. The CSI can co-opt members for the sub-committees from outside the CSI. Possible sub-committees are:
   - *Policy development*: while the CSI as a whole must approve all policies and the business plan for the SASDI, this sub-committee should prepare the draft policies, business plan and supporting documentation.
   - *Technical*: overall design of the system architecture, infrastructure, standards, ontologies (including taxonomies), data models, data encoding, security, and online processing and analytical services; registries and catalogues; and overseeing the actual system design, implementation and maintenance.
   - *Metadata*: given the burden of capturing metadata appropriate for the SASDI, there should be a sub-committee looking specifically at metadata issues, such as encouraging the capture of quality metadata, quality assurance of metadata, tools to automate the capture of metadata, etc.
   - *Data acquisition*: identifying core data sets, harmonizing and planning data capture, quality assurance of data, data interoperability and data integration. This sub-committee should be dominated by data custodians!
   - *Users*: user requirements specifications, usability testing, data dissemination, end-user support (overseeing the SASDI hot line), and promoting volunteered geographical information (VGI). This sub-committee should be dominated by users!
   - *Research*: because there are many unknowns related to implementing the SASDI, it might be appropriate to have a sub-committee promoting research in the field of SDI, both to address issues that arise and to develop advanced SDI skills in South Africa.
   - *Education*: the actual preparation of education and training materials, getting formal accreditation and the presentation of courses, etc, will require direct funding, but this sub-committee will be responsible for the overall framework for the education and training required, and adapting it as necessary.
   - *Marketing and communication*: the actual preparation of marketing and

communication materials will require direct funding, but this sub-committee will be responsible for the marketing and communication strategy and will oversee its implementation.

- *Monitoring and evaluation*: as an audit committee, this sub-committee should consist mainly of stakeholders from outside the CSI.

**2) Regulations**

a) While draft regulations have been prepared, these will need to be reviewed thoroughly by the CSI, before they are submitted to the Minister for approval. The strategy for the SASDI needs to be determined first; otherwise it could be in conflict with the regulations.

**3) Policies**

a) Policies are needed for the likes of data acquisition, data maintenance, data update cycles, versioning, data access, data dissemination, archiving, backups, data caching, online services, standards, metadata, copyright, pricing, funding, security, conformance testing and liability.

**4) CSI membership**

a) A concern is that the SDI Act in clause 9(5) requires a majority of all members of the CSI to constitute a quorum. Until this can be corrected through an amendment to the Act, it means that the success of the CSI is critically dependent on ensuring that the correct people are appointed as members and that their participation is maintained. Unfortunately, there are many stakeholders who are meant to be represented on the CSI but are not yet. However, the more members that the CSI has, the harder it will be to achieve a quorum for meetings.

b) It is essential that the members of the CSI must not only be knowledgeable about the geospatial data in their own domain, but they must also be knowledgeable about geographical information science (GISc) and the technical aspects of a GIS and an SDI.

c) A member of the CSI could have multiple interests in the CSI. For example, the CSIR collects, disseminates, archives and uses geospatial data, conducts research on GISs, SDIs and their components, develops standards, etc.

d) Key organisations that should either be members of the CSI, or with which the CSI should have a formal liaison agreement, include:

- The South African National Space Agency (SANSA).
- Vendors in the private sector of geospatial data and technologies required for an SDI.
- Users of the SASDI.

**5) Resources**

a) Each data custodian from all three tiers of government and from outside government will have to have a substantial line budget for their component of the SASDI. In addition, there will need to be a substantial budget for the

establishment and the day to day running of the SASDI itself.

b) It is not clear who will be responsible for the day to day running of the SASDI, or if they have the required capacity and ability to sustain the SASDI operations. For example, it would appear that the last time a valid metadata record was added to the Spatial Metadata Discovery (SMD) was on 29 January 2002.

**6) Architecture**

a) What is an appropriate architecture for the SASDI, given the peculiarities of the South African environment (legal, political, social, technical skills, technologies, etc)?

b) An SDI does not replace existing geoportals, but provides a one-stop data discovery and evaluation portal (though metadata) reaching across organisational boundaries, and then routes queries for data sets directly to the relevant data custodians for retrieval. It is a *virtual* repository of all the data. An SDI can provide web services for aggregating data sets and presenting them to the user as a seamless, integrated data set. It can also provide services for analysis, projection transformation, portrayal, validation, etc. An SDI obtains its metadata by harvesting automatically the metadata from its data custodians, or when a data custodian submits the metadata to the SDI.

c) An SDI should also provide easy access to the standards, taxonomies, terminology, ontologies and other things needed to exploit the data, such as through registries.

d) An SDI could also contain a repository of orphaned, historical geospatial data sets (for which there is no longer a custodian). However, an SDI cannot contain a repository of current data sets. Each data set needs to be housed by its custodian, which will have the domain expertise and line budget to maintain and update the data set and field queries about it, etc.

e) An SDI with a centralised repository of all its data will fail, simply because of the costs and complexities involved, never mind the inevitable lack of domain expertise at the central site. In any case, with the expensive, limited and unreliable connectivity we have in South Africa (for example, Kenya now provides better connectivity, with fibre directly to homes), a central repository is simply infeasible. The SASDI has to be decentralised.

f) The SASDI must not be a single point of failure, and hence should be available through mirror sites around the country.

g) The SASDI must be implemented through pilot projects, to test the technologies. Thereafter, it can be scaled up gradually. Invariably, everywhere in the world, the "big bang" approach results in failure, leading to resistance to the system.

**7) Data**

a) The core data sets for the SASDI need to be identified. For this, the CSI should exploit the work sponsored by the Department of Rural Development and the United Nations Economic Commission for Africa (UN ECA), for determining the fundamental Geospatial data sets for Africa. Once the core data sets have been

identified, the CSI will need to identify the data custodian for each of them.

b) The CSI should exploit the volunteered geographical information (VGI) available through virtual globes and open data portals. Studies have shown in other countries that VGI can be as good as, if not better than, official data sets. In particular, VGI data sets are often updated more quickly than official data sets, which adhere to an update cycle and have to provide national coverage, rather than just coverage of the "interesting" areas. Hence, VGI can supplement the official data sets to make the SASDI more responsive and even more successful. For example, in some countries VGI is used for change detection by the national mapping agencies.

c) The demand for conformance testing for, and validation of, data sets is increasing, particularly for dynamic applications such as in-vehicle navigation. Unfortunately, these are very expensive to do and hence would need extensive funding if they are to be a part of the SASDI offerings.

d) An SDI that charges anything for online access to its geospatial data sets will fail. The harsh reality is that users expect to obtain data on the Internet for free (particularly as they have already paid for the data collection and maintenance through their taxes), and they will merely bypass any SDI that charges them for data.

**8) Metadata**

a) All geospatial data *attempt* to model and describe the world. They are always an abstraction of reality; they are always partial (reflecting the conscious and unconscious biases of the compilers); and they are not complete. Any geospatial data set is always only just one of many possible "views" of the world – they cannot be an exact duplication of the world. For any data set, some things are approximated, some things are simplified and some things are ignored. Hence, there can never be perfect, complete and correct data! All the assumptions made in creating a data set and all of the limitations should be documented fully – as metadata.

b) Metadata is more than just data about data – it also describes processes, services, systems, etc. Metadata can describe a dataset series, a dataset, an individual record, or an individual field.

c) Metadata can be passive (documenting for use by humans, such as for data discovery and assessment, and free text is quite acceptable) or active (driving systems and processes, such as the automated selection of candidate data sets or triggering alerts about system failures, and hence needs to be encoded).

d) Implementing metadata is often not treated seriously, apparently because it is perceived to be tedious and expensive to capture and because there is no perceived value to the capturer.

e) How can we ensure that quality metadata will be provided by the data custodians and used correctly by the end users?

**9) Standards**

a) Internationally, standards for geospatial data are developed by the International Organization for Standardization's Technical Committee, ISO/TC 211, *Geographic information/Geomatics*, which works closely with the Open Geospatial Consortium, Inc (OGC). South Africa is active in ISO/TC 211, with more than 25 South Africans having participated in ISO/TC 211 meetings. ISO/TC 211 has published 41 International Standards and Technical Specifications, to date.

b) The local mirror committee for ISO/TC 211 is the South African Bureau of Standards' SABS/SC 71E, *Geographic information*. As well as adopting standards from ISO/TC 211, SC 71E has also developed several South African standards.

c) What are the standards that are needed for the SASDI to succeed (eg: data quality, metadata, ontologies, data models, unique identifiers, software interfaces, web services, network services, encoding and portrayal)?

**10) Data acquisition and maintenance**

a) Vast amounts of free or very cheap data are available. The problems are finding the data; assessing the suitability of the data (fitness for use) and quality of the data (currency (timeliness), spatial accuracy, attribute accuracy, resolution, consistency, completeness, etc); and maintenance of the data. The data acquisition policy should take the existing data into account in identifying the core data sets; harmonizing and planning data capture; setting data maintenance cycles; quality assurance of data; data interoperability and data integration.

**11) Education and training**

a) Training is required by various stakeholders, such as the members of the CSI; domain experts in all three tiers of government who will need to contribute to SASDI and/or local SDIs; data custodians; data base administrators; developers of SDIs; the end users; etc. Training will be needed in the form of interactive training workshops, formal university courses, and formal further education and training courses.

b) Firstly, it will be necessary to understand the education and training needs and to develop a framework of them, bearing in mind the requirements of the National Qualifications Framework (NQF) and life-long learning. Then, CSI can identify the existing courses that could meet some of these needs and arrange for the development the required courses and training materials.

**12) Marketing and communication**

a) The CSI and the SASDI cannot exist in isolation, so there needs to be a strategy for promoting them amongst stakeholders, such as government (who will have to fund both the CSI and the SASDI), data custodians (particularly their senior management) and potential users.

**13) Uncertainties that need to be researched**

a) How can we ensure that the SASDI actually does support effectively and

efficiently, participatory democracy, service delivery and sustainable development in South Africa, to improve the quality of life for all?

b) What are the characteristics of the South African environment that will make the SASDI either easier or more difficult to establish and sustain than SDIs in other parts of the world?

c) How should the SASDI ensure access to all, including people with disabilities?

**14) Good/best practices**

a) What existing good/best practices are there that can be exploited by the CSI for the SASDI? Are there any that the South African private or public sector can offer? What can South Africa learn from the SDIs around the world that have failed or succeeded, or that are currently under development?

b) For example, the Danish Enterprise and Construction Authority (DECA), recently published an analysis of the social and economic benefits associated with the decision in 2002 to provide the official Danish address data free of charge for public and commercial re-use. The direct financial benefits for society in the period 2005-2009 amount to around € 62 million, while the total costs up to 2009 were only around € 2 million. For 2010, they estimate the social benefits about € 14 million and the costs about € 0.2 million. For the summary report, see:
http://www.adresse-info.dk/Portals/2/Benefit/Value_Assessment_Danish_Address_Data_UK_2010-07-07b.pdf

c) Existing initiatives in South Africa that could provide the platform for SASDI or that could inform the development of SASDI include:
- The EO Portal, which currently harvests metadata from the likes of SAC's catalogue and from some government departments.
- SAC's DIMS, which locks each and every geospatial image and data file automatically as they are introduced to the archive. SAC has four people dedicated to DIMS, even though it is highly automated.

## 3. Issues regarding earth observation data

The Earth Observation Service Centre (EOSC) of the Satellite Applications Centre (SAC) has been providing remote sensing products and applications to its customers for over 25 years. A large archive of imagery is maintained and updated daily with new acquisitions. The earth resources information, supplied by the EOSC, provides valuable input to decision makers in areas such as food security, ocean resources, water management, disaster management and mitigation, agriculture, housing development, utilities and infrastructure planning, mine rehabilitation, national safety and security, and others.

The Satellite Applications Centre as part of the CSIR was established in 1961 and has participated in space science and technology ever since. Their involvement in remote

sensing and the managing of a large remote sensing archive, the processing and distribution of the imagery is one of its core functions. The CSIR SAC is recognised as a national key point and was also recommended as the prime facility to receive and distribute remote sensing imagery within the South African Earth Observation Strategy (SAEOS) for and behalf of Government.

The CSIR SAC realise the growth in the demand for remote sensing applications from low resolution to very high resolution imagery geo-processed to ortho-rectified level. The content of the Spatial Data Infrastructure Act 54 of 2003 provide a well establish guideline for the CSIR SAC to ensure that spatial data owned by Government is not duplicate in its procurement process. The CSIR SAC has a clear standing point in this regard and implement an aggressive strategy to ensure that remote sensing imagery is provided to government at the lowest possible prices and that datasets procured under a multi-government license are distributed at no cost to multi-departments to ensure optimised utilisations of remote sensing imagery within government. The sensors available under a multi-government license agreement include:

- Landsat 5 & 7
- Spot 2, 4 and 5
- CBERS 2B
- SAC-C
- MODIS
- NOAA

The CSIR SAC strategic intent is to serve an advance remote sensing service to its stakeholders and its continuous improvement of its sensor portfolio and geo-processing supply chain to ensure a world class product delivery. The supply chain available internally, named Data Information Management System-Earth Observation (DIMS-EO) control the production workflow process from order to delivery.

In conclusion, the CSIR SAC would claim its position as the low earth observation satellite custodian for South Africa. This will include the following services:

- Operate an earth observation sensor portfolio – tasking, telemetry, archiving, image processing and distribution
- Maintain a national remote sensing archive
- Update and maintain a remote sensing catalogue – http://catalogue.sac.co.za
- Maintain a remote sensing metadata standard for all products hosted
- Generate national datasets under multi-government license such as mosaics and national land cover and use classes

## 4. Conclusions

We have presented here a draft position paper on the Committee for Spatial Information (CSI) and the South African Spatial Data Infrastructure (SASDI). While this has been

developed based on experiences at a science council that collects, disseminates, archives and uses geospatial data, conducts research on GISs, SDIs and their components, and develops standards, it does not necessarily represent the opinions of the CSIR. It is also only a draft, so it might contain errors. It has been provided to stimulate discussion in the CSI, and hopefully it will be found useful for that purpose.

We look forward to contributing to the success for the CSI and the SASDI.

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Please note that the opinions expressed herein are not necessarily those of the CSIR.

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