

Systematic Land Titling and Registration: Methods for Boundary Demarcation and Survey in Poorly Mapped Nations



The importance of mapping for national and global management of resources and the environment as well as for sustainable development has been universally acknowledged. However, many developing nations are still poorly mapped according to past and recent studies. It is widely accepted that land administration systems (LASs) need to undergo modernisation, but which methods should be used for boundary demarcation and survey in such countries?

Using Africa as an example, the global status of topographic mapping as published in 1990 (see UN publication *World Cartography*, Volume XX) indicated 41.4% topographic map coverage of the region with only a 2.2% update rate. The results of another 2007 catalogue of available fundamental geospatial datasets at national and regional levels in

Africa confirmed the fact that Africa is poorly mapped; although a lot of the data was available in part, much of it was out of date and/or inaccurate (see 'Current Status of Mapping in Africa' by Derek Clarke at repository.uneca.org). Furthermore, results of the 2012-2013 UN study on 'Status of Mapping in the World' (unstats.un.org) confirmed that the majority of available topographic maps are out of date (some being more than 50 years old) while the national cadastral coverage is generally poor.

On the other hand, the importance of appropriate land administration (LA) for achieving sustainable development goals has been recognised by many national and global development initiatives because land is a cross-cutting fundamental resource. It has also been acknowledged that countries with a proper system of land registration thrive in business compared with countries with a less efficient registration system. Therefore, it is little wonder that the cadastral dataset is one of the fundamental datasets of the national spatial data infrastructure (SDI) in virtually every country that has implemented, or is planning to implement, SDI. However, as (re-)echoed by Lemmen et al (2015) (see *GIM International*, Issue 1, Volume 29, January 2015), about 75% of the world's people-to-land relationships are not documented and are outside the formal land administration domain. Intuitively, the percentage is arguably higher in poorly mapped nations. For example, in the 130 years since formal land registration began in Nigeria in 1883, no more than 3% of the land in the whole country has been registered, according to a report of Nigeria's Presidential Technical Committee on Land Reform.

Modernisation

Thus it is universally acknowledged that the land administration system (LAS) needs to undergo modernisation in order to fit into national SDIs and to enable sharing of information on land, its ownership and use across all government departments and agencies. As recommended by LA experts globally, the modernised LAS should be cost-efficient, reliable and scalable. Future disputes over ownership should be minimised, if not eliminated. To achieve these aims, a fit-for-purpose LA approach of Systematic Land Titling and Registration (SLTR) has been recommended by The World Bank, the International Federation of Surveyors (FIG) and other global LA players. The fit-for-purpose approach recommends the use of "general boundaries" without monumentation to identify the delineation of land rights (Lemmens et al., 2015). High-resolution images are the recommended basic spatial input data for this approach. With respect to the general boundary approach, this article will explore (i) coordination and monumentation of parcel boundary points, and (ii) apparent preference for use of (only) high-resolution image as a spatial data source.

Monumentation

The proponents of undiluted general boundary approach stipulate that monumentation in the field should be avoided (unless people organise it themselves) because it is expensive, time-consuming and not efficient for achieving SLTR with complete coverage. However, it should be noted that family members, in later years, have been found to contest boundaries they agreed on previously, even when such boundaries are monumented. Therefore, land owners should be encouraged to complete the monumentation (themselves) within a stipulated time frame, and definitely before issuance of the final certificate of ownership, in order to minimise future litigation. The

monumentation could in fact be done very quickly when the boundary points/lines are being agreed upon by the stakeholders. As part of the SLTR approach, the neighbours are expected to be present and to jointly agree to the common boundaries. Since this will usually be done by moving from point to point along a line, the monumentation and coordination of a point can be done while the team proceeds to identify the next point. Moreover, it is not always easy to arrange for all stakeholders to be present on site simultaneously to agree on parcel boundaries. Therefore, every aspect that warrants a simultaneous presence should be completed during the first site visit if at all possible. If monumentation is deferred and no physical demarcation is in place, disputes may arise when this is attempted at a later date.

CORS

Although it is generally agreed that it is not economically viable to establish survey coordinates and monumentation for an entire country undergoing SLTR, it should nevertheless be encouraged where continuously operating reference stations (CORS) have been already installed and are operational. This will help to “move from approximate boundary representation towards survey-accurate boundary representation” and facilitate “expansion from 2D cadastre to include the third (height) and fourth (time) dimensions”, thereby enhancing faster realisation of two of the six design elements recommended for land administration by Bennett, Kalantari and Rajabifard (see *GIM International*, Issue 7, Volume 24, July 2010). As indicated in LA literature, for a sustainable SLTR, boundaries of registered land are expected to be captured in terms of an unambiguous system of geodetic reference that supports demarcation of the boundaries of the registered land if a future boundary dispute should arise. Consequently, many of the land administration/reform initiatives being undertaken in African countries (e.g., Burkina, Ghana, Benin and Nigeria) have the installation of CORS as component. Countries that have installed CORS prior to their LA programme report that adoption of GNSS CORS technology has made it marginally cost-effective to produce georeferenced cadastral plans in accordance with the national technical regulations. Therefore, this should be encouraged in subsequent LA programmes. From practical experience, there will not be a significant difference between the time taken to establish the coordinates of the boundary points using CORS and the time gained by having a complete demarcation and survey. With this approach, the cadastral dataset will be ready to be a component of the fundamental datasets of the national SDI.

In terms of the use of high-resolution satellite imagery, the choice of appropriate source (satellite, aerial survey, UAS) should not be based on cost solely in the context of LA. Instead, the decision should also be based on its availability for the production of other relevant non-existent or out-of-date fundamental datasets for SDI, such as topographical maps and digital terrain models (DTMs). Consideration ought to be given to using imagery that will provide a resolution that is as close as possible to the 6-10cm precision of conventional land surveying for LA as well as generation of orthoimagery, DTMs and large-scale topographical maps. Therefore, use of high-resolution aerial imagery captured by conventional aerial photography or UASs should be given first consideration, subject to the availability of funding.

Biography of the Author

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