Richard Sliuzas *(Division of Urban Planning and Management - International Institute for Aerospace Survey and Earth Sciences)*

"Research issues for the adoption of Geographic Information Technology for Urban Planning and Management in developing countries."

The purpose of this paper is to contribute to the formulation of a relevant research agenda on urban management in the South. Emphasis is given to identifying issues related to the adoption of information technology, and in particular Geographical Information Technology (GIT), to enhance urban planning and management capacity at a local level. Two cases from cities in Sub-Saharan Africa where GIT has recently been used are presented to illustrate the opportunities and the barriers for using GIT and identify relevant research issues. A preliminary overview of contemporary urban management practice is made in order to provide some insight into the context in which GIT is being introduced and some of the expectations regarding the role of GIT.

Evolving approaches to Urban Planning and Urban Management

The post-war history of planning theory is one of great dynamism. Many ideas have evolved and developed in the debate on what planning should be about and what planner's should be doing and how. Both Healey (1997) and Sandercock (1998) explore the phases of development from rational planning styles with its heady belief in planning systems, the role of the State and the design of optimal urban forms, through a period of disillusionment with planning practice, to the post-modern period with its emphasis on communicative planning as a key ingredient in the search for good governance in increasingly diverse societies. Reflecting on this evolution in planning styles it is perhaps fair to say that the post-modern approach to urban planning has not superseded earlier models but rather has enriched it with a new opinions insights and vocabulary hitherto unheard or perhaps unacknowledged by the 'planning powers' of a given time.

Much of their discussion is based on study of intellectual and professional processes taking place in the North, yet it is hardly surprising to note that evidence of similar paradigm shifts can be found also in Sub-Saharan Africa. The influence of received planning concepts lingers on (Kironde, 1992), and is reinforced by the continuing substantial influence of International Development agencies and the 'donor community'. Other contributing factors are the rather limited numbers of local professionals working in the field of urban planning and management and the lack of financial, institutional capacity in the relevant organisations. In the face of such sources of power and influence it is hardly surprising that dissenting views, were they to exist amongst the local elite's, would be well heard.

Data and Information in Urban Planning and Urban Management

That the idealised planning process has also undergone a degree of rethinking would come as no surprise given the pressures for a more performance oriented and accountable urban planning and management practice. The planning process outlined by Devas and Rakodi (1993), or one of its many variations, will be familiar to urban planners and urban managers: a continuous cyclic process encompassing 6 main stages: 1) problem identification, 2)an assessment of stakeholders and their available resources, 3) development of alternative strategies, 4) evaluation of alternatives and choice of approach, 5) implementation, 6) monitoring and evaluation. Although in general terms this model of planning would probably be supported by planners of all schools (from rational - collaborative) there

is likely to be considerable difference in the methods favoured by the various schools. The inevitable potential for tension between protagonists of more rational or more collaborative styles of planning could divert professional energy and expertise from a common concern in achieving and maintaining a better quality of life for all urban citizens, to internal struggles for power and influence within the field of urban planning and management itself.

The ability of urban planners and managers to play their designated 'enabling role' will be influenced by their success in recognising the complementarity of their approaches to planning, including its concrete implementation in projects. Although public participation has long been recognised as an integral part of the planning process, various degrees of participation are possible. The legacy of planners who assume to know and act in the 'public interest' with minimal provision for consultation with the target population may well be a long one but it seems to be drawing to an end.

The work of Bryson and Crosby (1996) describes a 'shared power world' in which power and decision making is exercised by a multitude of stakeholders in numerous forums, arenas and courts. This is the situation in which urban planners and managers are increasingly working. The use of public forums throughout the planning process is an approach which is being widely promoted in SSA through internationally sponsored activities such as Sustainable Cities Programme, Healthy Cities Programme and many smaller programmes and projects related to urban development and urban poverty alleviation. Successful urban management cannot rely solely on such activities. More formal policy making and implementation arenas, preferably with a strong base in local government, remain essential, as are courts for the final resolution of residual conflicts not solvable through other means.

The more traditional views of the need for data and information requirements for UPM are very much related to rational views of urban planning and urban management functions. They therefore tend to take a rather narrow and more formal view of policy making and implementation processes supported by extensive data collection and analysis capacity. This is the utopian view of the technocrat planner, fully informed, producing objective analyses and assessments of alternative course of action for the ultimate political decision making level.

Clearly, informed decision making is recognised as being desirable, but the illusion of comprehensiveness has been abandoned in a rapidly changing urban environment. The increasing emphasis in current practice on the use of forums favours communicative processes which seek to create consensus and commitment amongst stakeholders. This is not to say that the more formal data and information sources are being replaced. Indeed, a critical feature of public forums in many countries is likely to be a great variation in the level of knowledge available to participants on any issue. A crucial role for the public planners may then be to ensure that all forum participants have equitable access to the information available to ensure that final agreements are not biased by knowledge gaps. That there are also considerable obstacles to collaborative planning, including power and access to information, is discussed by Watson (1998), in her description of the process to create a strategic vision for Cape Town.

Monitoring systems for urban managers, and therefore data on key aspects of the urban environment and the detection of change processes, are widely recognised as increasingly important instruments for guiding decision making (Webster, 1994). There is also considerable thinking about the nature of so-called Planning Support Systems by urban planners with a specific interest in IT in planning; see for example Batty (1995), Kammeier, (1998) and Harris (1996), amongst others. At the same time, few would oppose Webster's (op cit) view that "... the real problems facing city regions throughout the world are not technological..." .

If this position is accepted at face value there are few grounds for devoting attention to the IT issues in urban planning and management in developing countries. Doing so would however, ignore the fact that technology transfer will continue to take place through the effects of private (including transnational corporations) and public sector investment strategies, often supported by international donor funding. Indeed, the rate of diffusion of IT seems almost to know no bounds. That such technology is not 'value free' and can have both positive and negative effects in the host society has long been recognised by Maluzi (1975). Many of his concerns about the technological and intellectual dependency of African nations on the North remain valid today. In our current concern with urban planning and management it is therefore particularly useful to further consider the adoption of IT for the handling of spatial data.

GIT for Urban Planning and Management

The acronym GIT is used here to include all aspects of information technology and supporting infrastructure that is used for the capture, storage, retrieval, analysis and presentation of spatial information. It therefore includes not only various types of computer hardware and software for manipulating spatial data such as Geographic Information Systems (GIS), CAD and mapping systems, but also the associated agreements, laws, norms etc. which together establish a framework within which the technology is to be used. Most GIS's are not specifically designed for use in UPM; in fact the concept for a Planning Support System includes a GIS as one of several IT related tools in the planning process (Batty, 1995).

The application of GIT within UPM is certainly not surprising. Given that a major task of UPM is concerned with the planning, development and management of the built environment, local government is an obvious market for many suppliers of GIT products and services. In fact, it has been estimated that as much as 70% of all the data held by a local authority is spatially related (Huxhold, 1990). This, in itself, does not mean that creating and maintaining a digital record of the spatial context of all such data is essential, nor does it say anything about the type of data which may be required for specific planning or management tasks. It does, however, indicate the very real opportunity that exists for adopting GIT within local government, a market segment which is certainly actively targeted with some success by commercial GIT vendors.

Support Systems for UPM

The type of information support on offer to planners (commonly referred to as Planning Support Systems) may bear little resemblance to their actual requirements. A little more than 10 years ago, Yeh (1988), in a study of the use of micro-computers by planning departments in the UK, revealed considerable potential for the use of standard technology products (e.g. word processors, databases, computer graphics) and some more specific modelling and analysis tools in support of analytical planning tasks. While he also predicted a that there would be "...a great impact on planning departments which previously did not have access to computing facilities, especially those in developing countries.", he also noted the many barriers and difficulties in their introduction and effective use. The more recent research of Campbell and Masser (1996) on the use of GIS in UK local government authorities clearly identify the institutional issues and the need for an information strategy as major concerns in the successful adoption of such technology. Holmberg (1994), observes that planners in Sweden may well be passive consumers of the information technology services but have very little influence on their actual design. The consequence of this is likely to be at best under-utilised systems and unneeded functionality.

The power and availability of commercial GIT products has increased dramatically. Yet, a close comparison of the functions offered by standard products and the requirements of a given working environment will inevitably reveal the need for adjustments or tailoring of performance and functionality to suit the unique needs of the host organisation. While off-the-shelf GIT may be useful in a research environment the adoption of GIT in any formal production or administrative environment will require investments in technology adaptation, considerable capacity building and, in some cases, organisational restructuring. The lack of attention to these factors in any decision on whether to adopt GIT will significantly increase the risk of system failures, a matter of some significance in any environment characterised by a lack of financial, technical and human resources. Yet even in the cities of the North it has been found that there are considerable barriers to the adoption of GIS technology (Dangermond, 1988, cited by Taylor, 1991).

Experience has shown that the adoption of (G)IT by organisations often follows a gradual development through a series of stages from stand-alone applications through to fully integrated corporate information systems. While there are never guarantees of success in any IT venture, the four main issues identified by Campbell and Masser (1996, pg. 160) in their study of local governments in the U.K. perhaps deserve even more attention in developing countries:

1. develop simple applications which produce fundamental information
2. be aware of the limitations imposed by organisational practices and available
3. resources
4. adopt a user directed strategy based on staff commitment and real participation of users
5. be flexible as change (of requirements and technology) is a certainty.

The next section of this paper will briefly examine the current use of GIT to support UPM by Lilongwe City

Council and the Sustainable Dar es Salaam Project. The two cases will be considered in the light of the above discussion of planning approaches and the use of GIT technology. Following the review of these projects some suggestions for a relevant research agenda related to the use of GIT in urban planning and management will be made.

Case 1: Lilongwe City Council (LCC) GIS pilot project

The introduction of GIS at the LCC has been undertaken as a component of the World Bank financed Local Government Development Project for Malawi since 1995, with limited inputs over the last 2 years being used for consolidation activities. The project is due to be completed in September 1999.

The adoption of GIS by the LCC was somewhat controversial but eventually proceeded with the head of the city planning department clearly in the "champions" role. From the outset it was evident that the LCC would be a rather hostile environment for GIT. The city's existing computer network, which was designed for clerical support, rate collection and other financial services, was found to be in urgent need of upgrading, computer literate staff were in short supply, knowledge of GIT was virtually non-existent and the LCC itself was in a poor financial situation.

The focus of the project is on developing applications for routine support to the following functions of the LCC: development control, Traditional Housing Area management and creation and management of a large scale plot database; all of which are functions of the Town Planning and Estates Department. Progress has been much slower than originally anticipated. Although the intended applications have been developed and are being utilised, the gaps in human resource capacity and the current institutional structures and procedures have been major obstacles. Some of these aspects are described in more detail elsewhere (Sliuzas, 1995, and Sliuzas and Kawonga, 1997).

To date the most successful component of the project has been the support system developed for the development control section. The relative success of this component is attributable to a number of factors:

1. the availability of clear guidelines and procedures for this function
2. the priority given to the development of this system
3. the higher education level of the building technicians (compared to that of the THA staff)
4. the ability to provide immediate efficiency benefits from the system in daily working routines

The LCC experience with GIS is about modernisation of some of its operations. Support for the some of more routine aspects of the planning department's activities has realised some efficiency benefits. As the installed systems can also be integrated with other general computing services of the council this is a positive achievement that provides some scope for further consolidation. However, an assessment of the impact of these investments on the capacity of the LCC to raise its performance in enabling the provision of important services to the residents e.g. access to land, infrastructure, social facilities - which according to McGill (1998), a former manager of LCC in the 1980's, should be the focus of Urban Management - is likely to be less positive, certainly in the short term.

The need to integrate GIT investments in an overall IT strategy for the organisation is illustrated by the example of the LCC. The decision to introduce GIS was not linked to an overall IT strategy for the LCC as a whole. This was illustrated clearly during a workshop to discuss a strategic plan for GIS which was attended by all department heads and key staff of the planning department. During this workshop management gave top priority to improving the capacity of the LCC to collect its rates and taxes. In fact the threat of financial insolvency of the LCC is a major limiting factor which cuts across all aspects of its performance and will certainly determine to what extent the operations and maintenance of the GIS activities in the post-project period.

Case 2: The use of GIS in the Sustainable Dar es Salaam Project (SDP)

The SDP has introduced many new approaches into the UPM system of Tanzania and not without considerable resistance from the traditional planning organisations. Extensive use is made of participatory approaches and multi-stakeholder forums in all stages of the planning process through to implementation. As would be expected, the need for information on the state of the urban environment and tools to manage and visual the information (e.g. (carto)-graphic visualisation) for the many discussions and consultations was soon recognised. The initial environmental profile was prepared using relatively poor sketch type maps that barely met the initial requirements

and did not provide a suitable basis for monitoring purposes. In 1995 a GIS system was purchased and installed which is now being used to provide support for the strategic planning process for the city.

Superficially one may be tempted to claim success and certainly some important achievements have been made to date, in what is a very hostile environment for GIS (Sliuzas, 1993). A closer examination of the system and the way in which it has developed reveal several major shortcomings in the current approach to GIS:

1. the SDP was the sole Tanzanian user of the GIS package which was initially selected (Atlas GIS) and as a result no benefit could be gained by establishing contact with other GIS users at the National Environmental Management Council who were at the time already using ArcInfo (note: although it is intended to transfer the database into the ArcInfo/ArcView environment this is now proving to be a major challenge for the local operators who are not keen to restart the learning process for a new package)
2. the staff designated to operate the GIS had insufficient training to create and manage systematically a spatial database leading to continuing problems with data management and processing
3. there was a lack of clear specifications on the information support required by the various working groups and no operational concept of the GIS as supporting the management and use of data concerning dynamic environmental concerns
4. a lack of base-map materials and other thematic information of adequate quality for processing in the GIS
5. a poorly defined strategy for the development of the GIS component of the SDP's work
6. numerous problems with the working environment (e.g. lighting, appropriate furniture, storage cabinets, reliable power supply etc.)

In the face of these problems it is a tribute to the concerned staff that a database of some 80 coverages (a coverage refers to a set of files containing data concerning a particular feature or aspect e.g. land use, roads, rivers, soil conditions etc.) has been created and that some of this data has recently been included in an analysis which formed part of the strategic planning process.

Information received from the SDP staff in November 1998 indicated that the users, planners working on the preparation of the draft strategic plan, were satisfied with the outputs produced. A closer scrutiny of the database itself however, revealed major problems with the quality of the final product of the analysis routine. Although a complete analysis of the process carried out was not made it is very likely that much of the database has been severely comprised through poor data management procedures. As the database is intended to be used as the foundation of city-wide Environmental Management Information System (EMIS) there is good reason to question the long term value of such an effort.

In this case an attempt has been made to integrate the GIS with activities aimed at improving the planning process itself. The current system has been weakened as a result of shortcomings in the design of an appropriate and sustainable environment for the information system with the necessary consideration for technical, financial, human resource and institutional aspects. The value of the SDP's GIS and EMIS activities will remain limited until these aspects are dealt with in a more comprehensive manner.

Possible contributions to an urban management research agenda

The availability of relevant and timely data concerning the state of the urban environment and ongoing planned and autonomous development processes is considered to be vital to urban planning and management. While it cannot be denied that modern GIT has an enormous potential for addressing some of the knowledge gaps and data management problems of urban managers, advocates of GIT must also consider the very real limitations of the environment in which they are being introduced and the need for a deliberate strategy in deciding how and when to apply GIT. The definition of information requirements remains a task of the users of the information and should not be driven by supply side or technological considerations.

Given that local government is expected to bare an increasing responsibility in urban management research into their information requirements is required. The search for a generic definition of information requirements is futile, and can, at best, be of some remote academic interest. Data requirements will depend very much on the local problems and development processes, the local resources available and the mix of planning styles operating in a locality at a given time.

Standard solutions to data problems do not exist but important lessons can be learnt by specifically examining how information is used (created, analysed, shared, stored, displayed etc.) in urban management practice both within planning forums and more formal institutional settings. This knowledge could contribute to more effective application of (G)IT by local governments in relation to some of the critical priority areas identified by Rakodi (1999) e.g. land administration and management, finance, strategic planning and policy making and monitoring, infrastructure and service provision. Such knowledge may also contribute to increasing the return on resources devoted to (G)IT in resource poor environments.

Currently ITC's Division of Urban Planning and Management is revising its research policy to include many of these concerns. The main themes and topics proposed are:

Monitoring urban development processes: including the strategic use of aerial photography, satellite remote sensing and GIS for the capture and analysis of key data on the built and natural environment; urban indicators for local and national policy monitoring.

Planning urban service delivery: providing support for the planning of primary health services; transport management; urban infrastructure and hazard assessment and prevention.

Managing urban planning information: the diffusion and utilisation of GIS by organisations in the developing world; design issues for GIS in urban management; the use of property information for land market mediation and control.

The programme has a strong emphasis on applied research and includes active participation with partners in developing countries in Asia, Africa and Latin America.

References

Batty, M. (1995) **Planning Support Systems and the new logic of computation**, Regional Development Dialogue, Vol.16, pp. 1-17.

Bryson, J.M. & Crosby, B.C. (1996) 'Planniung and the design and use fo forums, arenas and courts' in Mandelbaum, S.J., Mazza, L. & Burchell, R.W (eds) **Explorations in planning theory**, Centre for urban policy research, New Jersey.

Campbell, H. and Masser, F.I.(1996) **GIS and organisations**, Taylor & Francis

Dangermond, J. (1988) **A review of digital data commonly available and some of the practical problems of entering them into a GIS**, Paper read to the International Geographical Union Conference, Sydney Australia, 18.

Devas, N. and Rakodi, C. (1993), **Managing fast growing cities: new approaches to urabn planning and management in the developing world**, Longman and John Wiley and Sons.

Harris, B. (1996), 'Planning technologies and oplanning theories' in Mandelbaum, S.J., Mazza, L. & Burchell, R.W (eds) **Explorations in planning theory**, Centre for urban policy research, New Jersey.

Healy, P. (1997) **Collaborative planning: Shaping places in fragmented societies**. Macmillan Press

Holmberg, S.C. (1994); **Geoinformatics for urban and regional planners**, Environment and planning B: Planning and Design, Vol.21. pg. 5-19.

Huxhold, (1990) **An introduction to Urban Geographic Information Systems**, Oxford University Press

Kammeier, H.D. (1998), **A computer-aided strategic approach to decision-making in urban planning: an exploratory case study in Thailand**. Cities, Vol. 15, No.2, pp. 105-119.

Kironde, J.M.L. (1992) **Received concepts and theories in African i\urbanisation and management strategies: the struggle continues**, Urban Studies, Vol.29, No. 8, pp. 1277-1292.

Maluzi, A.A. (1975) 'Development equals modernization minus dependency: a computer equation' in Taylor, D.R.F. and Obudho, R.A. (eds) **The Computer and Africa: Applications, problems and potential**. Praeger Special Studies in International Economics and Development

McGill, R. (1998) **Urban management in developing countries**, Viewpoint in Cities Vol. 15, No.6 pp. 463-471.

Rakodi, C. (1999), **Key elements in a European management approach for the developing countries: priorities to the poor**, paper for the N-AERUS conference, Concepts and paradigms of urban management in the context of developing countries, Venice, March11-12.

Sandercock, L. (1998) **Towards cosmopolis: planning for multicultural cities**, Wiley & Sons

Sliuzas, R.V. (1993) **Incorporating GIS in urban planning and management in Tanzania**, paper for the second seminar on GIS and developing countries, GISDECO'93, Utrecht University.

Sliuzas, R.V. (1995) **Training for the design and development of urban geographic information systems**, paper for Habitat II roundtable Human Resource Development for Better Cities, Institute for Housing Studies, Rotterdam

Sliuzas, R.V. & Kawonga, A.G. (1997) **Lessons from the GIS pilot project at Lilongwe City Council**, Joint European Conference on GIS, Vienna.

Taylor, D.R.F. (1991) 'GIS and Developing Nations', in Maguire, D.J., Goodchild, M.F. and Rhind, D.W. (eds) **Geographical Information Systems. Principles and Applications**, Vol. II, Longman Scientific & Technical, NY, pp. 71-84.

Watson, V. (1998) **Planning under political transition - lessons from Cape Town's Metropolitan Planning Forum**, International Planning Studies, Vol.3, No.3.

Webster, D. (1994) **Effective urban management: new challenges, new responses**, Editorial introduction in Regional Development Dialogue, Vol.15, No.2.

Yeh, A, Gar-On, (1988) **Microcomputers in urban planning: applications, constraints and impacts**. Environment and Planning B: Planning and Design, Vol.15, pp. 241-254.
