GIS SOLUTIONS AND LAND MANAGEMENT IN URBAN ETHIOPIA. PERSPECTIVES ON CAPACITY, UTILIZATION AND TRANSFORMATIVE POSSIBILITIES

Tendayi GONDO[1], Scelo ZIBABGWE[2]

[1]Urban and Regional Planning Department, University of Venda, P Bag X5050, Thohoyandou 0950, Limpopo province, South Africa, tendayi.gondo@univen.ac.za

[2]Urban Management Masters Programme, Ethiopian Civil Service College, P.O. 5648, Addis Ababa Ethiopia, zibagwes@gmail.com

Abstract

For strategic, operational and financial reasons, GIS solutions are becoming an increasingly important area for realizing effective land management systems for many municipal governments across the globe. Despite the obvious gains, many local authorities in Africa have not yet taken advantage of the new developments within this sector. The paper gives an anatomy of realities and challenges of using GIS solutions for improved land management in a sample of Ethiopian cities. Empirical evidence was gathered from a panel of experts drawn from at least 22 cities and towns through the Delphi method. The analysis was done within the context of the Capacity, Usage and Transformation (CUT) framework. The reality is that the status of GIS for land management in most cities is that of constrained capacity, usage and transformation. The analysis also reveals that access to GIS system software does not automatically translate to the attainment of organizational value. Instead, it enables the formulation and realization of organizational strategy that will direct organizational change and subsequently lead to increased organizational value. This however requires the fixing of challenges relating to finance, technical expertise, institutional arrangements and the implementation process.

Keywords: Organizational value, operational efficiency, implementation, capacity, usage, transformation.

1. INTRODUCTION

For strategic, operational and financial reasons, Geographical Information System (GIS) based mapping solutions are becoming an increasingly important area for realizing effective land management systems for many municipal governments across the globe. Despite the obvious gains, many local authorities in Africa have not yet taken advantage of the new developments within this sector owing to a myriad of resource challenges. With the advent of new technologies – such as global navigation satellite systems, remote sensing and new GIS based mapping solutions, it seems Africa might be on the brink of leap-frogging over a number of stages in urban planning as well as commercial and security systems (Masser, 2005; Opoku-Mensah and Salih, 2007). The drive towards the *information society* has seen public utilities such as electricity, gas and water, telecommunications and transport networks making extensive use of use of geographic products and services to manage their operations. In addition many local authorities in developed world are making use of geo-information products in developing and managing the land cadastre system.

We define geographic information as a branch of geography that focuses on collection, storage, analysis and display of geographic data and the application of such data to decision making (Opoku-Mensah and Salih, 2007). GIS therefore can be seen as spatial tool of analysis that facilitates the planning purposes and ultimately decision making at the highest corporate levels.

The invaluable role played by GIS in developing and managing an effective land cadastre system has been recognized by the Ethiopian government as enunciated in its proclamation 456/2005 on Land Administration and Use. The proclamation states that,

"*Whereas, it has become necessary to establish an information database that enables to identify the size, direction and use rights of the different types of land holdings in the country such as individual and federal and regional states holdings" (preamble, proclamation #456 of July, 2005)*

Urban land provision has been recognized as one major component that will go a long way in promoting urban socio-economic growth in the country. Other pillars as spelt out in the current Urban Development process include expansion of micro-business enterprises, housing development, provision of lands and development infrastructure, development of social services, and setting urban classification, urban planning and environmental protection (Melkamu, 2009). The lands component incorporates seven principles, including real estate registration, provision of title deeds and enhancing real property transactions (Urban Development Policy, 2006in Melkamu, 2009). The absence of a proper real estate registration system, aggravated by problems such as absence of good governance, proliferation of illegal (informal) settlements, poor urban management, outdated and/or rigid development plans, urban decay, and capacity problem saw the Ethiopian Authorities introducing a number pilot projects in a number cities in 1999 aimed at improving the land cadastre system through GIS applications. Cities that initially benefited from such projects included Bahir Dar, Mekelle, Awassa and Adama.

The paper reviews the realities and challenges of mainstreaming GIS mapping solutions in Ethiopia's urban land management system. Following this introduction we present the adopted analytical framework. This is followed by a sniper of the materials and methods utililized to generate empirical evidence. A results and discussion section is then presented in the next section. The paper winds up by forwarding a number of recommendation and giving major concluding thoughts.

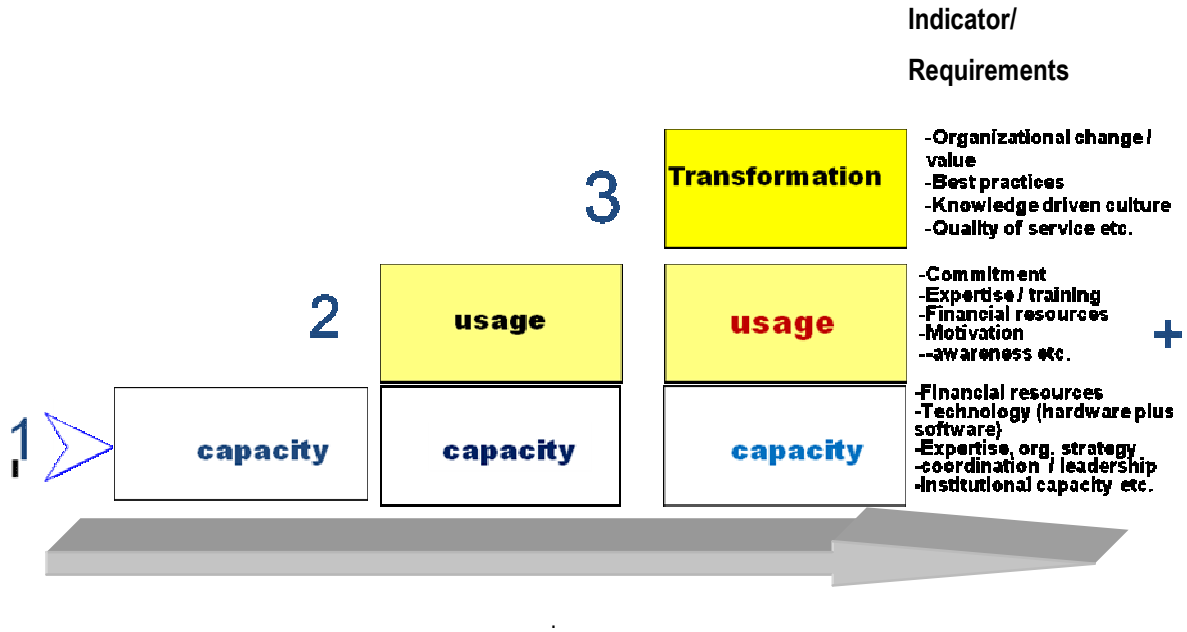
1.1. Analytical framework

The analysis is done within the context of the Capacity, Usage and Transformation (CUT) framework (Figure 1). Implicit in the framework is that change or transformation in land management can only be effected if capacity is built (through the acquisition of GIS hardware and software) and if that capacity if appropriately utilized to yield value. The capacity building process examines challenges and prospects in both the

implementation and system development process. In this analysis we question the financial, institutional, technical and / or system implementation capacity of local authorities in accessing and implementing GIS related resources. The "Usage" component looks at the ability of local authorities to utilize existing GIS system(s) in improving their land cadastre systems. The "Transformation" component looks at the extent to which GIS based strategies yields organizational change and subsequently organizational value. To facilitate a review of the extent to which GIS based solutions have been integrated into land management systems of various local authorities, a number of proxy measures have been developed within the "CUT" framework (refer to Figure 1).

2. MATERIALS AND METHODS

Empirical evidence was gathered from a panel of experts drawn from at least 22 cities and towns through the ***Delphi method.*** The Delphi Method is based on a structured process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback. In this analysis structured questionnaires were distributed to 62 experts in land management drawn purposively from at least 22 Ethiopian cities and towns in August – September, 2009. Only 50 were returned. Figure 2 portrays the names of cities and towns from which the experts were drawn. Owing to the their sheer sizes, the majority of the experts came from cities and towns from Oromia and Amhara regional states. Empirical data was also complicated by insights drawn from a number of independent studies facilitated by the authors in April – June, 2008 and April – June 2009.



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Management Research and Practice
Volume 2, Issue 2 / June 2010

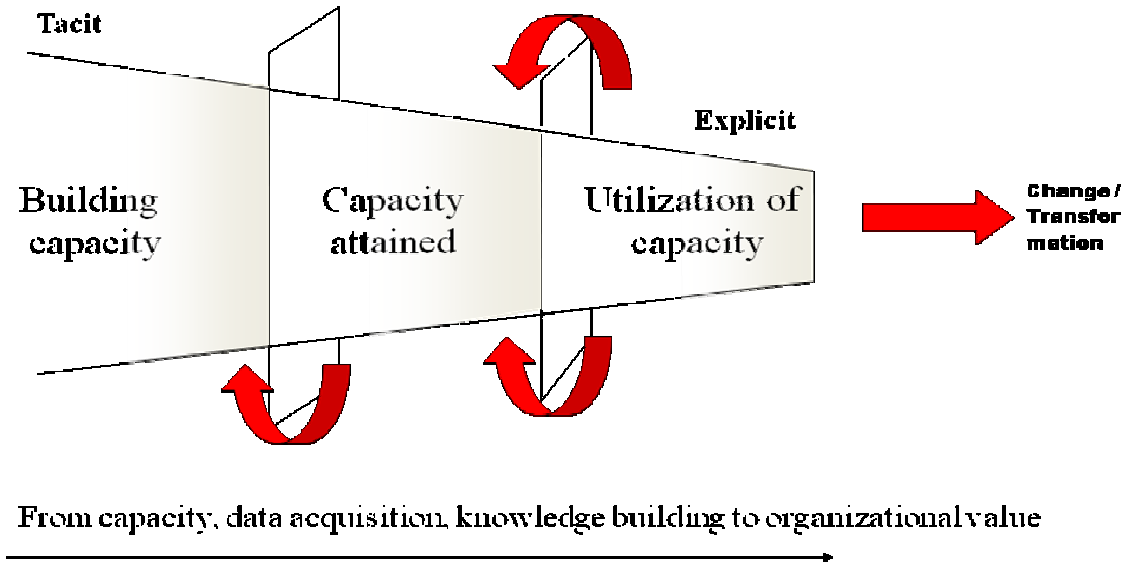

FIGURE 1: ANALYTICAL FRAMEWORK.

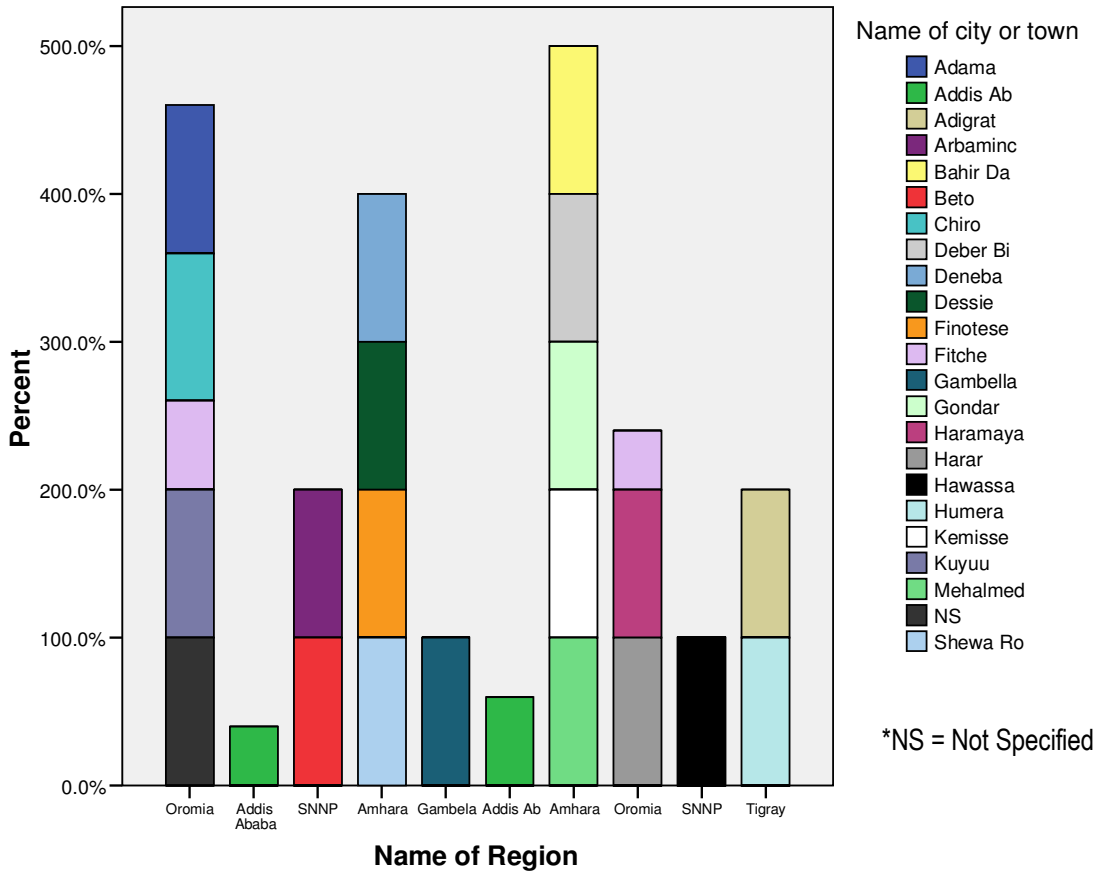

FIGURE 2 - SAMPLE CHARACTERISTICS

The average length of employment of panel experts is 5 years (standard deviation = 5.35)

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2067- 2462

3. RESULTS AND DISCUSSION

3.1. Realities

Most Ethiopian urban centres grapple with informal land markets and developments a phenomenon prevailing in most third world where, since the 1950s, 70-95% of all new housing built in developing countries are unplanned or have been developed on land acquired informally (Farvacque and McAuslan, 1992) and the trend does not show any sign of slowing down (UN-Habitat, 2003; Davis, 2004). As significant proportion of urban development occurs outside the official purview of planning while the long term benefits of planned settlements are recognized. To this problem urban/town planning acts & reacts on existing slums in a manner that fails to capture and incorporate preventative and proactive measures that could reduce the spread of future slum growth and ultimately mitigate the effects of unplanned settlements on the majority of urban dwellers in developing countries (Sietchiping, 2005). This is particularly pertinent in the urban fringe where informal subdivision processes outpace slow formal expropriation processes which when they materialize, they find the land already occupied informally and there voices calling for regularization or formalization as shown below.

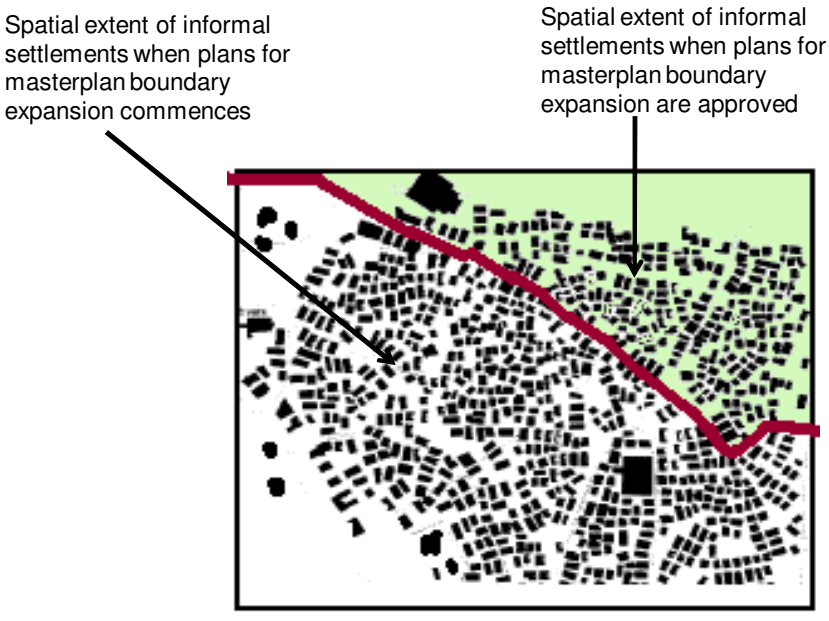


FIGURE 3 - SCHEMATIC OF INFORMAL LAND DEVELOPMENT IN THE URBAN FRINGE

Eight out of the 22 sampled towns and / cities (that 36 %) are already running a GIS based land management system (Table 1). These include, but are not limited to cities such as Addis Ababa, Adama, Adiggrat, Bahir Dar, Dessie, Gondar, Humera and Chiro town. Of the remaining 14 towns (64%) and / or cities plans were

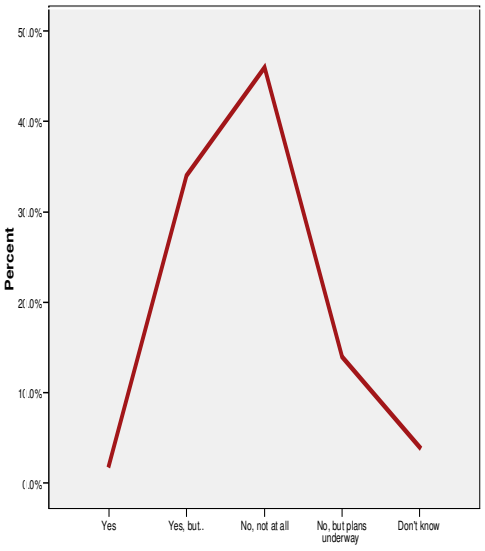
said to be underway to introduce a GIS based land management system in 3 (14%) cities, including Arbaminch, Hawassa and Shewa Robit. Absence of a GIS based land management system was acknowledged in 10 (45%) other cities and / towns (refer to table 1). Two officials from Gambella city (5%) were not sure whether the GIS based system existed. The analysis reveals that the majority of the sampled towns and / or cities are not running a GIS based land management system. In all of the cases where the system existed, it was acknowledged that the GIS applications in land management were not effectively delivering the desired results owing to a multitude of constraints relating to capacity, the utilization of GIS resources and the management of system development process. These shall be reviewed in later sections. As a result of the absence of a GIS based land management system and the poorly function GIS systems in some towns and cities, it is not surprising that the various facets of the land management process have not benefited much (Figure 3 and 4). For example, 62% and 60% of the panel experts reiterated that the land acquisition and land subdivision processes (respectively) of their respective local authorities had not benefited much from GIS based solutions (Figure 3).

TABLE 1: EXISTENCE OF A GIS BASED LAND MANAGEMENT SYSTEM.

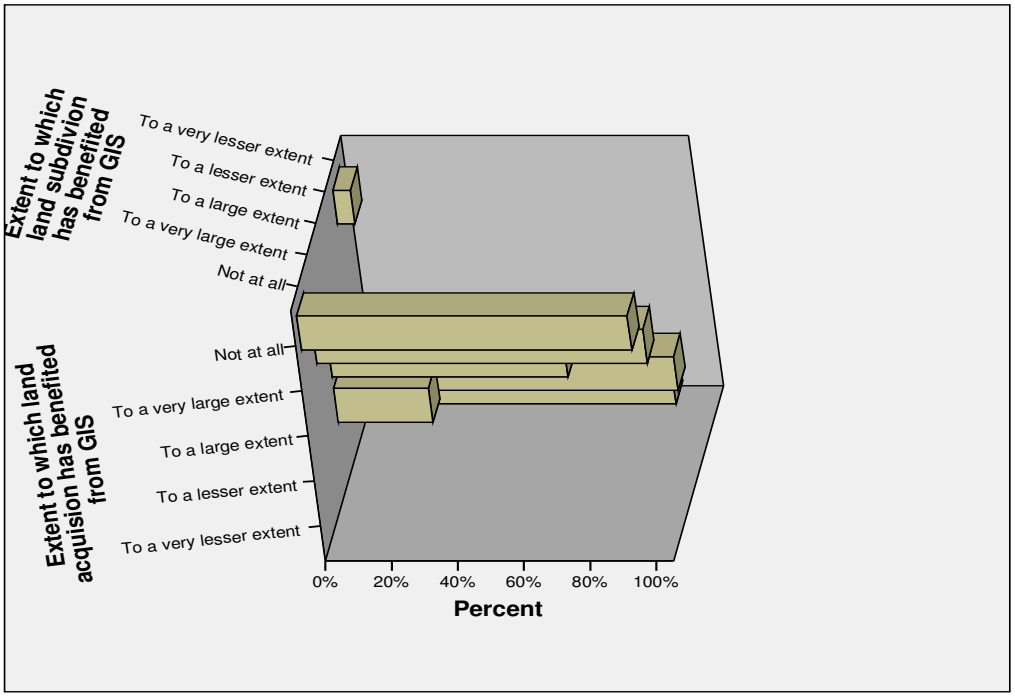
DOES THE LA RUN A GIS BASED LAND MANAGEMENT SYSTEM?COUNT

	Does the LA run a GIS based land management system?					Total
City/Town	Yes	Yes, but..	No, not at all	No, but plans underway	Don't know	Count
Adam	0	1	0	0	0	1
Addis	1	4	0	0	0	5
Adigra	0	2	0	0	0	2
Arbam	0	0	0	2	0	2
Bahir	0	2	0	0	0	2
Beto	0	0	2	0	0	2
Chiro	0	2	0	0	0	2
Deber	0	0	1	0	0	1
Deneb	0	0	1	0	0	1
Dessi	0	2	0	0	0	2
Finote	0	0	2	0	0	2
Fitche	0	0	5	0	0	5
Gamb	0	0	0	0	2	2
Gonda	0	2	0	0	0	2
Haram	0	0	2	0	0	2
Harar	0	0	2	0	0	2
Hawa	0	0	0	3	0	3
Humer	0	2	0	0	0	2
Kemis	0	0	2	0	0	2
Kuyuu	0	0	2	0	0	2
Mehal	0	0	1	0	0	1
NS	0	0	3	0	0	3
Shew	0	0	0	2	0	2
Total	1	17	23	7	2	50

Aggregated statistics reveal that the majority (46%) of the sampled panel experts acknowledged the nonexistence of a GIS based land management system. 34 % however acknowledged existence but were not happy with its effectiveness. Only 1 panel expert (2%) was content with the existence of a GIS based land management in Addis Ababa. 14 % of the experts said plans were underway to introduce a GIS based land management system. The rest (4%)



A similar picture is also portrayed for the land registration and lease administration process. An equal proportion of experts (66%) indicated that land registration and administration had not realized gains from GIS based solutions (Figure 4).



Extent to which land acquisition has benefited

	Frequency	Percent	Valid Percent	Cumulative Percent
To a very lesser extent	18	36.0	36.0	36.0
To a lesser extent	13	26.0	26.0	62.0
To a large extent	5	10.0	10.0	72.0
To a very large extent	9	18.0	18.0	90.0
Not at all	5	10.0	10.0	100.0
Total	50	100.	100.0	

Extent to which land subdivision has benefited

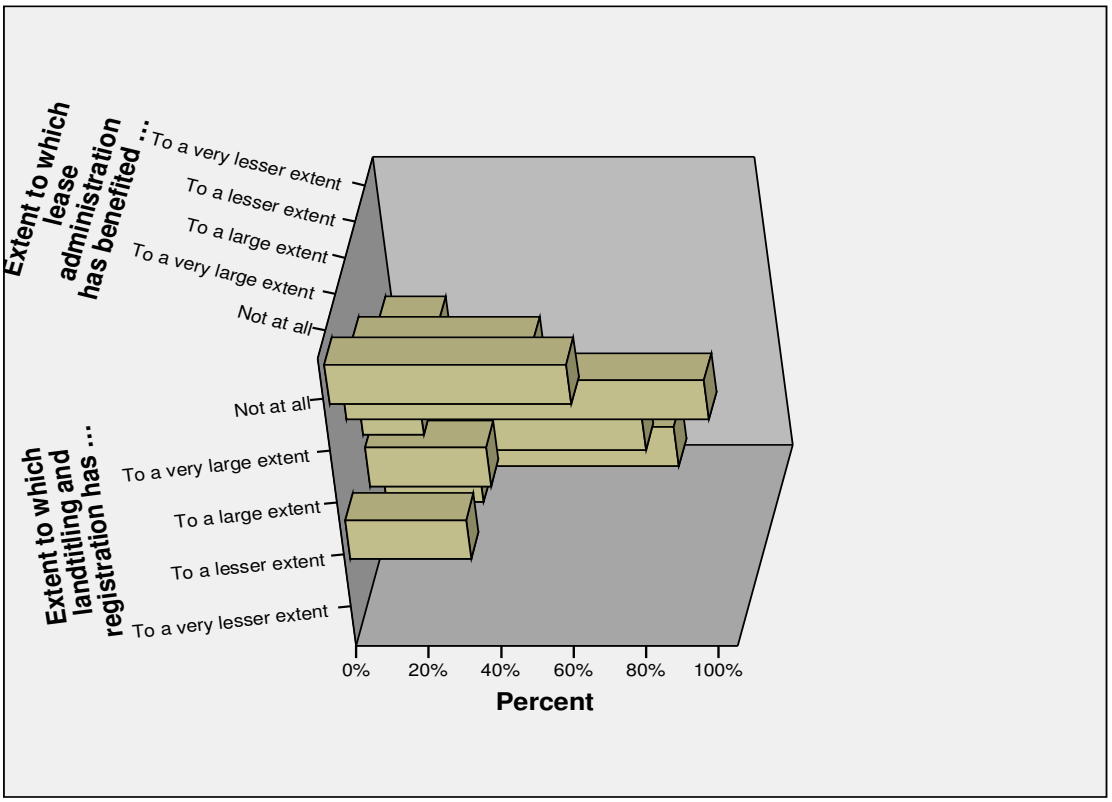
	Frequency	Percent	Valid Percent	Cumulative Percent
To a very lesser extent	19	38.0	38.0	38.0
To a lesser extent	11	22.0	22.0	60.0
To a large extent	7	14.0	14.0	74.0
To a very large extent	9	18.0	18.0	92.0
Not at all	4	8.0	8.0	100.0
Total	50	100.	100.0	

FIGURE 4 - EXTENT TO WHICH THE LAND ACQUISITION AND SUBDIVISION HAS BENEFITED FROM GIS (N=50)

It is also interesting to note that a significant proportion of experts from local authorities that are currently running GIS based land management systems have acknowledged marginal gains in their land management systems. For instance, 28% and 32% of the panel experts acknowledged improvements in land acquisition and subdivision processes respectively. Similar statistics for land registration and lease administration are 30% and 28% respectively. The major gains have been scored in the creation and management of a land

database system. GIS based solutions have managed to overcome some of the barriers associated with the old filing system (Figure 5). These challenges include but are not limited to;

- Data redundancy and inconsistence (multiple file formats, duplication of land information in different files).
- Difficulties in accessing data.
- Data isolation – Multiple files and formats.
- Integrity problems – hard to add new constraints or add existing ones.



Extent to which land registration has benefited

	Frequency	Percent	Valid Percent	Cumulative Percent
To a very lesser extent	18	36.0	36.0	36.0
To a lesser extent	15	30.0	30.0	66.0
To a large extent	4	8.0	8.0	74.0
To a very large extent	11	22.0	22.0	96.0
Not at all	2	4.0	4.0	100.0
Total	50	100.0	100.0	

Extent to which lease admin has benefited

	Frequency	Percent	Valid Percent	Cumulative Percent
To a very lesser extent	18	36.0	36.0	36.0
To a lesser extent	15	30.0	30.0	66.0
To a large extent	6	12.0	12.0	78.0
To a very large extent	8	16.0	16.0	94.0
Not at all	3	6.0	6.0	100.0
Total	50	100.	100.0	

FIGURE 5 - THE EXTENT TO WHICH LAND REGISTRATION AND LEASE ADMINISTRATION HAS BENEFITED FROM GIS (N=50).

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- Atomicity of updates – land database often left in an inconsistent state with partial updates being carried out.
- Challenges relating to concurrent access by multiple users – uncontrolled concurrent access often leading to inconsistencies.
- Data security problems.

Though to varying extents, the development of GIS based database systems have in most cases offered solutions to the above problems through,

- Controlling redundancy in data storage and in development and maintenance efforts.
- Sharing of data among multiple users.
- Restricting unauthorized access to data.
- Providing multiple interfaces to different classes of users.
- Representing complex relationships among data (in almost all the sample cases this has been achieved through the use of relational data base models).
- Enforcing integrity constraints on land databases.
- Flexibility to change data structures.
- Availability of up to date information.

GIS mapping solutions (such as the one shown in Figure 6) have necessitated the tracking land use, property and / or real estate changes in space and time. In Amhara Regional State general and more specifically in Bahir Dar city GIS has permitted the identification and definition of major attributes of properties and or parcels of land that are incorporated in the city owing to the inevitable expansion of city boundaries. Table 2 shows a sniper of major attributes in GIS database in the regional state.

FIGURE 6 - OLD MULTIPLE FILING SYSTEM IN ABIY ADDI MUNICIPALITY, ETHIOPIA.
Source: Abiy Addi Municipality archive, 2008

TABLE 2 - MAJOR ATTRIBUTES IN GIS DATABASE IN AMHARA NATIONAL REGIONAL STATE, ETHIOPIA

ITEM	GEOMETRY type	LAYER NAME	ATTRIBUTES	SOME EXAMPLES
			o Cluster/ Neighbourhood o Block o Parcel/Plot o Area	
4	POLYGON	Lot Boundary	o Lot ID o Lot Type o Area	Parking lot, reserved areas, etc
5	POLYGON	WATER BODY	o Lake o Swamp o Marsh o Pond o Area	
6	POLYGON	LANDUSE	o Residence o Administration o Commerce and Trade o Service o Manufacturing and Storage o Transport o Recreation o Forest and green o Agriculture o Special Functions o Area (sq mt)	
7	POLYGON	BUILDNG HEIGHT REGULATION	o BldReg_ID o Regulation Class o Area	

Parcel information	Building information	Address information
Property number	Building number	Street name and house number
Surface/area	Type of building/use	Information about various districts (school, parish, statistical area, etc)
Current land use	Number of floors	coordinates
Owners name and numeric identifier (transferred from the Land Book)	Numbers and data about each flat (number of sqm, number of rooms, etc)	
Owners postal address		

Contents of a parcel data (Source; Amhara National Regional State Bureau of Works and Urban Development, 2008)

3.2. Challenges

Mainstreaming GIS based mapping solutions into the land management system of many local authorities in Ethiopia has been constrained by many factors. We shall consider these within the "CUT" analytical framework.

Capacity

The capacity of many local authorities to acquire and effectively implement a GIS based land management system has been severely tainted by an overwhelming number of factors. Chief among these is inadequate financial resources to procure the much needed GIS technologies (Both hardware and software). It is only those few local authorities Like Addis Ababa, Adama City, Bahir Dar etc. that have managed to receive financial and technical assistance from a number of organizations, including the federal government of Ethiopia and GTZ just mention a few. Other small towns and cities have not taken an initiative and are waiting for such initiatives to be extended to them in the near or distant future. The constrained access to and utilization of GIS hardware such as computers is given in Figure 7.

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Volume 2, Issue 2 / June 2010

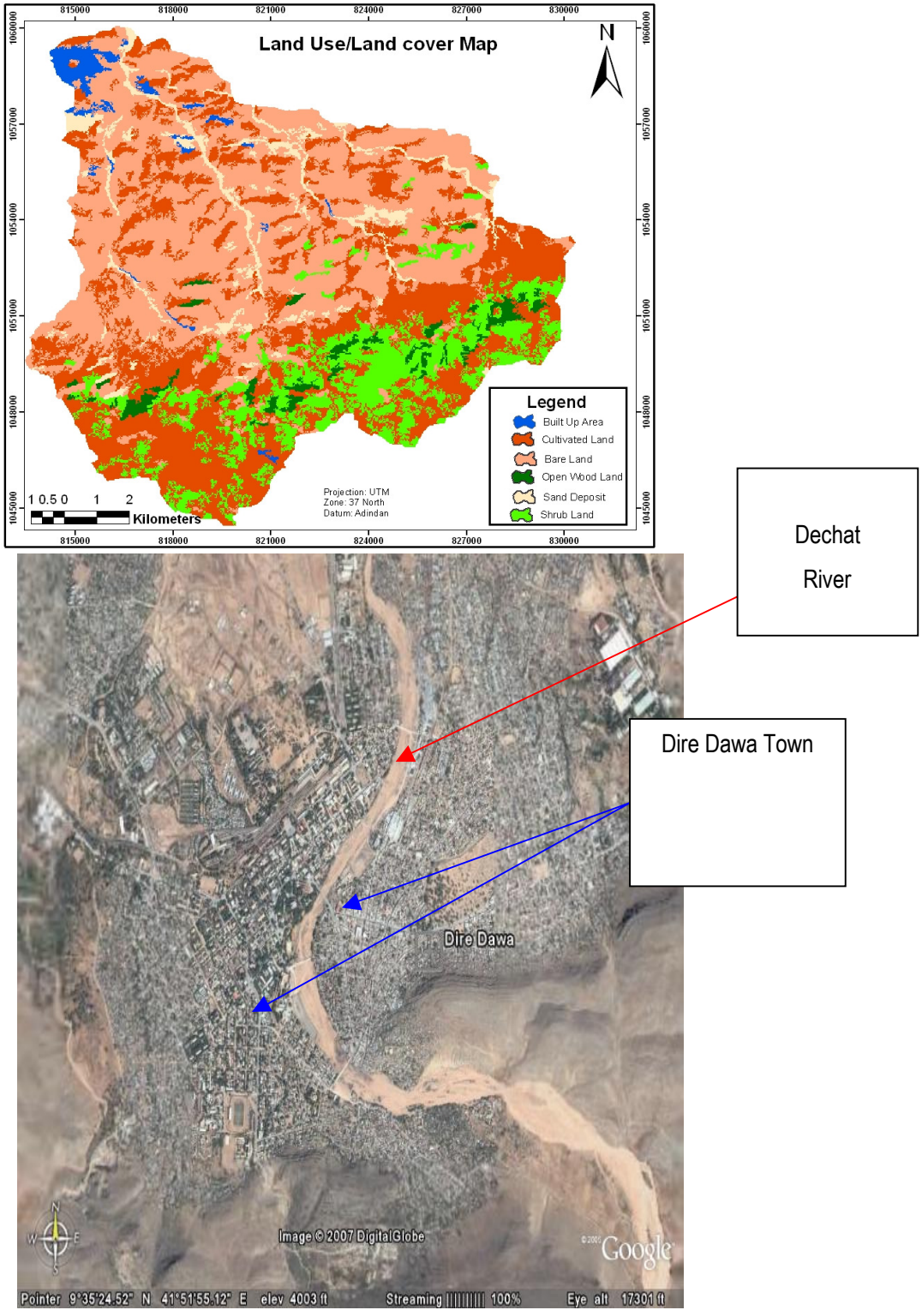

FIGURE 7: GIS BASED LAND USE / LAND COVER AND SATELLITE IMAGE OF DIRE DAWA CITY

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Computer ownership statistics are 42%, 44%, 10% and 4% for very low, low, fair and high response categories respectively. The fact that about 86% of the panel experts are acknowledging a generally low level of computer ownership in their respective local authorities means that implementing and effectively running a GIS based land management system is a daunting task for many. The situation looks dire when one considers the level of utilization of available few computers (Figure 7). Computer utilization statistics are 52%, 36%, 8% and 4% for the very low, low, fair and high response categories respectively. Computer usage has been construed by the general lack of expertise among the employees, and a lack of regular repairs on mulfunctional computer equipment. Lack of expertise has seen many local authorities who have been privileged enough to access some major developments in system software for the management of land and land related assets failing to realize potential value (Figure 8). Other capacity related charges are institutional in nature. In some urban centers such as Adama, The GIS system implementation process has not been streamlined into vision of the local authority through a clear know organizational strategy. This coupled with technical errors in the implementation process as well as a lack of proper coordination among different departments and a lack of commitment by some officials has rendered the whole system ineffective and inefficient. Even in those administrations such as Addis Ababa where the organizational strategy is clear, the strategy has not been effectively communicated to all relevant employees and this has negatively affected all efforts targeted at achieving commonality in objectives.

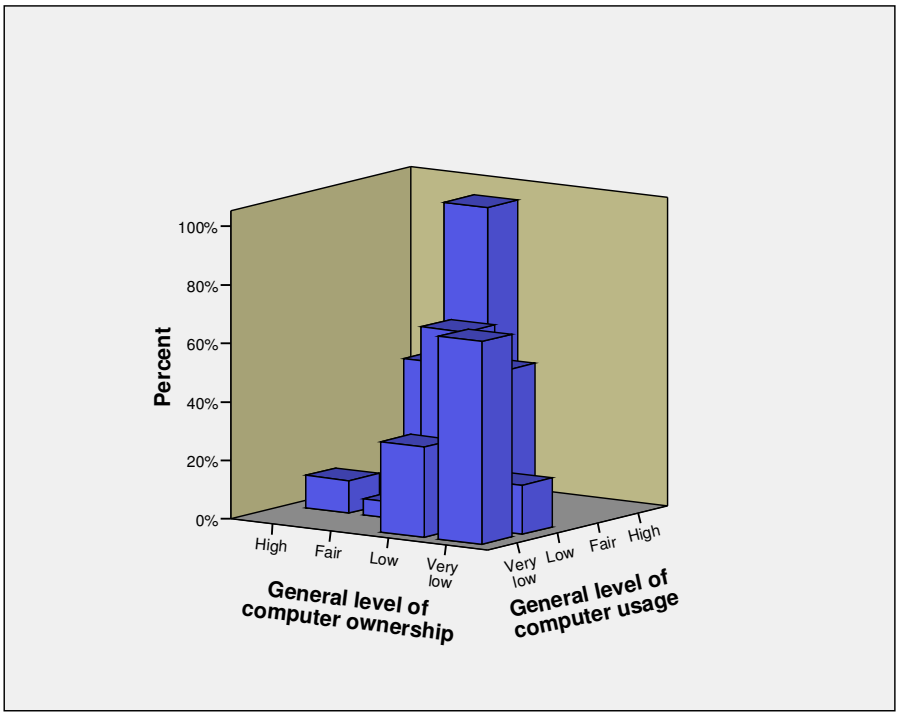

FIGURE 8 - PERCEIVED LEVEL OF COMPUTER OWNERSHIP AND USAGE (N=50)

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Management Research and Practice
Volume 2, Issue 2 / June 2010

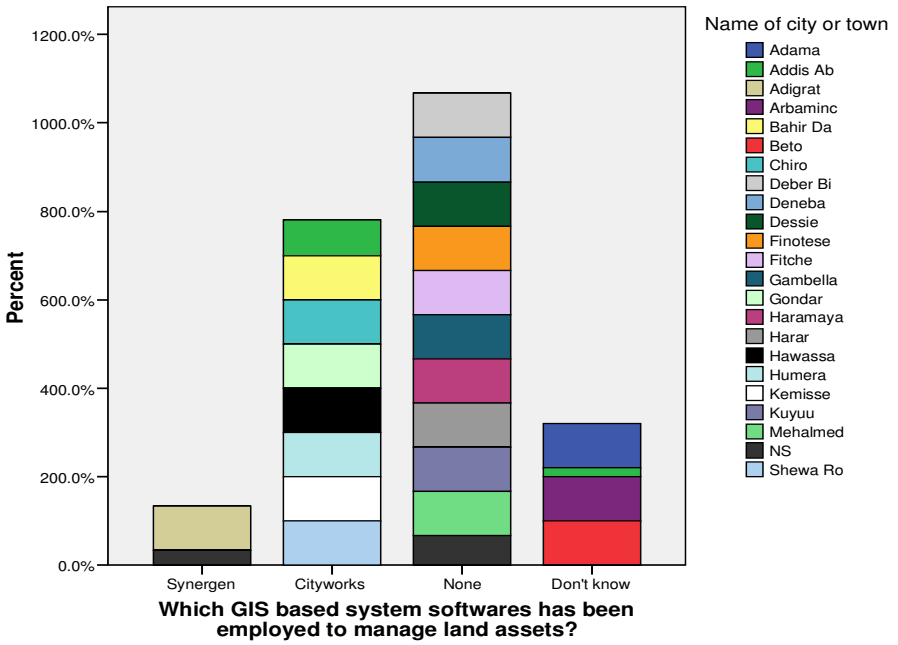

FIGURE 9 - GIS BASED SYSTEM SOFTWARE THAT HAS BEEN ACCESSED BY A SAMPLE OF CITIES / TOWNS (N=50).

Usage

The utilization of GIS resources has been constrained by such factors as lack of commitment, lack of skilled manpower, absence of incentives to motivate workers and a general lack of awareness of the utility of GIS resources in land management. Training programmes initiated in a few cities and towns have been limited to few people owing to financial constraints. The sheer small numbers of hardware components that exist in many local authorities has not helped the situation.

Transformation

Fostering organizational change that yields organizational value in the land management process has been difficult in many cities and towns owing to constraints characterizing *capacity* and *usage*. As a result service delivery has remained relatively low (Table 3)

TABLE 3 - EFFECTIVENESS OF THE LAND DELIVERY SYSTEMS OF TWO SAMPLE TOWNS

Urban land delivery system in Nekemte town (n = 150 households)			
	Very satisfactory	*Satisfactory*	*Not satisfactory*
No.	15	45	90
%	10	30	60

Remark: *The difference between proportions is statistically significant at 5% level of risk*

eISSN
2067- 2462

Urban land delivery system in Ambo town (n=200 households)				
	Very satisfactory	*Satisfactory*	*Not satisfactory*	*Worse-off*
No.	2	51	69	78
%	2	26	35	39

Remark: *The difference between proportions is statistically significant at 5% level of risk*

Table 4 summarizes a number of challenges affecting efforts aimed at reconciling GIS solutions and land management is a sample of towns and cities.

TABLE 4 - FACTORS CONSTRAINING THE MAINSTREAMING OF GIS SOLUTIONS IN LAND MANAGEMENT IN A SAMPLE OF SIX CITIES AND / TOWNS, ETHIOPIA.

Name of City / Town	Major Challenges
Hawassa city (SNNP)	- Shortage of manpower - Shortage of computers - Limited financial resources - Constrained human resource training programmes
Dessie City (Amhara)	- Technical errors at implementation - Lack of financial resources to update GIS technology - Lack of political will - Lack of staff motivation and awareness - Lack of a clear organizational strategy - Poor leadership.
Arbaminch (SNNP)	- Lack of GIS specialists - Inadequate GIS hardware resources - Limited staff training programmes
Fitche town (Oromia)	- Well engaged in reform but efforts thwarted by such problems as; - Shortage of professionals and requisite GIS equipment - Limited institutional and financial support from the national government. - Limited knowledge about GIS by the staff.
Humera city (Tigray)	- GIS land management system in place but not efficient because of; - Shortage of skilled manpower - Shortage of requisite GIS technologies - Very limited attention given to the GIS system.
Chiro town (Oromia)	- Lack of skilled manpower - A general lack of awareness among staff - Lack of political will from management

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Management Research and Practice
Volume 2, Issue 2 / June 2010

4. RECOMMENDATIONS

The effective implementation of GIS based solutions in Ethiopia requires that the following issues are addressed;

- The system implementation process must be strategy driven. It is imperative that urban managers craft a clear organizational strategy that will steer the much need change in land management and subsequently yield value. The relationship between these is portrayed in Figure 9. The relationship between the implementation of GIS based mapping solutions in land management and the attainment of organizational value is not a spontaneous a direct one as implied in Figure 10.

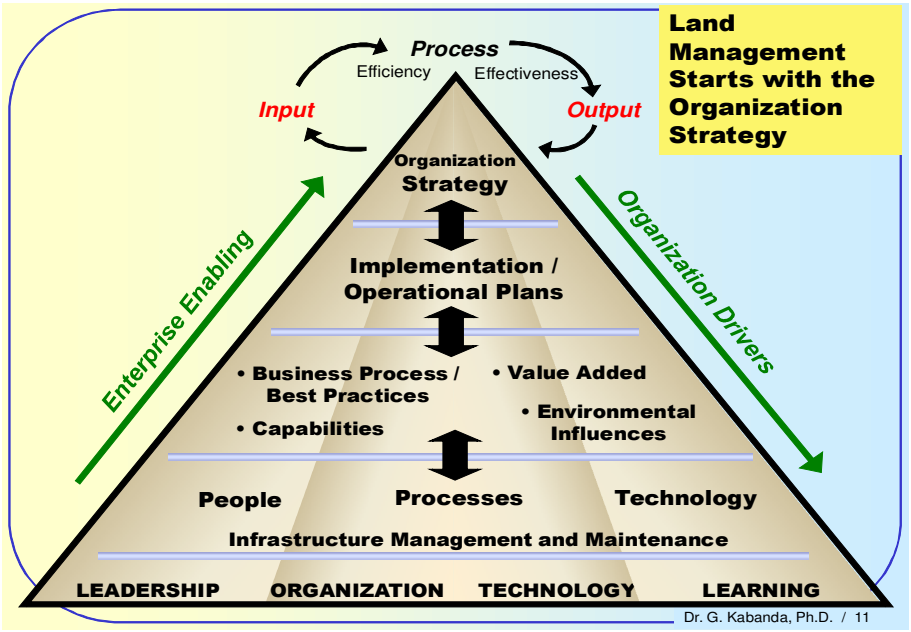

FIGURE 10 - THE PROCESS OF REALIZING *VALUE* IN LAND MANAGEMENT.

- Local authorities should strive to outsource financial assistance that will go a long way in the procurement of the much needed GIS resources.
- Human resource training programmes should be initiated or expanded (in cases where efforts are already underway) so as to impart the necessary skills required to handle GIS technologies.
- Good leadership that encourages a culture of knowledge building and sharing would go a long way in overcoming challenges leadership crises.
- Worker morale should be boosted through appropriate incentive skills. Training can be one such an incentive.

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2067- 2462

- General awareness can be raised by initially opening up intra-organizational channels of communication. The ideal starting point would be to communicate the local authority's strategy to all employees regarding the implementation of a new GIS system for land management.
- Need to go beyond the static GIS outputs through complimenting it with other techniques that have simulation and modeling capabilities to help predict future informal settlement expansion areas so that cities adopt preventive urban land management practices.

5. CONCLUSIONS

The reality is that the status of GIS for land management in most cities is that of constrained capacity, usage and transformation. Capacity related challenges include inadequate financial resources to procure requisite GIS infrastructure. Lack of implementation capacity, lack of a clear organizational strategy and a general lack of political will among officials are some of the capacity constraints. The utilization of GIS technologies has been constrained by the sheer small numbers of GIS resources (both hardware and software) characterizing many local authorities. Inadequate GIS infrastructure maintenance schemes and lack of computer knowledge are some of the bottlenecks that have seen the constrained utilization of GIS resources. The analysis also reveals that access to GIS system software does not automatically translate to the attainment of organizational value. Instead, it enables the formulation and realization of organizational strategy that will direct organizational change and subsequently lead to increased organizational value. This however requires the fixing of challenges relating to finance, technical expertise, institutional arrangements and the implementation process.

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REFERENCES

Abbiy Addi Municipality. (2008) Municipality archive files.

Amhara National Regional State Bureau of Works and Urban Development (2008). *A Manual for the Preparation of Cadastre for Urban Centres of the ANRS*, Bahir Dar, Ethiopia.

Davis, M. (2004). Planet of Slums. Urban involution and the informal proletariat. *New Left Review* 26, March 2004, pp. 5-34.

Farvacque, C. and McAuslan, P. (1992). *Reforming Urban Land Policies and Institutions in Developing Countries*, World bank, Washington D.C.

Masser, I. (2005). *GIS worlds: Creating Spatial Data Infrastructure.* Pg 9. Carlifonia: ESRI Press

Melkamu, B.M. (2009). Growing Initiatives for the improvement of cadastre in Urban Amhara: Potentials, Prospects, Challenges. Eilat, Israel.

Opoku-Mensah, A. and Salih, M.A.M. (2007). *African e-markets: Information and economic development*. Economic Commission For Africa. Centre for African Studies, Copenhagen University and International books.

Sietchiping, R. (2005). Prospective Slum Policies: Conceptualization and Implementation of a Proposed Informal Settlement Growth Model, *Third Urban Research Symposium On Land Development, Urban Policy And Poverty Reduction,* 4-6 April 2005, Brasilia, Df, Brazil.

UN-Habitat (United Nations-Habitat) (2003). *The challenge of slums: global report on human settlements* 2003. London: Earthscan.

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