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Role of Remote Sensing and Geographical Information System in Socio-Economic Development of Nepal

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Abstract:

Remote sensing and Geographical Information system (GIS) provide information which can be useful in the investigation of overall development for any country. Remote sensing becomes useful because it provides synoptic view and multi-temporal Land uses / Land cover data that are often required. Nepal is mountainous and land-locked country with an area of 147,181 kilometers. However, remote sensing and GIS tools are being used only for the preparation of woody vegetation cover maps of the hilly areas to some extent for planners and decision-makers. This paper try to analyze GIS applications are tools that allow users to create interactive queries, analyze spatial information, edit data in maps, and present the results of all these operations.

Keywords: Nepal, GIS, Remote Sensing, development, geography.

Introduction

In the present scenario the utilization and exploration of technological inventions and its advancement is a prime requisite for building a successful developed nation. To achieve the adequate growth of any nation worldwide, integration and coordination of three components is essential i.e. society, economy and ecology. Geographical Information System (GIS) is an information system technology that integrates stores, edits, analyzes, shares, and displays geographic information. Geographic information science is the science underlying geographic concepts, applications, and systems. It is attached to many operations and has many applications related to engineering, planning, management, telecommunications, and business. GIS applications are tools that allow users to create interactive queries, analyze spatial information, edit data in maps, and present the results of all these operations (Clarke, 1986; Maliene et. al., 2011).

Modern GIS technologies use digital information, for which various digitized data creation methods are used. GIS is also being used by developing countries to achieve socio-economic progress. Large investments have been made and will continue to be made in the future, centralized planning, management, anddecision making is continuing to increase in importance inmany developing nations because of increasing pressuresfrom overpopulation, depletion of natural resources, and financial instability (Todaro, 1994; Gillis et al., 1992). Slowly but steadily, the GIS is making its mark on the country as an indispensable tool for planning and decision-making.

Role and functioning of GIS in Nepal

Nepal is a developing nation, despite of many socio-economicchallenges;Nepal is making steady progress, with the government declaring its commitment to elevate the nation from least

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developed country status in 2022. Geographically it is a landlocked nation in the middle of Asia, north of India and south of China. Mount Everest rests inside its borders. GIS application has practically revolutionized the planning process in Nepal, and more and more people and institutions are being attracted to its usefulness and efficacy. The most recent population statistics (2008)have the population of Nepal at 26.9 million. With around 50% of its total area under forest cover, Nepal is rich in forest resources. Economic activities in Nepal are mostly based on agriculture. Nepal is rich with inland water resources and has great potential for electricity power generation. Hydropower is one of the most sustainable national income sources to increase the nation's gross national product (GNP) (CBS,2005). The success of GIS is one of the fastest growing areas of the computer industry in the globe as well as in Nepal for better economic growth and management practices.

Challenging points relative to GIS implementations in Nepal

There are many challenges in implementation of GIS in Nepal. These are data, people, technology and applications.

Data (lack of digitalization)

In the context of Nepal, GIS users have to acquire their own data by digitizing paper maps. Conventionally, geographic data came mainly from government sources. But data on the governmental level are still in the paper forms and they need to be digitized.

Access to geographic data

The availability of digital geographic data does not necessarily mean easier access to data.Users are simply unaware of what data are in existence or where they are found.In order to facilitate the sharing of digital geographic data, government agencies and the private GIS industries have joined forces to develop and promote the use of data standards.

Data ownership, copyright and Recovery

Data ownership is related to the issues of copyright and cost recovery of using the data.Government held data are regarded as a valuable commodity and the provision of such data to the public is a chargeable service.Many jurisdictions require secondary data users to pay royalties to the agencies that produce the base data. This requirement increases the complication of enforcing copyright laws and the ultimate cost of using the geographic data.

Liability of misusing data

A problem that is directly related to data ownership is concerned with the legal liability of the suppliers of geographic data. In order to encourage the sharing of geographic data among data collectors and end users, it is essentials to clarify define the limit of liability of the data suppliers when misuse of the data occurs.

Geometric Incompatibility

The problems of geometric incompatibility occur when digital geographic data captured from different map sheets or obtained from different sources fail to match (like change of georeferencing standard).Geometric incompatibility is also caused by using geographic data collected at different scales and map projections.To integrate data from different sources, it is

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necessary to convert data from one coordinate system to another; however there is no guarantee that the resulting data sets will be geometrically compatible with one another because of rounding errors.

People

For large scale corporate implementation of GIS, training of end users always represents one of the most difficult tasks.Senior management users require GIS user education rather than user training.The objective of GIS user education for senior managers is to ensure that they have a good understanding of the technology and a realistic expectation of what the system can and can't do.

Technology

From the technology perspective, the development of GIS is heavily dependent on the general trends of the hardware and software evolution in the computer industry.Not only to hardware and software to manage the GIS data, the technology involving to the data capture (like remote sensing, GPS) has major roles in GIS system development.

Situations and Activities

In the context of Nepal, GIS is a growing field. The technology, government policies, Country's economic Conditions directly affects the development of GIS.Different activities have been started in the field of GIS from different sectors (Governmental and non-Governmental). Some private sectors (like ECMODE) initiate the development of GIS by creating commercial data to specific fields. Similarly organizations like NGO federation, UNDP are lunching their projects to different areas of Nepal in which GIS plays major roles. For the enhancement of GIS technology, the dedicated site (www.gisdevelopment.net) has developed. We can see Most of changes in GIS through this site.

In Kathmandu alone, 200 to 400 organizations are making use of GIS database, informs GIS expert Nanda Kishor Shrestha, who is also the geographical information advisor of the Participatory District Development Programme, a flagship project of the UNDP. The programme, which is active in 30 districts in the country, started the GIS facility since 1992, and it now has an inventory of spatial and non-spatial information for at least 20 districts. This includes geo-physical information on river systems, road systems, boundaries, land utilization among others, and socio-economic information such as human settlement database, household and resource information, agriculture or food production database and flood damage data. The programme shares its information with other organizations, especially with the districts in its working area and also with different line ministries, educational institutions, organizations and even individuals. It sells its data as per guidelines set by the National Planning Commission.At present, USAID Nepal continues to develop applications and products to support U.S. Government assistance and development work in Nepal, primarily under the following broad areas:

Program planning and geo-design:

The technical offices make use of spatial information products generated by GIS unit in assessing the situation of the country at the national, district and village levels through a range

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of key indicators. This is followed by program design and streamlining the implementation process. In the GIS parlance, this is termed as project geo-design.

Geospatial performance-based management:

GIS captures performance information of USAID projects implemented by different partners to feed into gaps and overlap analysis, and for monitoring and communication of USAID's activities. This in the long run assists in managing results of all projects at the Mission level.

Responding to disasters and providing humanitarian assistance:

GIS provides mapping support with most essential data sets acquired through coordination with several agencies within andoutside country, and with processes for responding to disasters. This includes direct coordination with the Government of Nepal and humanitarian organizations.

Communication and collaboration:

USAID Nepal's spatial information products are shared widely within the Nepal Mission, with the Agency, partners, and the Aid Management Platform managed by Ministry of Finance, Government of Nepal. This has led to a coordinated approach to tackling multi- faceted development and humanitarian response problems.

Integration of socio-economic variables

Socio-economic impact assessment is anotherchallenging issue in hydropower development. Toaddress the socio- economic impacts properlyrequires integrating socio- economic variables withphysical components. Feasibility studies, EIA andproject design conducted for hydropower tend todiscuss the socio- economic and physical componentsseparately. Integration of socio-economic indicatorswith physical variables is lacking. GIS has thecapability to handle the socio- economic variable withreference to district,village development committee(VDC) or lower leveladministrative units.The topography and geographic setting provides bothprospect and problems for hydropower developmentin Nepal. It requires, therefore, using the most recentand accurate information about place and people, inaddition to infrastructure development. GIS andRemote Sensing have emerged as important tools forevaluation, management and monitoring of natural resources and the environment.

GIS Application for disaster management in Nepal

In the aftermath of the devastating 2015 Nepal earthquake a large-scale rehabilitation needs are foreseen. While environmental and economic aspects are important in this respect the socio cultural and human aspects need equal attention and this can be catered through a participatory land use planning process. As an activity that envisages future land management through a mix of top-down and bottom-up approach, such a land use planning is recognized not only as a key instrument for achieving sustainable development but also as a tool to mitigate risks due to natural disasters and man-made disasters like conflicts on usage and tenure of land. Land-use planning policies arevery much recognized for their capacity to improve the livelihoods of informal settlers, the forest-dwelling communities and rural poor by ensuring sustainable landuses prerequisite to poverty alleviation (FAO, 1993).

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Detailed information on and for the local land use planning was gathered and generated during the ground surveys through consultative process like enumeration, observation and questionnaire surveys. Collection of satellite imagery of the area of interest for the collecting of geospatial data on present land cover/use. The images were further used for preparing land use zoning map. The GIS and the database were incorporated all set of data acquired in spatial context. Field work was required in order to verify the processed data before finalization of the database. Assessed data for the assessment of the suitability of land, alignment of local needs in the system, and prioritization of land use options. The Government of Nepal has adopted the National Land Use Policy 2012, and issued the Land Use Program Implementation Directives, 2012. Both these policy and directive were yet to be implemented successfully. During the land use zoning phase basis are established for an appraisal of potential hazard risks. Landscapevisualization and learning tools have been developed to support land-use planning activities and help local people elaborate their own views based on a simple representation of the landscape (Rimal andChhatkuli). In this context, land use planning is instrumental in addressing the challenges posed by natural hazards (ex: earthquake) on built environment. Through land use planning, vulnerability parameters can be modified to reduce risks.

Application of GIS in rural development planning in Nepal

Spatial analysis of a rural service delivery system

Decline in biomass production in the hills of Nepal are linked to both human and livestock overpopulation. Efforts are being made by the government, as well as other institutions, to reverse this trend. Improved planning and management in the livestock sector are crucial. In cooperation with the promotion of livestock breeding project (PLBP), Majesty government of Nepal and the federal republic of Germany, the mountain environment and natural resources information system (MENRIS) of the international centre for integrated mountain development (ICIMOD) conducted a case study to demonstrate the use of GIS for improved livestock planning in kabhrePalanchowk district in the central development region of Nepal.

Pradhan and Pradhan, 1994 conducted a study to assess the population, natural resource, and infrastructure to present an overview of the district. The analysis was conducted at theVDC level. The GIS software, ARC/INFO was used to establish the data base. Geographic analysis was conducted on an IBM RISC system / 6000 and on a UNIX operation system. The global universal transfer Mercator (UTM) was used for map projection. This case study concluded that efforts should be made to reduce district's livestock population and to increase their productivity by using different management options. An infrastructure for extension services has been established but an integrated approach is required that can bring varied knowledge and skills to the farmer.

Land use planning practices and transportation infrastructure

Several current and planned transportation projects exist on the planning docket in Kathmandu. These projects are all at different stages in terms of planning and implementation, the planners of Kathmandu are taking initiatives that can follow along with the "The Physical Development Plan for the Kathmandu Valley." If implemented several of these projects may have immediate implications on the urban environment and infrastructure while the effects of others may only

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be seen in the future.Basic steps are required for planning practices includes; collection of information by field work and comparison of the data collected by ground truthing, including GIS data and hard copy topographic maps. As well, qualitative information from the initial research was assimilated with the data collected during field work.

Conclusion

It is appropriate to conclude by emphasizing that solutions to these issues are available and contributions of GIS to be worth the effort necessary to ensure successful implementation. This is truly a rich area for conducting research on the adoption and diffusion of GIS and other information technologies. It can be usedand applied extensively for any social, governmental and environmental issues prevalent in any developing nations including Nepal. In the above text several case studies have been reported that has been implemented and some of the projects are in progress which may led to assistance in development and growth of the country. This technology consist the potential to resolve the all disputes linked to public and private sectors of any nation. Integrated approach of GIS and RS may strengthen the all aspect of Nepal's growth factors.

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