Applications of Geographical Information System Infrastructure in Urban Land Management in Tanzania

A. KYESSI*

ABSTRACT
Community involvement in urban land regularisation process as an urban land management entity in securing tenure decisions process integrations with Geographical Information System (GIS) has long been recognized and discussed in national and international fora for land improvement in informal urban settlements. The challenges emanating from the discussion among others, limited application of GIS tools to create habitable human shelter in the context of urban environmental change, ineffective use of GIS technology in decision making at a local level, lack of updating the index numbers to reflect migratory trends in urban areas and changes of housing ownership in the rapidly growing settlements, which seems unmet. This paper contributes to this evolving debate focusing on how local community participates in land regularisation process and how effectively Geographical Information System can be applied in improving land development and management in urban neighborhoods which have grown as informal settlements. The case of Ubungo Darajani in Dar es Salaam city is taken as an example and it provides lessons potential for community involvement, effective use of Geographical Information System and policy gaps to be addressed in urban land management at the local level.

Key Words: Community Involvement, GIS Infrastructure, Land Regularisation, Informal Settlements, Security of Tenure

INTRODUCTION
Community involvement and use of Geographical Information System (GIS) infrastructure in urban land management have been perceived as a viable strategy to enhance communities’ decision making in land regularisation process for sustainable development in developing countries’ informal settlements (Kombe, 1995; De Soto, 2000). The community involvement concept has been widely discussed by Pretty et al. (2000) and Berman (1997). In their context it is conceived as a process of inclusion of landholders, tenants, private sectors, government and donor community in planning or guiding and controlling urban land development for sustainable settlement development. GIS Infrastructure has been widely discussed through Agenda 21-Chapter 40. It refers to a process of using combination of tools (computers hardware and software), data (spatial and non-spatial) and people/users (i.e. decision makers, managers, technicians, operators and public) in urban planning and management. Land regularisation refers to processes and procedures related to land use planning, cadastral surveying and land registration which are geared towards directing and guiding land development and enhancing security of tenure in informal settlements (Kironde et al. 2002). Informal settlement paradigm has been thoroughly discussed by Nurul Amin (1997) and Kyessi (1990). Informal settlement is conceived as a settlement that its inhabitants do not enjoy rights to an adequate standard of living and legal rights to access, occupation and use of land. The residents are exposed to risks of being evicted due to lack of security of tenure. Informal settlements are also characterised by inadequate access to basic urban services, informal agreement in land transaction and haphazardly housing development (Kyessi, 1994; Kironde 1995). Security of tenure refers to agreement between actors on the access, use and owning of land property. It is governed and regulated by legal and administrative

* Dr. A. Kyessi is a Senior Research Fellow in the Institute of Human Settlements Studies, Ardhi University. His contact address is P.O. Box 35124, Dar es Salaam, Tanzania. E-mail: kyessi@aru.ac.tz
framework under both written and unwritten norms. A person is secured when he/she is protected from involuntary removal from the land. Further, urban land management has been discussed widely by Mabogunje (1992) and Kombe (1995). It refers to a process of effective and efficient land development facilitation, control and tenure security to create a habitable, safe and competitive city. The application of GIS infrastructure in land regularisation process for effective urban land management in informal settlements is important for understanding ways of improving policies.

Discourses on community involvement and geographical information system in decision-making process

Incorporating local community into urban land management activities including land regularisation is an alternative to the more affirmative tradition of exclusionary planning approaches i.e. master plan (Armstrong, 1987; Majani, 2000). Implementing land regularisation activities through participatory approaches and use of Geographical Information Systems infrastructure became common in the last decade and it has been mainstreamed in policy and practice (Kyessi, 2004; Smith, 1997). Also, it has been taken as a strategy for enhancing community decision-making process in informal urban settlements service provision (Kombe, 1995; Magigi, 2004).

Information flows among actors, financial availability, government and legal support, spirit to volunteer in local community development initiatives and training of local communities on land development and management are critical elements in the success for local community involvement in land management activities (Amos, 1986). However, the urban planning cycle which is seen to have limited potential in delivering intended results based on social norms has become a hindrance to meet community needs (Berman, 1997; Smith, 1997; Kombe et al., 2000; Wit, 1998 and Kreibich et al., 2002). The authors observed that political interests may frustrate local community norms and procedures guiding and controlling land development, especially in neighborhoods with low population, which might not attract politicians. All these show the importance of community connectedness in implementing their intended activities to meet their needs. The social capital theory explains the importance of understanding the context including adequacy in information flows and its accessibility (Jacobs, 1961; Putnam, 1993; Robert, 1994). Other contributors to the debate observe outdated policy and legislative environment as constraints to enable community-taking decisions in their development (Topfer, 2002; Clarke, 1994).

Tanzania has undertaken policy reforms to ensure community involvement in land regularisation (URT 1995). She aims at establishing GIS units in district, municipal and city authorities to integrate information base derived from different stakeholders to be accessible for different uses. On one hand, there are financial constraints in implementing the strategy. On the other hand, policy and legislations supporting local community involvement in urban land regularisation, housing improvement and basic urban infrastructure provision are in place. Policies and legislations that are in place in Tanzania include The Urban Planning Act 2007; the Land Act 1999 No. 4 Section 56-60; the Land Policy 1995; the Human Settlement Development Policy 2000 and the Land Use Planning Act 2007. These are the main instruments regulating urban planning and management. They are also influential in promoting community decision-making in urban land development.

Dar es Salaam City, one of the fast urbanizing cities in the Sub-Saharan Africa has been impacted with increasing environmental risks resulting from rapidly growing informal settlements with enormous investment in housing, which comprise dead capital (De Soto, 2000). The latter limits residents from accessing financial betterment (World Bank, 2002; Kombe, 2000). By 2003, the city had have more than 105 informal settlements growing from 15 in the 1980’s (World Bank, 2002; Mghweno, 1999). The growing in number of informal settlements is a result of inter alia ineffective urban planning approaches. Strategic and participatory urban planning was absent. The Ubungo Darajani is
a unique case in its philosophy of local urban planning in Tanzania, where landholders using their own resources, without external financial support, have been able to initiate and accomplish the process of plan making up to a stage of land surveying. The landholders mobilised funds for land registration with use of Geographical Information Systems infrastructure. They managed to solicit for technical support from Ardhi University (ARU) then University College of Lands and Architectural Studies (UCLAS). The Ubungo Darajani residents together with ARU prepared detailed layout plan that has been approved by relevant authorities. They executed cadastral survey through the aid of Geographical Information infrastructure.

GIS infrastructure application in Ubungo Darajani, Dar es Salaam

Ubungo Darajani is one of more than 30 informal settlements in Kinondoni Municipality in the City of Dar es Salaam. It is located 9 kilometers from the city center (see Figure 1). It covers 26 hectares of land and established on a low lying area, experiencing frequent flooding. The settlement was occupied by a total population of about 4,245 people in 849 households. Close to 2,420 were women while the rest were men (URT, 2003). Approximately 269 households were landholders and the rest were tenants.

The selection of the settlement as a case in this paper emanates from the following factors:

- There was a strong CBO identified by the name Ubungo Darajani Settlement Development Association (UDASEDA).
- The community in the settlement had been involved in land use planning and cadastral survey for a period of 7 years starting in 1997.
- It is one of the settlements where residents prepared strategies of subsidising the poor households who could afford to contribute funds toward financing the process.
- It demonstrates how residents managed to develop and sustain trust among themselves, create relational and connectedness and made use of opportunities offered by the policy changes in land development in the country.
- GIS infrastructure has been applied in the area.

Information gathering, analysis and display

Different protocols were used to gather data. These included official and non-official interviews, aerial map analysis, resource mapping, focus group discussions and observation. Purposive sampling was adopted in picking respondents while the Kiswahili language was used to conduct the interviews. Data collected were analysed using Statistical Package for Social Science (SPSS) and Map/Info software. Throughout the analysis, data were disaggregated regarding actors’ roles and responsibilities in the land regularisation process in understanding the decision-making process in view of integrating geographical information and user interface demands. Descriptive statistics namely, averages and percentages were used to summarize the information collected. Thematic maps were part of the final products.
Figure 1: Formal and Informal Neighbourhoods in Dar es Salaam City

Results and Discussions

The population of Ubungo Darajani neighborhood is largely comprised of people from various tribal backgrounds with diverse social, cultural, economic and ethnic beliefs. The mixed set-up seems to have created conducive metropolitan environment, which in turn, has hasten the land regularisation process in the settlement. In addition, it has constituted important source of resources for implementing local development activities.
The major economic and income generation activities carried out in the settlement include urban gardening along Ubungo Kibangu river, animal and poultry keeping, business activities including petty trading such as retail shops, garages, hotels and restaurants. Additional subsistence activities include carpentry and sale of building materials. In fact, about 60% of the landholders were employed in formal sector while 40% were in informal sector (Wakuru, 2004).

**Policy and legislative environment on land regularisation**

A community’s desire to undertake land regularisation in its area is legally supported by Sections 57(2)(a-i) and 60(1)(e) of the Land Act 1999, No. 4. The sections stipulate necessary conditions to take into consideration if an area has to be declared a regularisation area, they include:

- The area should be substantially be built;
- A substantial number of landholders in the area lacking lawful title to their land;
- Land is occupied under customary tenure;
- The area is ripe for urban development i.e. has been declared by the responsible authority;
- Landholders have lived in the area for substantial period of time and existence of a substantial number of residents who have invested in houses;
- A substantial number of people and community organizations within the area wish to participate in the scheme of regularisation.

The Ubungo Darajani met all these provisions and in principle land regularisation was eminent.

The enactment of Information and Communication Technology (ICT) Policy in 2002 put in place the need to every sector to use information and communication technology in their activities to enhance national development. This policy is, *inter alia*, a strategy to enable the Land Act 1999 and other related supporting policies and legislation to use GIS infrastructure for urban land development and management in establishing sustainable urban centres in Tanzania.

**Steps followed in the land regularisation process**

Five steps were followed during the settlement regularisation process as summarized below:

- In step one, a written report describing the settlement profile was produced. Included in the profile is socio-economic set-up of residents, land occupation, and series of landholders meetings and agreement. It included housing development status and individual property and costs. Equally important preliminary land ownership register should be produced.

- In step two, a detailed land use plan was prepared through community participatory process and approved by both the Kinondoni Municipal Council and and by the Director of Human Settlement Development of the Ministry of Lands and Human Settlement Development.

- In step three, a surveyed layout plan was proced and approved by the Director of surveys and mapping of the Ministry of Lands and Human Settlement Development.

- In step four, a detailed infrastructure plan was proced through a community participatory process and approved by the Kinondoni Muncipal Council.

- In step five, a property registrar indicating all the land owners in the area and was produced.

**Local community involvement**

The Ubungo Darajani community embarked on land regularisation process since 1997 in order to get secure tenure of properties, improve infrastructure facilities and services and to prevent haphazard housing
development and encroachment on roads. Improving security of tenure was the first priority according to the landholders’ decision made in 1997. Land regularisation initiation in this settlement lasted two years. It involved establishing contacts with local authority and consultations with various institutions for technical support. Retired civil servants in the settlement initiated the process. Some of these retirees had started the process of surveying their plots but could not afford the costs involved on individual basis. Some had even been swindled their money by non-trusted persons. These problems triggered solidarity among the residents in solving their common problem.

During the initiation stage, a total of 14 general meetings were conducted in which a participatory mechanism in decision making was instituted within the settlement. Ten Cell leaders were very influential in organising the people for the activity. ARU was also engaged as the Consultant in order to elaborate on the regularisation process and to provide guidance.

**Land use (layout) planning phase**

In late 1998 the Ubungo Darajani Community Organization (UDASEDA) approached ARU with a view to seek their support in preparing a participatory regularisation plan. Before contacting ARU, the community organization had consulted the Kinondoni municipal authority seeking its support in preparing a land use plan, cadastral survey and processing of titles for landholders. The authority referred the community organisation to the Ministry of Lands and Human Settlements Development (MLHSD). It referred the community to the MLHSD in order to comply with the Land Act of 1999 No. 4 Section 58(1) which stipulates that:

“...The Minister may, on his own motion or at the request of urban authority or a village council within an urban or peri-urban area, either direct the Commissioner to consider, or appoint an inquiry under Section 18 to consider the question of whether any area to which section 60 to 64 declared to be an area of regularisation”.

Upon receiving the community’s proposal the MLHSD scrutinised it and advised them to contact ARU for technical support in carrying out the regularisation exercise. Indeed, when the participatory planning proposal was initially submitted to the MLHSD, the Ministry was hesitant to commit itself as it was not sure whether the community would have been able to mobilize the necessary resource for carrying out the regularisation exercise – i.e. plan preparation and its subsequent implementation including paying compensation in accordance with the Land Act No. 4 of 1999. Within a month the Ministry of Lands and Human Settlements Development endorsed the community’s request after satisfying itself that the community was very committed in the regularisation of their settlement.

The community contacted ARU for technical support and a contract for consultancy service to the community was signed. In phase one, the contract required the Consultant to assist the community in the regularisation plan preparation. Other phases, which were not included in the contract but considered by the community, were cadastral survey and land registration.

In the process of preparing the Ubungo Darajani layout plan, ARU undertook the following activities: field reconnaissance and general meetings where the regularisation process was explained and clarified to the community members. Also, base maps, forms for negotiation and property registration were prepared together with identification of areas for community facilities such as major roads and other public services. Other activities included plot demarcation through negotiations and layout planning. Submission of the detailed layout plan to the local authority for scrutinisation and endorsement were done by the Consultant. Presentation to

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1 Ten Cell leaders are hand picked or selected members of the community to represent households in a group of 20-40 houses.

2 An interview with Kinondoni municipal officials in early 2004, revealed that the local authority was hesitant to give the community a go ahead because there were unclear issues regarding the legal framework for regularisation and the approach in its implementation. This included unclear planning standards to be adopted, sources of funds for the activity and how to handle compensation issues.
the Ministry for Lands for approval was also done by ARU. The preparation and approval of the detailed layout plan took 3.5 years. One would wonder why land use planning took such a long period despite the presence of institutions and experts together with the community members in the settlement. One of the arguments is that participatory planning (bottom-up) approach takes longer time due to negotiations and training involved during the process.

**Cadastral Surveying**

Upon approval of the layout plan by the MLHSD in November 2002, local community leaders convened a general meeting in the settlement, involving all landholders to discuss the progress and the need to commence the second phase, which comprised cadastral survey. The meeting endorsed the progress and directed the community’s spokesman to identify a surveyor who could help in doing the work. Additional members from the community were elected in order to strengthen the community team known as Community Land Development Committee (CLDC). The committee in collaboration with UDASEDA leaders were in charge of monitoring the process of carrying out cadastral survey and title preparation.

In attempting to start the surveying work, UDASEDA and Mtaa leaders contacted a private city firm. The cost for cadastral survey by the private firm was TShs. 4,090,000/= equivalent to 3,800 USD for 237 plots. Subsequent to the issuance of survey instructions in November 2003, the community managed to mobilise funds for the survey. During this stage the Councillor and the Member of Parliament (MP) for the constituency stepped in to sensitise the community to contribute cash and in kind in order to implement the plan.

**Process involved in the application of GIS infrastructure in the land regularisation process**

GIS Infrastructure was integrated in the community-led regularisation process and this seemed to have enhanced community decision-making. Activities performed in the process included:


- Determination of the source of needed information, seeking institutional collaboration and preparation of regularisation procedure to be followed. Preparation of the data structure system needed in relation with the Microsoft word and Map/Info software. A collaborative planning team was formed between the CBO and Mtaa leaders. Technical support was obtained from ARU.

- Determination of level of detail necessary for project execution while meeting the National Policy on land regularisation. Preliminary data was collected through reconnaissance. Then, it followed the preparation of a settlement environmental profile including existing infrastructure services within the settlement.

- Establishment and organisation of the gathered information in GIS format – a data base was established for the various spatial and attribute data. Microsoft word and Map/Info software were used for processing, storage and retrieval of the data collected in the settlement.

- A map displaying the landholders’ properties and the plot boundaries as demarcated in the field were finally digitised.

- The GIS infrastructure was then used to display thematic maps in the regularisation process as shown in Figure 2 (a–c).
Figure 2: Land Regularisation Outputs

2(a) PART OF UBUNGO DARAJANI NEIGHBOURHOOD BEFORE LAND REGISTRATION

2(b) PART OF UBUNGO DARAJANI NEIGHBOURHOOD AFTER LAND USE (LAYOUT) PLANNING

2(c) PART OF UBUNGO DARAJANI NEIGHBOURHOOD AFTER CADASTRAL SURVEY

Source: Magigi, 2004
Geographical Information enhancing community decision-making in land regularisation

- Maps printed out as shown above were displayed in the settlement for the local community to scrutinise for possible amendment.

- Land use conflicting areas were mapped and displayed to allow community involvement in conflict mediation and resolution.

- Community and private properties were identified through plot boundaries displayed using the Map/Info software and therefore established.

- Map/Info and Microsoft word infrastructure software were used for database creation and management.

During land regularisation process property boundary conflicts arose. In resolving these conflicts the community established a task force which comprised of Subward leaders, Ten Cell leaders, community representatives and experts from UCLAS who provided technical advice. The conflict resolution process involved holding of meetings where affected parties presented their position to the committee and through negotiations and involvement of friends and relatives of the affected parties, some land conflicts were resolved out of court. Few land conflicts were referred to courts of law.

Major constraints in using GIS Infrastructure in land regularisation process

Two major constraints were observed during the process:

- The local actors involved in the land regularisation process were not adequately knowledgeable in map reading and interpretation. However, with technical explanation from the Consultant, they could read the thematic maps displaying property boundaries.

- The consultancy service was expensive due to the use of computer hardware and software and other related specialised equipments during plan preparation, surveying and map production.

Lessons of experience for sharing

The Land Act No. 4 of 1999 Section 57 provides for landowners to prepare their own regularisation plans. Similarly, the Town and Country Planning Ordinance (Cap 378) of 1956 as revised in 1961 (and now the Urban Planning Act 2007) the Human Settlements Development Policy of 2000 and the Information and Communication Technology (ICT) Policy of 2002 provide the same opportunity. However, operationalisation of this good policy at the grass-root level is still low.

A costly exercise and the longer time that it takes to prepare a plan and its approval and subsequently implementation of the regularisation plan seems to be a constrain in fostering community involvement in land management. Participatory land use planning procedures including preparation of the plan, presentation and agreement by the community, approval by Municipal Council and finally endorsed by the MLHSD seemed to have taken about five years. For a person wishing to use the land title as collateral or wishing to get his/her land regularised, this is long and may be disincentive to invest on land. The reduction in time in the plan preparation and approval process is necessary.

On the other side, several factors led to successful land regularisation process and subsequently integration of GIS infrastructure in the Ubungo Darajani case. These include:

- Existence of a strong community organisation to facilitate and safeguard community decision-making in land regularisation.

- Relatively easy adoption of the participatory decision-making process.

- High proportion of owner occupiers in the settlement and their willingness to contribute toward the settlement regularisation.

- Existence of links with other local institutions and their commitment in land development matters.
Proximity to and availability of technical support from external local actors.

Present of a clear mechanism of land conflict resolution

CONCLUSION

It has been demonstrated in the case of Ubungo that urban land regularisation is possible through community participation. It is concluded in the case that unless land development and management activities ongoing in informal settlements are closely monitored and regulated as the settlements grow, it would be costly-socially and economically to retrofit from GIS application in coordinating, controlling and monitoring the decision-making among interested stakeholders in the process of land management. GIS infrastructure application enhances urban land regularisation. However, community-based land regularisation using GIS technology may become an illusion if modest technical assistance is not made available from local actors external to the settlements including training institutions, the private sector and central ministry departments. Five strategies are proposed to enhance urban land regularisation and GIS infrastructure application in informal settlements. These include: determination of community willingness to participate in land regularisation exercise; identification of training needs of local actors in land regularisation process and in the adoption of GIS infrastructure; capacity building in terms of of office space, facilities and computer hardware and software as a-requisite for successful GIS infrastructure application in land regularisation, and involvement of external local actors to enhance collaborative planning and collective action.

REFERENCES

Development, Ardhi Institute, Dar es Salaam, Vol. 3, No. 2, pp. 23-30


Nurul Amin, (1997), Formal and informal sector Paradigm, Urban development dialogue Vol.6


