Target audiences, media and messages for SDI training

by Victoria Rautenbach and Serena Coetzee, University of Pretoria; Julian Smit, University of Cape Town; Heinrich du Plessis, Department of Rural Development and Land Reform; and Ivan Farayi Muzondo, Tshwane University of Technology

This article aims to report on research conducted to identify the different target audiences and corresponding SDI education and training media and messages that will contribute towards the development of the South African Spatial Data Infrastructure (SASDI).

Spatial data infrastructures (SDIs) emerged in the early 1990s when the emphasis moved from a stand-alone GIS towards a networked and collaborative information infrastructure [1]. Rajabifard et al. [2] define an SDI as a network-based GIS providing reliable and effective access to geographic information. The SDI cookbook [3] follows a more technical approach, defining an SDI as the basis for spatial data discovery, evaluation, and application for users and providers within all levels of government, the commercial sector, the non-profit sector, academia and by citizens in general.

The South African Spatial Data Infrastructure Act was promulgated in 2003 (Act 54 of 2003) and the Committee for Spatial Information (CSI), as described in the Act, was established in 2010. The main objective of the SDI Act [4] is "...to establish the South African Spatial Data Infrastructure (SASDI), the Committee for Spatial Information (CSI) and an electronic metadata catalogue; to provide for the determination of standards and prescriptions with regard to the facilitation of the sharing of spatial information; to provide for the capture and publishing of metadata and the avoidance of duplication of such capture; and to provide for matters connected therewith". According to the Act, SASDI is "established as the national technical, institutional and policy framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial information".

The passing of the Act can be seen as an acknowledgement of the strategic value of spatial information for South Africa [5]. The challenge now is to implement the SASDI in compliance with the objectives of the Act. For this, it is essential that an understanding and appreciation of the value of spatial information for planning, management and decision-making permeate all SASDI stakeholders, including SASDI users from all sectors of society. Ignorance and relevant skills shortages are potential impediments to the realisation of the SASDI objectives. Makanga and Smit [6] expressed their concerns over the lack of SDI expertise in the country and its negative effect on the successful development of a SASDI. This concern was reiterated at the first CSI meeting [7] and led to the establishment of the CSI sub-committee on Education and Training in 2011. According to its terms of reference, the goal of this sub-committee is to provide forums for sharing experiences and discussing issues relating to data, metadata, standards and systems; to determine the education and training needs for the stakeholders, i.e. users and contributors of the SASDI; to develop an overall framework of these needs and to develop a plan for funding the actual preparation of education and training materials, and registration of accredited providers of courses [8]. The latter could be done by encouraging institutions of higher learning, such as universities, that offer GISc as part of their courses, to include learning material on SDI in general and the SASDI in particular in their programmes. Learning material could also be made available for use during workshops, conferences, seminars and short courses accredited in terms of the South African Council for Professional and Technical Surveyors (Plato) rules for continuing professional development (CPD) points.

It is perhaps the lack of capacity due to inappropriate education and training which has been the downfall of many SDI initiatives in the recent past. Aditya [9] stresses the importance of awareness of the benefits and usefulness of an
SDI. The first phase of education and training requires workshops in order to create awareness within the geospatial community of the value and benefits of an SDI for a developing country such as South Africa [9]. National awareness projects are required to educate decision makers about the benefits and potential savings in resources when an SDI is implemented to gain managerial support for the implementation of SASDI at local, provincial and national government levels. As the implementation of SASDI is still in its initial phases, technology-specific training cannot yet be designed and developed, hence the focus is on awareness and generic SDI theory and practice.

The aim of this article is to report on research conducted to identify and describe the target audiences to be reached and the corresponding messages and media to be used in the education and training for the development of SASDI. To achieve this objective the article is structured as follows: the first section includes background information on CSI, SASDI, SDI education and training. Next the methodology to identify target audiences and corresponding media and messages is described, followed with the results and a discussion thereof. We conclude with a summary of our findings and an outlook into the future of SDI education and training in South Africa.

Background
This section provides background information on SASDI, the CSI and other related activities. The South African SDI Act describes SASDI as "the national technical, institutional and policy framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial information" and it is therefore appropriate to identify education and training objectives in support of the SASDI objectives [5]:

Technical education and training learning objectives include:
- Skills required to maintain the required information and communication technology backbone for SASDI (hardware, software, network, internet, etc.)
- GISc expertise and skills to produce, maintain, provide and/or use SASDI data and services.

Institutional education and training learning objectives include:
- Understanding of the institutional arrangements that are key to SASDI

- Understanding what is required from an institution for effective use of spatial information.
- Understanding of legislation and/or policies governing the use of spatial information, particularly in South Africa.
- Identification of any gaps within the existing policy and legislative landscape that hinder GIS usage, thus requiring policy intervention from government.

The CSI consists of a principal committee, established according to the Act, and six sub-committees on Data, Systems, Standards, Policy and Legislation, Education and Training, and Marketing and Communication, each with their own objectives as set out in the following terms of reference [8]:

Data
- Identify the fundamental or core data sets for the SASDI and the custodian(s) for each data set.
- Specify the feature types and feature attribute types required for each fundamental data set.
- Produce a realistic schedule for collecting the metadata and uploading the data.

Systems
- Adding additional metadata standards to SMD, so that it can be used in the initial phases.
- Identify suitable tools for capturing metadata and make them available to the data custodians.

Standards
- Identify and promote common standards and specifications.
- Develop and implement the relevant standards for SASDI.

Policy and legislation
- Review policies, primary and secondary legislation and recommend amendments as applicable.
- Recommend to CSI policies to be formulated, and when approved formulate new policies.

Education and training
- Provide forums for sharing experiences and discussing issues with data, metadata, standards and systems.
- Determine the education and training needs for the various stakeholders in the CSI and the SASDI, and develop an overall framework of these needs.
- Develop a plan for funding the actual preparation of education and training materials, getting formal accreditation and the presentation of courses.

Marketing and communication
- Make users and producers of geospatial information aware of SASDI.
- Make users, producers and the general public aware of the availability of geospatial information and promote the wide spread use of the data.

The decisions and work of all CSI sub-committees contribute towards the identification of SASDI-specific education and training requirements and serve as important input towards the work of the Education and Training Sub-committee. Some work has commenced in the sub-committees, but due to budget constraints, the majority of the work will only take off in the current fiscal year. The Data sub-committee partnered with the Development Bank of South Africa (DBSA) to determine criteria for the identification of the core (base) geospatial data sets and their custodians [10]. A literature review of international, regional and national scientific and policy documents, an internet survey and interviews with key stakeholders were conducted as part of the project. Legislation provided important guidelines for the identification of core geospatial data sets and their custodians. However, existing legislation may need to be reviewed and amended to facilitate the successful implementation of SASDI.

The Data and Systems sub-committees co-hosted a joint workshop in April 2012 to determine the user requirements for the technical platform of SASDI. The user requirements of the South African Earth Observation System (SAEOS) were used to guide stakeholders. These requirements were refined in the workshop and presented at a CSI committee meeting in June 2012. The Systems sub-committee is currently evaluating available systems to see if an existing system, a customised system or a completely new system will meet the requirements identified at the workshop.

In order to achieve a successful and sustainable SASDI, a number of enabling conditions have to be met (adapted from [11]):
In terms of these enabling conditions, South Africa is comparatively advanced in its SDI efforts at a national level. We can reasonably claim to have organisational, funding, legal and technical requirements in place for the implementation of SASDI [11, 12]. However the finalisation of regulations for the SDI Act, generation of metadata records, and critically education, training and awareness campaigns remain a challenge.

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<th>Media</th>
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<td>Apply solution</td>
<td>Diploma or certificate course at appropriate level</td>
</tr>
<tr>
<td>Decision makers, funders, and policy makers</td>
<td>n/a</td>
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</tr>
<tr>
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<tr>
<td>Providers of SASDI base datasets and services</td>
<td>Design solution</td>
<td>Four year degree or certificate course at appropriate level</td>
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<tr>
<td>End users and consumers of SASDI data sets and services through providers</td>
<td>Awareness</td>
<td>One-on-one discussion, presentation or material</td>
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Table 2: Target audiences, level of specialisation and corresponding media for the knowledge area “Design and use of SASDI tools”.

Plato as the national statutory body for surveyors and geographical information science (GISc) professionals in South Africa [13] is tasked with protecting the general public from incorrect or inconsistent data collected or maintained by organisations and professionals registered in terms of the Plato Act (Act 40 of 1984). In order to register with Plato as a GISc professional, an applicant must comply with certain minimum competency requirements in GISc. Currently, a few tertiary institutions are in the process of accrediting their...
curricula with Plato, which will facilitate the registration process for graduates from these institutions. The requirements for Plato registration contain a subset of the body of knowledge required for the development of SASDI. The Plato educational model for a GISc professional practitioner includes topics related to SDI:

- **Geo-spatial information science:** standards for geo-information, metadata and geo-libraries, and spatial data infrastructures
- **Information technology:** data warehouses and data mining
- **Cartography/visualisation:** web maps
- **Professional practice and ethics:** Access to Information and SDI Acts

These topics are not adequate for an SDI implementation because they do not make specific mention of the complex organisational and legislative environment in which SDI initiatives at a national level exist. Any educational model has to be continuously revised and updated in order to reflect the changing environment. The authors have witnessed the impact of new knowledge and technologies on existing geomatics programmes over the last decade at universities and universities of technology, specifically in study areas such as cartography, photogrammetry and remote sensing. These changes were positive and did not signal the death of any domain in geomatics, but rather the drift of a profession into the new GISc domain where programmes were adjusted to prepare students with different competencies. It is recommended that the results from the work reported in this article are used to inform the future revision of PLATO’s GISc education model to ensure the inclusion of sufficient content on SDI education in general and SASDI in particular.

Examples from other parts of the world confirm the need for SDI-specific education and training. In an example from Poland the authors state that the INFrastructure for SPatial InfoRmation in Europe (INSPIRE) has a number of implementing rules and processes that are complex and can be difficult to grasp for users and the average non-GIS employee [14]. To facilitate the adoption of INSPIRE, a training programme, “Geoinformation in Practice - the INSPIRE Academy”, was developed in Poland. The objective was to assist with the implementation of the INSPIRE directives at all levels of Polish government. The training was divided into four main groups (theory and practical): (i) introduction to geoinformation; (ii) presentation of scopes of duties of officials involved in spatial planning and environment protection industry; (iii) spatial data infrastructure; and (iv) introduction to issues associated with the INSPIRE directive. The developed training material was distributed to trainees at 150 municipalities in 150 counties in Poland.

In a related example, Boes and Pavlova [15] report that the implementation of the INSPIRE directives and implementing rules pose challenges to the competence of all INSPIRE stakeholders. They argue that inadequate competencies in the market have to be addressed and that this can only be done by university education and life long learning. Therefore a higher priority needs to be given to the development of new curricula and educational approaches for SDI and geodesy. Their work was done in the Association of Geospatial Information in South-East Europe (AGISEE) and resulted in the formulation of a four-part educational strategy, focusing on (i) dialogue among stakeholders in the region; (ii) awareness of the importance of education (including continuing education); (iii) promotion of the courses; and (iv) financing (finding funding).

### Methodology

An initial literature survey was done to obtain information about SDI stakeholders, SDI education and training and related research in South Africa and other countries and regions. Two workshops with individuals from academia, research institutes, government and industry were held at

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Table 3: Target audiences, level of specialisation and corresponding media for the knowledge area “Overview of SDI, SDI principles and its benefits”.

![Fig. 2: Delivering SDI education and training message through different media to identified target audiences.](image)
the University of Pretoria in November 2011 and July 2012 respectively. The objective of the workshops was to localise the literature review findings for the SASDI. Open invitations to the workshops were widely advertised via email and posts on SDI and GIS mailing lists in Africa. A workshop is a subjective method, but effective for a representative sample of interested parties to sit around a table and contribute towards the identification of target audiences to be engaged and corresponding media and messages to reach those audiences. Workshop participants identified, described and agreed upon target audiences to be engaged and the media and messages most suitable to reach those audiences. During the workshops an analogy from marketing communications was used as methodology for identifying the target audiences, media and messages. This is appropriate because awareness of the value of spatial information and communicating information about the SDI itself are an important part of SDI education and training [9, 14].

In marketing communications, a target market is defined as a group of consumers or organisations with which a firm wants to create marketing exchanges and relationships [16]. The target market is segmented into target audiences, i.e. groups of people at which a product or the product’s marketing message is aimed [18]. According to Blythe [16], developing an effective marketing communication strategy follows a six-stage process:

1. Identify the target audience (Whom should the message reach?).
2. Determine the response sought (What should the audience do after receiving the message?).
3. Choose the message (i.e. write text or produce an image).
4. Choose the medium (Which newspaper, TV station, radio station, etc.).
5. Produce the message (What about the product should be communicated?).
6. Collect feedback (e.g. market research to determine the success of the message).

In this research we followed a similar approach to identify the target audience, messages, and media: first, the different target audiences were identified, next the response sought (learning objectives) and message (knowledge area) were described, and finally, a suitable medium (including the level of specialisation) was selected to convey the relevant messages to respective target audiences. This article reports the results of these first four stages. The message, e.g. training and marketing material, still has to be produced. Existing education and training material will also be evaluated for reuse where applicable. The last stage, to collect feedback, will follow later.

**Results**

SASDI stakeholders represent the target market for SDI education and training in South Africa. SASDI education and training should empower geospatial information users, including but not restricted to, decision-makers, policy makers, community leaders and planners with the knowledge and understanding of SASDI in general, and the value and usage of spatial information in particular for proper planning and informed decision-making. Ignorance in this regard is likely to hinder the implementation of SASDI and empowerment should happen across the entire public service and society in general. To properly solve this problem, different target audiences within the target market need to be identified, messages aimed at the different target audiences need to be described and finally media need to be chosen through which the messages are transmitted to the target audiences.

**Target audiences**

First we grouped SASDI stakeholders into target audiences so that the SDI education and training needs could be assessed for each target audience and the appropriate messages and media could be developed in response to these needs. In the literature survey we found a list of SDI stakeholder types [18], which we used as a starting point for identifying target audiences within the target market:

- **Producer** (produces SDI data or services)
- **Provider** (provides data or services to users)
- **Broker** (brings users and providers together and assists in the negotiation of contracts between them)
- **Value-added reseller** (provides value-added data and service products)
- **Policy maker** (sets policies to be pursued by SDI stakeholders)

End user (uses SDI data and services)

SASDI stakeholders include users, consumers and value-added resellers of SASDI data and services; producers and custodians of SASDI data and services; providers and brokers of SASDI data services; SASDI policy and decision makers, as well as funders of SASDI activities and initiatives.

SASDI stakeholders are found in the public, private and social sectors of the economy, amongst others in [5]:

- National and provincial government
- Local municipalities
- Parastatals, such as Eskom, the State Information Technology Agency (SITA), and the Development Bank of Southern Africa (DBSA)
- Research institutes, such as the CSIR, the Human Sciences Research Council (HSRC) and the Agricultural Research Council (ARC)
- Academia and other educational and training institutions
- Non-profit organisations
- Users among ordinary citizens

Through combining the SASDI stakeholders identified in [5] and the generic stakeholders in Hjelmager et al. [18], the following target audiences for education and training of SASDI were identified:

- **CSI members**
- Decision makers, funders, and policy makers
Custodians of SASDI identified base data sets
Producers of SASDI non-base data sets
Producers of SASDI services
Providers of SASDI base data sets and services
End users and consumers of SASDI data sets and services through providers

CSI members represent the interests of their organisations on the CSI. Some of them are technical GISc experts, while others come from management and might not have a technical GISc background. Decision makers, funders and policy makers do not necessarily use SASDI data and services on a day-to-day basis, but they influence decisions related to SASDI. Custodians are described in the South African SDI Act as organisations or individuals who "capture, maintain, manage, integrate, distribute or use spatial information". Other producers of data sets and services were split into two different target audiences: producers of SASDI non-base data sets are not obliged by law to contribute their data sets, and the producers of SASDI services, typically from the information and communication technology (ICT) sector, provide the geopolitical and associated services.

SDI education and training messages and media

In order to determine the SDI education and training messages, learning objectives were specified for each target audience. The learning objectives describe the response sought from a target audience after receiving a message, i.e. stage 2 of the six-stage process. The learning objectives were compared, analysed and consolidated into a list of knowledge areas, not all of them applicable to all target audiences:

- The value of spatial information for their respective purpose or job in SASDI
- Spatial data and the principles of geographic information systems (GIS)
- Overview of SDI, SDI principles and its benefits
- SDI component: data and metadata
- SDI component: standards and specifications
- SDI component: web services
- SDI component: institutional agreements
- Laws other than the SDI Act related to SASDI, e.g. copyright and intellectual property right laws
- Relevant knowledge areas in the Plato educational model
- SASDI and its providers
- SASDI and the benefits to their respective purposes of participating
- SASDI base data and associated services
- SASDI policy and legal issues
- Legislative responsibilities inferred on participants by the SDI Act
- Information and/or training that providers have to pass on to users
- Design and use of SASDI tools (e.g. a geoportal or clearinghouse)
- Service implementation according to SASDI guidelines
- SASDI prescribed tools and technologies

These knowledge areas correspond to the message chosen during stage 3 of the development of a marketing communications strategy. After preparing the list of knowledge areas, it was necessary to revisit the target audiences and to match each target audience with knowledge areas, as well as the level at which members of the target audience should master the knowledge areas. Fig. 1 shows the different levels of specialisation with corresponding education and training media and examples of such media. The triangle represents the relative number of people in a target audience whom a message should reach at that level of specialisation. For example, awareness is aimed at large groups, while at the research level a smaller number of individuals are involved.

Table 2 shows the target audiences, level of specialisation and corresponding media matched to the knowledge area "Design and use of SASDI tools". Table 3 shows the same for the knowledge area "Overview of SDI, SDI principles and its benefits". Each knowledge area was matched to target audiences, level of specialisation and corresponding media. The earlier learning objectives provided guidance in the matching process.

Fig. 2 shows how relevant messages are delivered through different media to respective target audiences.

Discussion of the results

Target audiences were identified based on stakeholder roles in SASDI. An individual (organisation) can take on more than one stakeholder role. For example, an organisation could be both custodian of a base data set, as well as the producer and provider of services to access that data.

When matching the knowledge areas and target audiences, as described in the previous section, in some cases different levels of specialisation of a specific knowledge area are required for different members of the target audience. For example, all CSI members represent their organisations on the CSI. Some members will be expected to contribute on a technical level, while others will be expected to contribute on a strategic level. These contributions require different levels of specialisation of the different knowledge areas. Thus it seems that some of the identified target audiences, should be further segmented.

It is not yet known how end users and consumers will access SASDI data and services. Therefore we assumed that end users and consumers will always access SASDI data sets and services through providers. Depending on how SASDI is implemented, this assumption might not hold anymore. In that case, target audiences, media and messages need to be adjusted accordingly.

The complex organisational and legislative environments in which SDI initiatives at a national level exist are not adequately covered in Plato’s GISc educational model. A more detailed gap analysis needs to be done in which the Plato GISc educational model is compared against the knowledge areas identified in this article. The results of the study should feed into a next revision of the Plato GISc educational model.

As part of the GSDI project, we have started a survey of existing SDI education and training material available worldwide. The goal is to match material to the identified knowledge areas and levels of specialisation in order to determine which material can be reused. Preliminary results show that a wide variety of education and training material is available. Education and training on the theoretical aspects of an SDI and its components is readily available, some of it free of charge, but, amongst others, SASDI-specific material needs to be developed. Preliminary results of the survey are available online [19].

According to various reports [9, 14, 15], awareness of an SDI and its benefits is a major challenge for SDI education and training initiatives. Marketing activities promote SDI
awareness, but awareness can also be generated by including SDI in the tertiary education programmes of other disciplines, such as town and regional planning, civil engineering, environmental science and geology, and through short courses on SDI and related topics to practising professionals. These options need to be further explored for SASDI.

Conclusion

This article identified target audiences, media and messages for SDI education and training in South Africa. SASDI has an important role to play in the socio-economic development of South Africa. SASDI success depends on the ability of key stakeholders to make use of and take advantage of SASDI and spatial information. Education and training are central to providing all stakeholders with the necessary awareness, knowledge and skills to achieve SASDI success.

Capacity in GISc education at tertiary education institutions in South Africa compares well to the rest of the African continent [20]. However, in this article we identified a gap in South Africa’s tertiary GISc education: the complex organisational and legislative environments of SDI initiatives are not adequately covered in Plato’s GISc educational model. This gap needs to be addressed. An open question remains: how many GISc professionals are required in the public and private sector of South Africa to ensure a successful SASDI implementation?

SASDI’s long term success, given its technical nature, will depend on education and training. Apart from formal education and training of professionals before they commence formal education and training. Apart from its technical nature, will depend on education and training. Apart from its technical nature, will depend on education and training. Apart from its technical nature, will depend on education and training.

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SASDI’s long term success, given its technical nature, will depend on education and training. Apart from formal education and training of professionals before they commence their career, life long learning is needed to keep abreast of latest developments. SASDI can become an important impetus and resource (funding and otherwise) for GISc education and training, resulting in an inter-dependent relationship between SASDI and academia.

Acknowledgement

Members of South Africa’s Committee for Spatial Information (CSI), members of the CSI sub-committee on Education and Training, as well as selected individuals from the GIS industry, contributed to the workshop in November 2011 and July 2012 on the strategy of SDI education and training needs. Genock Mnisi from the Office of the Premier in Limpopo prepared a first draft framework, based on the outcome of the workshop, which served as input to this article.

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