Forbes,
Herewith the GIS note, pasted under this message. Sorry for the delay and the inconvenience.
I am asking Nevine to send you as attachment as well.
I hope that you like it.
Regards,
claudio

USE OF GEOGRAPHICAL INFORMATION SYSTEMS-GIS
By Claudio Acioly as a contribution to Forbes Davidson et al (Urban Projects Manual).
Cairo, 5 July 1999.

The technology of storing, retrieving and working with land based information using computers has become increasingly easy to use and affordable in recent years. This is known as Geographic Information Systems or GIS for short. It offers a useful set of tools to practitioners working on settlement upgrading and new development projects. This note outlines some of the main features of GIS and the potential advantages in its use. It also draws attention to the implications of using the technology in terms of the demands it places on institutions and their ways of working.

The start of an upgrading or new urban development process requires good knowledge of the physical conditions of the settlement and the profile of its inhabitants. Information about the physical features of the built-up space is collected together with social and economic data during the process of settlement plan making. It therefore forms an important basis for decision making. The data assembled should then be continuously updated via field surveys and retrieved to become a key decision support tool. The use of computers simply facilitates this work by introducing database management tools and other advanced instruments that facilitate data gathering, retrieval, manipulation and display during the various phases of the settlement upgrading or development cycle.

Urban development, and especially upgrading, implies a close interaction between many actors, including planners, project officers, policy makers and residents. The information needed for management and planning purposes needs to be easily accessible, updated and shared among them. Once agreements about data collection procedures are made in order to guarantee continuous updating and database management, the use of GIS becomes meaningful. It facilitates the job by organizing the amount of spatially referenced information in different thematic layers that can be superimposed to each other at will and by establishing the topological relationships between different types of data e.g. house location and ownership and income status. The rule is that all relevant information must be linked to a coordinate point (x,y) or a set of two or more coordinates (in case of a line). One data is of spatial nature while the other data relates to attributes assigned to that particular graphic element. Then thematic maps can be generated and be accessible in printed or electronic formats for different users.

In practical terms, when designing the settlement layout planners must have at hand the precise location of buildings as well as the boundaries of land parcels if an optimal settlement design process is to be achieved. This is really essential for an efficient process of "reblocking" and the planning of new accesses and roads. Data on income of the inhabitants and economic activities taking place within the settlement also allow scenario building and prognosis about the future development of the settlement when trends are properly monitored.

For example, the decision about the relocation of buildings and families and the subsequent payment of compensation for demolition depends on the availability of the basic information about the land parcel, the building unit and their occupants. Equally important are the location of the

plot, the situation of the building unit, its address, its size, building quality, ownership status, services available, family size of the occupants, name of owner, employment status, age, and time of residence. Geographical information systems make the access to this set of information a lot easier and offer an additional advantage in comparison to manual systems. GIS allow decision-makers to find immediate answers and visual outputs of queries that involve relationships and topologies between data. What it is, where it is situated spatially and what happens if any change is introduced.

The identification of who lives where is an important step during the preparatory phase of the upgrading program. The result of this step is often registered into a manual cadastre of the settlement and the residents. The difficulties derived from the lack of accurate maps is commonly overcome by the use of aerial photographs which together form the basis for launching the process of infrastructure improvement, accessibility, services and the registration of land ownership. These may be used to produce new cartographic maps. Field checks and on-site measurements help to bring accuracy to the cartographic basis of upgrading plans. Many GIS software programs are equipped with embedded tools to work with raster maps originated from photographs. Orthophoto are also a type of solution that eliminates differences commonly found in aerial photos. They can be used as the basis of thematic layers produced to form new sets of spatial data. This procedure is called map overlay. Users can turn on one layer and turn off another layer within an interactive process of superimposing spatially referenced data organized per themes.

As described elsewhere in the Manual, there are different types of surveys intended to provide the basic set of information to support the design and project preparation of the upgrading process. The result of these field surveys is commonly organized in an information system handled manually by project teams. This can form the embryo of a GIS at the settlement level. The advantage from using GIS is that a database containing all sort of non-graphic information (attributes) can be organized in an automated format. GIS makes the link with the graphic elements represented in the thematic maps a lot easier. This linkage allows not only data manipulation within the database management structure but also permits spatial implications from data manipulation to be visualized immediately in map formats.

A fundamental question one must answer is what is the potential benefit from GIS applications in upgrading and new development programmes. The establishment of a GIS will provide the means to establish the embryo of a land information system and a basic computerised cadastre of the area. This will depend on the capability of field checks to provide accurate topographic co-ordinates and measurements and on the ability of follow-up household surveys to collect data on land ownership. The database resulted from land ownership survey and data input in terms of digital mapping will be combined via a GIS program. Once these steps are undertaken, the use of GIS will make possible a continuous monitoring of the changes in the settlement both in physical terms and in land ownership transaction provided that updating mechanisms are put into place. Trends in land and housing markets can be monitored and scenarios can be drawn in order to assess opportunities and constraints relevant to the settlement. Information linking location and development potentials also allows local tax collection to be carried out in a more effective manner. Obviously, apart from finance, the preparation of such a settlement-based land information system and its operational aspects are highly dependent on organizational and human resources capabilities.

Given the fact that the infrastructure improvement programme will allow a proper registration and location of the networks within the settlement, GIS is likely to become a strategic support tool in the establishment of a utility information system. Experience shows that the maintenance of infrastructure networks depends on reliable information regarding the type of pipes and cables, dimensions, capacity, length, depth, location, etc. The more network in place the more coordination is required when malfunctioning or leakage is detected and repair needs to be undertaken in very precise locations under the ground. GIS is instrumental to establish an utility information system where cartographic information as well as attribute data regarding

connections, pipes, specifications, users, etc. are stored. This allows better management of the infrastructure networks and the co-ordination among various service providers for improving their provision, maintenance, use and the assessment of future demands. GIS can also provide a good base for establishment of transparent information systems - a major factor for improving governance.

Drawbacks

The financial resources needed to purchase the software and hardware and to train users of the system can certainly be considered as a serious impediment. Presently, a GIS unit composed of a powerful desktop PC computer, a digitizer A0, a plotter, a scanner and a color printer can be purchased for US$ 7,500. A commercially available GIS software lab composed of a core GIS program plus network analysis, overlay and additional issues can be purchased by an additional US$7,000. Training of personnel to operate and maintain the system require more time and continuous investment to keep updated with the rapid developments that take place in this field. Training and up-gradation of the system is required and therefore a budget line must be created to keep the system and its prerequisites operational.

The implementation of GIS in a local government institution does not imply redundancy of staff. On the contrary, it demands more capacity building to understand the technology and its use in the daily performance of tasks. However, resistance to learn to use new tools and to deal with new technologies may hinder the establishment of a Geographical Information System. Senior level managers tend to fear that the more transparency in information management and accessibility to data will threat their power and control on information. Furthermore, they may resist the ascent of junior staff - who are normally more literate with computers -who may create another layer of power in the information management cycle within the organization. One of the most important hurdles to be overcome is likely to be institutional and individual attitudes towards sharing information. GIS requires that information has to be collected from different sources to be able to be worked on later. There needs to be a strong will from top decision-makers to make the system work. Finally, the lack of proper follow-up or a solid organisational setting in handling data collection and data input may halt the process half way.

Steps to implementation

First, the advantages to management of the agencies concerned must be clear so that there is a commitment to implement and support the system. GIS is not only a computer based system. Therefore, in addition to looking at the technology parts of the system, it is necessary to pay attention to the human resources, the organisational setting and the arrangements for decision making regarding the management of the information which are required to have an information system operational.

There are a number of user-friendly and easy-to-learn packages in PC formats that are available in the market. These include ArcInfo, ArcView, AtlasGIS, MapInfo, etc. Before a decision is made about the technology choice one should look carefully at the type of software support that exists in the country/city and pursue professional advice about the specific properties and capabilities of the systems available in the local market. A comparison between systems capabilities and the main purpose to establish GIS should be made.

Possibilities for training personnel and managing the system, including options for data collection, storage and display should be considered at the outset. This is an important phase. A careful step in deciding what to purchase can save local governments and institutions the headache of investing in something that is difficult to use and whose benefits are difficult to prove. Thus proper planning will minimise the risk of wasting scarce resources.

Normally the existing manual system in data collection and storage should provide the basis for establishing a GIS. Once a choice is made regarding the software and the organisational setting

and human resources development, the next step is data entry. That means the organisation of graphic information and data related to it (e.g. road lines can be linked with data on width, type of pavement, addresses, co-ordinates, etc.). This implies the transformation (digitalisation) of basic maps, cartographic maps and aerial photographs via a digitizer (available in the market in different formats) as well as physical, social and economic data about the inhabitants into computer data via database management systems or embedded capabilities of GIS programs. There are many technicalities that are apparently complex, but simple when customised within the various software programmes currently available.

Finally, GIS is only a tool. Like any tool, it is what it is used for that matters. The benefits, which are potentially considerable, have to outweigh the significant costs involved. Those considering this option can find a wide range of publications on the topic. A classic work recommended is D.Maguire, M. F. R. Goodchild and D. W. Rhind (eds) Geographical Information Systems: principles and applications, Logman Scientific & Technical, John Wiley & Sons, USA, Volumes I & II. The reader will get a comprehensive overview of the history of GIS, the concepts and theories involved, different applications, concrete experiences and assessment of the results in different contexts.

(to add to acknowledgements: Claudio Acioly Jr)