Towards a National Geographic Information Infrastructure: Overcoming Impediments to the Development of SDI in Nepal

Raja Ram CHHATKULI and Durgendra Man KAYASTHA, Nepal

SUMMARY

The importance of geographic information system as an information base for planning and spatial analysis has been recognized in the national plan documents in Nepal since long. Many organizations use GIS, and there are many qualified and trained GIS professionals in the country. GIS is highlighted prominently in many University level education and other professional training courses. There is a distinct government programme dedicated to the development of a geographic information infrastructure in the country. Fundamental spatial database is existing and available to the users. But experience has shown that many enterprise GISes have emerged and failed. Development of spatial data infrastructure in the country is not taking the full direction as desired. In this paper obstacles to the harmonization of SDIs in Nepal are analyzed and the importance of a policy framework for the institutionalization of the National Geographic Information Infrastructure is emphasized.

Several past national five-year plan documents have been studied to look into the national focus on GII. Status of few prominent GIS projects has been analyzed to look in to the goals, objectives, functioning and their sustainability. The curriculum and content of few University level education and vendor level training courses have been explored. It has been found that there is a prominent disparity between the national focus on GII and how GIS projects are functioning. In many cases sustainability strategy are missing. GIS education is directed with more focus on GIS as a tool rather that as a system or an information infrastructure.

In conclusion, it was found that the GIS projects have failed because they were not designed as part of a greater GII initiative. Importance of a National Geoinformation Policy has been felt and the progress in its realization is highlighted.

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1. INTRODUCTION

Data on specific aspects of geography are customarily maintained by specialist agency. In order to facilitate the need of such data by other agencies for their own purposes, require development of a system where in data of any kind may be shared transparently and meaningfully. In order for making this a success, several factors need considerations such as data quality, data standards, access mechanism, maintenance etc. It is in this context that a geographic information infrastructure needs creation and maintenance. Successful placement of full functioning geographic information infrastructure is contingent upon the national policy concerning data creation and sharing (Kayastha 2003).

2. SDI INITIATIVES

2.1 GIS Activities

The 1990s witnessed the sporadic GIS activities in Nepal. Perhaps, it was the unprecedented growth of information technology (IT) worldwide and its gradual adoption in Nepal that the agencies were drawn into the GIS activities. The activities however, were primarily focused on digital conversion of maps, without sufficient understanding of the whole range of utilities geo-spatial data in digital form could offer. As a result, island of geo-spatial databases were built in the country. Digital topographic database developed by Survey Department, database developed by Local Governance Project (LGP) and Participatory District Development Project (PDDP) are the major outcomes of these efforts. Besides, there were other smaller databases created for their own specific purposes (Budhathoki & Chhatkuli 2003). Data and systems thus created were not desgined to ensure smooth data sharing but primarily to respond to specific needs of the host organization. Moreover, they are not interoperable and portable in many a cases.

Beginning in the late 1990s, discussions on the need of a comprehensive IT policy for Nepal were embarked- national information technology development committee was constituted, IT policy sub-committee was formed and subsequently, His Majesty' Government of Nepal approved Information Technology Policy 2000 in October that year (NPC 2001). This period also witnessed the initiation and a growth of GIS activities in Nepal. During the Eighth Plan (1992-1997) period many sporadic creation of spatial databases and mushrooming of isolated islands of GI systems were witnessed. Most of these systems started from the independent digitization of sometimes the then existing out of date one-inch to one-mile topographic maps of the area of interest. Lots of resources were duplicated in these (out of date) efforts. The Ninth Plan (1997-2002) focuses on the use of geographic information and spatial data with mention of the importance of GIS in many occasions. The base paper of Tenth Plan (2002-

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2007) for the first time mentions the importance of a geographic information infrastructure. One of the key sectoral policies and strategies outlined in the Tenth Plan states the development of a national geographic information system for the easy access and dissemination of geographic information. In the year 2002, His Majesty's Government of Nepal initiated the National Geographic Information Infrastructure (NGII) programme with one of the pronounced objectives of avoiding duplication in spatial data creation and usage through the networking of different GI Systems in the country. NGII is the spatial data infrastructure (SDI) initiative in the country at the national level. The comprehensive definition of GII is synonymous with the GSDI definition of SDI which is noted as the relevant base collections of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data, that provide a basis for spatial data discovery, evaluation, and application for users and providers within all levels of the government, the commercial sector, the non-profit sector, academia and citizens in general.

A survey of 1992 showed that out of the 41 geographical maps and information handling agencies approached only 5 responded that they were using GIS/ RS. This had already reached 27 by 1999. It is estimated that the users have grown manifold by now although a comprehensive list is not available. However since the sale of spatial data by Survey Department during the last half-year of 2004 alone was worth 3.6 Million Rupees, it can fairly be concluded that many users do use GIS/ RS.

2.2 NGII Programme

Against this background, in the year 2002, His Majesty's Government of Nepal initiated the National Geographic Information Infrastructure (NGII) Programme with one of the pronounced objectives of avoiding duplication in spatial data creation and usage through the networking of different GI systems in the country. NGII is the spatial data infrastructure (SDI) initiative in the country at the national level (Chhatkuli 2004). The programme was initiated with an overall objective developing a National Geographic Information Infrastructure in the country to strengthen the planning and resource management. Initially, the programme aimed to develop a platform to facilitate data sharing among the Central Bureau of Statistics (CBS), Survey Department (DOSM) and four other participating ministries at the center and 33 CBS Branch statistical offices at the districts. It also had a prominent objective of disseminating population and housing census 2001 results in hardcopy atlas, CD and web thereby providing opportunity to standardize, create and disseminate the spatial as well as socio-economic information as a test bed of GII. It is conceptualized that in course of time this will accommodate entire data production community in the country encompassing several other types of spatial and spatially related data.

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3. CAPACITY BUILDING

3.1 Education and Training

GIS capacity building within the country is achieved through education and training provided by the several universities and their colleges and the private sector training institutes. The popularity of GIS among many organizations coupled with the availability of softwares, several private institutions have started providing training. Majority of such trainings focuses primarily on the basic GIS functionality such as digitization of maps, creation of isolated database rather than GIS as a system. This gave rise to the notion that GIS is just a tool to manipulate large volume of spatial data. Nevertheless such activities have contributed towards greater awareness of the importance of GIS among the decision makers and planners. There has been a greater awareness in the GIS community for data sharing. That 35 out of 41 organizations surveyed in 1999 reported their interest in being involved in sharing of GIS/ RS information; and that one of the themes of the 10th Anniversary Day Seminar of the Nepal GIS Society (22 July 2004) was Inter-Agency Networking and Database Sharing which amply confirms this concern in the country.

Growth of GIS education was observed in the formal education sectors as well recently. Departments of some of the universities have included GIS/RS topics in their core course curriculum. In addition students are encouraged to use GIS technology during the course of their study. Since 2000, the Tribhuvan University has revised its curriculum for both bachelor and masters levels and also introduced GIS/RS technology in curriculum in many departments. This course at master's level of Geography is now offered at three departments of Tribhuvan University, namely Central Department of Geography, Geography Department at Prithvi Narayan Campus, and Geography Department at the Institute of Education. Two other Tribhuvan University campuses outside of the Kathmandu Valley including Dhankuta Campus and Mahendra Campus, Dang have initiated this course at the bachelor level in Geography. Other central departments such as Geology, Botany, Environmental Science and Rural Development have introduced GIS/RS course for master's level students. Tribhuvan University's other institutes such as Engineering, Forestry and Agriculture have also introduced GIS/RS curriculum. Unlike in Geography Department, the weightage to GIS/RS in other departments is rather low. Besides Tribhuvan University, other universities such as Kathmandu University and Purbanchal University and their affiliated institutes and colleges have adopted GIS/RS course in their academic programme (Pradhan 2003). Additionally many training institutes at the private sector like SeaGate Institute of Technology, Himalayan Institute of Technology, Advanced Engineering College do provide training courses in GIS/RS. A survey at the curriculum of these universities and private institutes show that there is more focus on introducing GIS/RS as tool of spatial data handling rather than GIS as an information system or an information infrastructure. The courses of private institutes are most often focused directly on use of different GIS software functionalities, while University courses as well do not provide adequate focus on issues like data standards and spatial data infrastructures.

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3.2 Databases

As has been mentioned elsewhere, geospatial data of different themes have been created to cater to their particular need without due regard to its usability in other situation or for that matter by any other organizations. Data, though created, differ in content and quality due to lack of agreed standards, such as differences in underlying coordinate systems, semantics, resolutions and quality among others, which hinders seamless integration (Kayastha 2003).

In addition to sporadic data creation, it was still difficult to obtain such data due to lack of information sharing mechanism. Data discovery is the major problem as yet apart from the cost incurred in procuring data from the custodians. Duplication of efforts are still seen even in the front of framework datasets, though Survey Department has been providing basic topographic data at some cost to the users almost transparently for several years now.

Recently Survey Department, through the National Geographic Information Infrastructure Programme (NGIIP) under the project "Population and Housing Census2001: Mapping Component" has integrated the socio economic data from CBS with the framework data of DOSM and produced a socio-economic atlas of the country based on the Census 2001 results. In addition the project has initiated activities through working groups to look into matters like data standards, pricing and copyrights, institutional aspects, data dissemination etc.

There are instances that an isolated system of GIS developed for a particular task did not last long due to several reasons, one of the prominent being lack of vision in developing such a system which do not think of itself as a part of a larger GII initiative.

3.3 Standards

Standards in terms of data and processes, application development are the integral part of the SDI initiatives. Standards facilitates seamless sharing of data and products, moreover, it enables smooth integration of disparate datasets. This in turn provides added thrust towards sharing of data among users at large. Though there are differing opinions that standards hinder free production and development of datasets which in essence defeats the infrastructure building but applying standards at later dates is more complicated that starting with a standard in place.

There are even instances of having different coding schemes for the administrative areas in data created by different institutions. Even the names of geographical locations differ due mainly to lack of standards in naming a place in roman though the names in vernacular remain the same. In such situation integrating datasets from the two require further mapping of codes, which is time consuming as well as not warranted in this age. There are transliteration rules adopted by the Survey Department while preparing topographical base maps. Again there are translation rule to map the transliterated names into plain roman as the former texts are not preferable to input in databases. Such standards are even not readily known to others outside the Survey Department.

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Similarly there are discrepancies in rendering spatial data for presentation in soft or hardcopy format among many institutions. These kinds of differences render difficulties in the meaningful integration of datasets.

Uniformity in models, datasets, and rendering are essentials to the success of enabling the reuse of valuable and important datasets. In general datasets should not be regarded in isolation at all, as its use can not be limited within the organization producing them.

3.4 Metadata and Clearinghouse

The tendency of most data producers is gradually changing towards sharing their datasets with others as otherwise before. This is a welcome change as no single data producer can produce useful datasets without integrating data from others e.g. all thematic datasets need topographic or at least administrative template to portray their data meaningfully. In addition any third party users might require datasets from different specialist agencies to obtain a meaningful solution to their problem. But the situation at present is that it is very difficult to find out whether data of a particular kind existed or not and if exited whether such data is useful for a particular application or not. The prospective user might then start creating datasets on its own, when such datasets might be actually in existence somewhere.

The clearinghouse concept might be the only answer to such a situation. Metadata of data from the producers be created and can be served to the users through a clearinghouse. Such an effort requires a consensus among the data producers in the first place to make available a well-documented metadata to the clearinghouse administrator. The problem would be there if some or the other organization do not prefer to participate. Such circumstances need intervention through well-developed policy guidelines.

4. POLICY

In the previous section the status of geographic information in the country and the capacity building initiatives were analyzed. There are many qualified and trained GIS professional in the country. Education and trainings are regularly conducted to introduce fresh brain in the foray. Specialist GIS professionals are continuously being produced through the university level education as well. Moreover, over the last decade there is added impetus from the government sectors. Several organizations including the national planning commission have used GIS for their regular activities. Survey Department is continuously striving for production of framework data in digital form and also trying to build upon the available resources towards development of a national level geosapatial data infrastructure in the country. Despite all these efforts the progress is not considered as satisfactory as can be expected.

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5. IMPEDIMENTS

Data alone does not make a GI infrastructure. In addition to the fundamental and other thematic geospatial datasets it consists among others the following (Kufoniyi 2004):
– Organizations and individuals who generates or use geospatial data;
– Technologies that facilitate acquisition, use and transfer of geospatial data;
– Geospatial data and infrastructure standards;
– Metadata, which enable coherent description of geospatial data and provide a disciplined vocabulary for intelligent geospatial search;
– Clearinghouse and data catalogue: discovery and access system that use metadata as the target for query on geospatial data.

Considering the state of affairs in the technological front compounded with the requirement of participation from many different agencies, the system will have to deal with the challenges of satisfying growing user demands, sustainability, and funding in addition to policy implementation encompassing the components listed above (Kayastha 2003).

Like many SDI initiatives, the approach undertaken in Nepal is rather a bottom-up approach, with an initiation for making the best use of already available resources: framing policies to accomodate already available data, technology and the instutional framework. It is more of a mending rather than a building approach. These are the challanges facing the NGII in Nepal, building a policy framework without losing too much of the existing developments.

Although the NGII in the present context in Nepal is still in the very initial stage of its development, there are several issues, which may need critical considerations. Some of the immediate issues may be listed as follows (Kayastha 2003):
– Coordinate system and projection or projection free
– Data resolution levels and format (image and or vector)
– Integration of framework data and other geo data
– On line GIS functionality
– Coordinating among stakeholders
– Legal amendments / reforms
– Copyright / Pricing
– E-commerce
– Quality management
– Proprietary software vs. freeware

Also balancing between the evolving technology and our own capicity of sustainability is an issue – we are not sure where it leads to? SDI developemnt is an expensive investment in terms of technolgy, human capacity and institutioanl coherence. A continued political, administrative and technological commitment is necessary. It is not always easy to maintain a policy continuity in a developing countries like Nepal after its first enunciation.

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6. THE EXPERIENCE

The NGII in Nepal is at a very infant stage and it has not received a full-fledged concentration yet - the primary objective of the efforts currently underway is the dissemination of the population and housing census 2001 results as a NGII node. Nevertheless, during this period, associated issues are being carefully looked at, which we believe will be of great significance during the upcoming phases in developing such an infrastructure at national level. An attempt is made to outline these experiences below (Budhathoki & Chhatkuli 2003):

– The assessment of the participating agencies reveals that most of the agencies do not have data in digital form. Even if digital data exists, they need significant amount of processing to bring them in sharable form. Since data development is generally time-taking and resource-consuming task, the NGII efforts should start developing data. Otherwise, we may come up with an infrastructure that will be severely underused.

– Agencies mostly private and non-governmental requiring relatively smaller volume of data are spending their resources in the development of data in isolated manner while the data could have already been in existence or when not currently existing could be developed in collaboration with others. Actions need to be directed towards avoiding such duplicated efforts.

– Only those users who have been users of traditional maps were considered as potential NGII stakeholders. However, new users with different information demands are coming up. Therefore, it is realized that efforts are not fully driven by the needs and expectations of the users. Ultimately, users' satisfaction will be crucial for the smooth expansion and sustained operation of the infrastructure.

– There is a very low level of awareness with decision-makers regarding the NGII and its potential benefits. Most of the agencies consider GIS as a map-producing tool. Thus, agencies - including those, which have participated in the consortium - lack the strategic vision for a meaningful participation in the infrastructure. As a result, there is a very low level of preparation with the agencies and this will be one the greatest challenges NGII may have to face in its expansion.

– Most of the participating agencies have acquired few computers, related devices and GIS software. However, they have not been able to transform these resources to full use. The existence, communication and diffusion of GIS knowledge among end users, technical professionals and decision-makers are crucial if GIS is to advance within an organization.

– The rationale behind the development of NGII is to minimize the gap between the users and suppliers of the geographic information- concept of metadata and clearinghouse services have indeed evolved around this. Paradoxically, accessing these services require certain level of infrastructure (computer, telephone, skill etc.) with the users.

– In addition to the complexities associated with the handling of geo-spatial data, NGII deploys the tight integration of diverse technologies and tools for database management system, data communication, development of custom applications etc. It is imperative to develop realistic coalition with the private and academic sectors for successful implementation of the system. However, there are very few private companies, which

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can contribute to the technology implementation in Nepal. Regarding the academia, the GIS or SDI course in the Bachelor and/or Masters level courses in the Universities in Nepal are far from satisfactory. This implies that implementation of NGII is certainly a challenging task ahead.

7. CONCLUSION

Nepal has launched NGII with relatively limited participation of the agencies and in practical terms, it is considered as a preparatory or pilot phase- exploring the issues that are associated with the full-fledged building of the infrastructure at national level. During this period, perspective changes with the participating agencies are seen- a stronger preparation is going with them, and have received growing concerns from the agencies that will be potential NGII nodes in the future. These can be considered as encouraging signs. The underlying technical complexities and the need of diverse skill sets has come to front- this helps to better prepare in these areas. A smooth expansion of NGII requires that due consideration and meaningful alliance be developed with key stakeholders. At the broad level, these are the private sector, academic sector and users community. A timely involvement of the users - for whom the whole infrastructure is being developed- will ensure that NGII will ultimately meet the expectations of the users and will be operational in a sustainable manner. A broader geoinformation policy framework is still to be enunciated at the national level. However, knowing that a national geoinformation policy cannot be borrowed from others, it should be developed within the national context

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