

The Imperativeness of Geographic Information System (GIS) in Contemporary City Planning and Challenges in Developing Country

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Abstract: Urbanization is inevitable, so are the impacts. In order to minimize these impacts we must have city infrastructure that are properly planned, designed, operated and maintained so that it provides optimal efficiency. Part of the problem with today's city structures in the developing countries is that they were built at a time when planning awareness was substantially different from today's techniques and advancement. In this work, the importance and role of using GIS in city planning and solving challenges were carefully examined and analyzed so that policy makers and city planners in the developing nations could adopt GIS techniques in achieving set goals and objectives.

Keywords: Urbanization, Infrastructure, Planning, GIS, Advancement, Techniques.

1. INTRODUCTION

With the dramatic evolution of information technology city planners, policy makers, and citizens now have more powerful means and analytical tools to study, monitor, analyze and visualize spatial data, plans and alternatives for their cities. Over the last four decades, expensive, fragile, remote and hard-to-use big and slow (mainframe) computers, with limited abilities, have been replaced by small, inexpensive, and easy-to-use desktop computers, with relevant supported devices, that get faster, cheaper, more powerful, and easier to use every day. The development of fast, high-resolution, true-color display and output devices has spawned spectacular advances in GIS technology and visualization techniques. Equally dramatic improvements in the capacity and speed of data storage and communication devices, from local area networks (LANs) to the Intranets and World Wide Web (Internet), have made a wealth of digital spatial information readily available to practicing planners in the smallest planning Organization, agency and firm.

The introduction of computers into planning is a part of a more fundamental transition from the profession's traditional concern with the design of the physical city to a new focus on the quantitative techniques and theories of the social sciences. Planning has become a rational process that applies scientific knowledge and techniques to the management of public affairs and the design of activities, flows and land uses (Cinderby, 1999).

The "applied science" model defined rationality in instrumental terms as finding the best means (technology, actions, policies, etc.) for achieving desired ends, and planning as an iterative process of defining problems, identifying goals, generating alternatives, and evaluating available alternatives with respect to designated goals. GIS technology plays, unambiguously, an important role in this task by collecting and storing the required data, providing systems models that could describe the present and project the future, and helping to identify the best plan from the range of available alternatives.

GIS is a central component in the world's environmental information structure, and it will continue to play a primary role. These systems are a main component of information technology, which creates new communications environment; there is a huge difference between the information capabilities and wealth of the developed Western world and that of

Developing World. The gap should be closing, not becoming wider. Developing nations need good, reliable information for survival and progress (Forrester, 1999)

1.1 Aim and Objectives of the Study:

The aim of this paper is to critically analyze the importance of adopting GIS methods and techniques in city planning and solving challenges that may arise during the process.

The objectives of this study are to:

- Look at the issue of GIS in planning in a changing technological environment
- Analyze information technology and city management
- Analyze issues relating GIS and spatial planning
- Analyze the role and importance of using GIS in city planning and solving challenges in developing country

2. GIS AND PLANNING IN A CHANGING TECHNOLOGICAL ENVIRONMENT

The progression from mainframe and timeshare computing to low-cost, powerful, flexible, user-friendly microcomputer and workstation computing of the 1990s has greatly contributed to the growth of GIS applications in planning. The widespread availability of computer platforms has enabled most planning agencies to obtain the basic hardware for GIS implementation. Indeed, many planning agencies have grafted GIS onto computer hardware acquired for office automation. While this does not remove the necessity to acquire other system components, it has enabled a number of GIS applications to evolve in stages. Dramatic changes have also occurred in the availability, price and product range of GIS software (El-Shakhs, 1998). Expensive mainframe, multi-user GIS software packages have been ported to less expensive microcomputers and thereby encouraged the adoption of GIS by many planning agencies. While funding for planning initiatives is limited, many agencies have sought and acquired money for GIS implementation. As a result, some form of GIS capability is now both available and affordable to most planning agencies. Perhaps of greater purport is the high cost and effort of generating suitable planning databases, though even here a growing number of geographical databases are freely available from federal agencies. These provide both a stimulus to GIS adoption and the basis of a planning database.

GIS also reshapes the planning organization and workplace. Many observers suggest that reorganization is a prerequisite for successful GIS implementation (Grimshaw, 1988). Institutional advances have not kept pace with technical innovation. Existing hierarchical organizational structures tend to maximize the operation of 'manual' data handling systems. New organizational structures to support shared GIS databases are obligatory, though they are invariably postponed. Furthermore, legal issues concerning privacy, information ownership, data access and product liability have also been thrown into prominence by GIS (Cinderby, 1999). These non-technological issues represent some of the biggest challenges to the integration of GIS with planning in developing countries, and yet they have been overshadowed by the more immediate desire to acquire the technology.

2.1 Information Technology and City Management:

The importance of current data and information cannot be over-emphasized for planning to be effective and efficient. Basic data and information needed for the planning and development of our cities centre on the spectrum of the information needed for meeting the functions of government at that level. Indeed data and information have traditionally been the underlying principles in any development initiatives. Data are facts and information collected to improve the quality of decisions and actions. It is therefore not surprising that recently, much effort and resources have been concentrated by agencies and projects in developing countries on the collection, coalition, analysis, and interpretation of information and data necessary for their effective functioning.

In recent times, there has been an increasing awareness of the role of information technology in achieving these tasks for overall societal advancement. Particularly, the development of Geographic Information System (GIS) has revolutionized the collection, coalition, analysis and interpretation of data for planning and decision making process especially in city and regional planning initiatives. This is because the data storage, updating, retrieving and manipulating capabilities of

GIS have implications for developing strategies for city management and planning for sustainability in the developmental process.

In general, application of GIS has the following advantages:

- Large quantities of data can be promptly updated than is otherwise possible,
- Eliminates manual operations between information input and output on the other hand,
- Helps in identifying, clarifying and addressing city issues through a geographically differentiated approach,
- Supports participatory decision making and the formulation of strategy for better implementation,
- Supports in producing, storing, and updating city information for planning and management,
- Helps to build broad based capacities in resource management.

In planning analyses, information is derived from printed maps, field surveys, aerial photographs and satellite images. GIS systems enable data from wide variety of sources and data formats to be integrated together in a common scheme of geographical referencing, thus providing up-to-date information. GIS has long been accepted as the most appropriate solution to address spatially referenced data. The essence of GIS in the plan making process, suggested that 'better planning will be achieved through better information, and better information will necessarily flow from an information system'.

2.2 Role and Importance of GIS in City Planning

In general, a GIS for City Planning (or City Information System) has to include three distinctive usage levels:

(a) Database management

This includes;

- Data acquisition,
- Data checking,
- Data transformation,
- Data update,
- Accuracy levels,
- Open source.

(b) Spatial analysis, monitoring and decision Support

This includes;

- Data development and utilization,
- Specialized applications,
- City monitors analysis and planning,
- Networks monitor, analysis and planning,
- Planning and management of Municipal properties,
- Planning and management of building permits process, etc.

(c) Information

- Thematic outputs, such as: maps, tables, figures, etc
- Special outputs and applications: Internet applications and data.

GIS is a part of the Planning Support Systems (PSS), which alone can support decision-making and urban problem solving to a considerable extent. However, planners will have to adapt existing GIS tools to meet their needs. A

combination of sophisticated GIS macro commands and traditional programming language can also be used to develop analytical models closely linked to full-featured GIS toolkits (Forrester, 1999).

The PSS which is a combination of GIS data, urban model and presentation technique using computer for planning support has been increasing in use for more enhanced end products. The inevitable evolution of Information Technology towards PSS means that the exploitation of GIS is more significant. GIS will serve first as a display and communicative device, producing maps and charts that describe past and present conditions and model outputs that suggest alternative futures, which support decision making. On top of that, the Decision Support System (DSS) is also known as a system in which decision makers could rely on in.

3. CONCLUSION

The new technology of Geographic Information System has brought and integrated diverse disciplines and professionals into a single framework for data acquisition, storage, and analysis and tracking a host of problems confronting city planning and urban management. The advantage of GIS to urban planning and urban management is therefore obvious. By using GIS, all necessary data and information needed for urban planning were stored, organized, and made available on request to users. It also provides the capability to respond adequately, to rapid urban growth and societal changes in norms and values with increasing ease, foresight, and responsiveness. The systems developed have made it possible to understand the dynamics of urban growth, to constructively manipulate those dynamics, and most important, to set forth better and practical urban futures.

4. RECOMMENDATION

The importance of GIS technology as analysed in this work cannot be neglected in the developing countries in planning and development activities, it is therefore imperative to key-in to this technology at all levels of government developmental goals and planning. Adequate resources must be channeled towards the development of this technology at various level of planning. This will translate to a sustainable city development.

REFERENCES

- [1] El-Shakhs, S. (1998) "The future of Mega-cities: Planning implications for a more sustainable development" *Sustainable Development and the Future of Cities* edited by B. Hamm and P. Muttagi London: Intermediate Technology
- [2] Cinderby, S. (1999) "Geographical Information Systems for Participation: The Future of Environmental GIS?" *International Jnl. Environment and Pollution* Vol.11 (3).
- [3] Forrester, J., S. Yearley and P. Bailey (1999) "Methodological Considerations for Involving the Public in Local Agenda 21" *International Sustainable Development Research Conference Proceedings* Leeds: ERP Environment: 120-124.
- [4] Grimshaw, D.J. (1988). *The Use of Land and Property Information System 2*: pp568