

GLOBAL SPATIAL INFORMATION ISSUES AND CHALLENGES AND OPPORTUNITIES FOR DEVELOPING NATIONS

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INTRODUCTION

As much as 80% of public decisions are spatially based therefore 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. There are a number of global initiatives that are addressing the need for looking beyond national boundaries to address the global need for integrated, easily accessible spatial information, namely the International Cartographic Association, the International Standards Organisation (ISO) Technical Committee 211 (Geographic Information), the Global Map Project, and Global Spatial Data Infrastructure. The latter two may not be well known and are discussed in more detail.

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 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);

“... 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...”

GLOBAL MAP

At the 1992 United Nations Conference on Environment and Development, held in Rio de Janeiro, it was recognised that there was a lack of comprehensive datasets at the global scale and a call was made for accessible and harmonious datasets to be prepared covering the Earth. In response to this the concept of a global map was developed by the Geographical Institute of Japan. The idea was to develop a global database consisting of framework spatial data of known quality, with consistent specifications, be considered a common asset of mankind, which will be accessible to the public and distributed at marginal cost (Nonomura, 1994; www1.gsi-mc.go.jp/iscgm-sec). The framework data was considered to consist of elevation, vegetation, land use/land cover, drainage, transportation, and administrative boundaries.

The outcome of this initiative is the Global Map Project. The Global Map Project is being lead by the International Steering Committee for Global Map. All countries are invited to participate in this project. This project has made good progress with the first version of Global Map in production and planning for phase 2 is progressing well.

COMPETING GLOBAL INITIATIVES?

Are the various global initiatives competing initiatives? In some respects the answer could be “Yes” while in others the answer must surely be “No”.

The work of the International Cartographic Association (ICA), through its Commission on Spatial Data Standards, is doing work similar to that of ISO/TC211. The ICA’s work precedes that of ISO/TC211 and it could be argued that its work has been a stimulus for ISO/TC211. The ICA is a Class A Liaison member of ISO/TC211 and is collaborating through having a number of common members. The two organisations are very different in their *raison d’être* but can undoubtedly work closer together to avoid obvious duplication.

Both Global Map and GSDI require international standards for spatial data and are largely reliant on the standards being developed by ISO/TC211. GSDI has recently obtained Class A Liaison membership of ISO/TC211. There is therefore no conflict between these initiatives.

GSDI and Global Map are not competing initiatives. The reason for this is that the two initiatives have different objectives.

Primarily, GSDI is concerned with the broad policy, organisational, technical and financial arrangements needed to support ready global access to geographic (spatial)

information. The emphasis is at the organisational level and the accessibility of geographic information. GSDI is dependent on national and regional spatial data infrastructures. The accumulation of datasets is not the objective of GSDI. GSDI should be applicable to any dataset deemed to be of interest at the regional and global levels (at least). The lack of datasets within GSDI is making it difficult to demonstrate the usefulness of GSDI. This could detract from its widespread acceptance, particularly at top government and corporate levels. Current participation in GSDI has seen an interest being shown from a range of institutions but mainly those from national mapping organisations, academia and organisations involved in national, or sub-national, spatial data infrastructure development. GSDI has also been developing relationships with regional and international bodies.

Global Map has as its main objective the provision of a consistent combination of framework datasets at the global level which will contribute to a better understanding of global environmental changes. Furthermore, these datasets must be available to scientists and others at marginal cost. To provide a consistent datasets implies that Global Map must have a set of specifications and standards. Involvement in the Global Map Project has largely been targeted at national mapping organisations. The first version of Global Map has recently been completed and a number of products from this have already been demonstrated. In this respect Global Map has an advantage over GSDI.

From the above it can be seen that there is no conflict of interest between GSDI and Global Map. Each one has a role to play in their own right. More importantly, it is contented that the two initiatives complement each other. GSDI is focusing on the infrastructure while Global Map is focusing on the datasets. The products of Global Map can be used to the advantage of GSDI to demonstrate the case for GSDI. The synergy between the two has previously been mooted by Kline, Estes and Foresman (2000). As these authors state, the success of this synergy will depend on communication, cooperation, coordination and collaboration (the “C⁴ challenge”) between the two initiatives. There is already evidence of this synergy. The ISCGM and GSDI Steering Committee have been holding meetings back-to-back with each other and the two steering committees have a number of members that are common to both. Should this persist then it can only augur well for future synergy.

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 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 in 2000 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 establishment of permanent committees for spatial information in the Asia/Pacific region (PCGIAP) and more recently for the Americas (PC-IDEA) has stimulated the interest in and development of spatial data infrastructures at the national and regional level. These permanent committees are assisting development of spatial data infrastructures in the developing countries, mainly by sharing of expertise and experiences.

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.

The position with Global Map is more encouraging with about 40 developing countries participating (approximately 16 African countries). Possible reasons for the improved situation are that Global Map is better established than GSDI and the support that is being provided by Japan, particularly in the training for Global Map. For the success of Global Map it does require a far greater participation. It will not be possible to obtain certain information and to undertake ground truthing without full participation.

As stated above, one of the challenges facing GSDI and Global Map is to involve the developing countries in these initiatives. 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.

CHALLENGES FACING DEVELOPING COUNTRIES

Developing countries have limited resources and skilled personnel and face numerous challenges to participate in global initiatives such as GSDI and Global Map. The issues raised here are based on experiences in African countries, but may well apply to most developing countries. 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. Funding is also not available for travel to attend meetings and conferences. This makes it difficult for these countries to participate at the necessary levels in global initiatives. This fact is compounded by the international expectation for these countries to participate in a number of different initiatives. Such participation often requires travel to a number of meetings and/or conferences each year.

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. This goes against the very essence of both GSDI and Global Map which are attempting to make spatial information accessible and easily available.

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.

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. Compliance to standards between organisations is seldom evident, although this situation is improving.

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 agencies 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 term 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, you feed him for life”. In recent times this situation has improved with new approaches being taken by donor agencies.

The Global Map has its own specific specifications which many countries are finding difficult to comply with, even if they do have the data available. The requirement for data to be structured in coverages (Arc/Info) is problematic for those who do not use Arc/Info. The expertise and costs to convert the data is beyond some countries.

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.

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 nor to contribute to the Global Map. 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 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.

- ❖ 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. They must take on the responsibility of ensuring the sustainability of the project by 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.
- ❖ 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.

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.

Developing countries must also accept their contribution to the global environment. They are affected by and contribute to global problems. Participation by developing countries in global initiatives, such as Global Map, is necessary the security of future generations.

The international community, particularly the developed countries, must have an appreciation of the situation of developing countries and help them to overcome the problems being encountered. It will not be in any ones interest for developing countries to be marginalised.

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

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