

Human and Organisational Aspects Of GIS Development on Gambia

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Abstract

The main characteristic of the implementation of GIS technology in Botswana is localised arrangement of resources in different government agencies. After the first enthusiasm shown in late 80's, and practical results achieved in the middle 90's, the efficiency of GIS systems on the country global level has been substantially reduced. The expected benefits in better decision-making and managing, using GIS tools have not achieved its maximum. Advances in IT technology evolved faster than the institutional and organisational capacities of different GIS users able to absorb them. In the absence of critical user mass, an efficient institutional and organisational setting for the future implementation of GIS technology is under serious threat. The aim of this paper is to give a brief guideline for GIS decision makers how to improve GIS diffusion based on human and organisational factors.

Theoretical Background

The development and implementation of geographic information systems (GIS) by different government, para-statal and private organisation worldwide, shows enormous progress in last two decades. However, the most of these positive trends in GIS global arena has rapidly advanced only in developed countries. Unfortunately, the third world societies did not have opportunity for a steady rise of GIS initiatives and technological advancements similar to their developed counterparts. Paul (1986) argues that nowhere is the need to manage both resources and information more acute than in developing countries, where poverty and underdevelopment have created a vicious cycle whereby those living directly from this resource base are, at the same time, wreaking such devastation on this resource base.

For example in many African countries GIS adoption, diffusion and utilisation of spatial technologies has proceeded at relatively lower rate. A little attention has been paid to improve current situation along the line of flexible approaches and efficient organisational frameworks. The implementation of GIS has been restricted by numerous factors such as financial, political, technical, technological, educational, organisational, human behavioural, etc. The most common explanation of GIS unsuccessful stories was covered under umbrella of financial, technical and staffing obstacles. Even in situations with secured funding, HW/SW facility donations and organised training programmes, initial efforts to establish GIS units in different governmental departments have not been always beneficial.

In regard to this a number of pertinent questions have arisen opening dilemmas about organisational settings and readiness of human crew to accept and apply GIS novelties performing daily duties and supporting decision-making process. Only few researches pointed out the problem of human familiarisation and organisational frameworks in which newly established GIS units were supposed to function. Efficiency and

effectiveness as criteria to evaluate how GIS may affect organisational performance have not been taken on board. In contrary GIS have not been recognised as a way to minimise the use of the financial, staff, space, and time resources needed to produce the same level of output or increase productivity using the same level of input (Budic-Nedovic, 1999).

Dependency between the successful use of GIS technology and a number of personal, organisational, and institutional factors has been widely discussed (Azad 1990; Campbell 1991; Croswell 1991; Campbell 1992; Brown and Brudney 1993; Budic and Godschalk 1993; Onsrud and Pinto 1993), but unfortunately these findings were not applied in changing GIS status within comprehensive political and socio-economic African milieu. The problem of researching and highlighting personal, organisational, and institutional factors in African GIS communities is still pending. Until it is resolved, the current GIS outcomes will be only recognised through mapping production, pore networking, duplication of data and efforts, organisational disharmony, unnecessary expenditures and unreliable decision making about allocation of natural, human and financial resources.

The way forward is to give an extra stimulus through initiation of research studies on organisational and human aspects involved in risky business of introducing GIS into different government machineries throughout the African continent, following common principles and schemes. The outcomes of such research initiatives can influence crossing gaps, which are stopping majority of existing GIS users to enjoy full commodities of GIS adoption in their organisations and working places.

The challenge of improving organisational and human GIS agenda for its better implementation rests firstly on our better understanding of the organisational structures and human behaviour in situation when the new technology is acquired. Budic (1995) argues that two simultaneous processes occur during the incorporation of GIS technology in local governments: *innovation process* and the *process of organisational change*. In African context the first phenomenon can be traced without serious hassle because most of the people are fascinated and impressed with computerised environs. But the second process can show very rigid consequences due to borrowed administration models from former colonial powers or traditional tribal authorities that are still constraining modernisation and faster socio-economic development in all African countries.

In such combination better outcomes of GIS adoption can be only expected if there is more flexibility in gathering information about technology (not exclusively reserved for decision makers and bosses), followed by analysis of organisational needs, and finally calculating cost and benefits associated with the new technology. In the same time the factor of personal animosities or acceptances towards innovations can heavily influence individual and small group reactions to support or refuse GIS technology. According to Lewin (1952) this process can be analysed through the following stages: a.) *unfreezing*, b.) *moving/change* and c.) *refreezing*. It is normal that any organisational set-up will experience a “disturbance” with initiation of an innovation and leaves a temporary achieved equilibrium. In the same manner GIS implementation process reflects organisational response/reaction to the innovation; and finally after the needed change is achieved, the organisations settles into routine and a state of new equilibrium (Budic, 1995).

Some organisational structures can be very prone and vulnerable to changes, and due to this failures in introducing new technologies are evitable. It is advisable that two major aspects of any organisation must be thoroughly studied and covered, before technology transfer takes place (King & Kreamer, 1985). The first phase of investigation should highlight characteristics that can influence change in organisational stability. A multiple background on organisation mission, structure, resources, operations and social relations should be conducted. This will help to assess the significance of expected change and human behavioural situation that can be crucial for sharing and development of GIS and data bases by various producer and user organisations (Budic-Nedovic

& Pinto, 2000). In most of the African GIS communities this stage has not been conducted and approved, and as a logical consequence organisational confusion takes over.

The second stage of organisational research usually deals with motivations for incorporating GIS technology, with recognised gap in organisational performance as the most common motivation behind organisational engagement in adoption of innovations (Zaltman et.al. 1973; Feller and Menzel 1977; Rogers 1983). Motivation is always important for smooth implementation, and usually is very high at the beginning. Once, when technology is acquired motivation curve is going down, before people have practical touch and produce the first GIS outcomes. Actually this is a crossroad point, and once when daily duties start to be performed by aid of new GIS facility motivation curve is again on rise.

In the findings presented in this paper intention was to examine and underline some important organisational and behavioural facts that influenced GIS development in Botswana. As a step forward our objective was to sensitise Botswana GIS community and responsible authorities about organisational and human restriction for the future expansion of GIS capacities which are in this moment under serious threat. We are hoping that this paper can contribute towards development of brief guideline for GIS implementation improvements based on human and organisational factors. A conceptual framework presented here draws on broader literature and analysis of local situation and prevalent conditions.

Botswana it and GIS Profile

The information technology (IT) in Botswana has been significantly developed along with common economic progress. The country has been well exposed to the international computer market and information revolution from the very early stages. The main role was allocated to the Government Computer Bureau (GCB) founded in 1966 as a special unit of Accountant General. In period from 1966-92, the introduction of IT into governmental agencies has gone through several stages: from accounting machines and card tabulators, over the first ICL mainframe computers (model 1901/72), and the ICL/80 series 39, to the introduction of mini and micro computers in all government agencies.

Today, GCB is an independent service department of the Botswana government as a part of the Ministry of Finance and Development Planning (MFDP). Its role has been changed from the advisory, research and design service in the period of 1970-80, to becoming the main co-ordinator of all IT activities in the country. At present, GCB serves several information systems (IS) such as: IS for car registration; personal management system for the Directorate of Public Service Management (DPSM); police IS with records on crime details; comprehensive stock control, accounting and management system; payroll; foreign affairs and taxes IS.

In the period of last 10 years, GCB has been requested to introduce specialised IS such as GIS to start catching up with global trends. There were several initiatives involving significant investments in different government ministries and agencies. Some pilot projects on GIS development in various disciplines have come out. Some workshops on the implementation of GIS have been conducted, and a GIS consultancy from USA (Associates in Rural Development, Inc.) has completed the first report project aiming at assisting the Government of Botswana in laying the groundwork for the effective implementation of a national GIS (Zhao and Selemogwe, 1993). Almost, in the same time the first GIS training programmes have been established at the University of Botswana under the auspices of the Department of Environmental Science and Civil Engineering.

During these “first prosperous years” the use of GIS in Botswana has proliferated mainly due to financial and technical support from international organisations. Various agencies of the United Nations have been engaged in the introduction of GIS technology in Botswana. The United Nations Environment Programme

(UNEP) based in Nairobi and Geneva helped several government agencies through the global resource information database (GRID) and several scholarships have been secured through United Nations Scientific and Cultural Organisation (UNESCO).

In addition a very informal group, the GIS Users' Group was started in mid 1989 to discuss the GIS issues and to provide guidance to the enthusiasm for GIS/LIS that had developed. The broad affiliation to the group individuals in their unofficial capacities provided a very good forum for discussing a wide range of ideas and problems related to GIS/LIS. Its affiliates included personnel from donor agencies (USAID, SIDA) international and local NGOs (IUCN, The Kalahari Conservation Society), many GOB departments including those who represented various departments on National Committee on Cartography and Remote sensing (NCCRS), and people from private sectors (Nkwambe, 1993).

Since then, many further GIS initiatives have been taken in isolation and without necessary synchronisation and co-operation. However, the key players in Botswana Government administration did not have proper understanding of principal factors for successful GIS implementation (e.g. flexible organisation, application development, continuous staff training and motivation, technical and technological standardisation). Individual efforts in designing departmental GIS installations have not been successful due to the lack of systematic approach. To date, many agencies that have acquired GIS SW and HW have not yet yielded comprehensive results and guidelines for better GIS utilisation internally, and in the country as a whole. All the time an umbrella for unification of various GIS efforts and campaigns was missing part of chain.

Today, after almost a decade of battling with basic prerequisites for better GIS status, networking and smooth GIS data flow among different departments are still utopian dreams. For most of local users GIS is recognised only as an exclusive tool for cartographic production, contrary to its numerous other important functions like spatial analysis, data base management, decision making support, visualisation, multi-media, WEB communication, virtual reality, etc. For example, in Botswana's practice its role as decision-making tool was not so popular amongst conservative decision makers (politicians, tribal leaders, ministry officials, departmental directors) who are comfortable with less sophisticated and controllable decision making instruments than GIS.

Unfortunately, in this moment only few institutions are really concerned with future countrywide GIS prospect. An old idea about the establishment of National GIS Centre is still floating if there is serious intent to support rationalisation, concentration and standardisation. Therefore, it is needed to raise new awareness around common and individual interests, having in mind available resources and capacities, Botswana's geographical extent, population size, political and socio-economic climate. Definitely, too ambitious and optimistic approaches based on "diamond booming" need revisions and replacement with more realistic, flexible and sustainable visions, especially in today's vulnerable world.

In conclusion about existing GIS profile, it is evident that beside the technical challenges, most of the current GIS problems in Botswana are related to organisational, institutional, and human factors. The technical nature of GIS goes against the preferences of the conservative and bureaucratic government officials. The popularity of GIS as a computerised decision making tool is very low. Most of decision makers are more comfortable with data presented in hard copy format and contained in often-voluminous reports. General awareness about GIS, its benefits, and potential is low. There are few opportunities to learn about GIS and to demonstrate to the decision makers, directors, and managers the utility of GIS. Being uninformed and unexposed to GIS, the policy makers and agency administrators rarely know how to take advantage of GIS and are often slow in initiating GIS projects and installing GIS facilities in their working environments. For most of the users even within GIS community the meaning of GIS is closely related to nice plotted maps only (Cavric, Ikgopoleng, Budic-Nedovic, 2000).

Research Methodology

Research Questions

In order to find out the extent to which GIS is implemented in Botswana, the following research questions were addressed in the survey to provide baseline data:

- Whether GIS is used in development planning?
- Whether the various stakeholders use GIS in decision-making processes?

Research Design

The research was designed to capture information from stakeholders presumed to be using GIS in their working environments. The design covered government departments, corporate organization and private companies. The main aim was to capture divergent views about the technology as much as possible.

The sampling frame and sampling strategy employed in the survey

Gaborone, the capital was considered an important research area because most government departments using GIS are within the ministries, which are in the city. All the Headquarters of Corporate Organization and almost all private companies do business in the Capital. A stratified sampling method was used to represent all the stakeholders. Three stratas were developed i.e. governments departments, corporate organization and private companies. For government departments stratification was done based on the total number of GIS registered user departments. For other groups a random sample was done in each strata to make a representative sample.

Data collection procedures

A mail interview method was used, questionnaires were sent to government departments either through surface or electronic mail. For Corporate Organization and Private Companies formal presentations were done first as a pilot study to establish the extent to which the technology has been applied and it was later followed by a questionnaire survey similar to the one used for government departments.

Data Analysis

This is the fundamental stage of research. The questionnaires were coded for the SPSS computer programme and the data was analyzed.

Research Findings

Rate of GIS diffusion

The growth in the use of computer based GIS in Botswana came with a group of both government and private GIS users who tried at beginning to come together with the principal aim of constituting a coordinating body. Their efforts were culminated in the commissioning of a study “ an assessment of country wide GIS potential in Botswana”. Although, there was an evidence of large investment especially amongst government

departments in GIS technology, there was less evidence that the technology is functioning satisfactorily and contributing to national development.

GIS information is still fragmented amongst different government departments despite the need to establish a National GIS Center, which has long been recommended. The research has also established the main constraint as lack of coordination or networking of GIS user departments. There is duplication of data; there are no mechanism in place to share geographic data amongst different departments.

The diffusion of GIS in Corporate Organization is still in its infancy; most of the organizations do not have the software for GIS let alone know its importance in their working environments. They only rely on base maps which are outdated, compiled by different agencies with different map scales. Different geo-coding systems also make it difficult to integrate with their systems.

Most private companies especially those in the consultancy industry use a lot of GIS like in government departments. They have GIS specialists. They face the same the problem information sharing. They argued it would be difficult for them to share information because they are competing with one another for consultancy jobs.

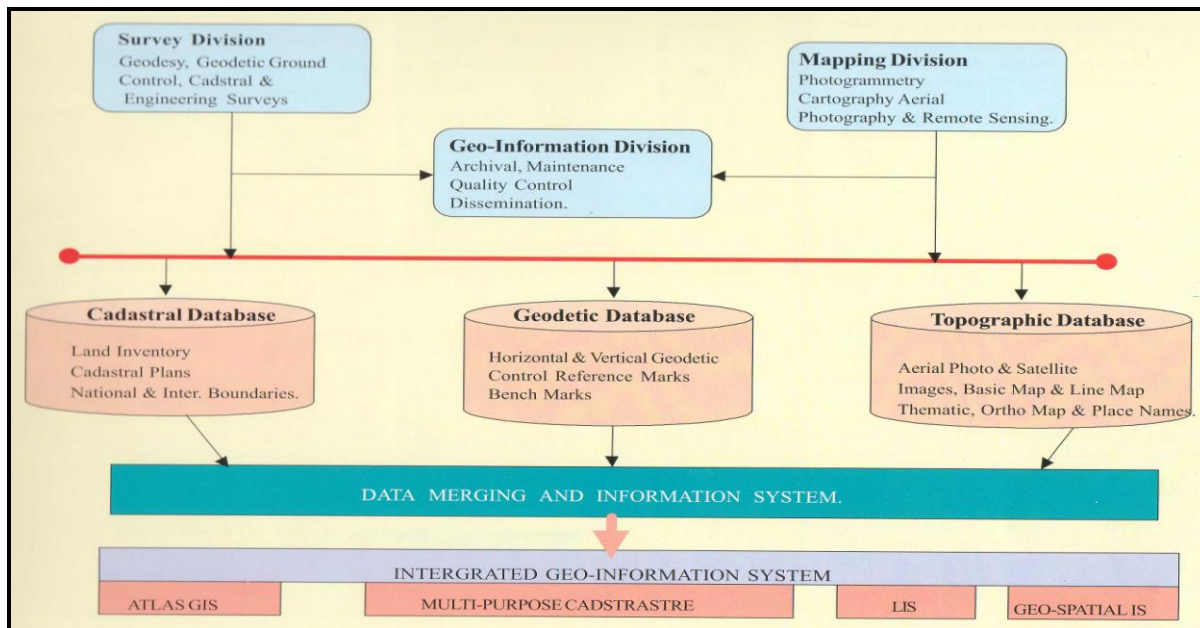
Some latest improvements came with several initiatives by the Department of Surveying and Mapping around the “National Atlas” and “Integrated Geo-Information System Project.” Using a different thematic maps with enclosed text, statistics, photographs and explaining pictures, the National Atlas of Botswana can be a good starting point for the formation of national Geographic Information Data Base System.

The idea around Integrated Geo-Information System is to automate a variety of analogue products and transform them into digital form suitable for different users. The complete computerization, automation, collation, structuring and formatting of these data sets is the basis of the vision of the Department in the new millennium (See Chart 1).

Human Problems

Few managers within government departments see the benefits of GIS tools. However but many remain disillusioned with the look warm success of the application to the general improvement of information management across information spectrum of their organization. Little effort has been spent on transforming data into information for decision making. In some cases organizations that have a potential for using GIS are headed by people who are not up to date with the latest technology.

Chart 1. Botswana Integrated Geo-Information System (GoB, 2001)



In most of the cases these people are also decision makers and they have in the past carried out decisions that have stifled the introduction of GIS within the respective departments. The implementation of GIS by individual departments and other stakeholders is therefore more of a trial and error exercise and has resulted in poorly designed digital topographic databases because organizations are eager to show results even with limited accuracy. Whilst users are demanding more digital data, useless data is generated and the hardware and software becomes obsolete in the process.

The research shows that there is a need to promote among decision makers the fact that GIS is not only drawing and a storage mechanism of spatial data but also a very good platform for spatial analysis. The promotion may be done through presentation of real world scenarios where a GIS based approach to analysis can be able to be compared to conventional techniques, hoping that decision makers may see it necessary to accelerate the introduction of GIS in their respective organizations.

Organizational Problems

The successful application of GIS technology within an organization can be largely dependent on how well that tool is integrated within the broad information environment of that organisation. It has been established that most departments lack coordination of sharing different geographic information, GIS data is only used by one unit within a department.

The other factor lies with strong leadership in an organization. GIS user departments have a weak leadership in integrating GIS within and outside various departments, there is also no institutional arrangement to update data after it has been created. As decision making needs up-to-date information, the system will be useless if its data is not updated on a regular basis.

For example the national mapping body which is the Department of Surveys and Mapping has had to undergo a dramatic shift in it's services from the production of conventional analogue maps to the creation of digital topographic databases. This has compromised mapping standards and has resulted in some departments opting to collect their own GIS data.

Another research finding is that a various government department, parastatals and private companies use GIS and these organisations see to understand GIS differently. The prevalent perception within government and some parastatals is that a GIS is drawing and data storage tool, whilst the private sector sees the potential of GIS as an analysis and data management tool. The reason for these divergent views is that the various stakeholders operate in isolation from one to another and they do not have a co-ordinated GIS strategy.

A National GIS strategy is not developed and is essential in this regard because it will compel organisations to not only avoid the duplication but rather to adhere to the same GIS standards of data collection, data structure and organisations, data storage and a good arrangement for the exchange of data. The research also shows that there is a need for standards and this can only take place if there is a proper co-ordination between the government, parastatals and the private sector. Standards will ensure that the data is generated is consistent in terms of accuracy. Furtteht standardisation will ensure that different parties generate data that can be exchanged and combined without any discrepancies since their data adheres to the same standards.

Organisational Agenda For Future GIS Development In Botswana

This article provides numerous details about burning issues and obstacles concerning GIS expansion in Botswana. It critiques GIS diffusion from organisational and behavioural angles trying to suggest acceptable solutions for future improvements. Plotting on numerous foreign cases and domestic expertise, the remaining portion of article intents to describe possible recommendation in a comprehensive manner which can satisfy GIS needs in Botswana and wider African frontiers experiencing the similar range of implementation difficulties. One of the reason d'atre for this, is the scarcity of local research on the topic, particularly with regard to expected impacts of GIS on organisational and human performances in different institutional frameworks (e.g. government, parastatal, academia, private, NGOs, tribal)

Recommendations concerning Institutional Organising

An excellent starting point for future guidance can be a set of questions that sounds very provocative even today. These questions have been raised in the Report on a Mission to the Central Statistical Board of the Government of Mongolian People's Republic (UNCHS, 1987). According to Cartwright (1991). Their application in Botswana or any other African country can be very useful especially as an additional clarification of analysed problems in pertinent GIS diffusion. If some of them have been answered on time we could have may be different situations and better GIS prospects. The following among them need special attention in the light of adequate GIS organisational set-up, and without them it is very difficult to design and organise an optimal, operational and efficient GIS system:

- Who is going to use it? – many people or a few, specialist or non-specialist, technical or administrative staff, etc.
- What will it be used for? – research or management, retrieval or processing, screen displays or printer output, etc.
- Where it will be used? – only at headquarters or in the regions (districts) as well, only at fixed office sites or out in the field or even mobile locations, etc.
- When will it be used? – occasionally or frequently, for short periods or long periods at a time, etc.
- How it will be used? – in stand alone use or in connection with other equipment and (if in connection) whether it needs to be on-line or off-line and in real time or not, etc.
- Why is it being used in the first place? – is it in order to achieve greater speed, or more accuracy, or better service to the public; or is it for something else like helping to promote regional development, etc.

The lessons learned from Mongolia can be easily applied in Botswana through organising large scale survey encompassing all GIS users that are likely to share different data sets and follow similar data collection, processing and dissemination procedures. The benefits of such large-scale survey are that it can serve as GIS manual for all existing and potential users. All of the above question are basic starting point for anybody who would like to be involved in GIS game.

Similar approach have been applied in one of the latest Budic-Nedovic and Pinto (2000) research. They organised face-to-face interviews all around the USA in order to determine motivations for the GIS and data-base sharing activities, organisational structures and policies employed, relationships developed, and the key events in the joint GIS history. To elicit responses systematically and to understand better the situation their protocol included open-ended questions on:

- History and reasons for the joint GIS activities.
- Participants
- Structure, that is organisational forms, information flow, joint oversight, and management.
- Extent of the relationships.
- Formalisation of the relationship by contracts and agreements.
- Rules, procedures, and policies for database sharing with regard to standards, development, maintenance, ownership, and use.
- Financing and incentives.
- Assessment of outcomes; and
- General organisational and Interorganisational background.

The result of their case studies and numerous interviews indicate that the interorganisational and organisational context, the structuring of the GIS-related interaction, and the co-ordination and implementation process, are all relevant for understanding the reasons, practice and outcomes of multi-participant GIS and database activities.

In similar research by Cavric and Ikgopoleng (2000) the results suggests that majority of GIS users in Botswana is working in an uncoordinated manner, expressing no interests to co-operate and function on multiparticipant basis. A prevalent disharmonic approach and dispersion of technical and human resources is Botswana's reality that restricts more beneficial outcomes from existing GIS capacities. In regard to this, future GIS activity should continue to build multiparticipant environment in which limited technical and human resources have to complement each other geographically and functionally. Also, interorganisational and interorganisational dilemmas and confusions must be addressed through the separate researches on GIS project design and management, for each individual case. Question on technical issues should be ultimately combined with the question on behavioural and organisational dilemmas.

The another set of organisational dilemmas which could be also discussed in Botswana case is given in Masser's and Campbell's (1991) research on contextual factors. These factors are the internal organisation and the external environment which together provide the background against which GIS diffusion takes place. The internal organisation usually relates to the attributes of the organisation in which GIS is located. The features such as the organisational structure, administrative arrangements and procedures for decision making in general, and specifically with regard to computing resources might influence GIS adoption in different organisational neighbourhoods. For example in Botswana the factors which should be examined: first, are those that relate to the individual department (agency) and second, the characteristic of wider organisations in which is set (e.g.

ministry).

The external environment also influences the development and utilisation of GIS technology. In National and international socio-economic changes in general, or shivering in IT industry in particular can inhibit internal GIS organisational plans. The Botswana limited computer market was several time in difficult situation due to IT suppliers failures and unpreparness to offer full long term services. While there is evidence of large investments having been made to acquire GIS technology on one side, there is much less evidence that the GIS systems are functioning satisfactorily and contributing to national development efforts. Very common behaviour of GIS and IT vendors is to deliver equipment and SW only. Aftermath of supply there is nothing seriously achieved in the area of maintenance and proper support. Very soon equipment is becoming out-dated, basic training skills are vanishing due to the occupancy with other daily duties not GIS related, and funding for annual HW/SW upgrades are not secured and utilised. Under these circumstances and with aid of bureaucratic inertia, sometime political instability and personnel cynicism, double standards, combination of all these and previously discussed internal and external factors can easily lead to the ill-conceived GIS investment.

In our further evaluation of different foreign recipes suitable for Botswana's GIS melting pot a special attention is given to Budic (1994) comprehensive collection of GIS implementation factors in different organisational settings. She pursued an exceptional analysis of numerous GIS implementation factors developed by different authors, that can guide any organisation aiming to introduce GIS. The synthesis of her research findings examines the following organisational factors identified as important components of effective geographical information systems: 1) political support for GIS; 2) staff support for GIS; 3) length of experience with GIS; 4) system sharing; 5) comprehensiveness of GIS data base; 6) number of GIS applications; and 7) type of GIS application.

Organisational GIS politics in Botswana should play an important role because the entire administrative machinery in central and local government is very politicised. Winning *political support* and getting its blessing for future faster and more delightful GIS development must become prerequisite. In the same time, familiarisation of politicians and decision makers through user- friendly GIS interfaces can make their job easy and attractive task during political relies and latter when they have to translate their policies and promises into real socio-economic and physical world. In her research Budic (1994) concludes that political support, which secures commitment to GIS implementation, is expected to correlate with more effective use of GIS technology.

Staff support for GIS practical utilisation in the country should be based on different pillars then it is now. Each department interested in GIS application must have unit consisted of at least 3-5 people trained in complex combinations of GIS hardware, software and data base elements. Continuation with the "one man GIS units" is definitely not answer for the most of the departments in which GIS skills must be coupled with expertise in a substantive professional field. In this regard more general and specialised training is needed to catch up with the latest voices in GIS technology. Bridging existing staff gaps will be possible only through arisen of a new GIS profession trained partly in the country and partly overseas.

The time component and *length of experience* with GIS in its future diffusion will also play a crucial role. Any GIS success can't be achieved instantly. Mastering GIS requires time and intensive work, although technology itself is becoming more user friendly comparing to situation ten years ago. After adjusting to an automated way of working employees can take a more creative approach exploring new ways of performing the old duties (Budic, *ibid*). Initial euphoria after the first coloured map came out from the plotter is a typical reaction of GIS beginner. A long way forward is something expected for all who intend to exploit a full range of GIS capabilities. The proper guidance for new generation of Botswana's GIS fans is that the benefits of this

inviting technology are not attained overnight. Honestly speaking, only the length of GIS use which proportional to the training time (2-4 years) can yield first high quality benefits.

System sharing is definitely another important element for inclusion into further GIS development in the country. Existing duplication of efforts, data, HW/SWs in limited personnel and staffing conditions is asking for radical change. A multi-departmental and inter-ministerial or corporate approach to this sensitive issue is required in a very near future. As a result of system sharing more benefits and savings in all aspect of GIS performing can be expected. Operational and decision-making effectiveness will yield the highest returns on investments, which was not the case by now.

As a normal consequence of system sharing more **comprehensive GIS database** is viewed to be developed. Such data base should encompass more distinctive features suitable for a wider range of applications and decision-making alternatives. The number of mapping layers will reflects such complexity and influence multi-purpose utilisation by different departments and agencies. Furthermore, this can increase the **number of GIS applications**, and in turn the better GIS likelihood will be created helping numerous and diverse activities.

Finally, also is important to advance existing routine GIS functioning towards more complex **typology of tasks** that can be performed with the GIS aid. For example most common GIS task in Botswana such as hard-copy mapping, must give chance and room to GIS intelligence and brain automatisation. The nature of GIS and complexity of real world call for this historic move. Actually, today is the last time for key players in Botswana GIS world to promote this technology from simple drawing tool to the engine for spatial synthesis and rational decision making.

Beside all previously elaborated ideas and concepts, we can also add some of Cartwright's (1991) recommendation to conclude our discussion. He notes that there are three additional important factors to be applied in future organisational contexture of any GIS development. Firstly, the widespread of computer literacy within organisation is an undoubtful objective, meaning maximum entrance provision to hardware, software, training and technical support. Secondly, phasing is only response to real and pressing needs, rather than trying to create a comprehensive, general-purpose information system. Thirdly, all the costs, as well as all the benefits, of creating new or improving existing GIS should be anticipated and calculated in advance. These guidelines will not guarantee success, but may help saving organisation from grief.

Recommendations concerning Human behaviour

On the individual or human side of familiarisation with GIS technology, there is a colourful palette of determining factors that can be selectively included in any expert study for different Botswana's agencies before they acquire new, or plan to upgrade the existing GIS complex. Unfortunately, this kind of specialised GIS research has not been conducted before and immediately after acquiring GIS technology. In most of the government and parastatal agencies GIS has been introduced through more and lees spontaneous activity.

Based on Budic and Godschalk (1993) researches in different governmental agencies one of recommendation for successful GIS implementation is to investigate the following: 1) GIS users (employee who personally operate GIS technology); 2) prospective GIS users (employees who will be direct users of GIS technology); 3) indirect GIS users (employees who use products generated with GIS technology but do not operate the technology personally); 4) GIS non-users (employees who do not use GIS technology either directly or indirectly); and 5) higher level administrators (GIS non-users in organisational positions able to initiate and support GIS implementation, e.g. department heads).

Adoption, therefore, will results from opinions and influences of different stakeholders. Expression of their common interests, as well as agreements and disagreements will help for more creative system design. However, their vote for yes or no, will heavily depends on different situations determining individual decisions. In most of the cases individual preferences can vary, but in the same time there is high level of correspondence based on different theoretical propositions. A number of authors (Rivard 1987, Igbaria and Nachman 1990, Croswell 1991, Carey 1988, Campbell and Masser 1991, Budic and Goldschak 1993) highlighted the following factors as a dominant criteria in personnel evaluation and attitudes towards GIS acceptance:

- Perceived relative advantage
- Compatibility with personal and cultural values, and beliefs.
- Compatibility with computer experience
- Perceived complexity of GIS technology
- Exposure to GIS technology
- Computer/GIS related anxiety
- Attitude toward work-related change
- Networking

Employees vary in their (perceived) need for GIS technology. Diffusion among them depends on the type of function and operations performed by an agency, as well as the particular staff member's current involvement in different projects, imposed deadlines, supervisor's tolerance for experimentation with new task approaches, expectations about his/her performance, knowledge, experience, and personal history (Budic and Goldschak, 1993). A very common situation in Botswana is that the staff designated to develop departmental GIS facing numerous constraints. For example, the time factor is one of the crucial and it is limiting people to master technology. Short GIS courses, individual learning and difficulties with parallel office duties (e.g. GIS training combined usual daily working load). In such position individual frustration and stress are common followers and people are starting to express anxiety and animosity towards technology. To avoid similar difficulties in future it is an imperative to approach each individual involved in GIS venture as a separate entity. Discovering all personal preferences and attributes concerning expression of their interests to learn and use GIS can on contrary improve the entire GIS climate and secure organisational efficiency.

Until all of these important considerations are not being assessed and incorporated into future GIS debates and feasibility expertises, the Government and other GIS pools will continue to face haphazard distribution and inefficient utilisation of GIS resources and human unsatisfaction. It is evitable that the highest GIS concentration will remain in the capital city of Gaborone, leaving district centres and local authorities with disastrous shortages in equipment and untrained staff. However, even in Gaborone which houses the majority of government professional agencies, the transfer of GIS technology could be hampered by shortage of interdisciplinary and well co-ordinated professional teams. Hopefully, some of GIS decision makers will read these lines recognising current loopholes and needs for necessary changes aiming to facilitate and co-ordinate organisational and human GIS rejuvenation and renaissance from the bottom to the top of government hierarchy.

Conclusion

This paper has shown that little has been done in implementing GIS in the country, based on adequate human and institutional framework. The main objective was to raise awareness about the importance of human and organizational factors that can influence smooth and beneficial GIS use. The implementation of GIS still confronts numerous difficulties and the question of organizational needs and institutional change due to introduction of new technology is entirely unexplored. The paper counters the claim that the lack of adequate organizational schemes and procedures is the main reason why so little has been done in an inconsistent and

sporadic fashion.

Continuous deliberate action in human and organizational sphere will be the main prerequisite for the radical changes in existing haphazard and random diffusion of GIS technology in different government, parastatal and private organizations. The information acquired through our research is a starting point in recognising the dynamic relationship between those two: human and organizational aspects of GIS technology implementation. efforts to make positive step forward. The existing implementation framework assumes bureaucratic heritage, which is contrary to the modern GIS system building, in which proper sensitizing of human crew and organizational base flexibility, should be the major features for successful GIS development.

The most prominent measures are suggested from the different international sources especially those that have been implementable in third world countries. All of these masseurs have been discussed within local environs in which they can provide organizationally sound and efficient acting. The suitability of specific methods proposed in Botswana set-up might vary among different departments and parastatal agencies. It will be necessary to devote more financial and managerial efforts to look at the positive side of GIS use in different organisational and human settings. However, the revised approach will definitely effects organizational performance and influence different individual and group behavior towards wider acceptance of new technology.

The results of our study gives clear evidence that the fay forward is not going to be easy and short one especially with regard to the existing functionality of GIS which does not correspond fully to the requirements of different users. Interorganisational GIS activities will continue to raise the opportunities for complications in establishing departmental partnerships, and require additional negotiations over cost, accuracy, responsibility and many other issues involved. It is clear that the future of human and GIS organisational changes in Botswana will be easier to advocate than to practice (Azad and Wiggins 1995; Budic-Nedovic and Pinto, 1999)

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