Strengthening Cooperation Mechanism in using Spatial Data Infrastructure for Substantial Disaster Risk Reduction

Suresh JOSHI and Shanti BASNET

sureshjoshi2034@gmail.com, peacebsnt@gmail.com

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Abstract

Asia and the Pacific is the most disaster prone region in the world. People living in the region is almost twice as likely to be affected by a disaster as people living in Africa, almost six times as likely compared with Latin America and the Caribbean, and 30 times more likely than people living in North America or Europe. Rapid economic growth and population expansion over the coming decades, along with the impacts of climate change, will increase the exposure and vulnerability of the region to disasters. As all sectors of the economy are disrupted by disasters and the hardly earned developments are destroyed, it is critical that effective disaster risk reduction measures are incorporated into development plans and poverty reduction strategies.

On the other hand, technological innovations in the modern world provide unique opportunities to build resilience and deepen connectivity amongst each other. Experiences from the surrounding region and around the world have proved that disaster prevention and preparedness, enabled by communication and spatial data infrastructure (SDI), can be far more effective and cheaper than ever before. Spatial infrastructures have been proved as highly effective in disaster monitoring, early warning and emergency response efforts.

Despite the enormous advancement in expanding regional relationship through information and communication technologies, Asia and the Pacific is still the most divided region in the world. Hence efforts should be focused on strengthening regional cooperation for sustainable development and approach has to be based on multidisciplinary analysis and multi-stakeholder partnerships.

The intergovernmental platform of the spatial data infrastructure has to be provided for member states to address natural disaster challenges, discuss and take up regional disaster risk reduction strategies that are integrated with an inclusive, sustainable development agenda for the region. Technical assistance, capacity building, developing frameworks of regional cooperation and regional advisory services, facilitation on regional cooperation towards disaster risk reduction is a must to strengthen co-operation mechanism in order to facilitate the expansion of benefits to other countries in the region, primarily countries with special requirements.

1. INTRODUCTION

Increasing awareness on the global challenges that human faces today tend to realize that the challenges can be coped only by implementing significant changes in the way we act and manage our lives. This demands a better understanding of the biophysical and social environment and proper management of our activities on all levels and at all scales.

It is a matter of fact that the Asia pacific region is prone to all the disaster and people living in this region is affected very much unlike people in Africa, Latin America and the Caribbean, North America or Europe (www.unescap.org). In recent years it has faced series of multiple such shocks that exceed the geographical boundaries and endangered most of the communities (ESCAP, 2013). In 2015 alone large scale natural disaster brought huge devastation: the recent earthquake 2015 and the Jure Landslide in Nepal, the Cyclone Pam wrecked havoc in Vanuatu and affected the Pacific. In 2014, Asia and the Pacific continued to be the region that is most affected by natural disasters; over half of the world's 226 natural disasters occurred in the region where 6050 lives were lost, 80 million people seriously affected with $60 billion costs. Similarly in 2013 alone, natural disasters in this region affected more that 57 million people causing $128 billion damages.

Despite the rapid economic growth in the region many developing countries are more and more vulnerable to disaster and both magnitude and the frequency of extreme disasters are estimated to rise due to the effects of climate change. This demands building resilience of the region to intense disaster in multi- dimensional ways (ESCAP, 2013).

In recent days space technology and Information infrastructures especially spatial data Infrastructure (SDI) have become indispensible part of the modern information society. SDI can be favorably implemented in the prominent area for disaster and disaster risk reduction. As disaster are more frequent and intense causing severe damage, demand for these technologies is increasing in order to save lives, minimize economic losses and build resilience. It is crucial that the policy and decision makers make rigorous efforts to widen and deepen the use of the applications to mitigate the adverse affect of the disaster.

As a result of disaster being an interdisciplinary issue, there is a need for an integrated approaches and strengthened cooperation mechanism in using SDI for Substantial Disaster Risk Reduction. (Sutanta et al, 2009). Efforts in reducing risks in disaster entail many disciplines hence there is an utmost need to bring together all resources and data available hence SDI platform is needed to facilitate data sharing and data integration between many agencies, regions and states. Hence, strengthening cooperation between regional and sub-regional organizations remains very important today given the magnitude and complexity of challenges facing the international community.

2. SDI IN DISASTER RISK MANAGEMENT

SDI constitutes a set of political, technological and institutional framework to facilitate spatial data availability, access and utilization (Putra, et al, 2008). It is also the metadata, spatial data sets and spatial data services, network services and technologies, agreements on sharing, access and use and coordination and sharing mechanism, processes and procedures (European Parliament, 2007). It provides a basis for spatial data discovery, evaluation and application for all different organizational levels- global, regional, national and local. SDI developments range from local to state/provincial, national and international regional levels to a global level (Masser, 2005). But experience shows that the use of the geospatial data to respond disaster risk reduction and management has never been so extensive as it has to be.

In other words "Spatial Data Infrastructure (SDI) is an initiative intended to create an environment in which all stakeholders can collaborate with each other and interact with technology, to better achieve their objectives at different political and administrative levels. SDIs have become very significant to determine the way in which spatial data are used throughout an organisation, a nation, different regions and the world. In principle, they allow the sharing of data, which is extremely useful, as it enables users to save resources, time and effort when trying to acquire new datasets by avoiding duplication of expenses associated with generation and maintenance of data and their integration with other datasets. By reducing duplication and facilitating integration and development of new and innovative business applications, SDIs can produce significant human and resource savings and returns" (Rajabifard et al, 2001).

An SDI is much more than data and goes far beyond surveying and mapping, it creates an environment within which organisations and/or nations interact with technologies to foster activities for using, managing and producing geographic data (Rajabifard et al, 2001). Also, with the speedy development in spatial data collection and communications technologies, SDIs have become very important in the way the spatial data are used, a governmental agency, a nation, throughout regions and even the world. Moreover, as stated by Rajabifard et al (2001) an SDI is seen as basic infrastructure, like roads, railways and electricity distribution, which supports sustainable development and particularly economic development, environmental management and social stability. Importantly it must be users or business systems which drive the development of SDIs. In turn the business systems which rely on the infrastructure in turn become infrastructure for successive business systems. As a result a complex arrangement of partnerships develops as the SDI develops (figure 1).

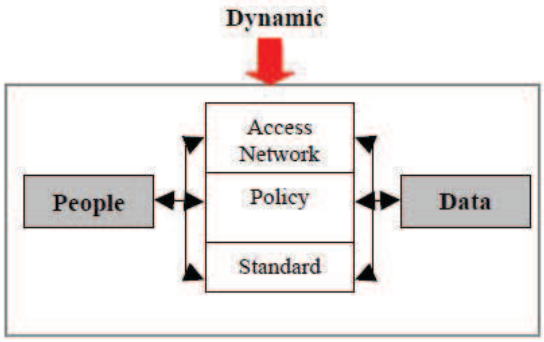

Figure 1: SDI Components (Rajabifard et al, 2002)

Rajabifard et al (2001) has pointed out six key factors that has to be considered to realise the advantages of an SDI and to speed up its development. These factors are:

- awareness of use of Spatial Information and SDIs;
- cooperation between the various stakeholders;
- involvement of the decision- makers and politicians concerned;
- knowledge about the type, location, quality and ownership of datasets;
- discovery and accessibility of datasets; and
- the successful widespread use of the spatial datasets and services.

Knowledge about the data and services types, their quality and locations are also required. It is also essential to provide access to the data and services as the measure of success of the SDI will be the widespread use that is made of it and an appreciation by its users that the platform is providing the promised benefits which were the justification for establishing the SDI.

2.1 Overview of Current SDI Initiatives

With the increasing use of the spatial data stakeholder including technical people, politicians, decision makers are aware of the potential advantages of geographic information and to develop a SDI is a subject of partnerships and cooperation between all stakeholders. Assess of the data and the widespread appreciation of the users and stakeholders proves to be a promised benefit which provides enough justification for the establishment of SDI. Hence SDI has been developed in national, regional and global level.

At national level SDI is developed by countries throughout the world to manage and utilize the spatial datasets in a better and coordinated manner. And these countries have felt the necessity to cooperate with other countries and go beyond this to regional and global SDI to support in informed decision making that can make a huge impact across nations.

Based on the use and the current progress of national SDI's, regional SDI initiatives have developed. The two examples of regional SDI are the Asia-Pacific SDI (APSDI) and the European geographic Information Infrastructure (EGII). Beyond this at the global level there is Global Spatial Data Infrastructure with proper organizational model, frameworks and policies with setting different working groups in order to design and conduct research on the important components of GSDI (Rajabifard et al, 2005)

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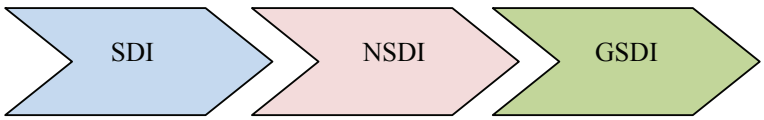

Hence, the coordination groups in a regional and state level provide a forum to select and disseminate information on developing consistent networks of solutions. National coordinating bodies provide a forum for the agreement of common acceptance of the standards and practice it as a whole function as a spatial data Infrastructure, while the global spatial data infrastructure (GSDI) initiatives seeks to promote compatible SDI in a large scale.

2.2 Disaster Management cycles

Disasters are incidents that cause adverse effect in the normal life of lives from ordinary expectation of individuals and groups. There are two broadly divided cause of disaster: Natural- *Earthquakes, volcanoes, tsunamis, avalanches, storms etc* and human induced- *Explosions, fires, traffic accidents, pollution etc*. mostly disasters have crucial negative effects on people, environment and economy.

A basic understanding of the phases of the disaster management cycle is required for the data integration challenges associated with disaster management (Asante, et al, 2007). Although various alternative classifications exist this cycle is composed of five phases as shown in figure 2:

- Preparedness

- Early warning
- Response
- Recovery and
- Reconstruction

The assimilation of hazard and vulnerability information make the basis to find out which individuals and infrastructure are at risk and warning messages are developed with recommendations for immediate action to minimize the loss of life and damage to the property. After the occurrence of the hazard response is initiated to minimize damage to the loss of life and property by removing the secondary hazard to provide humanitarian assistance to the urgent needs. Hence Baseline geospatial information is of utmost importance for identifying those hazards in order to response planning activities and providing humanitarian supplies. Nonetheless such information has to be accurate and available in the form that is easily integrated with the other available information related to the damage reports and the location of the hazards.

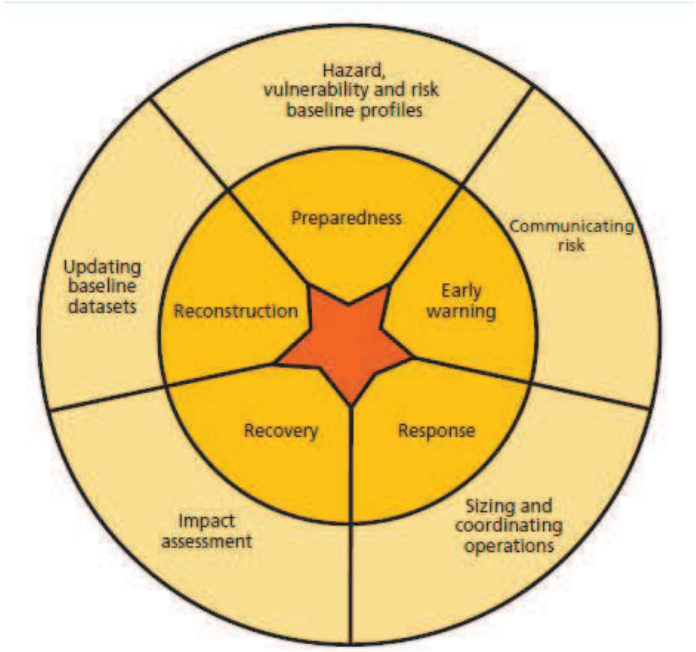

Figure 2: SDI Roles in Relation to the Disaster Management Cycle (Asante, et al, 2007)

Hence, it is a challenge for the geospatial community to develop and integrate spatial database well before any hazard events or face the risks of being irrelevant to effort made on disaster management. Similarly SDI can be used for variety of purposes:

- SDI's in hazard characterization
- SDI's in vulnerability assessment
- SDI's in preparedness and response planning
- SDI's in recovery and reconstruction

According to Wisner (2004) as cited by (Asante, et al, 2007), two equally severe hazards that pass over areas of similar geomorphology will not necessarily cause equal level of damage or elicit similar response. The differences in the physical infrastructure and socioeconomic factors determine vulnerability to hazard. Therefore the value of a well developed and up-to-

date spatial data infrastructure becomes evident in assessing vulnerability even during the preparedness phase. Likewise the determination of socioeconomic vulnerability requires a number of data inputs and basically a national land use data is required as an input in the analysis.

Therefore while making the decision often large number of geospatial variable are faced and may even necessitate the utilization of complex decisions analysis model. The physical infrastructure components of SDI play a crucial role to ensure that end users have access to the most up-to-date geospatial datasets through the integration of web mapping technologies and system architecture.

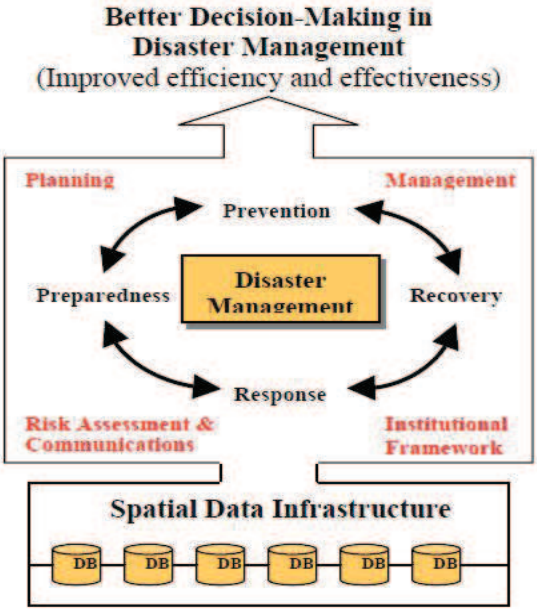

Figure 3: SDI to Facilitate Disaster Management (Rajabifard, et al, 2005)

Hence SDI plays a crucial role in making better decisions in disaster management with improved efficiency and effectiveness.

3. STRENGTHENING COOPERATION MECHANISM

Strengthening co-operation mechanism between states or organizations in regional and sub-regional level is crucial because of the magnitude and complexity of the challenges international community are facing. Efforts in reducing disaster risk involve many disciplines and can be seen from many perspectives such as data sharing and integration, modeling and management perspective (Rajabifard, et al, 2005). As a result of interdisciplinary environment therefore there is a need for an integrated approach in the use of SDI in disaster risk reduction.

Since SDI facilitates data sharing and integration through the arrangements of policies, people, organizations and technology necessary for spatial planning formulation, mechanism should be developed in order to strengthening cooperation between regions and countries. This is because all the countries globally and regionally do not have the same capacity for developing and maintaining SDI. This also depends on their contextual situation, technological capabilities, policies and practices in place, available data sets and so forth.

In order to develop the efforts for the regional cooperation following points has to be considered:-

- Identification of possible strategic partners.
- Explore the possibility and develop regional cooperation mechanism: bilateral and multilateral cooperation
- Establish cooperation institution
- Explore the possible capacity of the related state or organization
- Develop regional network/platform on information sharing and analysis
- Forming different working groups in different levels
- Developing principles and standards and its Accreditation
- Develop infrastructure for using SDI
- Capacity building or optimizing the capacity of the stakeholders
- Build network for supporting capacities
- Regular monitoring and evaluation mechanism

The cooperation mechanism can also be enhanced through

- Learning from good policies, expertise and practices
- Strengthening capacity building to address the technical gaps
- Conducting regional and sub-regional training
- Carrying out joint actions on regional disasters
- Providing satellite imageries and spatial information products

To strengthen the coordination developing partnership amongst the related stakeholders is glue. The proper governance of the community and nation is necessary through a variety of obligations, roles and responsibilities. The governments or NGO's has to partner with other levels of government and related sectors to promote the 360 degree coordination. The government should be able to fund agencies or should be able to seek the fund to further the efforts towards achieving the common goals. The partnership could be extended in terms of data, skills, technologies, logistics and so forth.

3.1 Guiding Principles

There need to have some guiding principles in order to carry out the cooperation whether it be a national regional or global. The guiding principles that has to be made an important considerations are-

- Develop and make use of spatial resource for the benefit of humankind
- Equality and mutual benefit
- Mutually complimenting and common development goals
- Follow principles of international law
- Essential measures should be adopted to protect the space environment and space resources for international space cooperation.
- Simultaneous increment in the competency of techniques and space technologies especially in case of developing countries
- Enabling to enjoy the benefits of space technology to the regional members
- Responsibilities and Obligations

3.2 Benefits

There may be many benefits of the cooperation mechanism but some of the important ones can be listed as follows-

- Sustainable Mutual Benefit
- Risk management and Reductions
- Technological Advancement
- Enhanced Regional Cooperation
- Promotion of Space Technology market
- Contribution Towards sustainable development

3.3 Challenges

The challenges of the coordination can be listed as follows-

- policies and practices and alignment with national policies at varying levels across regions
- Lack of effective co-ordination
- Lack of effort to address the need for greater coordination
- Coordination may fall weak and practice falls far short of policy
- Participation of the relevant stakeholders in coordination bodies
- Address the meet the actual need
- Differing technical competencies
- Lack of operational capacity and affordability
- Monitoring and evaluation

4. CONCLUSION

Since the Asia-Pacific is prone to multiple forms of disaster in the past few decades. The overlapping and interlinked character of the devastation requires comprehensive approaches to build resilience forming strong partnership mechanism. SDI and its products and services play a very vital role in strengthening a much required cross-sectoral partnership and linkages in the support of reducing disaster risk, response, recovery and long term development planning. Spatial information and information communication technology has to be regarded as the important elements in disaster management. Thus member states in the region have to move towards determined efforts to fill in the all possible gaps through institutional arrangement for the effective application of these technologies and takes steps to march forward to mainstream disaster risk reduction policies into their development plans. This will improve the decision making process and increases efficiency as well as effectiveness in all levels of disaster management actions from mitigation to preparedness, response and recovery phases. This results in quality decision making in relation to disaster management contributing directly to sustainable development of the community in social economic and environmental perspective.

There are many such examples of good practices globally for the effective application of SDI and it is imperative to enhance and facilitate data and information sharing so that they can be scales up and replicated. In this regard, the regional cooperative mechanism plays a very crucial role and effort has to be made to strengthen and harmonize the efforts in order to deepen and widen the use of SDI to achieve wide-ranging and sustainable development.

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BIOGRAPHICAL NOTES

Suresh JOSHI, Head of the district survey office Dhanusa. He has ten years of experience in the surveying and mapping field. He has worked in the Remote sensing section for about 6 years in the Survey Department. He holds M Sc. Degree in geo-information science and earth observation in Land management from University of Twente, The Netherlands. His fellowship during the study was granted from the Erasmus Mundus. He has also completed Masters Degree in Physics and Geography from the Tribhuwan University, Nepal.

Shanti BASNET, working as a survey officer in the survey department since nine years. Currently she is working in the planning and monitoring section of the department. She holds M Sc. Degree in geo-information science and earth observation in Land management from the University of Twente. She was awarded prestigious World Bank Scholarship in order to persue her study. She has also completed Masters degree in Geography and Management Studies from the Tribhuwan University.

CONTACTS

Suresh Joshi
Survey Office Dhanusa
Janakpur,
Dhanusa, Nepal
Tel. + 977 1 4622713
Fax + 977 1 4622957
Email: sureshjoshi2034@gmail.com

Shanti Basnet
Survey Department
Minbhawan,
Kathmandu, Nepal
Tel. + 977 1 4622733
Fax + 977 1 4622957
Email: peacebsnt@gmail.com; basnet26050@itc.nl
Web site: www.dos.gov.np