Cadastre and Land Information Systems for Decision-Makers in the Developing World

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ABSTRACT

Land Information Management Systems (LIM systems) for many African countries should be designed without a cadastral layer, as most countries have only about 1 percent cadastral coverage and the average GDP per capita of the continent is USD665. Joining LIM systems with cadastral systems has prevented the technical innovation required for the development of practical land information systems for poverty alleviation in Africa. Rather, a national spatial framework should be set up with visualization as its core component Such a framework could be used by a wide range of decision-makers, including non-specialists. Linking mechanisms could be used so that the existing cadastre could be a sub-system of the LIM system, but not dominate it.

Keywords and phrases: *Africa, land information for decision-makers, inadequacy of cadastre, poverty alleviation, equity, new technical approaches, identifiers, reference frameworks, visualization, informal settlement*

INTRODUCTION

This paper discusses a number of issues that were raised at a United Nations Economic Commission for Africa Ad Hoc Expert Group Meeting held in Addis Ababa, Ethiopia, from the 23-26th November, 1998. It is based on the working document 'An integrated geo-information (GIS) with emphasis on cadastre and land information systems (LIS) for decision makers in Africa' (UNECA:1998), which was discussed and amended at the Expert Group Meeting.

One of the central issues discussed was the notion of setting up a national spatial framework based on visualization, to aid the development of a country's Land Information Management system (hereafter termed LIM system). We discuss this notion by firstly, showing that existing cadastral/LIM systems in Africa are largely undeveloped and decision-makers often have to make critical decisions based on very little information. Secondly, we discuss the income profile of Africa and indicate that present cadastral/LIM systems are too expensive and are not geared to poverty alleviation, which has serious implications for equity and development.

Thirdly, we argue that the design of present cadastral/LIM systems is preventing the technical innovations that are necessary to deliver land information to decision-makers. We show how LIM systems need to be able to accommodate a range of identifiers and survey products. In relation to the former, we show, by using examples from the management of informal settlements, how parcel identifiers are not adequate on their own. In regard to new survey products, we argue that geodetic standards are impractical. Instead, a new spatially referenced framework should be developed which can be understood and used by a wider range of stakeholders and decision-makers, including non-specialists, with visualization being a core component of such a framework. At the same time the framework should not ignore the needs of measurement experts.

Finally, we describe some of the recommendations from the Expert Group Meeting relating to the creation of a national spatial framework based on visualization, to facilitate the development of a country's LIM system. It should be noted that, for the purposes of this paper, information is used to mean both data and information, as what is information to one person might be data to another (Nichols:1993:5).

BACKGROUND

Revolutionary

The conventional view is that a core data set of any LIM system must be the cadastral layer. We are proposing that an LIM system should be designed without a cadastral layer, with the cadastral system linked only as a sub-system to the LIM system (see Diagram 1. below). Only in this way will it be possible to supply sufficient spatial information in an equitable and timely manner for poverty alleviation in Africa. There are a number of reasons why this unconventional approach has been adopted.

The existing systems are not providing sufficient information

Firstly, a review of the cadastral and LIM systems in Africa indicates that decision-makers are not presently obtaining sufficient information from these systems to make informed decisions (UNCHS:1991:1-3). This is largely because:-

- There is no documentary evidence of title for up to 90 percent of the parcels in developing countries (UNCHS:1991:3), with an estimated less than 1 per cent of sub-Saharan Africa being covered by any kind of cadastral survey (1990:4);
- Most African countries, and many other developing countries, do not have an LIM system using LIS/GIS as a management tool. LIS and GIS systems either do not exist, or have lapsed, or are seen as too expensive (UNCHS:1991; Williamson:1997);
- Cadastral systems, generally in manual form, and with incomplete coverage, are supplying most of the available land information. No alternative source of comprehensive information for land management has been developed (Okpala:1992; UNCHS:1991).

The approaches and difficulties associated with most of the cadastral systems have a direct effect on the quantity, timing and type of information available to decision-makers (UNCHS:1990:17). Some of the major problems are:-

- There is a general lack of financial, technical and human capacity throughout Africa. Often this is because of the colonial history of countries. Because the systems are under-resourced many of them are out of date, expensive to maintain and inefficient. This restricts the amount, and type of information that can be acquired, stored and disseminated for use by decision makers (Ezigbalike:1996:350; Okpala:1992:93-4; Durand Lasserve:1997:4-5,12,16);
- A World Bank study on Africa showed that "..if no dispute occurs, the process of land registration takes an average of 15 to 18 months, and that normally, a period of two to seven years is not uncommon. This lengthy and costly procedure (means that) tens of thousands of land titles (are usually) pending." (UNCHS:1991:5);
- "Despite numerous initiatives during the last decade in sub Saharan Africa to set up new land information systems or to modernize existing ones, limited results have been achieved." (Durand Lasserve:1997:12);
- Available information often relates only to the part of the city (or rural area) where formal legal procedures were used for planning (UNCHS:1998:4). Yet most decisions need to be made about the "..customary.." (Okpala:1992:94) and/or informal parts of the country, which are not covered by the cadastre;
- Where information exists, it is often spread among several government departments. Most developing countries, and African countries are no exception, have an excessively large number of institutions involved in land management and information flows. They are usually public, highly centralized, not well managed, and have over-lapping responsibilities (Dale and McLaughlin:1998:183; UNCHS:1998:4; Farvacque and McAuslan:1992:7-10,23,60);
- Surveyors are often reticent about changing existing legal frameworks, or relaxing current registration systems (Williamson:1997). Yet high standards of accuracy linked to legal accountability issues often make cadastral systems cumbersome and inflexible. This in turn slows down information creation processes (UNCHS:1998:6,8) and increases costs.

Systems need to be extended to the poor

The second reason why an unconventional approach has been adopted is that it has become clear over the years that our present cadastral/LIM systems have largely been used by business and the middle class and the vast majority of the poor have not benefited from the systems. System design needs to address this and be more sensitive to issues around poverty, equity and cost avoidance, so that unaffordable costs are not created, for the state and/or for poor users.

The amount of disposable income of people in Africa and other developing countries should be borne in mind when systems are designed. For example, from 1985 to 1995 for the whole of Africa there was a negative growth rate in GDP per capita. In 1986 GDP per capita was USD 714 and in 1995 it was USD 665 (UNECA:1997: 13,3,9). In addition to this, 38.8 percent of all urban households in sub-Saharan Africa are considered to be poor (UNCHS:1997:29) and the land/man ratio, indicating pressure on land, for the African continent, has decreased from 0,62 in 1965 to 0,26 in 1995 (de Wit:N.D., based on FAO statistics).

This information is critical as highly technical approaches and costly solutions are often proposed in the cadastral and spatial information field. The above information should enable better decisions to be made when alternative solutions, such as the ones presented below, are proposed for the development of LIM systems.

From the literature it has been possible to draw a number of conclusions about the relationship between poverty, conventional cadastral/LIM systems, and the financial costs of these systems. Durand Lasserve (1997) argues that the failure to adopt, at all levels, appropriate rural and urban land management practices remains a primary cause of inequity and poverty. With respect to this, a number of authors are arguing that existing registration systems are not delivering sufficient land and/or information to users, and especially poor users, because they are:

- Centralized and therefore not accessible to the majority of the population (Fourie and van Gysen:1996);
- Expensive to the user (Farvacque and McAuslan:1992);
- Designed for use by the middle class and educated (Fourie:1996) and/or previous settler population (United Nations:1997:1-4);
- Serviced exclusively by professionals who are generally expensive (Fourie:1996);
- Only capable of recording legal land parcels (Government of Namibia:1995) and not the 30-80 percent of illegal urban land parcels (Durand Lasserve:1997:1) and customary areas (Bruce and Migot-Adholla:1993), which are the most common form of land holding of the poor in any country;
- Based on colonial laws in regard to family law, inheritance, forms of evidence, administrative procedures etc. (United Nations:1997:1-4; Government of Namibia:1996). This affects the poor who generally rely on local social systems;
- Not designed to resolve conflict over land use and facilitate decision-making (UNECA:1996; Farvacque and McAuslan:1992:90-1). Land allocated to investors and developers is often already occupied by the poor (Borges:1992);
- Not designed to give legal advice to poor people who cannot afford to pay for legal services (Government of Namibia:1995).

Also Bruce and Migot-Adholla argue that although conventional wisdom has been that large-scale compulsory systematic titling of small holders is more cost effective then sporadic titling, this is no longer accepted. Rather, doubt has been cast on this approach especially in rain fed agricultural areas under customary tenure in the sub Sahara (1993:261-2), as well as for highly mobile poor urban populations (Davies:1998).

A number of authors are also arguing that the conventional land use planning (rural) and/or urban planning approaches, usually associated with land registration, are out of step with the requirements of developing countries and affect the poor adversely. The conventional approach of the 'Package of Plans' has largely been discredited because:-

- It is seen as an imposed top down exercise by centralized authorities (Farvacque and McAuslan:1992:xii,63-4; Pieri:1997:223) and is not demand driven at the local level (de Wit:N.D);
- Central government institutions have not had the capacity to implement the plans at local level (de Wit:N.D);
- Of the vast costs associated with the collection of comprehensive and accurate information (Dale and McLauglin:1988:219);
- It does not take into account the *de facto* situation on the ground (Farvacque and McAuslan:1992:63-4; UNCHS:1990; Borges:1992) because there is no information available.

Instead a participatory approach that accommodates the poor is becoming popular (Durand Lasserve:1997; Pieri:1997; Muchena and van der Bliek:1997:229; Kutter *et al.*:1997:278; de Wit:N.D:5-6).

Systems need to accommodate a range of identifiers not just parcels

The third reason why an unconventional approach to LIM system design is being suggested, is because the present design of cadastral/LIM systems is limiting necessary technical innovation. An example of this relates to identifiers.

Conventionally LIS systems have used parcels, and specifically cadastral parcels as identifiers. Parcels have been the basic unit of data collection and the linking mechanism to other information in the database. This has meant that most information about the land in developing countries could not be utilized in LIM systems, as the information is generally not parcel/polygon based, let alone cadastral parcel based. We are arguing, based on Latu, that instead, LIM systems need to be able to use a range of identifiers within a common reference framework (N.D.). Examples from urban areas illustrate why it is vital to have a range of LIM system identifiers to be able to manage cities, and some appropriate identifiers are suggested. A similar situation exists for rural areas but will not be spelled out (see UNECA:1998:27-8).

Prior to upgrading and/or regularizing an urban informal settlement, information is required about occupation patterns and what exists there legally (UNCHS:1998:4; Davies:1998). Large-scale informal settlement development often occurs contiguously over a range of legal land tenure types (Jenkins *et al*.:1986) such as:-

- State land. Often the state does not have an inventory of its land. Also, often state land has not been parceled. Generally the informal settlement boundaries do not coincide with the state land boundaries (Jenkins *et al*.:1986);
- Privately owned land. The location of the informal settlement does not always precisely match the cadastral parcels and is likely to cover many properties in one spatially contiguous unit (Cowie:1999; Jenkins *et.al*:1986);
- Customary land which is conventionally not parceled (Okpala:1992; Latu:N.D.:33).

Building on work by Latu (N.D.), Davies (1998:117-125) and Cowie (1999), we are arguing that aside from the property parcels of privately owned registered land, information in the form of thematic polygons of low accuracy should be created showing the location and approximate boundaries of the informal settlement and the customary areas. Lists of leaders (Ezigbalike and Benwell:1994) should be attached for the purposes of identifying stakeholders and decision-makers.

Houses or buildings within the settlements cannot be used as a parcel equivalent identifier for a range of reasons:-

- In urbanizing customary areas, if a layout plan, based on existing houses, is created by using aerial photography the land actually under use by that household is arbitrarily removed from that household and allocated to someone else. This is not a sustainable land use strategy (Fourie and Hillermann:1997);
- Often in low-income formal settlements designed for one house per parcel, a second informal house is constructed on the same parcel utilizing most of the services in the formal house (Cowie:1999). This doubles the water, sewerage and transport requirements for the area;
- One house generally includes more than one household.

Also, it is not possible to use the cadastral parcel as the only identifier, even if cadastral surveys have been completed for a low income development, but no permanent structures were erected in compliance with building standards, but instead informal structures were erected, because:-

- Often when land is invaded after a cadastral survey, but before the land is registered as individual parcels, no registration is effected by the authorities until, and unless, the informal settlement is regularized (Davies:1998), which generally involves adjustments to the layout and cadastral boundaries;
- If the surveyed parcels have not been registered, other unregistered titles might still be in existence in the area, with the 'owner' holding a document giving a description and sketch map (Government of Namibia:1995);
- Often the boundaries of the informal settlers' properties do not accord with the cadastral layout, and this can vary across the settlement and between settlements (Jenkins *et.al*.:1986).

In these situations a more useful identifier could be a geo-code (and text) against a location (Latu:1997:22-26), such as an informal site, or house, or part of a house (UNCHS:1998:4; Davies:1998:117-125; Durand Lasservre:1997:12). Davies argues

that by using a geo-code as an identifier, information on the informal settlement could be acquired in a logical way and organized within an LIM system (1998).

Besides the fact that parcels as the sole identifier have only limited use in Africa, because so little land is parceled (UNCHS:1990:4, 1991:3), there are additional factors which limit the use of parcel identifiers. Latu argues that one of the major problems in the information field has been the integration of different data from different sources, which was captured using different methods, at varying accuracies and resolutions, and stored in different formats, using diverse referencing mechanisms (N.D.). Given the lack of capacity in Africa to undertake professional surveys, it is critical that land information produced by surveyors with basic training and non surveyors, using the new cheap technologies available, can be used to populate the GIS/LIS. To do this would mean that information of varying quality would somehow have to be integrated within the LIM system. This implies that new technical approaches have to be developed to integrate information produced under these conditions.

Latu states that such integration requires both a range of identifiers and a common referencing mechanism (N.D). Building on Latu, we argue that not only are a range of identifiers required, but that the present geodetic framework cannot supply the required common referencing mechanism. Instead, a graphical (pictorial) reference framework, based on visualization, should be set up as the common framework. That is, in a number of ways the present design of cadastral/LIM systems is limiting technical innovation and needs to be re-engineered to be able to accommodate poverty alleviation.

CONCLUSION

We have shown that present cadastral/LIM systems in Africa are not performing adequately in general, and that their performance is also largely unsuitable for the task of poverty alleviation. In addition, we have shown that the present design of cadastral/ LIM systems is limiting technical innovation, in relation to identifiers, as well as the use of new, cheap and user friendly technology. We have reviewed some of the literature developing fresh technical approaches to solve these problems, and will continue below on this theme by introducing additional innovative, cost effective and practical approaches, specifically with regard to the creation of a new inclusive spatial framework, based on visualization.

SUPPLYING DECISION MAKERS WITH THE 'BIG PICTURE' BY USING VISUALIZATION

Introduction

Surveyors have for years shared and used a spatially referenced framework, namely the geodetic network. Adapted from Pieri, we are arguing that a spatially referenced framework should be developed which can be understood and used by a wider range of stakeholders and decision makers (1997:226-7), including non-specialists, with visualization being a core component of such a framework.

As less than one percent of sub-Saharan Africa is presently covered by cadastral records (UNCHS:1990:4), and 90 percent of land parcels are undocumented in

developing countries (UNCHS:1991:3), it can be presumed that the cadastral layer in any existing, or future, LIM system will in all likelihood either not exist, or exist in an extremely incomplete form.

If the cadastral layer is completely left out of the initial design of an LIM system, it is possible to take a fresh approach in designing LIM systems, as the system's design is not constrained by the limitations created by the cadastral layer. African conditions therefore allow new approaches, whereby the cadastre becomes a sub-system of the LIM system, rather than as is more conventional, where the LIM system is subordinate to the characteristics of the cadastral system. If the LIM system is the dominant system, it is possible to avoid some of the design characteristics associated with a cadastral system, such as high accuracy and legal evidence requirements, reliance on measurement based approaches and professionals' skills etc., and instead introduce other approaches which facilitate the development of an LIM system.

This does not mean that the cadastral layer should be eliminated entirely from the total LIM system. It also does not mean that the LIM system should be used to re-place the national cadastral system by including in its design some of the characteristics conventionally found in cadastral systems in a lesser form, for example weaker forms of legal evidence, reduced accuracies. Instead the design of the LIM system should not allow these cadastral characteristics to limit the scope of the LIM system. Rather, in a phased design, linking mechanisms should be set up so that the existing national cadastral sub-system can be coordinated with the LIM system, but not dominate it (see Diagram 1. below).

Design criteria

The major design criteria should be to create an LIM system for decision-makers which supplies an overarching national reference framework for a range of spatial information products and users. A shared reference framework or 'big picture' needs to be developed for an LIM system which is inclusive rather than exclusive, to be used by both non-experts, such as most decision makers, and (measurement) experts.

Such a national overarching framework should accommodate:- high and low value land, people in the capital city and rural areas, skilled professionals and technicians with basic training, raster and vector spatial data from a range of techniques and technologies, GPS, conventional terrestrial approaches, remotely sensed images. It should also accommodate, defined in Dale and McLaughlin terms, graphical (pictorial) data, geometric (measurement based) data and topological (connectivity not absolute position) data (1988:10).

Design criteria for the overarching or reference framework should include:-

- An ability to link to the LIM system existing (and future) GIS data sets of varying accuracies (Latu:N.D) and scales, as well as cadastral information, both locally surveyed low accuracy and professionally surveyed (Barnes-personnel communication);
- An ability to service national, regional and local level (urban and rural) decision makers (Pieri:1997:25; de Wit:N.D.);
- The facility for decision-makers to visualize the spatial information, both with respect to the framework and the information outputs, rather than geometric data being the core component of the system.

Innovative and cost effective approaches can be developed if the design is not constrained by cadastral system characteristics and makes use of the new technologies coming on line.

Visualization: A shared reference framework

The reference frameworks for cadastral/LIM systems have generally been measurement based. Skidmore *et al*. show how a graphical (pictorial) information output can make it possible for decision makers to visualize the spatial information and make informed decisions (1997:311). Torhonen and Goodwin argue that decision-makers should be able to see (visualize) what exists on the ground, so that they could make better and more appropriate decisions (1998:103-106). To make such visualization for decision-makers common place, a graphical (pictorial) national reference framework should be created. It should also be possible to link the decision-maker's graphical (pictorial) framework to geodetic framework, so that the tasks presently being done by the measurement experts could continue to be undertaken (see Diagram 1.).

Building on earlier work (Fourie *et.al*. :1987; Mozambique:1996), we are arguing that a graphical (pictorial) framework consisting of small scale base maps, created through cartographic generalization, should be created based on features which aid the visualization of decision makers. These features should include among other things firstly information about major features in the country, such as coastlines, rivers, roads, mountains. It is not useful to include all topographical features as this could make the map too noisy and technical for non–experts.

Secondly, geographic names should be included as they serve as a common reference for most non-experts and are crucial for decision-makers to orient themselves. Thirdly, major administrative boundaries, such as international boundaries and other major boundaries, should be included. Fourthly, human settlement patterns should be mapped. To date official maps have shown only human settlement that conforms to cadastral parcels, or is considered as legal. As much of human settlement (for example, 30-80 percent of all developing countries' cities –Durand Lasserve:1997:1) is not considered legal and/or is not on the cadastral records, maps of human settlement have been largely incomplete. Fifthly, land use/tenure patterns should be depicted, but not by using the conventional land use classifications such as soil types or land cover, as they do not give decision makers sufficient generalized information (de Wit:N.D.:2-5). Also, they should not depict what *de jure* land use should be in place in terms of the land use zoning, but rather depict the existing *de facto* land use, irrespective of its legal status.

Graphical (pictorial) base maps

A data rich source should be used to create such a graphical base map. Satellite imagery could be the cheapest way of creating such a base map and populating the associated GIS. Cartographic generalization should be used to depict the land use/land tenure, through the interpretation of the remotely sensed images. Such a national base map should give small scale, topologically correct land use linked to human settlement patterns. In order to avoid costs, it should only supply a

generalised ‘big picture’ of a country or region. It should not be used to supply any detailed boundary information.

Based on Nino-Fluck and Chodota (N.D. 55-58), we are arguing that this accords with the AFRICOVER approach in regard to, the use of visualization as a key component, a simplified topographic layer, high resolution satellite imagery, a cartographic output and finally a hierarchical classification system. However, it is suggested that to aid visualization by decision makers an additional category is included in the classification system, notably land tenure patterns (social, legal, formal, non-formal).

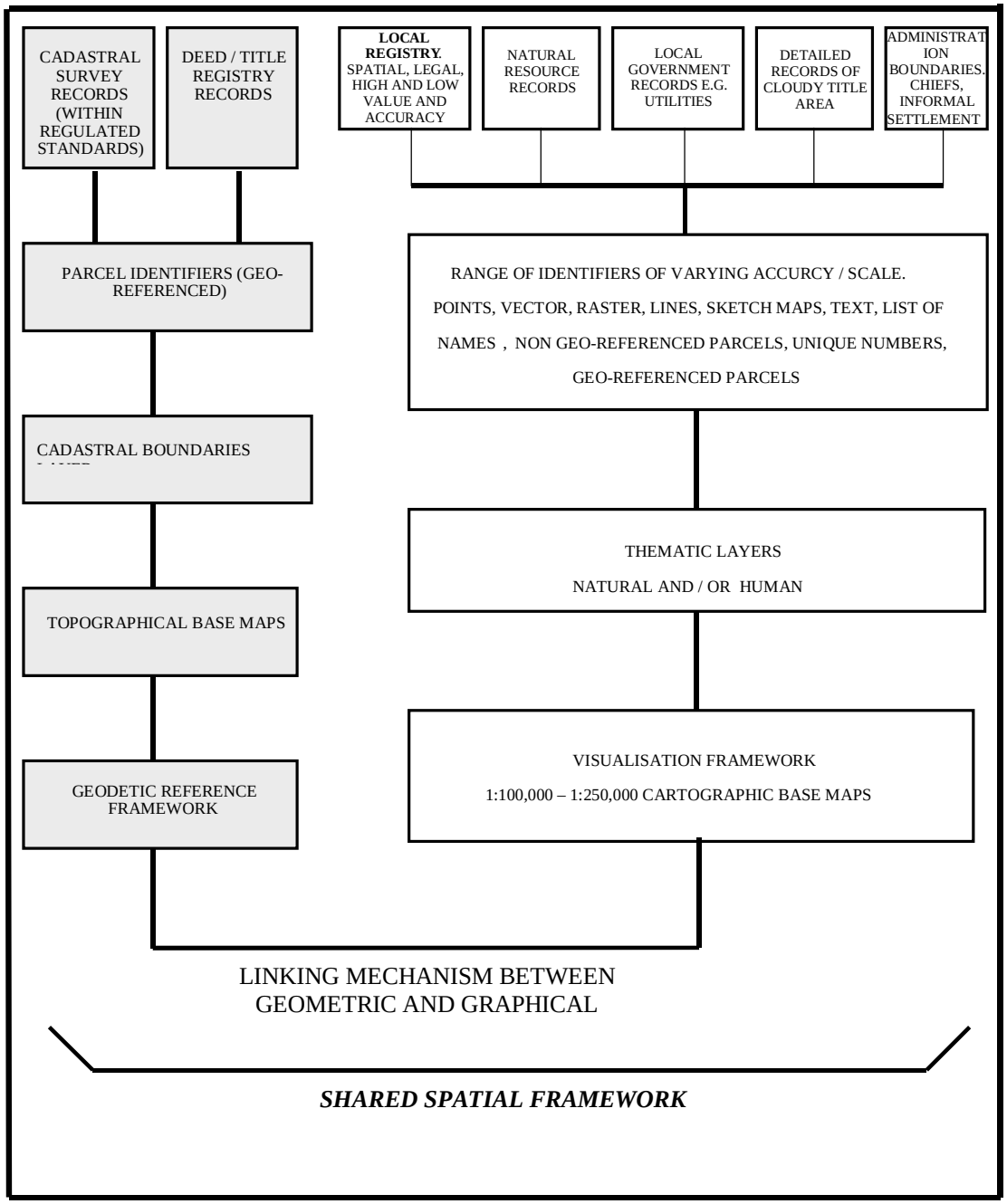

Diagram 1. Shared Spatial Framework (adapted from Latu: N.D.: 30; Groot: 1997)

This type of base map should allow a fairly small scale to be used making it quite a cost-effective approach. In regard to this, it has been decided that scales of 1:250,000 to 1:100,000 will be used for the AFRICOVER land cover map series (Nino-Fluck and Chodota:1993:10). A range of base maps of different scales should be created, starting with very small scale for national coverage, and where greater spatial resolution is required, such as for urban areas, slightly larger scale base maps should be created. The result should be a series of layers, all linked graphically and/or geodetically.

Finally, the graphical and geodetic framework should be linked. This should enable (measurement) experts to work from the geometric data to the graphical (pictorial) and back again (see Diagram 1), in a broadly similar way to that suggested by Torhonen and Goodwin (1988:103-106).

With respect to such a visualization framework, the Expert Group Meeting concluded that research and development should be undertaken into this approach. Issues which should be addressed prior to the establishment of such a visualization based LIM system should include: - awareness creation among users, a feasibility study including a pilot project, learning from best practices and experience, the development of system's requirements and a project proposal, system testing and evaluation, system acquisition and start up, and finally system operation and review.

Linking the central and local levels: Data flows and technical processes

Adopting a visualization framework would open up a range of possibilities in relation to new, more practical technical and administrative processes. Cconventionally processes have been developed whereby as much information as possible is generated in the capital city, to enable efficient centralised decision-making. This approach has generally not facilitated information availability and efficient equitable decision-making (Pieri:1997; Kutter *et al.* :1997). Present approaches emphasise the need to link the central and local levels more closely on the one hand, and decentralise decision making and information on the other (Durand Lasserve:1997; Pieri:1997; Muchena and van der Bliek:1997:229; Kutter *et al.*:1997:278). This has a wide range of implications in relation to an LIM system based on visualization.

Firstly, a graphical base map should enable decision-makers based in the capital city to make better decisions but only for broad brush planning. They probably would not have sufficient accurate/large scale information to make a final land use planning decision. However, this technical limitation is not a problem, providing planners move away from top down land use planning decisions made in the capital city, with little consultation of the people on the ground, an approach being advocated by a range of authors (Farvacque and McAuslan:1992:xii,63-4; Pieri:1997:223; de Wit:N.D.).

Decision makers should make initial broad brush land use planning decisions for specific areas based on the 'big picture' supplied by the base maps, but the final decision should only be made after consultation with the people in the local area. The local consultation exercise should then generate the additional large-scale information required. While local information is not always of the highest accuracy or completeness, work in Namibia has shown that its symmetry and richness often largely makes up for its deficiencies (Government of Namibia:1995). Again gathering such information is more cost effective because it forms part of the consultation/negotiation exercise.

Secondly, it should no longer be necessary to attempt to generate and maintain high accuracy and/or large-scale spatial information giving complete coverage for all possible circumstances for use by decision-makers in the capital city. It should only be necessary to create high accuracy/large scale data once an initial decision had been made about a specific area, from the base map's generalised information. This approach makes it possible to avoid costs on the one hand, and streamline resource allocation on the other, making information acquisition much more cost effective.

Thirdly, it should be possible to map general land tenure and land use information (with no legal status –ownership or zoning) at any central point using remotely sensed images and make them available locally. It is not possible to do this with cadastral and titling information, as users drive the updating of this information on a parcel by parcel basis. Therefore, cadastral and land registration systems need to be decentralised to facilitate local land management and information currency (Government of Namibia:1995,6).

Fourthly, by decentralising the LIM node, information could be provided by people with fewer skills using lower grade and cheaper technology. This is possible because:-

- The graphical (pictorial) nature of the base map allows a textual description of features in the field, making it possible to use lower accuracy surveys;
- Surveys will generally be topologically correct relative to each other and to the graphical features;
- Local level information symmetry and knowledge (visualization) makes it possible to check and improve less accurate information;
- The work of local surveyors often supplies sufficient security of tenure to local people because these people have local knowledge (visualization over time) and because it is linked into the public witness system.

By making it possible for less skilled surveyors, as well as other people, to produce usable information the amount of data and coverage within an LIM system should be increased, the cost of new data acquisition dramatically reduced and non-experts, could also produce land information. Yet at the same time, if the base maps accommodate both graphical and geometric use, this survey information can be cleaned up when necessary by professional surveyors, along the lines suggested by Torhonen and Goodwin (1998:103-106). Using local surveyors and lower forms of technology unless and until more accurate information is required, makes it possible to avoid costs.

Fifthly, if the land records are decentralized, and land use decisions made in the capital city are not finalized without the consultation of those in occupation of the land, it should not be necessary for the capital city to hold all the cadastral and land registration records. If most property information is kept at the local level, it should not be necessary to transfer information from the local level to the central level, as long as the administrative processes ensured that the final decision is only made at the local level, utilizing both central and local sources of information. Low value land surveyed to lower accuracies should be kept at the local land registry, along with the local high value land surveyed to higher accuracies. However, to avoid costs, no record of the low value land should be maintained at national level, and if the authorities wish to alter the rights of any land, local investigations by professionals should be undertaken first. This should mean that the lengthy technical processes, because of the number of steps, would be short-circuited for low value land, which should improve all round costs.

The above illustrates new practical approaches which would be made possible by using visualization, rather than measurement, as the core component of an LIM system.

RECOMMENDATIONS

A number of recommendations, in relation to using visualization as the core component of a country's LIM system, were discussed and accepted at the Expert Group Meeting. However, it should be noted that the approach described was not considered as a blueprint to be applied across all Member States. Rather, it was suggested that the new technical approaches could be utilized to a greater or lesser degree to improve the amount and type of information available to decision makers, but this would vary across the Member States, as it would depend on the level of their existing cadastral development. Some of the key recommendations, which emerged from the meeting, were: -

- LIM systems should be primarily designed to assist decision-makers. The major focus of the LIM system should not be on the technical issues and logic associated with such systems;
- The cadastral system should be separate, but linked, to an LIM system, so that its characteristics do not dominate the LIM system;
- Graphical (pictorial) base maps should be introduced and the Africover project should be used to do this. The Africover project will supply most of the visual information required, but should also include land tenure (social, legal, formal and non formal) as one of its classes, to facilitate visualization by decision makers;
- An LIM system should make full use of the new technologies, especially with respect to outputs that allow decision-makers to visualize and use spatial information;
- A pilot program/project(s) should be developed in the region to demonstrate the feasibility/ viability/ replicability of a GIS/LIM system based on the visualization approach developed by the present study. A cost benefit analysis of the pilot/LIM system should be undertaken to assess the extent to which such an approach is self-sustainable, both economically and technically. These exercises should give guidelines in regard to the further institutionalization of this approach in National and Regional programs. Regional organizations, together with selected interested countries, should be invited to formulate such a pilot project at country level.

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