

Examining the Challenges of Cadastral Surveying Practice in Zambia

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Abstract

Based on interview data from registered land surveyors, academics in land surveying, government surveyors and relevant secondary data, this article presents a case for improvements in the cadastral surveying practice of Zambia. It argues that current cadastral practice in Zambia is outdated and requires improvements that will position it in line with current international practice and technological advancements. The paper examines the role of the Surveyor General in cadastral survey practice with respect to providing reference information, testing of survey equipment, lodging and examination of survey records, cadastral survey standards and regulations. In addition the paper also examines the challenges faced by surveyors in the existing cadastral management with regard to legislation, archiving of cadastral information, quality control, and delivery period of cadastral survey services, professionalism and continuous professional development. The paper offers a modest empirical basis for examining cadastral survey practice and how it can be improved.

1. Introduction

A cadastral survey system is an interactive multitude of land administration sub-systems including adjudication, boundary definition and demarcation, surveying, registration, dispute resolution and information management (Larsson, 1991; Cheng & Tang, 2002). There has been a rapid rate of advancement in technology for surveying data collection tools: for example Total Stations, Global Navigation Satellite Systems (GNSS), Digital Photogrammetric work stations as well as survey processing software such as Model Maker, AutoCAD, Arc Cadastre, SURPAC to name just a few. Although these technological advancements have been well embraced by cadastral surveyors in Zambia, there have been little or no corresponding changes to the cadastral survey legislation and regulations which control the practice of cadastral surveying in Zambia. It is from this background that this paper addresses the management of Cadastral Surveying in Zambia in the light of technological advancement.

1.1 Land titling and evolutionary theory of land rights

The neo-classical property rights paradigm has been the driving force behind land reform in most sub-Saharan African countries (Barrows and Roth 1990; Place and Hazel 1993). It is argued that this approach promotes investment, economic development, and sustainable use of land (William, 1997; Cheng & Tang, 2002; Williamson *et al.*, 2010). However, during the 1990s, the neo-classical property rights theory has been questioned and reassessed with regard to tenure reform in sub-

Saharan Africa. Some researchers have shown that some land registration and titling programs in Africa have not served the intended objectives and have instead often exacerbated land conflicts and social inequalities (Shipton 1988; Attwood 1990). Observers have now recognised the dynamism of African land systems referred to as the ‘Evolutionary Theory of Land Rights’ (ETLR). The main thesis of this theory is that indigenous land rights, under the impulse of market forces, are capable of autonomous evolution towards efficiency. As a result, private property rights in land tend to emerge and, once established, to evolve towards individualisation and formalisation (Platteau, 2000). In such circumstances especially in customary lands where population pressure, commercialisation and competition for land has taken root, cadastral surveys for the purposes of land titling may be justified (Chileshe, 2005).

1.2 Land tenure categories in Zambia

Zambia has an area of about 752614 km² and the last census of population conducted in 2010 showed that the country’s population stood at 13,046,508. The population density stands at 17.3 persons per square kilometre. Sixty-one (61) percent of the population resides in rural areas and thirty-nine (39) percent reside in the urban areas (CSO, 2010).

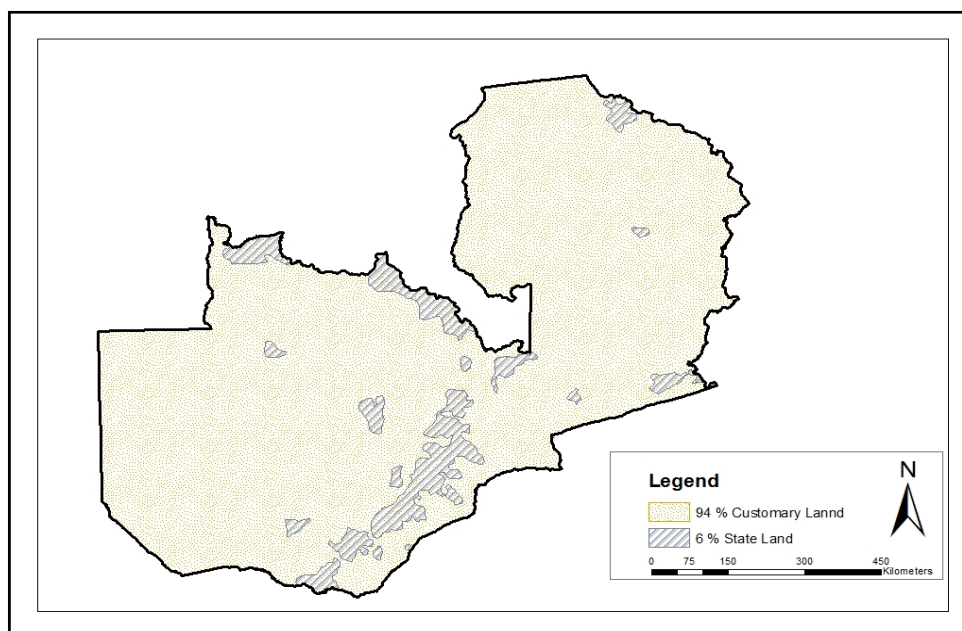


Figure 1. Map of Zambia showing land tenure categories (adapted from Siddle 1971)

Zambia’s land tenure is classified into two categories (see Figure 1): (i) State Land covering about 6% of the country and governed by a statutory leasehold system; (ii) Customary Land covering the remaining 94% and mainly held under customary tenure. These figures have not been updated since the early 1970s and therefore fail to account for any title conversions from customary tenure to statutory tenure. Brown (2003) has indicated that the area for State Land may be as high as 10%. Presently, the greater part of surveys for title is undertaken in State Land with a few in Customary Lands. However, in some Customary Lands of the country pressure by some commercial farmers, tourist operators, and mining exploration companies is increasing for cadastral surveys to be

undertaken for the purposes of conversion of customary land tenure to 99 year leases (Chileshe, 2005).

1.3 Research method

The focus of the research approach used was mainly interpretative and in-depth inquiry rather than a broad survey. It was complemented by data collected through secondary sources. Thus, data was collected through un-structured interviews from purposively selected practicing cadastral surveyors, graduate surveyors, Geomatics academicians and government employed graduate surveyors. Subsequent analysis of data involved transcribing, segmenting and coding of notes from interviews. Throughout the research process data were triangulated through conversations with various cadastral survey professionals.

2. Cadastral Surveying Practice in Zambia

Cadastral survey is the identification, demarcation, measuring and mapping of new or changed legal parcel boundaries and this may include the process of re-establishing of lost boundaries and sometimes resolving disputes over boundaries or other interests in real property. The product of such surveys is a Survey Diagram, which is a prerequisite for obtaining a 99 year title deed in Zambia. This makes the survey diagram the focus of all cadastral surveying activities in Zambia.

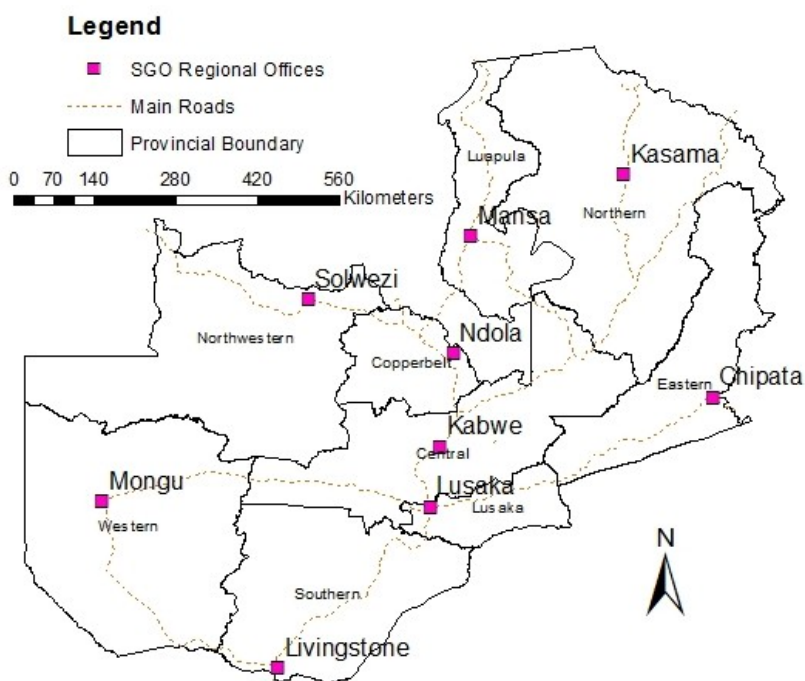


Figure 2. Map of Zambia showing SGO regional offices

The Surveyor General's Office (SGO) has been operational from about 1918 to date. It has nine branches in all the provincial headquarters, except Muchinga Province (see Figure 2).

Apart from cadastral field surveying the Surveyor General's Office is also in charge of archiving cadastral survey records, examining of survey records submitted by both private and government surveyors for the purpose of quality check before approval, establishment, extension and maintenance of Geodetic control monuments and records, production of national topographic and thematic maps, maintenance of boundary records, contracting of aerial survey missions for mapping purposes, as well as processing and archiving of aerial photography and remote sensing imagery. Apart from the Ndola regional office, which is a sub centre for Copperbelt, North-western and Luapula provinces for processing title deeds including the process of approving survey records, the rest of the regional Surveyor General's Office only perform the cadastral survey field work functions. All other Surveyor General's Office (SGO) functions are only performed at the headquarters situated in Lusaka.

3. The Role of SGO in Cadastral Survey Practice

The Surveyor-General of Zambia is responsible for setting and monitoring cadastral survey standards and practices in Zambia under the Land Survey Act Chapter 188 of 1960. The Land Survey Act also sets out the role and functions of the Survey Control Board (SCB) which is primarily concerned with the registration of Land Surveyors and controlling and regulation of the practice of cadastral survey profession. The SCB is composed of five members who include: The Surveyor General, who is the Chairman, a Government surveyor, two private land surveyors, and one legal practitioner who is an advocate of the high court. However, the Land Survey Act does not give a limit to the tenure of office to the SCB members, who can serve for their entire active professional life time unless any of them is removed by the Minister responsible for Lands at his or her own discretion or for professional misconduct.

The Land Survey Act restricts the practicing of Cadastral Surveying to licensed land surveyors. Currently (September 2013) there are only twenty-nine (29) licensed private land surveyors and seven licensed surveyors working under SGO. Out of the seven licensed surveyors working under SGO, only four are appointed as Government Surveyors who have the powers to approve cadastral survey records. Low staffing levels in terms of licensed land surveyors coupled with a few Government surveyors to approve the cadastral survey records has been cited as one of the reasons for the huge survey backlog (van Loenen, 1999).

3.1 Providing reference information

The SGO is the custodian of survey control data which include geodetic control records and all approved cadastral survey records. This information is archived at the headquarters in Lusaka in hard copy format and cannot be accessed via internet or by courier service. Therefore, regardless of where they operate from, land surveyors have to travel to Lusaka to collect this information. The gathering of required survey information is a big contributor towards the cost of cadastral surveys. It disadvantages the people living in the far lying areas of the country (Chileshe, 2005). In addition

this gives unfair competition to the land surveyors who operate from outside Lusaka compared to their Lusaka based colleagues.

The other challenge faced by land surveyors in provision of cadastral survey services is the lack of geodetic control in rural areas, where the coverage is sometimes over 50 kilometres apart. This density of control points is not sufficient to support cadastral survey activities and in order to avoid the cost of transferring geodetic control to the area of interest, most land surveyors resort to using arbitrary local coordinate systems that are not linked to the national geodetic control system (Interview with Government employed graduate surveyor, July 2013). Such local arbitrary coordinate systems cause a lot of encroachments which in turn affect the entire land administration process. The survey services branch of SGO responsible for the provision, densification, and maintenance of geodetic control has been inactive for over three decades. This inactivity has been attributed to over concentration on cadastral surveys by SGO, poor funding and lack of personnel (Interview with Government employed graduate surveyor, July 2013).

The SGO has embarked on production of digital cadastral index map that involves converting all hard copy survey diagrams to a digital seamless layer that is planned to be linked to the Land Information System (Interview with Government employed graduate surveyor, July 2013). This project is facing a lot of challenges as some records are not in the national reference system and have to be either transformed, where common data is available or some of the points have to be re-surveyed to make them compatible with the other data in the national system (Interview with Government employed graduate surveyor, July 2013).

3.2 Testing of survey equipment

In order to meet the set accuracy standards cadastral survey regulations compels all land surveyors to have their equipment regularly tested under the direction of the Surveyor General (Republic of Zambia, 1960). The SGO has established baselines for testing and calibrating EDM equipment in Livingstone, Kasama and Kabwe (see Figure 2 for appreciation of geographical location of these centres). In addition there is another baseline in Lusaka for testing tapes. Although there are well set standards for testing Taping, EDM, and theodolite equipment, there are no standards for testing GNNS equipment, which is now the most commonly used equipment in cadastral surveys. As at now (September 2013), fourteen (14) of the twenty nine (29) licensed land surveyors , own a GNNS receiver, and out of the nine (9) regional SGOs seven (7) own GNSS receivers, these numbers are changing rapidly making GNSS receiver the most popular type of equipment used in cadastral surveys (see Table 1).

Table 1. Comparison of survey records lodged using GNNS compared to Total stations

Year	GNSS surveys	Total stations	Total number of lodged records
2010	625	456	1081
2011	834	336	1170

Zambia Survey Department survey records, (2010 and 2011)

This is a cause for worry, because most of the surveys are performed using equipment that is not tested and casts doubt on the reliability of the results that are achieved using this equipment. Therefore, the need for establishing standards for testing GNSS receivers cannot be over emphasised. The present danger is that the majority of the current pool of licensed land surveyors has little or no educational background on the use of carrier phase GNSS technology and its field/office procedures for them to understand its strengths and limitations (Interview with Geomatics academician, July 2013). However, it is the land surveyor's duty, under the land Survey Act, to ensure that the equipment and methods used are capable of meeting the accuracy requirements.

3.3 Lodging and examination of survey records

In line with the existing regulations and standards all cadastral records are lodged at the SGO in Lusaka and Ndola in hard copy format. In spite of the digital or electronic execution of the works land surveyors still have to produce hard copies to lodge at the SGO for examination. While there are well documented standards and regulations on how cadastral surveys should be conducted using theodolites, EDMs and tapes, (Republic of Zambia, 1960) the same does not apply to surveys conducted using GNSS techniques, which is a challenge to examine such records. Moreover, the existing pool of survey examiners is not well abreast with GNSS which is another handicap in their ability to conduct thorough examination of such records in the absence of standards and regulations (Interview with Government employed graduate surveyor, July 2013).

The manual lodgement of cadastral records demands a lot of storage room and the existing storage infrastructure is inadequate (Interview with Government employed graduate surveyor, July 2013). Although the storage of these data is well indexed in the computer based land information system (LIMS), it sometimes takes days, to locate the records of interest due to misfiling and general poor management of the plan room where these records are archived. The hard copy records introduce unnecessary duplication of work for the land surveyors and cartographers who have to convert their digitally compiled records to hard copy format.

The centralised nature of this service and the lack of manpower have caused a huge backlog of over two years (Mulolwa, 1998). As a result there is a long queue of survey records to be examined which is a cause for corruption (Mwanza, 2004). The same survey examiners also do examine the cadastral jobs performed by SGO and sometimes they are also involved in conducting such surveys (Interview with Government employed graduate surveyor, July 2013). This introduces unfair advantage of SGO done jobs against jobs done by private land surveyors. Moreover having the same institution to perform as an enforcer of standards and quality control as well as a competitor in the provision of the same service attracts a lot of criticism from the private cadastral surveying fraternity on the independency and impartiality.

3.4 Cadastral survey standards and regulations

Cadastral surveys are carried out according to accuracy standards prescribed in Regulation 25.2 (see Table 2).

Table 2: Cadastral surveying standards of accuracy

Survey Class	Linear Misclosure	Designation
Class A	1/12 000	Reference marks, Township control
Class B	1/ 8 000	Surveys in townships
Class C	1/ 4 000	Surveys not included in A and B

Source: Zambia Survey Department, 1986

Other survey regulations relating to horizontal angles, national geodetic control, and conduct of traverses, linear measurements, field checks, allowable misclosures, and verification of existing beacons are well prescribed. However these cadastral survey standards and regulations were set in the 1960s and were meant for using tapes and optical theodolites. They do not provide for use of modern equipment such as total stations and GNSS. Therefore, even where total stations are used, they have to be used as optical theodolites and all readings have to be booked manually in the field book.

Apart from the manual recording of the readings, the total station fits well in the current standards and regulations since it involves measuring of angles and distances just like the earlier instruments. It is the GNSS instruments which have a completely different approach to surveying with different limitations and sources of errors, which causes major concern for lack of standards and procedures. The absence of standards and guidelines on how GNSS surveys should be conducted can lead to abuse and misapplication.

4. Challenges in the Existing Cadastral Survey Management

An appropriate cadastral survey management system should provide for: easy access to cadastral reference information, a predictable delivery period, transparent quality control system, well defined standards and guidelines, competitiveness, clearly defined professional development path, and adaptability to technological advancement and public needs. However, the management of cadastral surveying has been criticised as inefficient (van Loenen, 1999) and unresponsive to the changing public needs. This could be partly attributed to the challenges discussed below.

4.1 Outdated legislation, regulations and standards

The current survey standards and regulations were established over four decades ago and are backed by the Land Survey Act of 1960. Land Surveying practice in terms of methods, procedures and technology has changed tremendously since then which renders this Act and accompanying regulations inadequate to regulate cadastral surveys. Most surveys are now performed using digital equipment (Interview with Government employed graduate surveyor, July 2013). Despite the wide use of digital equipment the records still have to be converted to hard copy format to satisfy the law and regulations. There is no doubt that the current Act and regulations limits the medium of archival, accessibility, management and delivery of cadastral services to clients.

4.2 Poor archiving of cadastral information

The current centralised hard copy archiving of cadastral reference information breaches the principal of provision of access to cadastral survey related information which is critical to meeting the definition of the cadastral survey system. The hard copy and centralised information storage system has been outpaced by current technological trends. Firstly, it limits the mediums of delivery to clients as it can only be accessed by physically visiting the archive centres, which are also heavily centralised. Secondly due to poor storage facilities and wear and tear over time most old records are mutilated and are in unusable state. Thirdly, the increasing number of survey records has exceeded the capacity of existing fixed storage room which leads to misfiling and difficulty in finding the required information.

4.3 Absence of an independent quality control board

The Surveyor General's Office (SGO) is the leading provider of cadastral survey services national wide and the same organisation is also responsible for enforcing cadastral survey standards and regulations. This dual role of competing with private land surveyors in providing cadastral survey services is viewed as unfair competition by many actors in the profession. There is a feeling that the jobs handled by SGO are not given a strict scrutiny since officers who perform survey examination and field surveys report to the same management. This is compounded by the fact that the officers who conduct the quality checks or survey examination are normally junior and have inferior academic qualifications compared to those who perform field surveys.

4.4 Unpredictable delivery period

When a land surveyor receives instruction to survey a property it is difficult to give the client a guarantee on delivery period because it is dependent on a number of unpredictable factors such as: how long it will take to find reference cadastral survey information, how long the survey examination process will take and availability of the Government surveyor to approve such records. This has caused dissatisfaction of clients who apply for cadastral survey services. The quality of the work process should not only be focused on the accuracy or certainty of results but also on the delivery period.

4.5 Lack of competition

Major Government funded projects like those funded through the land development fund to local authorities for survey of large number of plots are done by SGO to the exclusion of private land surveyors. This brings unfair competition and is detrimental to the growth of the profession as a poorly funded private sector means poor service delivery to the public. For the SGO; there is guarantee of lucrative jobs regardless of quality and period of delivery much to the disadvantage of the clients. Generally, due to the low number of licensed surveyors, there is a limited choice for clients as they are forced to select from the limited list of private land surveyors or the SGO, which makes the services less competitive.

4.6 Weak professional involvement

The cadastral survey services in Zambia are characterized by very little professional involvement emanating from the absence of a strong professional board leaving the control of the profession in the hands of the Government or Surveyor General. This is made worse by the lack of limit in tenure of office for the members of SCB, which regulates the practice of cadastral surveying. The unlimited tenure in serving on the SCB brings complaisance to the serving members, which could be the reason for not revising the legislation, standards and regulations to meet the current trends in the profession.

4.7 Lack of continuous professional development

In the management of cadastral survey services in Zambia, continuous professional development (CPD) is not a requirement to holding a practicing license (Republic of Zambia, 1960). Once someone manages to pass the rigorous licensing procedure and is awarded the cadastral survey practicing license, it is not mandatory for them to upgrade their skills to match new technological development. In fact in the current setting, the cadastral surveying practicing license surpasses academic professional qualification because there are no categories of allowable practice for different levels of qualifications.

5. Suggested Improvements

5.1 Review of current legislation

The improvements in the current survey practice should start with the review of the archaic Act to include: the strengthening of the professional body, new equipment, guidelines and procedures. This will provide for change in the conduct of cadastral surveys as well on contents of the survey report lodged for examination and archival at SGO. For example electronic options can be explored for lodgement of records, examination of survey drawings, storage of survey records, dissemination of cadastral survey reference information, and access of cadastral survey information. Further limiting the tenure of serving members on the Survey Control Board (SCB) could bring improvement in the running of the cadastral survey services.

5.2 Provision of cadastral reference information

Firstly, the SGO should decentralise its management and storage of cadastral survey information by making it available at its regional offices and concerned local authorities to cut down on travelling costs. Secondly the SGO should consider migrating to digital system archiving and management of cadastral survey information which could be accessible to the public either via email on request, or through the internet. To bring integrity to cadastral surveys, there is need for SGO to embark on a geodetic control densification mission covering the entire country. This process will not only provide for consistent cadastral surveys but also facilitate for the easier resolution of future boundary disputes since all surveys will be connected to one consistent control network.

5.3 Setting up an independent cadastral quality assurance board

There are two options towards cadastral survey quality assurance: (i) establishing an independent survey examination board to be responsible for scrutinizing cadastral survey work carried out by private or government surveyors; (ii) the SGO to delegate the provision of cadastral survey services to private surveyors and concentrate on quality assurance and the provision geodetic survey and mapping services. Whatever case to be adopted, it is important to define the period the records will take to be examined so as to give a guarantee on the delivery period to the clients.

5.4 Compulsory continuous professional development

Cadastral surveying is a continuously changing profession due to fast technological advancements and as such a properly structured plan to enable professionals keep pace with skills requirement is necessary. This can be achieved through compulsory CPDs as a requirement for annual renewal of practicing license. Such CPDs should focus on developing new skills and enhancing the existing ones.

6. Conclusion

This paper has discussed the cadastral survey practice in Zambia with a view of suggesting possible improvements. The paper has shown that technological advancements have outpaced the ability of the regulatory body to react quickly and make appropriate changes in survey standard and regulations. As a result, GNSS receivers, the now most popular tool for data collection in the Zambian cadastral surveying circles, are used without any guidelines or regulations from the regulatory body, which compromises the quality of the achieved cadastral survey results.

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