

Spatial Data Infrastructure as a Vehicle for Sustainable Development in Zimbabwe

Charles PARADZAYI, Zimbabwe

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SUMMARY

The Zimbabwe Spatial Data Infrastructure (ZSDI) steering committee is a group of voluntary geographic information practitioners that is advocating for the establishment of a functional spatial data infrastructure (SDI) in Zimbabwe. The initiative began in the late 1980s, but the progress has been painfully slow. Lack of awareness of SDI issues, knowledgeable personnel, and lack of government support, among other factors, has contributed to this slow pace of development. This paper is directed towards politicians, senior managers and professional organisations (high-level public and private sector officials) to solicit their involvement and support for the Zimbabwe Spatial Data Infrastructure initiative. The paper aims to provide a greater understanding of the need for Spatial Data Infrastructures (SDI) and how they can be used to support sustainable development in the country. As such, the paper shall not dwell much on the technical aspects of SDI, but will focus on making SDI relevant and pertinent to the current political and socio-economic climate prevailing in the country so that decision-makers can see the need to invest in a legal spatial data infrastructure framework. This paper will try to justify that a sound spatial data infrastructure is the basis for sustainable socio-economic development for the country.

Formalised spatial data infrastructure frameworks assist decision-makers to effectively implement and manage a number of national initiatives and/or policies related to sustainable development. The relevance of SDI, in the Zimbabwean context, to some of these national initiatives and policies will be presented. A brief history of the development of SDI in Zimbabwe will be presented, and some of the current problems hampering the establishment of a legal spatial data infrastructure will be identified. The paper will chronicle some of the efforts that have been undertaken by the Zimbabwe Spatial Data Infrastructure steering committee towards the formalisation of a legal Zimbabwe Spatial Data Infrastructure Framework. A number of lessons will be drawn from successful spatial data infrastructures that have been launched both regionally and internationally. The paper will try to outline how the SDI practitioners in Zimbabwe can benefit from the experiences and lessons learnt from these success stories, so that they can be adopted and adapted to meet the challenges presented by the Zimbabwean situation.

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1. SUSTAINABLE DEVELOPMENT AND SPATIAL DATA

Development is the managed process of change designed to improve the conditions of members of a society. Development must ensure the survival of future generations by not compromising the ability their ability to meet their own needs. Sustainable development balances the exploitation of resources, the direction of investments and the advancement of technology in a manner that affords the same opportunity to future generations. The sustainable exploitation of resources requires data to be available, current, reliable and usable at the appropriate level. The data should indicate the quality, quantity and spatial location of the various resources and the size and spatial distribution of the population who depend on these resources. Spatial data is data with a direct or indirect geographic reference to the surface of the earth. Spatial data about the environment comes from a myriad of sources and in different formats. Meaningful combination of spatial data from one or more different sources using a common reference system creates spatial information. Spatial data and information has strategic importance to decision-makers at all levels since more that 80% of all information in society has a spatial reference. The hard part of taking advantage of this flood of geo-spatial information is turning raw data into understandable information (Al Gore, 1998). Technological innovations such as Geographic Information Systems (GIS) can now be used to integrate, analyse, model and visualise spatial data from different sources on the local as well as on the national and international level.

Spatial data and information is an indispensable part of the basic infrastructure of any individual country as are roads, schools and hospitals (FIG Publication No. 30, 2001). As such, spatial information is a public good, so there is a need for development and implementation of spatial data infrastructures (SDI) based on a holistic approach comprising organisational, political and technical matters. A national spatial data infrastructure (NSDI) is the technology, policies, standards and human resources necessary to acquire, process, store, distribute and improve the utilisation of geo-spatial data within and outside a particular country (FDGC, 2004). The spatial data should be available locally, nationally, regionally as well as globally. There is need to create vertical and horizontal information highways to enable stakeholders to share data in order to avoid duplication and redundancy at the different levels. The highways enable decision-makers to aggregate or integrate information through local, national, regional and global levels. This approach to recycling information through different levels of the spatial data infrastructure will ensure that datasets are current and compatible. NSDI is the pre-requisite for a sustainable future where:

1. data collected and maintained by one administrative unit are available for other users
2. data from different sources can be combined in seamless models without loss of information
3. dissemination, modelling and visualisation are based on international standards (FIG Publication No. 30, 2001).

2. STATUS OF SPATIAL DATA INFRASTRUCTURE IN ZIMBABWE

Mavima *et al*, 2001 summarises the status of the SDI development in Zimbabwe. There is no formal spatial data infrastructure (SDI) in Zimbabwe. The history of SDI development dates back to the mid-1980s with the formation of the national GIS Association, which then died a natural death around 1998 due to lack of commitment from members. This was due to the lack of support for the initiative by the Department of the Surveyor-General (DSG), the major custodian of geospatial information in the country. There was a general lack of appreciation for the GIS association by the senior management within the DSG. In 2000, a national workshop was convened at Monomotapa Crown Plaza Hotel to discuss the way forward about SDI related issues. Most participants were technocrats, with very few senior government officials present, even though invitation had been sent out to them (Mavima and Chikukwa, 2001). The National Spatial Data Framework (NASDAF) was launched at the end of this workshop. Among some of the terms of reference, NASDAF was to raise awareness of SDI issues in the country. NASDAF died a natural death even though the NASDAF steering committee comprised of some senior officials in both government and private sector. Efforts to resuscitate the initiative resulted in the formation of the Zimbabwe Metadata Working Group in 2001. This group was transformed into the Zimbabwe Spatial Data Infrastructure (ZSDI) steering committee when members realised that metadata is just a component of the wider spatial data infrastructure.

An interim SDI committee was set-up to advocate for the establishment of a formalized spatial data infrastructure in the country. This committee is made up of voluntary GIS technocrats who do not have resources at their disposal and it has been very difficult for this committee to carry out any meaningful work. No institutional arrangements have been put in place to facilitate the development of a formal SDI. Different institutions and departments are independently generating datasets to meet their own needs. Some thematic data sets are available from agencies such as the Forestry Commission, the Department of Natural Resources, the Department of Agricultural Research and Extension Services (AREX), the Environment and Remote Sensing Institute (ERSI) and the Central Statistics Office (which provides socio-economic data). Each of these data sets is produced in an arbitrary standard, which makes it very difficult to combine data sets from different agencies. Efforts are underway to create digital databases through conversion of existing maps into digital format. Some of the organisations involved are the Surveyor General's Department, Forestry Commission, Natural Resources, National Parks, and Ministry of Health. However, it is still difficult for potential users to establish the data sets that exist and if these can satisfy their requirements.

These developments are taking place amid a harsh economic and political climate. Zimbabwe is now popularly recognized for its revolutionary and controversial land reform programme that it embarked on from the year 2000. The political and socio-economic climate has changed drastically since then, with the year-on-year inflation reaching a peak of upwards of 600% in mid 2004. A formal SDI has failed to kick off due to lack of awareness of SDI issues, lack of knowledgeable personnel, and the lack of high-level government support.

Financial resources are scarce and investments in spatial data projects are long term rather than immediate. The other major problem facing Zimbabwe is the lack of prominent SDI champions at high government levels. Politicians usually want to participate in seeking funds for short-term projects that will yield results during their terms of office than for long-term projects in order to brighten their electoral fortunes. The ZSDI steering committee has tried to bridge this 'political divide' by inviting high-ranking government personalities to speak at the annual SDI national workshops. The Honourable Minister of Lands, Dr. Joseph Made officially opened the first Zimbabwe national SDI workshop in November 2003. The committee has been caught up in the red tape that normally characterises most government operations as some of the invited guests have failed to turn up. The constant reshuffle of key government personnel makes it almost impossible to establish sustainable partnerships with these high-level government officials for the pursuance of the ZSDI objectives. Moreover, these partnerships are likely to form and dissolve frequently as, because of their informal nature, they are likely to be dependent on certain people being committed to SDI projects and their remaining in relevant positions in key institutions (Mavima *et al*, 2001).

2.1 National initiatives and policies that support sustainable development

The stakeholders in the ZSDI initiative include decision-makers from different applications areas such as; health monitoring programmes, cadastre and land management, transportation and land reform programmes, among others. The variety of applications implies the need for co-operation between data custodians and other possible users on standards, common data models, object definitions, common keys, availability, copyrights and pricing models among other things. The use of spatial information to support sustainable development will only be achieved when solutions start with realistic objectives and grow incrementally through political and market needs (FIG Publication No. 30, 2001). The concept of spatial data infrastructures is new to most of the stakeholders although they recognise the need to share interoperable datasets.

2.1.1 Economic position

The economic down turn over the past four or so years has hampered the establishment of a formal ZSDI in the country. This is true to a large extent because much of the limited resources (both financial and material) have been diverted to meet basic requirements such as food and fuel. However, the economy is slowly recovering and hopefully, decision and policy-makers from the various organizations represented in the ZSDI steering committee will see the need for a formalized SDI and spare resources for its establishment in order to promote sustainable development of the Zimbabwean society. The Governor of the Reserve Bank of Zimbabwe has set aside a Z\$ 200 billion facility for capacity building in the land surveying sector (Gono, 2005) as part of the Parastatal and Local Authorities Re-orientation Programme. This is a good indicator that high-level government officials are beginning to appreciate the importance of the geoinformation sector's contribution to sustainable development in the country. The SDI steering committee could benefit from this facility for funds to raise awareness about SDI issues as well as developing 'proof of concept applications'. The introduction of trans-frontier projects (such as the Zambezi-Limpopo

trans-frontier project), which are geospatial in nature, will stimulate the need for a formal spatial data infrastructure.

2.1.2 Socio-political aspects

The socio-political climate in the country is conducive for the establishment of a formal SDI to manage the plethora of spatial data required for the execution of central and local government functions. The central government has embarked on a land redistribution exercise for the past five years. Most of the land records for this historic exercise are not fully documented and the spatial locations of the various plots are not readily available. This is because the ministry involved is working independently of the data custodians and users, in order to pursue the political gains of the exercise. Some of the major players on the Zimbabwe spatial data landscape include most of the public sector organizations as well as private sector players. Public sector players include the Department of the Surveyor-General, Ministry of Lands, Ministry of Transport and Communications, Ministry of Environment and Tourism, Ministry of Defence, among others. The private sector stakeholders include power utilities, post and telecommunication companies, and academia, just to mention a few.

2.1.3 Current problems

As pointed out earlier, the major problems faced by the ZSDI steering committee are institutional, economic and political in nature. The major problem is the lack of awareness among the high-level decision-makers about the need for a formal SDI. This could be due to the current political environment where government authorities are wary of giving away information that may be used against them in future. During the inaugural speech on the first national SDI workshop in 2003, the Minister of Lands extended a hand to have the SDI initiative formalized through his Ministry. This move was stalled a few months later because the Minister was moved to a new portfolio in a cabinet reshuffle.

The other problems are technological limitations imposed on the various stakeholders due to the depressed economic climate that has been prevailing in Zimbabwe for the last five years or so. This has made it almost impossible to source funding for equipment that may be necessary to set up an infrastructure of this magnitude. Donor-dependency has resulted in some projects being abandoned before when the donors withdrew their support. A case in point is the geographic information standards project that was started by some Norwegian consultancy in the mid 1990s. These standards form an integral part of the ZSDI, as a result launching the ZSDI initiative will result in a stillbirth as long as the geographic standards have not been adopted.

3. LESSONS FROM REGIONAL SDI INITIATIVES

SDI initiatives have a regional and global context and Zimbabwe stands to gain from the various success stories of SDI development at both SADC and international levels. SDI practitioners in Zimbabwe can benefit from the experiences and lessons learnt from these success stories by adopting and adapting them to meet the challenges presented by the

Zimbabwean situation. The concept of SDI has just been introduced in the SADC region. According to Mavima *et al* 2004, SADC SDI developments vary from fully developed (South Africa), those that have so far implemented some components (Botswana, Namibia and Malawi) and those that are just taking off the ground (Zimbabwe, Swaziland, Lesotho, Zambia, Tanzania, Seychelles and Mozambique). A number of SADC member states have made significant progress in developing their national spatial data infrastructures after securing high-level government support. Among the best practices are South Africa, Botswana, Mozambique, Swaziland and Malawi. SADC member states had the opportunity to share lessons and experiences during the four-day SADC SDI workshop held in Pretoria, South Africa in 2004. Some of the themes of the workshop included:

3.1 The need for Public Private Partnership (PPP) as a strategy for SDI development

Presentations in this theme focused participant's attention on the mutual benefits that can accrue through the effective engagement of the private sector. Presenters and discussants emphasized the importance of identifying private businesses within and outside the geo-information forum as partners for the development of SDI. Participants also learned of the significance and importance of sensitising and engaging communities at the local level. One such initiative is the use of GIS in the Komati Downstream Development Project in Swaziland.

3.2 Sharing SDI experiences from SADC member states

Participants to the workshop elaborated on the country SDI reports that were already compiled in the handouts. Overall the country reports allowed SADC partners to learn from each other's experience thereby enriching the workshop significantly. Countries such as Swaziland, Mozambique, Botswana and South Africa have managed to include SDI activities into mainstream government activities, thereby attracting funding for SDI initiatives. These success stories are summarised below.

3.2.1 Swaziland

Swaziland has made great strides in the formulation of a NSDI framework plan within a space of a year. This was attributed to the country's small size and the ready access the SDI champions have to the higher authorities. Most of these committed and dedicated champions are from the Surveyor General's Office (the country's national mapping organisation) who seems to have a good understanding of how the SDI initiative should move forward. Swaziland has realised that the national mapping organisation is a key stakeholder in the development of NSDI and as such should be a focal point for all SDI related activities (SwaziMinutes, 2005). Swaziland has been fully supported by United States Geological Services (USGS) and the SADC Regional Remote Sensing Unit (RRSU) in its endeavours. According to Mavima *et al* 2004, the interim SDI steering committee has managed to influence government to include the NSDI proposal in its national Information and Communication Technology (ICT) policy. The policy will guide the handling of spatial data in the country.

3.2.2 Mozambique

In Mozambique, the National Directorate of Geography and Cadastre (Dinageca), as the main institution responsible for the establishment, maintenance and updating of the national land cadastre in Mozambique, has lead the Government of Mozambique to strengthen the institution's ability to deliver its cross-sectoral mandate on administration and management of the country's most important and precious natural resources. Thus, the current mandate for Dinageca is to design and build a modern, efficient, cross-sectoral and transparent Land Information Management System for: Internal land administration and land management responsibilities within the national directorate and its provincial offices by cross-checking and validating all land rights registration applications; Inter- and intra-governmental land and other natural resources administration and management through cross-checking and validating all concessions (land, forestry and wildlife, water resources, mineral resources, etc.); Inter- and intra-governmental natural resources planning and management activities; Provision of a consistent database of land and other natural resources utilization for all users (SADC SDI, 2004). Dinageca has successfully lobbied the government to develop an integrated system so as to achieve sound decision-making on the utilisation of natural resources. In Mozambique, approval for developing a NSDI was obtained from the office of the Prime Minister and the President. Natural disasters such as floods had a positive role in SDI development in Mozambique. Following the floods in 2002, there was greater realisation of the role of spatial information in disaster rescue and recovery operations.

3.2.3 South Africa

South Africa has made great strides in the development of a formal spatial data infrastructure following a 1999 cabinet mandate for the establishment of a legal SDI framework. As a result of these concerted efforts, the South Africa spatial information Act was promulgated in 2003 to facilitate the establishment of a formal spatial data infrastructure in the country. Participants learned about the important role that the spatial information Act has for a structured and regularized development of SDI programs in South Africa. To get an insight of their latest news, the spatial data discovery facility, metadata services, standards, the spatial information act and related policies, visit their website www.nsif.org.za (Mavima *et al*, 2004). Clearly there is much to be learnt from South Africa's SDI model.

3.3 The need for Communication Plans

One of the themes of the Pretoria workshop was the need for national communication plans on SDI issues. This theme proved to be the most important of all. Participants learned that without effective communication strategies, SDI couldn't take on a life of its own; which is eventually what we all aim to achieve. Through this theme participants learned and shared experiences on what it takes to sell SDI and how to develop effective communication skills and strategies in this regard. The theme also provided a forum for participants to develop their own communication plans. There was need to link SDI initiatives to key national

initiatives (such as land reform, HIV/AIDS). Political leaders and ordinary citizens want to see the benefits of SDI and not the abstract concepts.

4. WAY FORWARD

Different countries are at different stages of formulating appropriate policies and institutional frameworks that should facilitate co-operation amongst SDI stakeholders. Experiences and lessons abound, but the challenge faced by SDI champions in Zimbabwe is to adopt and adapt these experiences and lessons to meet the needs of the Zimbabwean situation. As a result, the second national SDI workshop was held at Jameson Hotel, Harare in November 2004 under the theme '*making SDI everyone's business in Zimbabwe*'. The aim of the workshop was to come up with ways of how to make SDI everyone's business in the country. The recommendations are summarised henceforth. The workshop was funded using part of the GSDI Small Fund Grants.

4.1 Making SDI everyone's business in Zimbabwe

The greatest challenge is to raise awareness of SDI issues in Zimbabwe. The few technocrats in the GIS industry have a sound idea of what it takes to establish a sustainable spatial data infrastructure. However, the problem lies among the high-level government decision-makers who have the final say in the disbursement of funds to sustain national initiatives. Before embarking on the awareness drive, there is need to clearly spell out the targets of the SDI development. Of great concern was the lack of interest shown by the print and electronic media on covering issues pertaining to SDI issues. There was no coverage of the second national SDI workshop. It was noted that although invitation had been extended to national newspaper groups (Herald, Financial Gazette and Standard) and the electronic media, none of them had turned up. It was further suggested that the chairman of the steering Committee should go on air on one of the national radio stations to articulate the position of ZSDI.

The ZSDI steering committee should take out a thorough inventory of the relevant SDI decision-makers who will help the establishment of formal SDI framework. The Steering Committee should take for a more aggressive approach such as visiting some of the high-level decision-makers at their respective places. The executive has to identify these decision-makers and incorporate the relevant members into the steering committee. Since the ZSDI steering committee holds monthly meetings, it was recommended that hosts for these monthly meetings should invite high-level personnel to attend. This will add more weight to the initiative and help raise the awareness in high-level management circles of most organisations. Once the relevant high-level stakeholders are identified, the Steering Committee should hold a national workshop with Directors of stakeholder groups and/or with the Permanent Secretaries in the relevant ministries. This is meant to foster high-level participation in ZSDI issues. At the moment, the SDI initiatives are restricted to technocrats. On a national workshop of this nature, there is need to develop a prototype ('proof of concept application') to show the high-level decision makers.

4.2 Sustaining ZSDI activities

The achievement of the ZSDI targets requires a formal way of governing and coordinating the initiative. Currently, the ZSDI initiative is being championed by a group of volunteers, with no formal institutional arrangements in place. The Department of the Surveyor-General (DSG) as the national mapping organisation (NMO) and a major custodian of spatial data in Zimbabwe is a key stakeholder who should take a leading role in the coordination of ZSDI initiatives. Concerted efforts should be made to enlighten high-level officials in this department about the need for a formal SDI as a vehicle for sustainable development in Zimbabwe. In this regard it is recommended that the DSG should approach the Research Council of Zimbabwe (RCZ) for the development of SDI policy. The Research Council of Zimbabwe (RCZ) is currently involved in developing a national Information and Communications Technology (ICT) policy. It is possible to dovetail SDI policies into the national ICT policy. This is the way Swaziland has moved in seeking high-level support. The RCZ had a GIS and Remote Sensing committee that died a natural death which could be revived for the purposes of pursuing the ZSDI initiatives.

Various funding mechanisms have been mooted to finance the ZSDI initiatives. These range from setting up of a fund-raising committee, the introduction of subscriptions and seeking donors to fund the activities. Training programs should be cost-recovery with the proceeds going towards financing the ZSDI activities. The initiative has benefited twice from the GSDI Small Funds grants programme. The funds have been used to hold two national workshops, the Bulawayo outreach as well as running a metadata and clearinghouse training course. This paper (presented at the FIG Working Week 2005 and GSDI-8 international conference) is part of the ZSDI steering committee's efforts to gain international recognition for the establishment of a formal SDI in Zimbabwe. The recent announcement of a two billion Zimbabwe dollar capacity building facility for the land surveying sector by the Governor of the Reserve Bank of Zimbabwe should open another avenue for funding the ZSDI initiative. This facility is an indicator that some high-level government officials are beginning to realise that spatial information is vital for sustainable development.

4.3 ZSDI identity

The ZSDI Steering Committee has embarked on creating a corporate identity so that it can market SDI issues in the country. The Committee has so far developed a brochure and an accompanying logo (Figure 1 below). As part of the 'proof of concept application', the Steering Committee has initiated the development of a website and metadata service searchable index application. The development of this service has started and a keen student from the University of Zimbabwe has approached chairman of the Steering Committee. The research project will also address the question of which metadata standards to use (either ISO and FGDC). If the project adopts ISO metadata standards then an investigation into the relevant software to translate FGDC-based metadata records into ISO standard records need to be carried out.



Figure 1 ZSDI logo

5 CONCLUSIONS

Before the SDI practitioners can convince high-level government people about the need to develop spatial data policies, establish SDI coordinating bodies or the adoption of a legal SDI framework, there is need to dovetail SDI initiatives to social, political and economic objectives. Through the SADC SDI workshop (Pretoria, South Africa 2004) all participants have appreciated the need to link SDI to key national and regional policy initiatives and legal instruments such as the Land Policy, Land Act, Poverty Reduction Strategies, HIV/AIDS, and Land Reform etc. This is a key strategy in justifying SDI and getting governments and civil organizations to adopt SDI as a platform for developing information resources and enhancing capacity to use information for knowledge based policy development, Planning, monitoring and decision making. National and regional governments and institutions should assign as much importance to information infrastructures as they assign to communications and road infrastructure. Emphasis must be put on selling SDI (transparently) as essential to the success of all national development programs and SDI must be budgeted for through other national development initiatives. Zimbabwe should adopt a deliberate policy to develop and strengthen national, regional and international links as a strategy for developing technical and financial capacity for SDI development.

In the words of George Tandoki who works for UN/OCHA “to succeed we should ‘*Communicate SDI in Tangible Forms*’ not ‘*Abstract Forms*’. The creation of a ‘proof of concept application’ can be used to gain and continue political support whilst feeding into the formulation of NSDI policy and strategy. Hopefully, it will not take as long as it has taken us to move from “Pharaohs to Geoinformatics” for the high-level public and private sector decision-makers in Zimbabwe to realise the importance of a formal spatial data infrastructure as a means of sustainable development in the country.

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BIOGRAPHICAL NOTES

Charles Paradzayi, is currently lecturing GIS, Surveying and Computer Application modules at the Midlands State University in Zimbabwe. He holds an MSc (Engineering) Geomatics degree with the University of Cape Town in South Africa. He is currently the deputy chairperson of the Zimbabwe Spatial Data Infrastructure (ZSDI) Steering Committee, a group of volunteers who are advocating for the establishment of a formal spatial data infrastructure in Zimbabwe. He is a member of the Survey Institute of Zimbabwe (SIZ) where he is the GIS discipline representative.

CONTACTS

Mr. Charles Paradzayi
Department of Surveying and Geomatics
Midlands State University
P. Bag 9055
Gweru
ZIMBABWE
Tel. + 263 11 401 756
Fax + 263 54 60311
Email: cparadzayi@yahoo.com or paradzayisdi@yahoo.com