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THE GLOBAL SPATIAL DATA INFRASTRUCTURE AND EMERGING
NATIONS-CHALLENGES AND OPPORTUNITIES FOR GLOBAL
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THE GLOBAL SPATIAL DATA INFRASTRUCTURE AND EMERGING NATIONS – CHALLENGES AND OPPORTUNITIES FOR GLOBAL COOPERATION

by

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INTRODUCTION

Good public decision-making and development planning is dependent on relevant spatial information. Should this spatial information not be readily available in an accessible form then it cannot be expected that good public decisions are made or that development projects are properly planned and executed. It has been reported that one of the main reasons why development projects fail is the lack of information appropriate for that project.

In most of the developed countries it is widely acknowledged that spatial information is part of the national infrastructure and extensive effort and resources are being expended on this. The same cannot be said for developing countries. Although this is changing. Developing countries are starting to establish digital spatial databases – largely with the assistance of foreign donor aid. These national initiatives are going beyond just establishing databases for specific projects but towards harnessing the information resources of all government departments and agencies. This new direction is geared to minimise duplication of effort and data between agencies. This requires national policies and infrastructures. There is no doubt that spatial information at the national level should be the priority of all countries.

Many issues, such as atmospheric pollution, global warming and water catchment management, do not know national boundaries and transcend the national interest. These global issues require spatial information at the regional and global level. To make decisions on global issues requires spatial information appropriate for these purposes. This information must be shared and integrated across national boundaries. The requirement for this then is a global spatial data infrastructure.

“... The policies, organisational remits, data, technologies, standards, delivery mechanisms, and financial and human resources necessary to ensure that those working at the global and regional scale are not impeded in meeting their objectives...”

CHALLENGES FOR GSDI

To date there have been four meetings of the GSDI. The concept of the GSDI started to be formulated at the first conference of GSDI held in September 1996. This was taken a step further at the conference in North Carolina in November 1997 where specific questions were asked as what GSDI was and what was the way forward. The GSDI Steering Committee and its Working Groups that were formed started to find good direction and this was reflected in the more directed conference held in Canberra in November 1998. GSDI started to take shape and significant progress was recorded at the latest conference held in Cape Town in March 2000. So much so that GSDI is no longer just a concept but something tangible which people are coming to take on board. An example of this is the GSDI Cookbook (implementation guide) produced by the Technical Working Group.

Many challenging issues still face the GSDI before it becomes a reality globally (Holland, 1999):

- “Raising the level of awareness, acceptance and support. The GSDI concept is not widely known, let alone well accepted and supported. Given the requirement for a broad group of stakeholder interests to be satisfied this presents a significant communication challenge. Perhaps the most important task at this present juncture is to gain the support of the senior-most members of government, non-government, business and community groups, and in doing so influence legislative, policy and financial decisions that are critical to effective GSDI implementation.
- Recognising and complementing related initiatives. The GSDI is but one of many global, regional and national initiatives aimed at improving access to geographic information. It is essential that these initiatives are identified, recognised and appropriately supported so that the maximum synergy can be obtained from their collective outcomes. This requires a continuous scan of the external environment and effective communication networks amongst those involved.
- Including all stakeholders. For the GSDI to be seen to be truly successful by its stakeholders they must be appropriately involved in, and contribute to its design and realisation. Given the breadth of the GSDI stakeholder group – government and non-government organisations, education and research institutions, the commercial sector, and the general community – it is not surprising that many, if not a majority of stakeholders are not yet included.
- Engaging the less developed economies of the world. Much of the thought, discussion and effort thus far in defining and implementing the GSDI has been from

CHALLENGES FACING DEVELOPING COUNTRIES

The issues raised here are based on experiences in African countries, but may well apply to most developing countries.

An analysis of the challenges facing developing countries in establishing a NSDI can be based on the definition of the GSDI (see above), that is, in terms of the policies, organisational remits, data, technologies, standards, delivery mechanisms, and financial and human resources. These are discussed below, but it must be noted that not all of the issues apply to all countries, or, the issues are found to be present at differing levels across countries.

Policies

A discussion of policies includes the political environment of the country. The political situation in many African countries is characterised by power cliques where strong central control is exercised. There is also a focus on remaining in power. This results in political priorities strongly influencing the budgetary allocations with programmes that win votes at the next election receiving the biggest slice of the cake. Programmes such as spatial data collection and SDI are not regarded as being politically important. The result is that national mapping programmes (and SDI) are generally under funded.

Due to lack of importance afforded to national mapping and SDI there is generally a lack of policy on these issues. In a number of countries the military are an important player and have influenced policies on data collection and dissemination to the extent that such data is regarded as classified information.

Organisational Remits

The national mapping organisation is traditional regarded as the organisation responsible for the collection and maintenance of spatial information, through the traditional mapping programmes, and it is taken for granted that this organisation will be responsible for the NSDI. This could be a valid argument. However, many national mapping organisations in these countries are ill-equipped to take the lead role in establishing the NSDI. The reasons for this include the fact that many of them are old establishments, positioned in central government and are steeped in tradition. The implications of this are that these organisations are structured in the old style civil service with strong bureaucracy and are very slow to change. The organisations are structured for the production of 'paper' maps and have not modernised their procedures. Usually these organisations are also responsible for the cadastral survey of the country, which often enjoys a higher priority.

Where a country is involved in NSDI activity it is often found that the national mapping organisation has modernised and restructured to take advantage of the opportunities of the information technologies.

Financial and Human Resources

The problems of securing adequate funding for national mapping programmes and NSDI establishment have been discussed above.

Human resources capable of making a difference for a country in its SDI activities are a major challenge. The local tertiary academic institutions often are unable to provide the people with required technological skills. These people then have to be educated and trained in developed countries – at great cost. The numbers that can be educated in this way are limited. To further complicate the situation, many of these people do not return to their home country because of better employment opportunities elsewhere.

The building of capacity within the appropriate organisations is the highest priority. Without the resources to undertake the work of developing policies, standards and organisational arrangements as well as sustainable data collection, the developing countries will not make any progress in establishing a NSDI. This in turn will retard the establishment of a GSDI for the good of all humans and the environment.

OPPORTUNITIES FOR GLOBAL COOPERATION

The benefits of GSDI will not materialise without the completion of the NSDI's or regional SDI's around the globe. The efforts of all those concerned about the need for global spatial datasets will come to naught unless something is done to resolve the outstanding issues and find solutions to the challenges. How then can GSDI foster global cooperation to bring about its own life?

Considering the above challenges strategies must be developed:

- ❖ An awareness campaign must be conducted to inform politicians, decision-makers and other stakeholders of the need for SDI as part of the country's national asset. The GSDI Steering Committee has embarked on an awareness campaign to raise the profile of GSDI as well as commencing with the development of an outreach program. It has also commenced with a business case study, which will be used as a benchmark.
- ❖ The regular conferences as well as the web-site and e-mail discussion list provide for regular contact between the leaders in this field with colleagues from other countries. These fora provide opportunities to share ideas, experiences and provide for informal assistance. Participants from developing countries can learn of the pitfalls their colleagues went through and in that way learn to avoid them. This provides developing countries with the opportunity to leapfrog into the future. Surprisingly, these fora also provide an opportunity for fellow countrymen to meet on 'neutral ground' and to work out their supposed differences.
- ❖ Regional initiatives, such as the UN Regional Cartographic Conference for Asia and Pacific, the Permanent Committee on GIS Infrastructure for Asia and Pacific, the newly formed Permanent Committee for GIS for the Americas and the Committee on Development Information (Africa), provide for countries in those areas to participate

CONCLUSION

Developing countries are being challenged in particular to join the global community in furthering the needs for spatial information. The place to start is at 'home' with the development of a national spatial data infrastructure and then to extend this to the regional and global levels. Efforts towards a NSDI should be in conformance with the guidelines of the GSDI, thereby ensuring the later global connection.

Establishing a NSDI or regional SDI in developing countries will not be an easy task, as can be seen from the challenges that face such countries. However, developing countries can also learn a lot from the experiences of other countries through participating in the GSDI. They can also be assured of the support that the GSDI community is willing to provide them with. This will benefit them in setting up their own NSDI's and through this fostering the efforts to achieve the GSDI.

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Further information on GSDI can be obtained from the Internet web-site at [//www.gsdi.org/](http://www.gsdi.org/).

in a regional context. Many countries can only afford to travel within their own region. These regional initiatives also concentrate on regional issues, which are more applicable to the countries of that region.

- ❖ The GSDI Steering Committee is following a strategy of inclusivity by participating in associated global efforts, such as Global Map, and in this way is promoting stronger global cooperation. Through this approach many more stakeholders are becoming involved. Assistance is also being provided to developing countries in these projects.
- ❖ The GSDI Cookbook is a significant contribution to the establishment of SDI's. Developing countries can use this document to learn from the wealth of knowledge and experience in SDI's at virtually no cost. This strategy can also be regarded as capacity building and accelerating the establishment of NSDI's.
- ❖ Capacity building is a high priority and must support the development of individuals and of organisations. NSDI's and GSDI requires that individuals are put in place to champion the cause of SDI and to re-engineer bureaucratic organisations to make them functional in modern day. International exchanges of personnel can take place through cooperative projects. Donor agencies should be canvassed to ensure that all projects include a significant component on building capacity – individual and institutional. They must take on the responsibility of ensuring that the work is continued in a sustainable way by the local organisations when the donor project is complete.
- ❖ The GSDI can assist in providing the required critical mass that is required to make progress with SDI's. The organisations establishing a NSDI can rely on this for support in convincing their political masters of the advantages of a NSDI. This is also part of the outreach strategy.
- ❖ The GSDI Steering Committee has accepted a proposal to establish a permanent secretariat. The Federal Geographic Data Committee (FGDC) of the USA has offered to sponsor the initial secretariat. The FGDC is proposing that the secretariat comprises of nationals from any country that would work from Reston, USA. This is a golden opportunity for a person from a developing country to obtain high exposure in this environment.
- ❖ A strategy is being followed to engage with the United Nations for recognition of GSDI. By working closely with the UN will influence the politicians of developing countries to support the establishment of a NSDI. Such engagement will be extended to the World Bank and other donor agencies. The objective is to influence these agencies to insist on conformance to national data standards when ever a project takes place.
- ❖ Support to the ISO/TC211 and OpenGIS initiatives in establishing standards are fully supported. This work has brought together many people from different countries. The establishment of internationally recognised standards will go a long way in support of GSDI.

Politicians and senior management of government organisations lack awareness of the value of spatial information and importance of a NSDI. Commitment by these decision-makers has a serious implication on the needs of the national mapping organisation or other organisation responsible for the NSDI for appropriate structures, policies and resources.

Data

Inter-agency cooperation in developing countries is a rare characteristic. The various organisations are protective of their power bases and there is a lack of willingness to share data. The result is that duplication of data collection and effort takes place. Also silos of data exist, many of which are difficult to be found. Datasets are independent of each other making data integration a non-starter.

Much of the data that does exist was either collected by the colonial powers prior to independence or by foreign donor agencies. In the former case, the data is out of date and has never been updated. Data collected by donor agencies was often project oriented. The donor agency came into the country, with their own personnel and equipment, completed the project and then withdrew. In many projects this data was not regarded as a valuable resource, but only the means required to undertake a project. The data left behind may have been used for a short period of time but more often than not could not be used because of a lack of capacity. The long benefit to this data was soon lost. As the proverb goes "If you give a man a fish, you feed him for a day. If you teach him how to fish, to feed him for life". In recent times this situation has improved with new approaches being taken by donor agencies.

Technologies

The evidence of information and communication technologies (ICT) in developing countries is low. These technologies may be available in the main centres but once you move into more rural areas they do not exist. In many countries electricity is only available in the cities and main towns, and then in these places power cuts are a daily occurrence. NSDI and ultimately GSDI hinges on the availability of ICT.

Hardware and software must be imported at great cost, considering the low value of the local currency. Maintenance facilities within these countries is rare with equipment standing for long periods awaiting repair or having to be shipped to another country for repairs.

Standards

Without inter-agency cooperation, support for applicable policies, lack of resources and out-dated data, it is not surprising that standards are non-existent in most developing countries. Standards consume scarce resources which can be better used elsewhere. The result is data of dubious or unknown quality. Many donor agencies exacerbate the problem by not insisting on the adherence to recognised standards.

the perspective of the more developed economies of the world - Europe, North America, parts of Asia and Australasia. Most of the globe – generally the less developed economies of Africa, Asia, the Middle East and Oceania – has played only a minor role, if any role at all. If the GSDI is to be a truly global initiative and confer its benefits to all global citizens then a way must be found to bring these nations on-board.

- Maintaining enthusiasm and momentum . Having made the previous point it would be unfair and misleading not to recognise the many individuals and groups who have contributed to the GSDI thus far. This enthusiastic and committed global group must be encouraged to expand their efforts and bring others on-board, thus increasing the momentum of the GSDI initiative.
- Delivering beneficial outcomes. The final, and arguably the most important, issues of all to be addressed is ensuring that the GSDI delivers benefits that can be described and measured in some way, and are regarded as important by the relevant stakeholder group. If this does not occur for some time, or not at all. Then the significant effort involved in realising the GSDI will be questioned and potentially compromised.”

THE POSITION OF DEVELOPING NATIONS

A global survey on the status of spatial data infrastructure activities, conducted by Harlan Onsrud in 1998 and updated in 1999 on behalf of the GSDI Steering Committee, received responses from seven emerging (developing) nations (Onsrud, 2000). While it could be questioned whether all developing nations that have established or are well advanced in establishing a national spatial data infrastructure (NSDI), responded it none the less shows a very low involvement in NSDI activities in developing countries. A survey conducted of most African countries more recently received a response from 14 countries (Interim Africa SDI Task Team, 2000). This survey showed that six African countries are actively engaged in NSDI activities. There are also three regional SDI activities in evidence. The fact that 14 African countries were represented at the 4th GSDI Conference was a very encouraging sign of the interest being shown in SDI activities.

The ultimate success of GSDI rests on the successful establishment of NSDI's and regional SDI's. To be truly global means to have global involvement. It will be unreasonable to expect every country to have a NSDI which can be aligned with GSDI, but in such cases it is hoped that a regional SDI will then fulfill the role of the NSDI.

As stated above, one of the challenges facing GSDI is to involve the developing countries in GSDI. This will by no means be an easy task considering the varying requirements of developing countries. It will be necessary to gain an understanding of the challenges being faced by these countries and then to develop strategies to address these.

GLOBAL SPATIAL DATA INFRASTRUCTURE

The Global Spatial Data Infrastructure (GSDI) was conceived only in recent years although the concept has been around for a lot longer.

“... By the early 1980's, the notion of 'information as a corporate resource' ... and the information resources management movement encouraged individual organisations to implement collective approaches to the collection, management and sharing of designated hardcopy and computer-based data holdings of 'corporate-wide' interest ...

... The manifestation of these data sharing precepts evolved from early dreams of centralised 'land information databanks' through the 1960's and 1970's ... into the vision of more complex distributed land information networks in the 1980's. This vision conveyed the idea of linking together organisations responsible for the management of land-related information in a jurisdiction into a network to form a 'virtual' geographic information system which could be queried in a manner similar to a single database ...

... critical mass has now been reached in a number of more recent enterprise – or jurisdiction-wide efforts. At least five important reasons account for this acceleration ... Increasing prominence of spatial data handling within organisations ... robust, easy-to-be-use and relatively inexpensive tools ... ubiquitous data ... ubiquitous communications ... greater availability of experienced people ... ubiquitous and expensive positioning, tracking and navigation capabilities of GPS ...

... By the early 1990's, the concept of spatial data infrastructure (SDI) development was being proposed in support of accelerating geographic information exchange standards efforts, selected national mapping programs and the establishment of nation-wide spatial information networks in the United States ... the United Kingdom ... Canada ... and the European Community...

... Finally, the Santa Barbara Statement prepared from the Interregional Seminar on Global Mapping for Implementation of Multi-National Environmental Agreements (held Santa Barbara, California, USA, in November 1996) made a strong plea for the accelerated collection, promotion and use the output from national and global mapping programs and the coordinated development of a global spatial data infrastructure ...” (Coleman and McLaughlin, 1997).

The GSDI has been as envisaged to encompass the broad policy, organisational, technical and financial arrangements needed to support ready global access to geographic information. The definition of the GSDI adopted at the 2nd GSDI Conference is (GSDI 1997):

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