Improving end to end delivery of land administration business processes through performance measurement and comparison

Dorman Chimhamhiwa

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Dedicated to my daughters Vonai and Tadiwa

Disclaimer

The work described in this thesis was carried out in the School of Environmental Sciences, University of KwaZulu Natal, Pietermaritzburg from July 2006 to January 2010 under the supervision of Professors Onisimo Mutanga and Paul van der Molen and Dr Denis Rugege. The thesis consists of a series of Chapters that have been published in or accepted for publication in a range of international scientific journals.

I hereby declare that this is an authentic record of work and has not in its entirety or in part, previously formed the basis for the award of any degree of this or any other University. Wherever use is made of other's work, it is duly acknowledged in the text.

…………………………………. 19th March 2010
Dorman Chimhamhiwa

…………………………………. 19th March 2010
Professor Onisimo Mutanga (Supervisor)

Supervisory committee

Professor Onisimo Mutanga, University of KwaZulu Natal, School of Applied Environmental Sciences, Pietermaritzburg, South Africa.

Professor Paul van der Molen, School of Land Administration, University of Twente, Faculty of Geoinformation Management and Earth Observation, Enschede, The Netherlands.

Dr. Denis Rugege, UNDP, Kigali, Rwanda.

Abstract

The delivery of land administration (LA) systems particularly in urban areas underpins housing, industry and infrastructure development as well as the smooth operation of land and credit markets. However, fragmentation of LA activities across several autonomous organizations generally impairs end to end business processes flow and delivery. To facilitate improved service of LA systems we suggest the end to end measurement and monitoring of their business processes across organizational boundaries.

This study proposes a performance measurement system that can facilitate end to end measurement and comparison of cross organizational business processes (CBPs) in LA. The research, which is structured in 2 parts, is based on a multi site study of LA CBPs in 6 urban municipalities across Namibia, Zimbabwe and South Africa. First, a measurement instrument (scorecard) built on six key CBP performance measurement areas of quality and technological innovation (enablers of results), cost and time (measures of results) and customer satisfaction and society (measures of external success (or impact), is presented. To facilitate measurement across organizational boundaries, the proposed dimensions were embedded onto a multi level structural model that link process activities to sub processes and CBPs. For 5 of the 6 municipalities, a conventional case of subdivision of privately owned land within an established township was used to develop CBP descriptions and process models for each municipality. A comparison of CBP and sub process similarities between municipalities was then done using the similarity scenario degree. Our results showed similarities of over 60% for most CBPs while mixed values were obtained for sub processes. The similarity results were further used as a base for the construction of a business process reference model.

The second part of the research tested the applicability of quality and time dimensions. Using the survey examination and approval and deeds examination and approval sub processes, the quality of submitted work was measured using performance indicators of process yield and rejection rates at 2 survey examination and 3 deeds registration sites. Our results showed that 80% and 60% of survey records submitted at both survey examination sites were rejected and returned backwards for corrections due to quality deficits. Based on our results, we conducted

a root cause analysis at one of the survey examination sites to identify major contributors to lower process yield. In addition, we suggested numerous technological innovations to improve quality. Using the same sites, we then went on to measure and compare cycle times for cadastral survey examination and approval considering quality. Our results showed that 70% and 52% of survey records with good quality had approval times of 20 days or less for the first and second sites, respectively while only 32% and 18% of records with poor quality (for same sites) were approved within 60 days. Furthermore, shorter cycle times appeared to indicate lower process costs. After the separate analysis of the quality and time measurements, a global performance index that aggregates individual measures into a composite value was presented.

Overall, the study has shown the potential of end to end CBP performance measurement in improving delivery and service of land administration in a holistic manner. The results are important for initiatives directed at integration and improvement of land administration operations.

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Acronyms

ARIS	Architecture of Integrated Information Systems
BP	Business process
CBP	Cross organizational business process
CT	Cycle time
COST	European Cooperation in the field of Scientific and Technical Research
CS	Cadastral Surveyor
DLGTA	Department of Local Government and Traditional Affairs
ESF	European Science Foundation
FIG	International Federation of Surveyors
GPI	Global performance index
GTZ	German Technical Cooperation
ICT	Information and Communication Technologies
KZN	KwaZulu Natal
LA	Land administration
MOLA	Meeting of Officials in Land Administration
PMS	Performance measurement system
PPMS	Process performance measurement system
QPM	Quality performance measurement
SDI	Spatial Data Infrastructure
SSD	Similarity scenario degree
UML	Unified Modeling Language
UN	United Nations
UNECE	UN Economic Commission for Europe

Chapter 1

General Introduction

1.1 Introduction

Land matters in most African countries are mostly dealt with by numerous scattered organizations often without a common strategy or cooperation. This arrangement usually leads to a multitude of delivery problems particularly for requests that are processed across organizational boundaries. Measurement of performance of land administration (LA) activities across organizational boundaries (from end to end) as well as comparisons of how similar business (work) processes are done between jurisdictions can be an important source for learning from each other, identifying strengths and weaknesses of current practices, establishing standardized approaches as well as setting improvement targets.

This chapter briefly introduces the study and motivation for the research. It states the problem that this thesis intends to solve as well as the objectives and scope. The research approach is summarized and the thesis outlined.

1.2 Background

1.2.1 Land administration

LA is concerned with the administration of land as a natural resource to ensure its sustainable use and development. The term *land administration* was introduced in the 1990s and got prominence mainly through activities of the UN Economic Commission for Europe (UNECE)'s ad hoc group of experts named the 'Meeting of Officials in Land Administration' (MOLA). In their guidelines, the UNECE defined land administration as the processes of recording and disseminating information about the ownership, value and use of land and its associated resources when implementing land management policies (UNECE, 1996). It is considered to include land registration, cadastral surveying and mapping, fiscal, legal and multi - purpose cadastres and land information systems. Dale and McLaughlin (1999) defined land administration as the processes of regulating land and property development and the use and conservation of the land; the gathering of revenues from the land through sales, leasing, and taxation; and the resolving of conflicts concerning the ownership and use of the land. They identified three key attributes of land that jurisdictions are often concerned with: ownership, use and value. While components of LA may differ from country to country, a relative consensus prevails on its core function, namely that of supporting land registration (GTZ, 1998). At the core of a LA system is the cadastre (Williamson, 2001), which is normally a parcel based and up to date land information system containing a record of interests in land. In this regard, land administration and in particular, their cadastral components can be viewed as essential parts of a country's national infrastructure (UN/FIG, 1999). The expected benefits of operating and maintaining a LA system have been publicized widely, see for example (Habitat, 1990; UNECE, 1996; Dale & McLaughlin, 1999).

1.2.2 Performance measurement and comparison

The general trend in public administration to adopt 'new public management' strategies is also present in LA where management practices now help organizations to perform at a level of international best practice (Steudler *et al*, 2004). One of the management approaches adopted in this trend is performance measurement. Performance measurement contributes to the effective management of organizations by facilitating planning and control of operations. Clichés such as "what gets measured gets done" or "if you cannot measure it you cannot manage it" have often been used to justify the measurement of performance in organizations (Robson, 2004). Performance measurement has however been predominantly a private sector practice and has often been approached within the context of single organizations. Measurement of performance across the value chain is relatively new (Folan & Browne, 2005). The supply chain discipline has been leading in this area.

1.3 Problem statement

In many southern African countries, formal LA systems have existed mostly on freehold areas although recently land recording has been extended into customary and informal areas. The formal systems have generally lacked reform over the years and most still operate under complex legislation and practices of the past 50 or so years. Whilst back then the systems could adequately cope with the fewer transactions and small numbers of users, the present day demands and volumes of submitted work have generally placed significant pressure on current institutions often resulting in poor LA services. Further to lack of reform, conservatism attached to land related institutions, lack of cooperation between organizations and fragmentation of LA activities across organizations, have often been cited as key causal factors for the present state of LA services. In most countries, the core LA functions of survey and mapping and registration are often operated separately and in some cases under different ministries. Furthermore, planning and development activities are also conducted elsewhere often under the local government line of ministries and municipalities. When one considers, from an external customer's perspective, the end to end execution of requests that require the cooperation between these geographically separated organizations and coordination of activities across them, then the challenges of delivery become evident. Improvement of cross organizational business (work) processes can be difficult if there is no holistic framework that facilitates measurement of work activities across the value chain. Where reforms have been carried out they have often been limited to within boundaries of specific organizations and not across the whole system. This thesis therefore presents a cross organizational measurement approach that can be used to facilitate measurement and reform of the 'whole' LA system based on its core cross organizational business processes (CBPs).

1.4 Objectives of the thesis

The main aims of the study were: (1) to develop a performance measurement system (PMS) that can be used to measure, monitor and compare LA cross organizational business (work) processes, from end to end, and (2) to test the applicability of such a performance measurement system in a regional context.

1.5 Scope of study

In an attempt to develop more efficient and effective land administration services, numerous initiatives aimed at improving LA systems have been undertaken over the past half a century (Burns *et al*, 2006). These range from: reforming and strengthening policy, legal and institutional frameworks, introducing formal land titling systems or other forms of secure tenure, improving registration practices, upgrading survey and record keeping technologies, capacity building etc. While these initiatives remain critical and relevant for most LA systems in developing countries and Africa in particular, the scope of this thesis lies primarily with the improvement of delivery particularly for cases where LA activities are fragmented and mandated to different organizations. An end to end perspective of cross organizational business processes aimed at analyzing and improving the whole chain is adopted. The study focuses on subdivision activities at the municipal level - a critical level for the delivery of most services in many countries. Six municipalities in Namibia, South Africa and Zimbabwe were used as test sites.

1.6 Study area

The study focused mainly on LA processes delivery at the municipal level in three neighbouring countries. The case of a conventional subdivision within an established township was explored in five predominantly urban municipalities of: Windhoek (Namibia), Msunduzi, eThekwini and Newcastle, (South Africa) and Harare (Zimbabwe). A sixth municipality, Zululand that was originally incorporated into the study was later excluded. The 6 case study sites were selected based on: (1) similarities in the land development processes and delivery challenges faced (2) fragmented nature of land delivery across each case and (3) high demand for land in each municipality. Harare and Windhoek, with populations of over 2 million and 235 000, respectively are the prime municipalities in Zimbabwe and Namibia. Both municipalities host the capital cities of the respective countries. eThekwini is one of South Africa's top metropolitan municipality, with an estimated population of 3.5 million. It is the largest municipality in KwaZulu Natal (KZN) province and incorporates the city of Durban. Newcastle and Msunduzi are both local municipalities also within KZN province. Newcastle municipality, which includes the town of Newcastle, has an estimated population of 423 600 (in 2008) while Msunduzi, which hosts KZN's second largest city, Pietermaritzburg, where the provincial legislature seats, has a population of around 616 000. Subdivision CBPs across the five municipalities were studied between 2006 and 2009. Subdivision was chosen mainly because: (1) it is a very popular transaction that constitute considerably high volume of requests in most urban municipalities (2) spans across several organizations, and (3) is critical for urban housing and infrastructure development.

1.7 Thesis outline

The thesis is comprised of a collection of 4 papers that have been submitted to peer reviewed international journals. Of the 4, 1 paper has already been published and the other 3 are at various stages of the review processes. Each paper has been presented as a standalone chapter, making it a distinctive piece of work that contributes to the research question. As much as possible the content of the journal papers have been maintained. In this respect, each chapter is introduced separately with separate conclusions that link with subsequent chapters. The approach makes some overlaps of method descriptions and illustration inevitable in the different chapters. This drawback is however considered to be of less significance considering the critical peer review processes and it makes the chapters solid papers that can be read individually without losing the context. The chapters are presented under two main sections. The first section focuses on the development of the performance measurement system for LA CBPs and process model representations while the second part concentrates on testing the applicability of the performance measurement system.

1.7.1 Development of a performance measurement system and business process representations

Chapter 2 focused on the development of a performance measurement system that comprise a measurement instrument (scorecard) and structural model to facilitate measurement across organizational boundaries. Based on a case study of subdivision processes across the selected municipalities, six critical success factors that are internal and external facing, were identified. These were embedded onto a multi level structural model that linked activities, sub processes and the CBPs. In Chapter 3, the case of a simple subdivision CBP within an established township was analyzed and modeled from end to end in 5 of the 6 municipalities. Three key diagrams, linking more than 20 institutions in 3 countries were developed and presented. Comparisons of CBPs were conducted using similarity measures and a business process reference model for subdivision was proposed.

1.7.2 Testing the applicability of the model

The second part of the study focused on testing the applicability of the performance measurement system. Chapter 4 explored how quality, a core enabler of results proposed in the measurement instrument, can be measured along the CBPs. A quality performance measurement model was developed and performance indicators of process yield and rejection rate used to measure quality performance on the survey examination and approval and deeds examination and approval sub processes at 2 Surveyor General and 3 Deeds Registries sites. Chapter 5 investigated the applicability of the time dimension. A performance indicator, cycle time, was proposed and used to measure time. Taking into consideration the quality of submitted work, the cycle time for survey records lodged for survey examination and approval was measured, analyzed and compared at 2 Surveyor General sites over a 6 year period. Furthermore, variations of cycle time measures between Cadastral Surveyors and the influence of internal activities were also explored in the same Chapter. Based on the promising results for quality obtained in Chapter 4 and those for cycle time (in Chapter 5), an illustration of how the different performance indicators are aggregated into a single global performance measure was presented.

Chapter 6 provides a synthesis of the study, summarizes the contributions of each chapter in the context of the research objectives and highlights issues for further research.

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Chapter 2

A performance measurement system for cross organizational land administration processes

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*This chapter is based on

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Abstract

Land administration delivery problems, particularly in developing countries, are generally systemic and complex. Requests in land administration are mostly delivered through business processes that run across multiple organizations. Since the delivery challenges go beyond the capabilities of single organizations to solve alone, a multi organizational approach is suggested to detect, assess and improve LA processes.
This paper presents a conceptual model for measuring end to end performance of land administration systems based on cross-organizational business processes. The model, which is constructed on six measurement dimensions, is built on a case study of subdivision processes in six urban municipalities, across three developing countries.

Keywords: Performance measurement, cross organizational business processes, land administration

2.1 Introduction

Land is one of a country's most important assets. Land and buildings account for between half and three quarters of most countries' national wealth (World Bank, 2006). The way that subdivisions, transfers or consolidations of land are processed by the formal land administration (LA) system, particularly in urban jurisdictions, underpins the development of housing, infrastructure and the smooth operation of land and credit markets. In most developing countries, several autonomous organizations, such as Municipalities, the Surveyor General, Cadastral Surveyors, Conveyancers and Registry of Deeds/Titles, are usually involved in the end to end execution of LA business processes. These independent organizations often do not cooperate in the most effective way. From an external customer’s perspective (e.g. property developer, general public), the fragmentation of LA activities across several organizations can present numerous delivery challenges. For example, to formalize a legally obtained home in Peru takes 207 steps, spread across 52 government offices, consuming on average 6 years and 11 months, while to obtain legal title for that piece of land takes an additional 728 steps (de Soto, 2000). Similarly, land registration in Africa can take 15 - 18 months on average, while two to seven years is not uncommon (World Bank, 2003). Such lengthy and costly procedures mean that tens of thousands of land titles may remain pending, and can become obsolete over time. Burns *et al* (2006) allege that the LA operational framework in most developing countries has, over time, largely remained unchanged and tends to get bogged down in the sheer volumes of uncoordinated and disintegrated land-related legislation and practices. In the same study, the authors further challenge the conservatism attached to land-related institutions in developing countries, in contrast to most developed countries where institutional re-engineering is relatively common.

To facilitate the improved service of LA systems across organizations, we suggest the end to end measurement and monitoring of their business processes. In this regard, LA business processes are analyzed as an integrated chain of activities that traverse organizational boundaries to achieve a specified goal. We call such processes cross organizational business processes (CBPs). By focusing on CBPs, we aim to facilitate a holistic assessment of LA activities by measuring “complete processes.”

Performance measurement is often discussed within the context of single organizations. LA products, on the other hand, are mostly delivered through business processes, which span multiple organizations. This justifies the development of a multi-organizational measurement model to enable the systematic assessment of CBP performance across organizations. In the absence of such a measurement approach, each participating organization will tend to use local measurement and monitoring systems that are independent of those of its upstream and downstream partners. This, in most cases, leads to different organizations measuring different things, which is not conducive to the optimal performance of the CBP (and LA) as a unified whole. Furthermore, it would be difficult to assess the downstream impact of certain actions on the part of upstream organizations in the absence of an end to end performance measurement approach. We thus argue that measuring CBP performance presents an opportunity for network-wide assessment, diagnosis and improvement in LA, which otherwise would not be possible if the individual parts (sub processes) were analyzed separately. In this regard, CBP performance measurement is used as a strategic tool to facilitate an integrated and cross organizational analysis and reform of LA.

In this paper, we present a performance measurement framework for LA CBPs. The multi criteria instrument is built on 6 key measurement areas (critical success factors) that are developed through a case study. The framework, which is integrated both across the distributed sub processes of the CBP and through its hierarchy, can be used to measure performance across the chain of participants as well as benchmark similar CBPs in different parts of a country or across countries. This paper is based on a case study of subdivision CBPs in 6 urban municipalities in South Africa, Namibia and Zimbabwe. The remainder of the paper is structured as follows: in Section 2.2 we discuss different approaches for evaluating success of LA systems. We suggest an analysis based on business processes as the most appropriate for our goal. In the same section, performance measurement methods are reviewed, with a particular focus on cross-organizational scenarios. In Section 2.3, we present a subdivision CBP case study carried out to determine critical measurement areas for CBP delivery. A framework for CBP performance measurement is then developed based on these measurement areas. Section 2.4 concludes and summarizes the paper, and highlights issues for further research.

The work reported in this paper is valuable for a number of reasons. First, it is one of only few studies to identify the critical success factors for improved LA business processes flow and delivery across organizations, and how these can be measured. We propose a comprehensive set of measures and a framework upon which to assess the performance of LA CBPs. The measurement framework developed here attempts to provide a balance between measures of external success and internal performance and measures that are designed to give an early indication of future success as well as a record of what has been achieved in the past. Secondly, by proposing an integrated multi criteria set of measures that span several organizations, the model widens the scope of performance measurement initiatives in LA by enabling a whole system planning approach.

2.2 Evaluating Land Administration success

A lot of work has been done in developing guidelines as to what constitutes a good LA system (Williamson & Ting, 2001). Given the challenges associated with LA, can a government know if it has a successful system? This can be better understood by comparison to similar systems elsewhere. While there are still no internationally accepted methodologies for evaluating and comparing LA systems (Steudler *et al*, 2004), some useful work has been undertaken, particularly in cadastral systems. For example, the International Federation of Surveyors (FIG) suggested the criteria of security, clarity and simplicity, timeliness, fairness, accessibility, cost and sustainability, for assessing actual or potential success of a cadastre or LA system (FIG, 1995). These measures, which are customer-oriented, can be used to evaluate LA effectiveness. FIG Commission 7 has explored another approach by developing a model to benchmark cadastral systems across countries (Steudler *et al*, 1997). Their model, which is built on the 5 measurement dimensions of (1) general statistics and content, (2) performance and reliability, (3) completeness, (4) personnel and salary structure and (5) cost recovery aspects, along with several performance indicators, is used to benchmark the cadastral systems of 53 countries. Building further on the benchmarking model, the cadastral template of (Steudler *et al*, 2003; Rajabifard *et al*, 2007) suggests additional dimensions for cadastral systems performance evaluation. Using the measurement categories of (1) parcels to survey and register, (2) informal occupation of land, (3) completeness, (4) comprehensiveness, (5) use and usefulness of spatial cadastral data and (6) capacity in place, and numerous indicators (Rajabifard *et al*, 2007), this cadastral template has been tested in 34 countries. Equally important is the work of Steudler *et al* (2004) who suggest a LA evaluation framework based on the 4 core elements of objectives, strategies, outcomes and review process. Their framework, which presents a management model that links LA operational aspects with policy, was tested on the national LA system of Switzerland (Steudler & Williamson, 2005).

It is evident from the few studies above that LA success can be evaluated through several multi-dimensional approaches. However, the goals pursued in an evaluation should determine what to measure and how. This paper is interested in the end to end measurement of LA business processes whose activities are fragmented and mandated to different organizations (as is the case in most developing countries). We therefore pursue a business process based analysis.

2.2.1 A business process based analysis

To understand and improve a system, one can analyze its business processes (Navratil & Frank, 2004). While several evaluation studies on LA have been conducted, few have focused on business processes. Some of these are discussed here. The ESF - COST project presents a transaction based analysis of real property procedures in a number of European countries (Stubkjaer *et al*, 2007). The project, whose aims were to develop a comprehensive and comparable description of real property transactions as well as to assess and compare the costs related to these transactions, focused exclusively on transaction costs. Process activities are proposed as the basic elements for transaction analysis (Ferlan *et al*, 2007). Also related to the European Science Foundation Cooperation in the field of Scientific and Technical Research (ESF – COST) is the work of Lisec *et al* (2008) who present activity based models of a rural land transaction that can be used to compare, simplify and optimize transactions across different real estate markets. Similarly, the benchmarking project of Nordic countries (Eriksson, 2007) attempts to assess cadastral procedures for subdivisions of 3000m^2 or less in 5 countries. The study captures the full cycle of activities, from receipt of an application to registration of the new property unit. Also worth noting is the ongoing *Doing Business initiative* (http://www.doingbusiness.org/) by the World Bank, which captures and monitors the processes for registering property as an indicator for business activity and reform in over 181 countries (in 2008). To assess property registration, three key indicators are used: (1) number of procedures (2) number of days and (3) cost (World Bank, 2005).

The above list of works, which is in no way exhaustive, presents some different contexts where LA business process evaluation models have been developed and applied. All initiatives embrace a cross organizational orientation, an element that is especially relevant for this research. Furthermore, some common business process measurement dimensions of cost and time can be identified across all cases. It can, however, be argued that what is measured and how, in each case, is different due to different goals pursued, e.g. economic efficiency of cost under ESF - COST, increased cost efficiency and better client service under the Nordic project, and ease of doing business under the *Doing Business initiative*. Our goal is to build on a value chain premise where multiple business processes are viewed as seamlessly linked within and beyond individual organizational boundaries. The end to end measurement of such business processes has not, to our knowledge, been widely investigated.

2.2.1.1 A case for end to end business process measurement

CBPs consist of multiple business processes. A typical CBP can consist of, say, 3 sub processes: *sub process*$_a$, *sub process*$_b$ and *sub process*$_c$, which are distributed across organizations *A*, *B* and *C,* respectively. If we focused only on what happens in *sub process*$_b$ (*organization B*), (which is what often happens), we would optimize the activities and routines associated with this sub process, thereby improving its productivity. If, on the other hand, we were to consider what happens to process requests once they arrive at *C*, our decisions and actions might be different. Improved handling of *sub process*$_b$ alone may result in an increased workload at *C* (downstream), which can cause queues and backlogs to form. In contrast, an end to end perspective that views *sub process*$_a$, *sub process*$_b$ and *sub process*$_c$ as components of one bigger system (the CBP) provides opportunities for improving the whole that are not immediately evident from an analysis of each part separately. It is, however, important to acknowledge that not all business processes within LA deserve end to end attention. We thus suggest that critical CBPs be identified. These can then be decomposed into sub processes and activities to address their detailed performance.

2.2.2 Performance measurement

Performance measurement contributes to the effective management of organizations by facilitating planning and control. Neely *et al* (2005) define performance measurement as the process of quantifying the efficiency and effectiveness of actions. Effectiveness refers to the extent to which customer requirements are met, while efficiency measures how economically the organization's resources are utilized. It is assumed that measurement provides a means of capturing performance data that can be used to inform decision making. To measure performance in a given context, one has to determine what to measure (i.e. the measurement areas or dimensions). The choice of dimensions is influenced by measurement purpose (Nenadal, 2008). Enough dimensions must be captured to give a comprehensive picture of performance, but not too many, lest they overload and confuse users. To ensure a minimum level of measurement in each key area, at least one performance indicator must be developed for each dimension.

Process performance measurement is defined as the monitoring of agreed performance indicators to identify whether a process meets planned targets (Nenadal, 2008). Its purpose is to offer relevant and objective data about the real behavior of a process. Such information can be used to communicate goals and current performance directly to the process team, to improve resource allocation and process output, to give early warning signals, to make a diagnosis of the weaknesses of a given business process, to decide whether corrective actions are needed and to assess the impact of actions taken (Kueng, 2000). If it is not understood how business processes perform, it will be extremely difficult to figure out how they can be improved. Since performance measurement systems have not been extensively developed and systematically implemented in LA, the model proposed for measuring CBPs here is mainly informed by works in mainstream performance measurement and process based measurement. Some key works in this field are discussed below.

2.2.2.1 Conventional and process based performance measurement

From mainstream performance measurement several frameworks, encompassing multiple dimensions, have been suggested. Some examples are as follows: Kaplan and Norton, in their renowned balanced score card framework (Kaplan & Norton, 1992; Kaplan & Norton, 1996), suggest that an organization’s performance can be measured through 4 linked variables: financial (how do we look to our shareholders), internal business (what must we excel at), customer (how do our customers see us) and innovation and learning (how can we continue to improve and create value). Keegan *et al* (1989) attempted to ‘balance’ the measurement of performance into financial, non financial, internal and external perspectives. The performance pyramid (Lynch &

Cross, 1991) makes explicit the distinction between measures that are of interest to external parties (customer facing) and measures that are of primary interest within the business (organization facing). Under the results and determinants framework, Fitzgerald *et al* (1991) propose to distinguish between measures of results obtained from past business performance (lagging) and measures of the determinants of the results (leading). Most of these frameworks have, however, focused on performance measurement from a single organization point of view (Bititci *et al*, 2005), and have tended to be hierarchical (functional) in orientation (Neely *et al*, 2000). They, however, provide an essential platform to inform research into cross-organizational performance measurement. Common themes emerging from these models that are relevant to this research are that performance measurement should:

- consist of multi-dimensional, comprehensive and balanced measures (short term vs. long term objectives, financial vs. non financial, leading vs. lagging, internal vs. external etc.) (Bourne *et al*, 2000; Neely *et al*, 2005).
- identify a minimum set of measures, i.e. the vital few (Brown, 1996).
- have their measures integrated (links between measures should be understood) (Neely *et al*, 2000; Bititci *et al*, 2005; Neely *et al*, 2005).
- identify the key objectives to be measured (Bourne *et al*, 2000; Bititci *et al*, 2005).
- focus on business processes that deliver value (Bititci *et al*, 2005).

In addition to the mainstream measurement frameworks, other models more aligned with the horizontal flow of materials and information, i.e., the business processes, have also been proposed. Among these is the process performance measurement system (PPMS) of Kueng (2000), which evaluates performance based on 5 stakeholder oriented dimensions: societal, financial, employee, customer and innovation. By focusing on stakeholders, measurement within PPMS is targeted at those who have an interest in the business process. In addition, process relevant goals are identified for each stakeholder group. Recently, Chan and Qi (2003) suggested a cross-organizational performance measurement model that is constructed based on linkages between upstream and downstream business processes and activities. The model, which builds on the PPMS (Kueng, 2000), suggests the measurement of performance primarily based on activities. Another conceptually appealing, process-oriented model is the input, processes, outputs and outcomes framework (Brown, 1996). The author argues that each stage of this framework is the driver for the next.

The works discussed above have sought to develop various performance measurement frameworks for different systems. In each case, key design features and dimensions, that are appropriate for the system under construction, are suggested. To our knowledge, extensive studies on performance measurement system design for cross-organizational business processes in LA are scarce, hence, a case study had to be conducted.

2.3 Case study

The case study seeks to determine key measurement areas for LA CBPs and their performance indicators. A structural model to aid in the actual measurement of performance is also constructed. To this end, we analyzed subdivisions of 4 property units or less in 6 urban municipalities across 3 neighbouring countries, namely Windhoek (Namibia), eThekwini, Msunduzi, Newcastle and Zululand (South Africa) and Harare (Zimbabwe). Windhoek, Msunduzi, eThekwini and Harare are metropolitan municipalities, while Newcastle and Zululand are categorized as district municipalities. As expected, the demand for land in urban municipalities is generally high, and all 3 case countries have been experiencing a surging property market lately.

2.3.1 Choice of subdivision

The subdivision CBP was chosen for two main reasons: first, subdivisions are very popular because they are the primary means of creating new properties. They therefore constitute a considerably high volume of LA requests in most urban municipalities. Furthermore, from an external customer‘s perspective, subdivisions involve several sub processes that span many organizations. Thus, analyzing subdivision CBPs gives a cross organizational ‘feel’ for the LA system, rather than an organization specific sub process. Secondly, Namibia, South Africa and Zimbabwe have ongoing land reform/redistribution and customary tenure registration (for South Africa and Namibia) programs, whose business processes closely resemble current subdivision processes in urban areas.

2.3.2 Brief processes descriptions

For each municipality, an end to end business process walkthrough was conducted, and a brief description is provided below. However, detailed business processes descriptions are not covered in this paper. To subdivide land in Windhoek Municipality, an initial proposal is prepared, usually by a Consultant, then lodged with the Municipality's Town planning division (for conformity) and then passed through the Township Board (for consent), a Cadastral Surveyor (for survey), Surveyor General (for survey examination and approval), a Conveyancer (for deed drafting) and finally the Registry of Deeds (for deed examination and approval). In the metropolitan Municipality of Harare, subdivision proposals are often drafted by private Planners and then lodged with the Municipality's Town Planning division (for plan examination and approval) then handed over to a Cadastral Surveyor (for survey), then to the Surveyor General, a Conveyancer and finally the Registry of Deeds. In eThekwini, Msunduzi, Newcastle and Zululand Municipalities, an initial subdivision proposal is generally prepared through a Cadastral Surveyor. For Newcastle and Zululand, the drafted subdivision proposals are lodged with the Municipality's Town planning division (for conformity), and then the Department of Local Government and Traditional Affairs (for conditions of establishment) while for eThekwini and Msunduzi, proposals are lodged with the Municipality's Town Planning and Survey divisions, respectively for conditions of establishment. The conditions of establishment (consent) are then handed to a Cadastral Surveyor (for survey), then to the Surveyor General (for survey examination and approval), a Conveyancer and finally the Registry of Deeds.

2.3.3 Determining what to measure

2.3.3.1 Steps followed in determining measurement areas

To determine the measurement areas, 3 key steps were followed. First, an extensive investigation was carried out, through key informant interviews, a questionnaire survey, direct business process observation and analysis of secondary data (reports, transactional data and lodgement data). Over 70 key informants, amongst them: Town Planners, Cadastral Surveyors, Surveyor Generals, Cadastral survey Examiners, Conveyancers, Deeds Registrars and Deeds Examiners, were interviewed between 2005 and 2008. These key informants were distributed across 6

Municipal Town Planning departments, 4 Surveyor General Offices, 4 Deeds Registries, 6 conveyancing firms, 10 cadastral survey firms, 11 Town planning institutions, 3 Local Government departments and a Township Board. Second, to discuss and further build consensus around critical CBP measurement areas, 3 workshops were conducted: 1 in Harare (with Cadastral Surveyors and Surveyor General staff) another in Pietermaritzburg (with Surveyor General and Registry of Deeds) and a third in Windhoek (with private Town Planners, Municipal Town Planners, Local government, Conveyancers, Registry of Deeds, Surveyor General and Cadastral Surveyors). Third, two papers were presented at conferences and emerging issues were discussed with LA experts.

2.3.3.2 Selecting measurement areas

The choice of measurement areas was guided mainly by investigation results, workshops and conference feedback, as well as the guidelines on performance measurement system design raised in Section 2.2.2.1. The three (3) core dimensions of: time, cost and quality were identified. These are already being measured and monitored frequently in various formats in almost all organizations. In addition to cost, quality and time, it was recognized that technological innovations, in particular Information and Communication Technologies (ICT), drives business process improvement in LA. We therefore introduced a fourth measurement dimension, technological innovation. Furthermore, since our overall focus was to maintain an end to end view of business process activities (all the way to the customer) we added customer satisfaction and society as fifth and sixth measurement dimensions, respectively. These core measurement areas were placed into a framework (figure 2.1) where possible goals for each dimension were suggested.

A detailed discussion of each dimension, including some suggested indicators, is presented below. For some dimensions, multiple subcategories of measures are discussed.

2.3.3.2.1 Cost

Cost is an indispensable dimension for the performance measurement of a business and business processes. Resources such as labour, materials and equipment are consumed, and these have costs. While many elements of cost can be studied in a business environment, the cost to deliver and revenues generated (mainly through fees) are critical elements at the business process level. The cost to deliver a business process instance can be assessed at the activity and process levels. These are elaborated below.

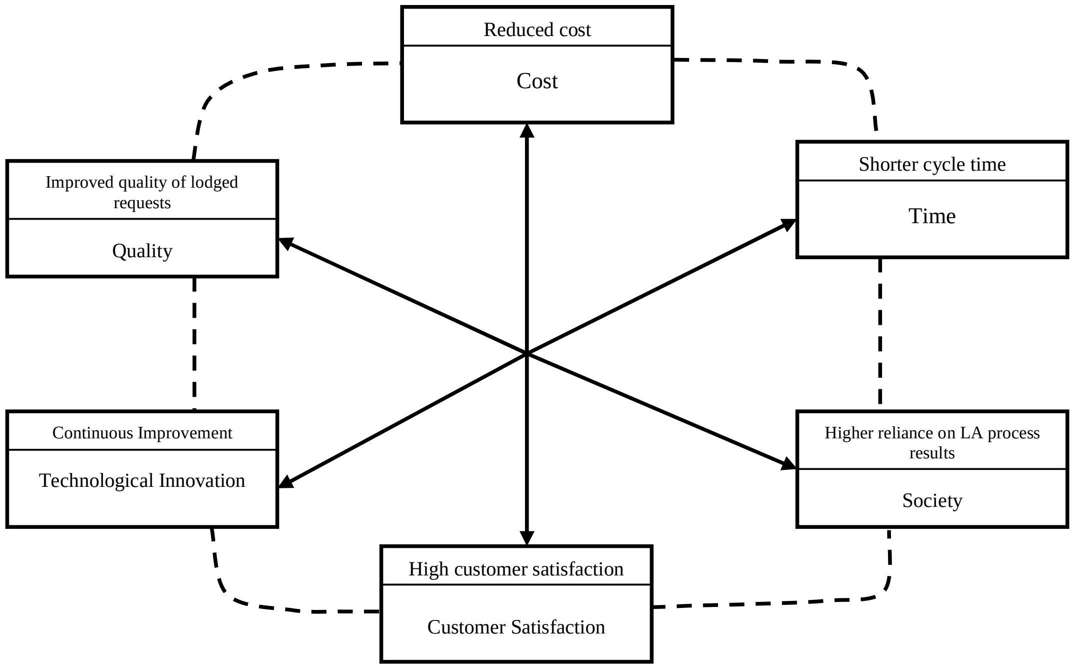

Figure 2.1: Cross organizational business process measurement framework

Activity cost: the activity cost is the cost of carrying out an activity for example, the cost to do a field survey for a subdivision or the cost to examine a survey record. Requests consume activities, which in turn consume resources (such as labour, technology and equipment). Resources consumed can be measured by resource usage units, e.g. number of hours, material cost, equipment cost, etc. Activity costing is an ideal tool for business process analysis, because it assigns costs based on the resources consumed by a specific customer or product line (Brown, 1996). Possible indicators may include the average cost per activity unit, e.g., the cost per survey examined.

Process cost: the process cost can be viewed as the total cost to produce a process output based on its activities. The process cost (cost to deliver a process instance) can be computed by aggregating the costs of all activities associated with the business process.

2.3.3.2.2 Quality

The quality of documents lodged along the subdivision process chain is controlled through examination. Examination is carried out to ensure that the proposed plans, cadastral survey records and deeds that are lodged conform to relevant legislation that govern each sub process. This ensures reliability, security, certainty and confidence in the LA system. Society wants to be able to trust the LA system (Zevenbergen, 2004). Palmer (1996) categorizes those systems that examine incoming documents and allow only records that pass to be registered as ‘active,’ and those that merely file records without examination as ‘passive’. Dale and McLaughlin (1999), however, caution that quality control may be expensive if attempts are made to check all aspects of each job carried out by the private sector. Evidence from the case study reveals several quality management challenges along LA CBP chains. First, poor quality work lodged upstream often causes approval delays and incurs extra costs downstream. Second, poor quality work tends to lead to process back flows, as jobs are frequently returned for corrections. Because there is no limit imposed on the number of times a job can be returned for corrections and no resubmission time is stipulated, a significant portion of the lodged jobs continuously circulate back and forth in some segments of the chain, causing CBP congestion and keeping customers waiting indefinitely. The quality of the lodged records affects, among other things, the process throughput, delivery time and cost. Several performance indicators, such as the percentage of documents processed free of errors, and the average number of times a request is returned for corrections, can be used to assess quality.

2.3.3.2.3 Time

Time is a critical dimension for measuring business processes. (Jonkers & Franken, 1996; Franken *et al*, 1997) suggest multiple time variables that can be analyzed for business processes: the response time, processing time, completion time, throughput and utilization. In addition, based on field evidence, we further propose the waiting time, speed, resubmission time and request crossover time. These are briefly discussed below.

Response time: the time between issuing a request and receiving the result. The response time is a customer facing measure which is critical for customer satisfaction.

Processing time: relates to the time that actual work is performed on a request. This can be measured as direct labour hours (man hours) or machine hours or a combination of both. A key indicator for the processing time is the productive processing time.

Completion time: represents the time required to complete an activity, sub process or CBP case.

Throughput: measures the number of requests processed per time unit. For our case, the throughput can be measured at multiple levels e.g. at the activity level (e.g. the number of survey records approved per month), the organizational level (e.g. number of deeds processed per week) and the CBP level (subdivisions processed and completed within 5 years). The throughput is affected by, among other factors, the number of available resources, the resource capacity and the resource efficiency.

Resource utilization: indicates the percentage of operational time that a resource is busy. On the one hand, the utilization is a measure of the effectiveness with which a resource is used. On the other hand, a high utilization can be an indication that a resource is a potential bottleneck. Increasing that resource's capacity (or adding an extra resource) can lead to a relatively high performance improvement. In the case of humans, the utilization may be used as a more or less objective measure of work stress.

Waiting time: waiting (or queuing) time represents the time between the arrival of a request and the start of work on it. Due to several factors, requests often have to wait for a resource to be available. Waiting leads to the emergence of queues. In theory, a distinction can be made between stations where requests have to wait to be served and those where they rarely wait. Furthermore, waiting times vary between stations along a CBP. In our case study, higher waiting times (and queues) were evident in, for example, cadastral survey examination and approval. High waiting times can be attributed to factors such as inadequate resources. On the other hand, the absence of queues may be viewed as an indication of resource underutilization.

Speed: the rate at which requests are processed. Several factors, such as capacity, workload, number of resources and resource efficiency, affect the speed at which requests are processed. Speed can also vary along different segments of a CBP or sub process. Examples of indicators for speed include the percentage of requests completed within various time targets at the activity, sub process or CBP levels.

Resubmission time: the time taken to correct and resubmit a previously rejected request. This dimension is closely related to the quality, and applies to requests returned for corrections.

Cross over time: in a CBP context, the cross over time is the time taken to connect from one sub process to the next. Several factors, such as the infrastructure that connects sub processes, affect the cross over time, for example, the use of courier services to lodge cadastral surveys by out of town Cadastral Surveyors versus online submission.

2.3.3.2.4 Technological innovation

LA is an information intensive discipline that generates huge data sets that require regular changes and updates. Technology can be a major facilitator for improving data management in such contexts. However, in most developing countries, the level of technological innovation in LA is generally low compared to their developed counterparts. Several factors, such as inadequate funding to purchase technologies and train workers, lack of skilled personnel, resistance to change and legislation hamper innovation. Key points where technological innovations can make a significant difference include (1) data capture (2) data processing and management, and (3) data access and dissemination. Examples of innovations that can be adopted at such points include the following:

- Use of GPS and remote sensing based systems e.g. Ikonos, SPOT, quick bird. These provide faster and lower cost data collection options. Remotely sensed data can be integrated with other ancillary data to assist with, for example, town planning approvals and cadastral boundary demarcation (if suitable), etc.
- Computerization of land information records, which makes data more shareable and accessible.
- Use of standard GIS and databases that enable large spatial data repositories to be build and shared between applications and organizations. This can be done through the adoption of Open GIS standard based databases, which support interoperability between services and devices through open standards. Standards also encourage data portability.
- Provision of online access to and digital lodgement of survey records. This improves cadastral survey and examination processes.
- Electronic conveyancing, which expedites the processing of deeds.
- Online provision of land information via internet and the World Wide Web.
- Adoption of software for LA, e.g. Arc Cadastre.
- Use of Spatial Data Infrastructures (SDI). SDIs support the storage, use and transfer of spatial data.

- Use of computer supported cooperative work tools, e.g. workflow management and monitoring systems, online tracking etc.

While ICT is only an enabler, it provides an infrastructure for cooperative working, coordination and communication within, between and across organizations. Benefits include shorter processing times, reduced costs, improved efficiency, improved customer satisfaction and improved quality.

Technological innovation can be measured through its impact. Possible indicators could include the percentage reduction in processing time due to computerization.

2.3.3.2.5 Customer satisfaction

Customers are the ultimate recipients of products, services and outputs delivered through LA CBPs, sub processes and activities. They provide essential feedback on the quality of services offered. Zevenbergen (2004) argues that though customer satisfaction is often used as a buzzword, most land right holders consider getting a land transfer a "*pain in the neck.*" Several criteria can be used to measure customer satisfaction. Two common approaches in LA are the World Bank measures of the number of procedures, cost and time (World Bank, 2005), and FIG (1995) of security, clarity and simplicity, timeliness, fairness, accessibility, cost and sustainability. To evaluate the customer's satisfaction with the performance of a business process, Kueng (2000) suggests two possible options (1) comparing customer expectations against perceptions or (2) using a defined quality criteria and asking customers to rate both the degree of fulfilment and importance of each criterion. Indicators such as the percentage of customers that are satisfied with the CBP or sub process output can be used to assess customer satisfaction.

2.3.3.2.6 Society

LA is not an end in itself, it serves society. In this regard, LA and its CBPs can be viewed as instruments for achieving social goals. For example, banks want the LA and its processes to facilitate a smooth land and credit market and to provide security for credit. Local governments mostly expect LA to enable orderly property development, to deliver land information for governance, the protection of public lands, planning and building modern cities and facilitating improved urban planning and infrastructure development. National governments may be more interested in base data for land and property taxation and social and economic development statistics, while ordinary citizens are mainly concerned about whether LA and its CBPs guarantee ownership and security of tenure, support environmental management and alleviate poverty. The societal dimension is therefore a constant reminder of why LA or its CBPs exist. A LA system can be “very busy” but be accomplishing little from society’s perspective. Imagine a subdivision CBP that exceeds it targets in delivery time but has negative impacts on urban development or the environment. The measurement of the societal dimension covers numerous clusters, including financial institutions, citizens, local and national governments. Criteria related to the broader social goals of LA or specific CBPs can be defined. Members are then asked to rate the degree of fulfillment and importance of each criterion. Cluster specific indicators could include, for example, the percentage of citizens satisfied with security of tenure, or the percentage of credit providers very satisfied with the security provided by LA CBPs. Overall dimension indicators can be developed through the aggregation of cluster measures. A composite indicator could be the percentage of citizens satisfied with CBP outcomes.

2.3.4 The performance measurement framework as a single entity

The previous sections have discussed the individual measurement areas that constitute the proposed CBP performance measurement framework. Possible indicators were suggested for each dimension. In this section, we examine the use of the measurement framework as a unified entity. First we discuss the linkages between measurement areas and then the trade-offs between different dimensional goals. A structural model for measuring performance is then presented, followed by a discussion on aggregating performance for the CBP. We conclude the section with implementation and maintenance issues.

2.3.4.1 Linkages between measurement areas

The 6 proposed measurement areas attempt to provide a balance between measures of CBP external success (customer satisfaction and society) and internal performance (quality, technological innovation, cost and time). Technological innovation and quality are suggested to give an early indication of future success (enablers of results) while time and cost record what has been achieved in the past (results). By distinguishing between internal and external perspectives, measurement initiatives are resultantly directed towards these two views. Measurements in the external (customer-facing) environment gauge CBP effectiveness, and thus provide essential feedback that influence internal practices and efficiency (organization-facing).

2.3.4.2 Trade offs between goals

As in most measurement frameworks, the goals of different measurement dimensions often stand in either a complementary or conflicting relationship with one another. Thus, too much emphasis on one goal may be to the detriment of others. For example, high customer satisfaction cannot be solely pursued at the expense of quality. That is why lodged deeds, proposed plans and cadastral surveys are rigorously examined to ensure their reliability and the trust in LA by society and customers. Such rigorous examination, however, increases the completion and response times as well as costs. Similarly, while technological innovations may be pursued to improve quality and response time, costs can stand in the way. Thus, due to interdependencies between measurement dimensions, trade-offs between goals (relaxing one goal to achieve another) ought to be considered in order to design optimal systems. This can be achieved by assigning weights to different measurement goals.

2.3.4.3 Measuring performance - a structural model

In this section, a model that facilitates measurement of CBP performance based on suggested measurement areas and performance indicators is presented. In designing the model, we recognized that (1) CBP performance is derived from the results of different sub processes implied in the CBP, together with the performance of the interaction between sub processes (2) organizations ideally want their performance to be measured based on results that they can control, which might not necessarily be (final) CBP results. We thus suggest that measurements be carried out at 3 linked levels of: CBP, sub process and activity (figure 2.2).

At the CBP level (level 1), the final output (i.e. the complete subdivision) is measured, while at the sub process level (level 2), intermediate outputs, such as surveyed portions (by Cadastral Surveyors), approved survey records (by the Surveyor General) and drafted deeds (by Conveyancers) are measured. Interaction measures between the sub processes can also be captured at level 2, e.g. the cross over time. Activity outputs are measured at the activity levels (level 3). CBP measurement is, in this regard, transformed into assessing the performance of sub processes and activities in the lower level hierarchies.

Level 1: CBP

Cross organizational business process (e.g. subdivision)		
	Performance dimension	Performance indicator
Internal	Cost	Total cost of CBP
	Quality	% of CBP documents processed free of error
	Time	CBP completion time
	Technological Innovation	% reduction in processing time due to computerization
External	Customer satisfaction	% of customers very satisfied with CBP output.
	Society	% of society satisfied with CBP outcomes.

Level 2: Sub processes

Sub process 1: Cadastral survey (Cadastral surveyor)		
	Performance dimension	Performance indicator
Internal	Cost	Total cost of sub process 1
	Quality	% of sub process 1 documents processed free of error.
	Time	Sub process 1 completion time
	Technological Innovation	% reduction in processing time due to computerization across sub process 1
External	Customer satisfaction	% of customers very satisfied with sub process 1
	Society	% of society satisfied with sub processes 1 outcomes

Interaction measures

Sub process 2: Survey examination (Surveyor General)		
	Performance dimension	Performance indicator
Internal	Cost	Total cost of sub process 2
	Quality	% of sub process 2 documents processed free of error
	Time	Sub process 2 completion time
	Technological Innovation	% reduction in processing time due to computerization across sub process 2
External	Customer satisfaction	% of customers very satisfied with sub process 2
	Society	% of society satisfied with sub processes 2 outcomes

Level 3: Activities

Activity 2.1: Examine		
	Performance dimension	Performance indicator
Internal	Cost	Total cost of activity 2.1
	Quality	% of documents processed free of error at activity 2.1
	Time	Activity 2.1 completion time
	Technological Innovation	% reduction in processing time due to computerization at activity 2.1

Activity 2.2: Approve		
	Performance dimension	Performance indicator
Internal	Cost	Total cost of activity 2.2
	Quality	% of documents processed free of error at activity 2.2
	Time	Activity 2.2 completion time
	Technological Innovation	% reduction in processing time due to computerization at activity 2.2

Figure 2.2: Structural model for multi level performance measurement

In other words, the performance of activities is used as a base to build sub process and CBP performance. However, since activities are contained within sub processes, it is assumed that their measurements are only relevant to internal LA views.

2.3.4.4 Aggregated performance

To compute the aggregated CBP performance, a number of steps are required: (1) Derive performance values for each indicator. Such values usually come in different units: e.g. percentages for customer satisfaction, days for process completion time, dollars ($) for process cost etc. To ensure that all dimensions are covered, at least a single indicator must be selected for each measurement area. (2) Translate performance expressions into a common reference (normalize) - e.g. through satisfaction degrees (by using ratios, difference, etc.). (3) Derive weights for the different indicators. In most measurement systems, some measures are more important than others. Weights can be developed by asking decision makers the importance of each measure with respect to overall performance. When all the measures are perceived to be equal, simple averaging can be used. Aggregated performance is computed from weights and normalized measurement expressions.

2.3.4.5 Implementation and maintenance of the measurement framework

The paper has focused on performance measurement system design for cross organizational LA processes. Based on our main goal, key measurement areas and indicators have been established. The next logical step after design is implementation. This involves putting in place systems and procedures to collect and analyze performance data, report results, review current measures against targets and identify areas of improvement (figure 2.3).

These procedures can be assisted by the use of measurement templates such as the record sheet (Neely *et al*, 1997), which aid in the capture of target values, units of measure, formulae, frequency of measurement etc for each proposed indicator. Furthermore, ICT could play a key role in capturing, storing, managing and presenting performance data. A phased approach can be adopted where two or three organizations and about three measurement dimensions are selected first. To keep the framework up to date with the measurement needs and purposes, regular reviews are conducted to accommodate additional requirements and fine tune the measures.

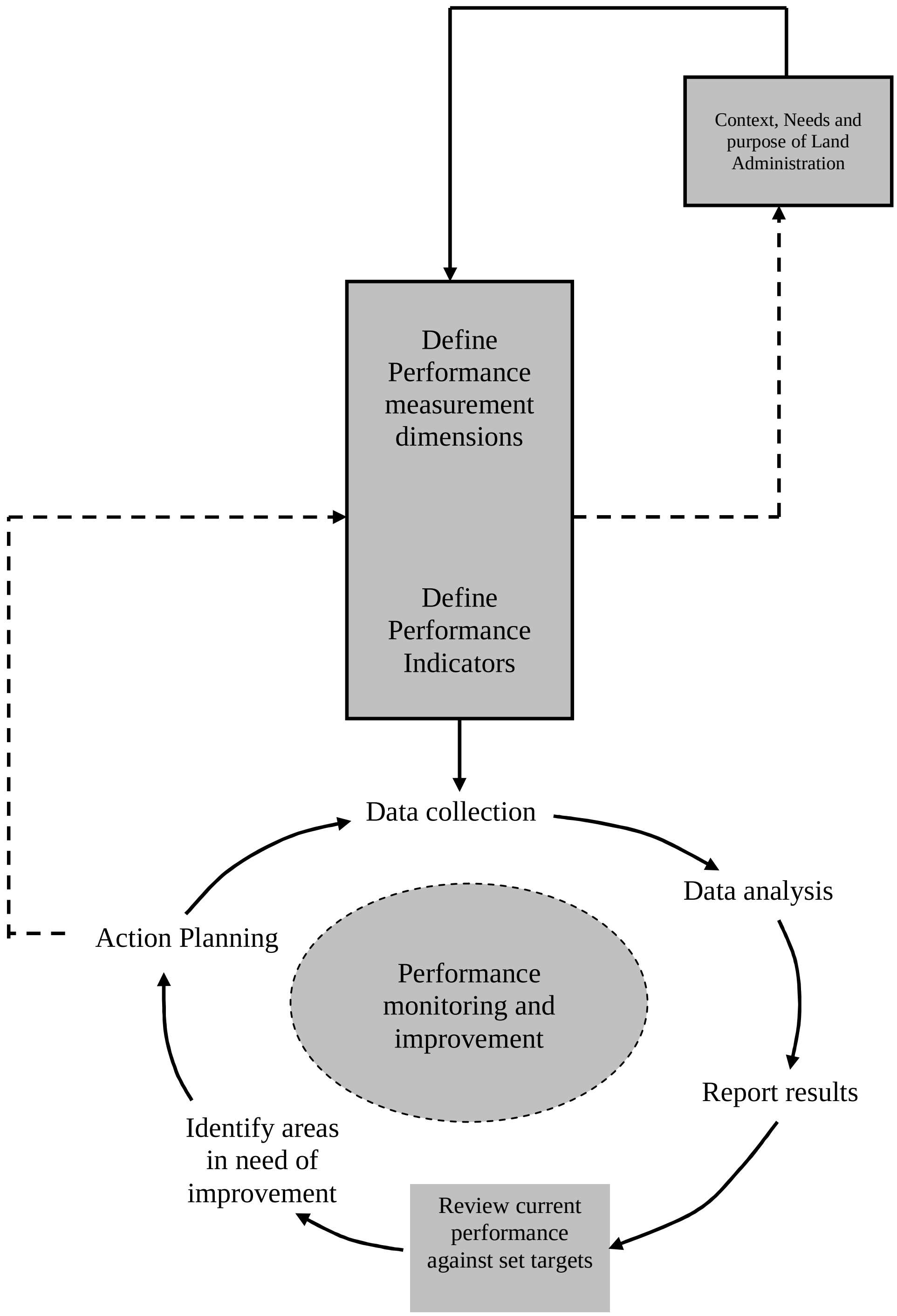

Figure 2.3: Performance monitoring and implementation model

2.4 Summary and future work

The delivery of LA, particularly in urban areas, underpins housing, industry and infrastructure development as well as the smooth operation of land and credit markets. However, fragmentation of LA business processes across several autonomous organizations generally impairs end to end business processes flow and delivery. A framework that can facilitate the end to end measurement and comparison of cross-organizational business processes in LA is developed. The model, which is built based on the six measurement dimensions of quality, cost, time, technological innovation, customer satisfaction and society, attempts to provide a balance between external success and internal performance of CBPs.

However, it is important to make a few remarks on the limitations of the present work and suggestions for future research. This work will have to be completed through field validation. Some work is already in progress on the application of the framework in the case countries, by considering the linkages between measures within dimensions and aggregated performance. In addition, further research on CBP modelling and management within cross organizational LA is essential.

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Chapter 3

Modelling and comparison of land administration cross organizational business processes

*This chapter is based on

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Abstract

Recent decades have witnessed a rising interest in the operations of land administration and cadastral systems globally. Both developed and developing countries accept the need to improve present land administration systems to address current challenges and incorporate future needs. Several improvement strategies are being used to analyze current operations amongst them, business process modelling and comparison.

The paper presents a comparative analysis of the cross organizational business processes associated with the delivery of a subdivision in 5 municipalities across 3 countries. Our results showed similarities of above 66% for most process pairs, though mixed results were obtained for sub processes. Based on the common activities between the different municipal processes and good practices, a business process reference model is proposed.

Key words: cross organizational processes, similarity scenario, subdivision

3.1 Introduction

Recent decades have witnessed a rising interest in the operations of land administration (LA) and cadastral systems globally. Both developed and developing countries accept the need to improve present LA systems to address current challenges and incorporate future needs. Many countries are implementing various improvements and comparing their systems with others to identify best practices within nations of the same economic standing (Rajabifard *et al*, 2007). Whilst several initiatives aimed at comparing various aspects of LA systems across countries have been undertaken recently, see e.g. (Steudler *et al*, 1997; Burns *et al*, 2006; Rajabifard *et al*, 2007), few studies have compared the different business processes (BPs) associated with e.g. registration of transfers or subdivision of land parcels. One prominent study in this regard is the Cooperation in the field of Scientific and Technical Research (COST) G9 action (Stubkjaer *et al*, 2007), which examined and compared BPs associated with the acquisition of a single family dwelling and the subdivision of a parcel with intention to build, in a number of European countries. In most African countries, the processes of subdividing land are very central to the provision of housing and infrastructure development in urban areas yet to our knowledge, no extensive studies aimed at understanding and comparing such processes have been conducted. Insight gained from such studies would be useful for regional jurisdictions seeking: to develop new subdivision processes, reform existing ones, better understand present practices or identify drawbacks and identify good practices from leading jurisdictions. Furthermore, comparisons can lead to the development of common BP reference models that can be used to facilitate standardization and provide support for the design of software and ICT infrastructures.

To better understand (and compare) how LA business processes are conducted in different jurisdictions formal representations, through clear descriptions of activities involved, can be used. Subdivisions are often cross organizational - meaning that several autonomous and geographically dispersed public and private sector institutions are often involved in the end to end execution of their activities. We refer to such processes as cross organizational business processes (CBPs). In this regard, the aims of this paper were: (1) to analyze the CBP activities associated with the subdivision of privately owned property into 4 land parcel units or less across five urban municipalities in South Africa, Namibia and Zimbabwe, and (2) to compare the similarities and differences between the CBPs and their sub processes across the different jurisdictions, and (3) to develop a process reference model for subdivision.

This paper contributes to the ongoing efforts towards the standardization of the cadastral and land administration domains by proposing a BP reference model, which is important for the development of shared process models for key LA BPs across jurisdictions. In addition, the reference model developed in the paper is based on common activities and good practices between municipal BPs, which to our knowledge is one of only few studies at that level. The similarity scenario used to evaluate similarities and differences between BPs provides a systematic means for quantifying commonality which assists with selection of peers for subsequent comparisons or planning site visits. The paper further provides an assembly of BP descriptions and models that reveal how the same CBP is carried out across more than 20 institutions in five municipalities and three countries. Such models and descriptions are usually not readily available. Finally, the models developed provide a basis for CBP measurement.

To analyze the subdivision CBP in each municipality, descriptive and graphical views for 6 core sub processes, identified as the key components of subdivision, were first developed and presented. Similarities and differences between CBPs and sub processes were then computed through matching of corresponding activities using the scenario similarity degree. A BP reference model was then constructed based on common activities and good practices. We used the municipalities of: eThekwini (case 4), Msunduzi (case 3) and Newcastle (case 5) (in South Africa), Windhoek (case 2) (in Namibia) and Harare (case 1) (in Zimbabwe), as our case study sites.

The rest of this paper is structured as follows. In the next section, we present the background and context to the study. Based on our chosen goal for BP modelling, three key perspectives for BP representation are selected. Furthermore, a brief overview of the subdivision CBP for the 5 case sites is also presented. Section 3.3 discusses the methodology followed to develop this study while section 3.4 presents the CBP analysis and comparisons. Section 3.5 summarises the paper and highlights issues for further research.

3.2 Background and context

3.2.1 Modelling business processes

To understand and compare BPs associated with the delivery of a given output one can construct models. BP models can be built in many different ways depending on the objectives pursued, the perspectives that fit the objectives and the BP modelling techniques selected. While Luo and Tung (1999) suggested communication, analysis and control as the most common objectives for modelling BPs, several goals can co exist in a modelling exercise. Thus, to describe a BP adequately, many forms of information must be integrated into the model. Four essential perspectives commonly used to represent a business process are functions, organizations, data and process flows (Scheer, 2000). Curtis *et al* (1992) further argued that the perspectives that people ordinarily want to extract from a BP model include: what is going to be done (activities and outputs), who is going to do it (roles), when and where will it be done (dependencies between activities), how and why will it be done (goals) and who is dependent on it being done (linkages). Each viewpoint on its own only gives a partial view of the process. Deciding which perspectives to capture is therefore, directed mostly by the objectives pursued. While several techniques (e.g. event driven process chains, Integration Definition, Petri Nets etc) can potentially be used to model a BP, different techniques not only have different features and capabilities but also view BPs from different perspectives. Hence, in addition, the choice of a modelling technique limits the ways in which a BP can be described and analysed (Luo & Tung, 1999).

Although several BP modelling and comparison initiatives have been conducted in disciplines such as manufacturing, logistics, insurance and banking, fewer studies have been carried in LA. Some notable works, in this regard, are briefly discussed here. One such study, carried under the COST G9 action is by Ferlan *et al* (2007) who uses text descriptions and activity diagrams to describe instances of property transfer and formation in Slovenia and Sweden. Their comparative study, which expounded models for international comparisons of property transactions, presented activity based models of the two countries together with the actors involved. In addition, a side by side comparison of models, based on actors and activities, was undertaken. A recent study in Namibia by deVries and Lewis (2009) analyzed and compared 5 different cases of subdivision processes for: single parcel, township establishment, subdivision of agricultural land, subdivision of a sectional title scheme and establishment of a block and individual parcels under the flexible land tenure system. BP models were developed in the study to facilitate the comparative analysis of new and old land tenure regularization practices. Lisec *et al* (2008) developed and presented a rural land transaction procedure in Slovenia to justify for closer and systematic inter governmental coordination and cooperation in public administration concerning real property transactions. The study provided a foundation for simplification, measurement and comparison of rural land transactions in different real estate markets. Similarly, in a quest to explore options for improved integrated land delivery in Zambia, Mulolwa (2002) examined and constructed BP models to represent the full cycle of business process activities involved in the planning, surveying, allocation and registration of an original grant of a 99 year lease.

While different goals were pursued and various perspectives were captured in the different studies above, Unified Modeling Language (UML) diagrams were mostly used to represent BPs in almost all cases. In some cases the developed models were used as a basis for further BP based analysis. However, comparisons of processes (such as property transfer or subdivisions) can be a scientific end in itself (Ferlan *et al*, 2007).

Based on the goal chosen for our case (that of analyzing BP activities across the subdivision chain) we selected three key perspectives: (1) the causal order of activities (input/output flows), (2) order of activities in time (work flows) and (3) who does what (roles), for modelling of the CBPs.

3.2.2 Process similarities, differences and development of reference models

Although the development of cadastral and LA BP reference models is rather recent, significant progress has been recorded in the construction of a reference data model in the form of the core cadastral domain model (van Oosterom *et al*, 2006). The model acts as a reference data model for arbitrary cadastral systems. Since reference models are often based on commonalities, a number of approaches have been proposed to assess similarities between BPs. In the framework of the COST G9 action, BP similarity was derived directly through a side by side comparison of BP models. Hess and Vaskovich (2007) however proposed comparisons based on ontology models and computation of correspondences by ontological reasoning. They argue that their approach has the advantage of incorporating multi criteria and computational support. From a manufacturing processes perspective, Juan and Ou -Yang (2005) suggested a process logic comparison approach for analyzing similarities and differences between BP pairs. In their model, BP similarity is evaluated through the similarity scenario degree (SSD). The SSD concept, explained later in section 3.3.3.1, is used in this paper.

3.2.3 Cross organizational business processes and sub processes within the context of case study sites

For the 5 municipalities considered, the subdivision CBP was analyzed from the point where a property owner within an established township approaches a consultant to draft subdivision plans to the point where the new subdivision is registered in the Deeds Registry as a separate land parcel. A closer look at the BP flows between the institutions and across the cases revealed 6 key common sub processes of the subdivision CBP: (1) plan (permit) drafting (from point of receiving client request to draft plan submission), (2) plan examination and approval (draft plan lodgement to issuing consent), (3) cadastral surveying (receive consent to lodging of survey record), (4) cadastral survey examination and approval (receive survey record to dispatch approved diagrams), (5) deeds drafting (receive approved diagram (plus other requirements) to delivery of draft deed), and (6) deeds examination and approval (draft deed lodgement to delivery of an approved deed). These sub processes flow across a number of organizations that include: Planners, Municipalities, Cadastral Surveyors, Department of the Surveyor General, Conveyancers and Deeds Registries (figure 3.1). Sub processes 1, 3 and 5 are executed mostly by private sector entities while 2, 4 and 6 fall primarily under the control of public sector organizations. Each sub process is influenced by different legislation, regulations and professional norms. For example, land use planning activities (that affect sub processes 1 and 2) are based mainly on the Townships and Division of Land Ordinance 11 of 1963 in case 2, the Natal Town Planning Ordinance 27 of 1949, for cases 3, 4 and 5, and on the Regional, Town and Country Planning Act 29:12 for case 1. Sub processes 3 and 4, and 5 and 6, respectively are guided by the cadastral surveying and deeds registration legislation of the respective countries.

For cases 1 and 2, the subdivision CBP is distinct from end to end, while for cases 3, 4 and 5 the CBPs start as separate processes but converge into a single CBP channel from cadastral surveying downwards (figure 3.1).

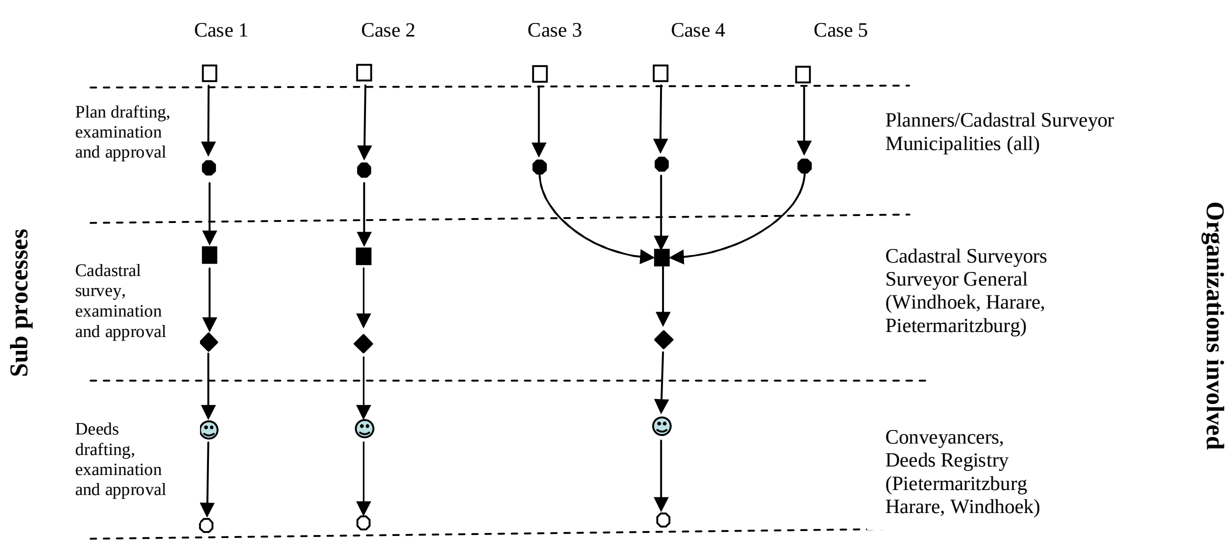

Figure 3.1: Illustration of the subdivision CBP and its sub processes for the 5 municipalities (cases) examined

3.3 Methodology

3.3.1 Determining boundaries of business processes and decomposition

To analyze the CBPs in a consistent manner their boundaries must first be established. Boundaries of sub processes of the CBP can then be demarcated by identifying organizations that participate in the CBP chain and then creating an input/output matrix of what each organization produces/consumes and the flow of such products between organizations, from end to end. In this regard, decomposition of CBPs to sub processes and activities can be facilitated through the structural model (figure 3.2).

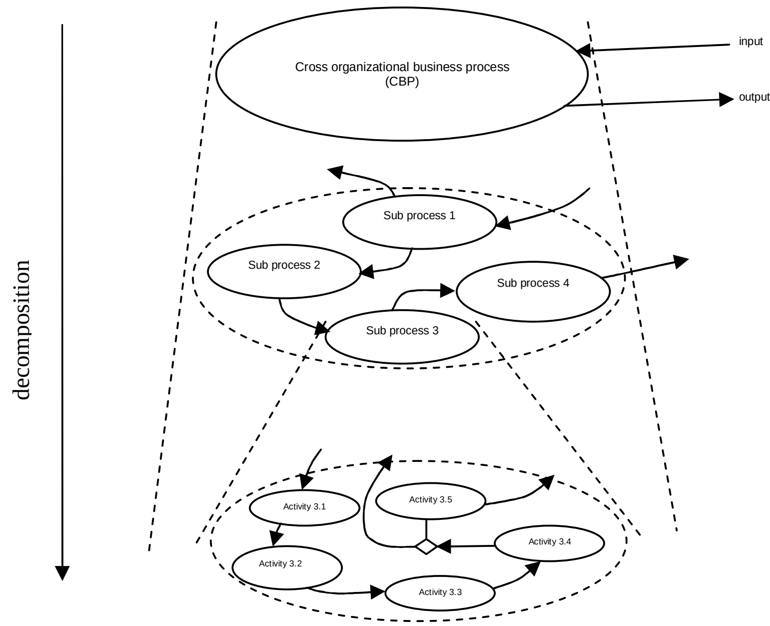

Figure 3.2: Structural model for cross organizational business process decomposition

3.3.2 Developing process descriptions and graphical views

To capture work process descriptions in depth, the individuals linked to the various CBP chain activities within each organization/function were identified. Key informant interviews were then arranged and conducted. The interviews were mostly open and iterative and the veracity of responses was regularly checked with the respective stakeholders. Additional information was obtained through process observation and analysis of supplementary documentation such as reports and legislation.

With the CBPs described, BP models were then developed using UML activity diagrams in the Architecture of Integrated Information systems (ARIS) tool. Following the capture of the descriptions and development of the models, an appropriate way to compare the CBPs had to be established.

3.3.3 Comparison of the business processes

Our comparison of the subdivision CBPs was aimed at assessing similarities (or differences) between different CBPs and their sub processes. While several variables can be considered when assessing similarity, we limited our focus to the common activities between CBPs. In this regard, we used the scenario similarity degree (Juan & Ou - Yang, 2005) to analyze similarities (or differences) between CBPs (or portions of). The approach is briefly discussed below.

3.3.3.1 Scenario similarity degree

The scenario similarity degree (SSD) (Juan & Ou - Yang, 2005) quantifies similarity between 2 or more processes paths based on their common activities. The SSD is evaluated using the formulae:-

$$SSD\ (CBP_1, CBP_2) = \frac{2\ |CAct|}{|ActCBP_1| + |ActCBP_2|}$$

where CBP_1 and CBP_2 represent the 2 CBPs used for SSD computation, $ActCBP_1$ and $ActCBP_2$ being the sets of activities belonging to CBP_1 and CBP_2 respectively, $|ActCBP_1|$, $|ActCBP_2|$ are the number of activities in sets $ActCBP_1$ and $ActCBP_2$, $CAct$ represent the set of common activities to CBP_1 and CBP_2, and $|CAct|$ the number of activities in the set $CAct$. In theory, an SSD value closer to 1 reflects high similarity between BPs while a value closer to 0 reflects high dissimilarity. In practice an SSD threshold value is usually set and only those comparables that score higher than the threshold are selected and used for subsequent analysis. Our use of SSDs is only limited to quantifying the similarities between the whole CPBs and their sub processes. A comparison of activities is carried out only where it is deemed necessary.

3.3.4 Development of a reference process model for subdivision

To develop the reference process model for subdivision, common activities between the different subdivision CBPs and sub processes for the five municipalities were identified and listed. Focused group discussions were then held with key stakeholders in each process cluster to examine the BP models, reference lists and good practices. The opinion of two regional cadastral domain experts was also sought in the selections.

3.4. Results and discussion

The results of the study and discussions are presented under three main sections (i) analysis of BP activities and development of models, (ii) comparison of similarities and differences between CBPs and their sub processes, and (iii) development of a reference process model for subdivision. The first section is predominantly descriptive whilst the last two are more comparative and discussion oriented.

3.4.1 Analysis of the business process activities and development of models

For the sake of easier representation and comparison, the 6 core sub processes for each CBP (identified earlier in section 3.2.3) were clustered into 3 categories of: plan drafting, examination and approval (incorporating sub processes 1 and 2), cadastral survey, survey examination and approval (representing sub processes 3 and 4) and deeds drafting, deeds examination and approval (incorporating sub processes 5 and 6). Common activities are indicated on the BP models with solid boundary line while those activities which are specific to given cases are shown with dashed outlines and the case number in brackets. Activities chosen for the BP reference model are indicated with a red outline. A discussion of the activities and resultant BP models for the subdivision CBP cases is presented in the next sections.

3.4.1.1 Plan drafting, plan examination and approval

The activities associated with plan drafting and plan examination and approval at all 5 sites are shown on figure 3.3.

3.4.1.1.1 Plan drafting

In all cases, subdivision proposals are prepared on behalf of the client mostly by Cadastral Surveyors or Planners. On receipt of a request to draft a subdivision plan the Cadastral Surveyor/Planner searches for parcel and ownership information and checks whether the subdivision is feasible. Except for case 2, a tacheometric survey is often carried out to locate the extent of the parent property and approximate boundaries for the proposed subdivision.

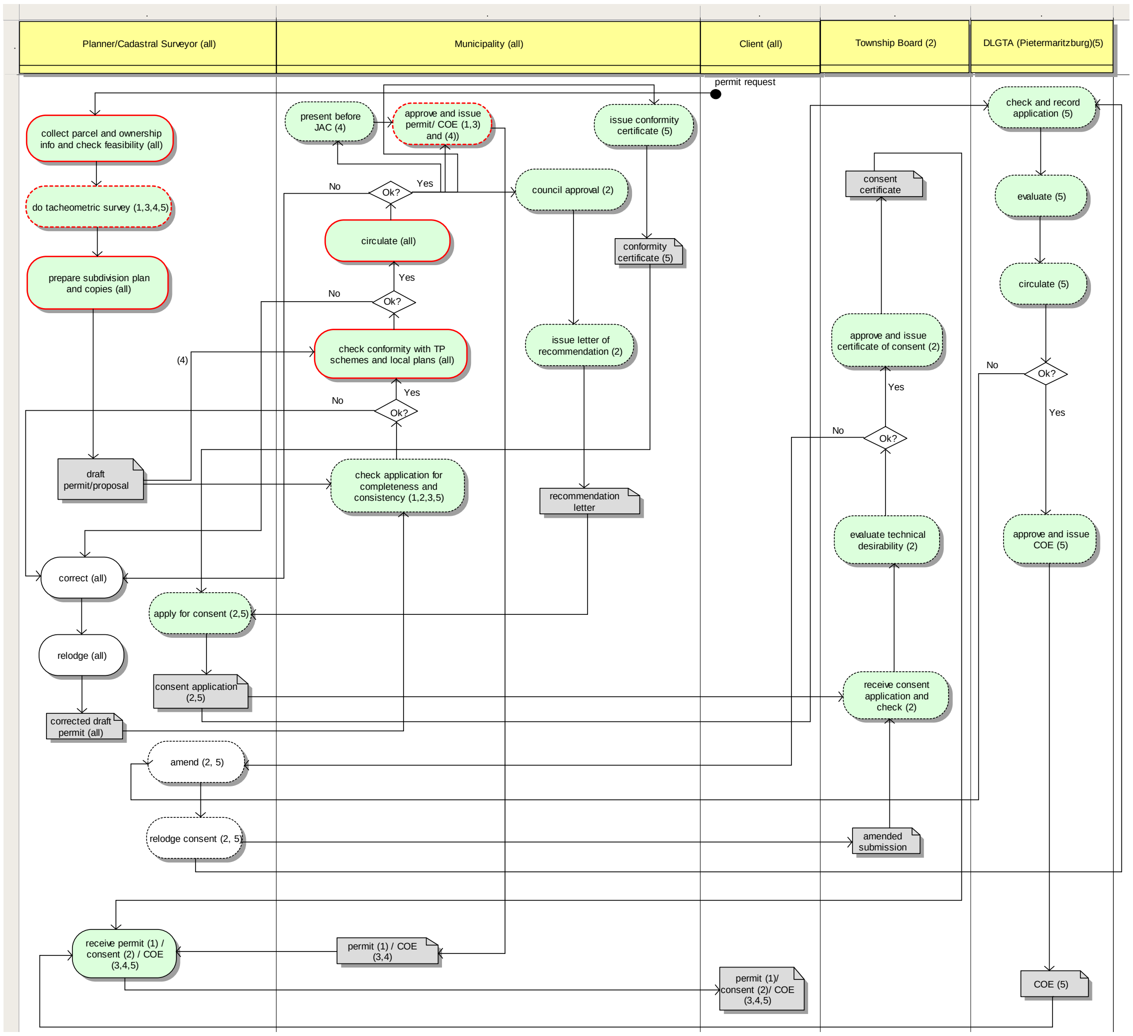

Figure 3.3: Model for plan drafting, plan examination and approval

A draft plan is then prepared in accordance with the requirements of the particular municipality. The required number of copies together with application forms, fees (excluding case 2) and written consent of any holder of a real right registered over the property (for case 1), are lodged with the land survey division (for case 3) and Town Planning (for all other cases) at the Municipality for plan examination and approval.

3.4.1.1.2 Plan examination and approval

The draft proposal is received by the respective division at the Municipality and checked for completeness and consistency. Incomplete applications are rejected while accepted applications are checked for conformity with existing town planning schemes and local plans.

If the application meets basic requirements, it is prepared for circulation. For case 4, conformity is checked first before the application is accepted. In all cases, the application is given a reference number and for case 1, a letter of acknowledgment is sent within two weeks.

Draft plans are circulated to various municipal departments and external entities to solicit for comments. External entities consulted include: the Zimbabwe Electricity Supply Authority and Tel One (case 1), Telecom Namibia (case 2) and Uthekela water (case 5). Comments raised during circulation are forwarded to the concerned Planner/Cadastral Surveyor to attend to and resubmit. Once the application is cleared by all departments, it is approved and a permit is issued (for case 1) while a recommendation for approval by council is given (for case 2). For case 3, conditions of establishment which specify requirements to be complied with are prepared and issued. These empower the client to appoint a Cadastral Surveyor to carry out field demarcation. For case 4, a recommendation to the Joint Advisory Committee is prepared on approval while for case 5, a conformity certificate is issued. As shown on figure 3.3, recommended proposals (for case 2) are presented before Council. If the drafts are acceptable, approval is granted and a letter of recommendation is issued by Town Planning. On receipt of the recommendation letter, the consultant prepares an application for consent, which is lodged with the Township Board (constituted under Namibia‘s Land Ordinance of 1963) for evaluation and approval. Township Board applications are received and checked by the secretariat. The Township Board evaluates the technical desirability of the proposal and if satisfied recommends to the Minister of Regional and Local Government, Housing and Rural Development that approval be granted. A consent certificate, which empowers the owner to appoint a Cadastral Surveyor to carry out field demarcation, is then issued by the Minister. For case 4, the recommendation (for approval) is presented before the Joint Advisory Committee (figure 3.3). If the draft is deemed to be in order it is approved. A town planning approval certificate is granted together with the final conditions. For case 5, the Cadastral Surveyor prepares an application for consent to the Department of Local Government and Traditional Affairs (DLGTA), based on the issued conformity certificate. Such application is received by DLGTA registry, checked and recorded. It is then allocated to a staff member who evaluates it in terms of compliance with town planning schemes and checks that conditions on the title allow the property to be subdivided. Depending on the particular case, interested parties are selected and the application is circulated. The official waits for comments and further consultations (if necessary). Based on the comments received the DLGTA decides either to approve the application or reject it. If approved conditions of establishments are prepared and issued.

3.4.1.2 Cadastral survey, survey examination and approval

3.4.1.2.1 Cadastral survey

On receipt of the subdivision permit (case 1), consent (case 2) or conditions of establishment (cases 3,4 and 5), the Cadastral Surveyor searches for data on previous surveys and geodetic control around target property.

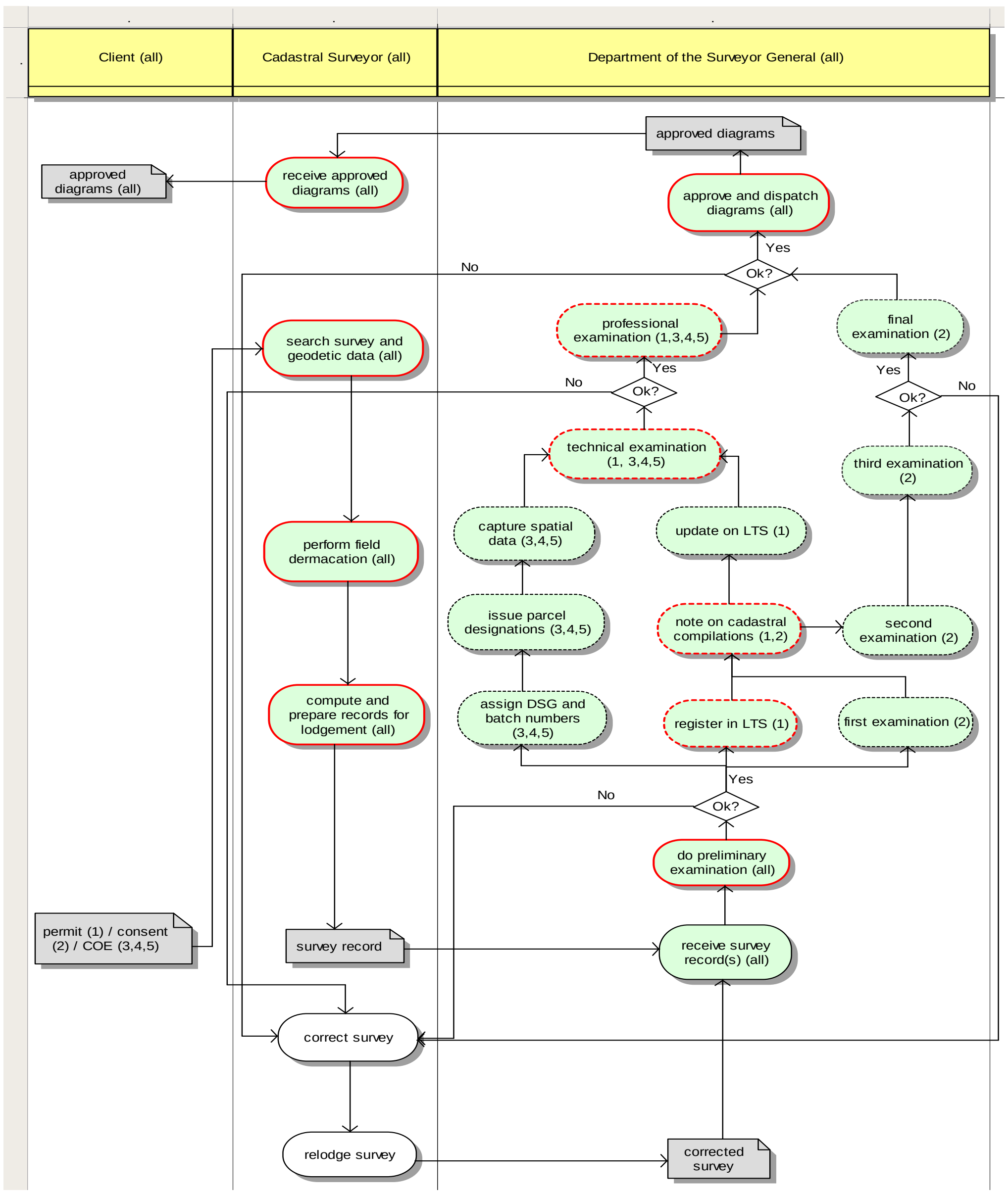

Figure 3.4: Model for cadastral survey, survey examination and approval activities

The Cadastral Surveyor then goes to the terrain to demarcate the property. On return from the field, survey computations and documents are prepared. A survey record is then compiled and subsequently lodged with the respective Surveyor General for survey examination and approval (figure 3.4).

3.4.1.2.2 Cadastral survey examination and approval

Incoming survey records are received at the respective Surveyor General. In all cases, a senior examiner checks the new survey records for correctness and completeness. This activity is called preliminary examination. Incomplete records are rejected. From this point forth, different activities occur depending on the specific case. For case 1, (figure 3.4) the survey records are dispatched for registration in the Land Transaction System (LTS), a database used to manage and monitor survey records within the Surveyor General.

From LTS registration, the survey records are forwarded for cadastral noting, which involves the updating of cadastral plans. After noting the records are returned to the LTS for updating. They are then given to the Assistant Surveyor General for allocation to examination units. The examination units perform a technical and professional examination of the surveys. Technical examination evaluates the execution of the cadastral survey from an instrumentation and methods perspective while professional examination verifies that the survey was done in accordance with the Land Survey Act. Errors picked during examination are noted on examination dockets. Survey records deemed to be acceptable are approved while those that require further corrections are returned to the Cadastral Surveyor. Approved survey diagrams are deposited in the Cadastral Surveyor's pigeon hole for collection.

For case 2, after preliminary examination the received survey record is given a survey record number and diagram numbers (or general plan number(s) where appropriate). Relevant examination dockets are then attached in preparation for first examination. New surveys are distributed to first Examiners by the Chief Surveyor. First Examiners check several designated items, which include: beacon descriptions, coordinate lists against calculations, coordinates of trigonometric points used, placing data, property identification and cross referencing. Comments are noted on examination dockets. After first examination, the records are taken to the noting section, as in case 1, to update the cadastral compilation sheets. The survey records are then filed in examination cabinets awaiting second examination. Second Examiners confirm that first Examiners have checked through their designated items correctly. In addition, they examine working plans, the survey report and verify if comparisons and the survey have been carried out satisfactorily. When completed, second Examiners return survey records to the filing cabinets and update the examination status in the lodgement book. Third Examiners collect survey records from cabinets and check them once more in accordance with the Surveyor General‘s examination procedures. In particular, they assess comments raised by first and second Examiners and decide whether to return a survey record to the Cadastral Surveyor for corrections or not. If the survey is returned, this is noted in the lodgement book. Final examination is carried out by the Chief Surveyor and/or Surveyor General. The final Examiners check the survey for the last time and confirm or reject comments raised by previous Examiners. They then approve or reject the survey record. If approved, 2 copies of the approved diagram are deposited in the Cadastral Surveyor's pigeon hole for collection while the office copy is filed in the diagrams cabinets.

For cases 3,4 and 5, after preliminary examination, 2 copies of the survey documents are made: an examination copy and a data capture copy. The records are then delivered to technical registry which assigns the Surveyor General, survey record and batch numbers to the records. From technical registry the records are moved to maintenance where parcel numbers (designations) for surveyed portions are issued, captured and maintained. From maintenance, the survey records are moved to data capture, where the spatial documents are captured. After data capture the records are placed into cadastral drawers awaiting examination. Technical Examiners collect the records from the cadastral drawers and examine them. Comments are noted on examination dockets. The records are then scrutinized by the Chief Technician before filing in the professional examination drawers. Based on the comments raised by the technical Examiners and the Chief Technician, the Professional Assistants decide whether to approve or reject a survey record. Survey records deemed to be in order are approved while those that are not are sent to Cadastral Surveyors for amendments. Approved survey records are sent to the Registry where client copies of the approved diagrams are dispatched to the Cadastral Surveyor. The office copy is kept in the department. In all cases, the Cadastral Surveyor on receiving the approved subdivision diagrams informs the client who collects the diagrams and approaches a Conveyancer to draft deeds for ownership transfer.

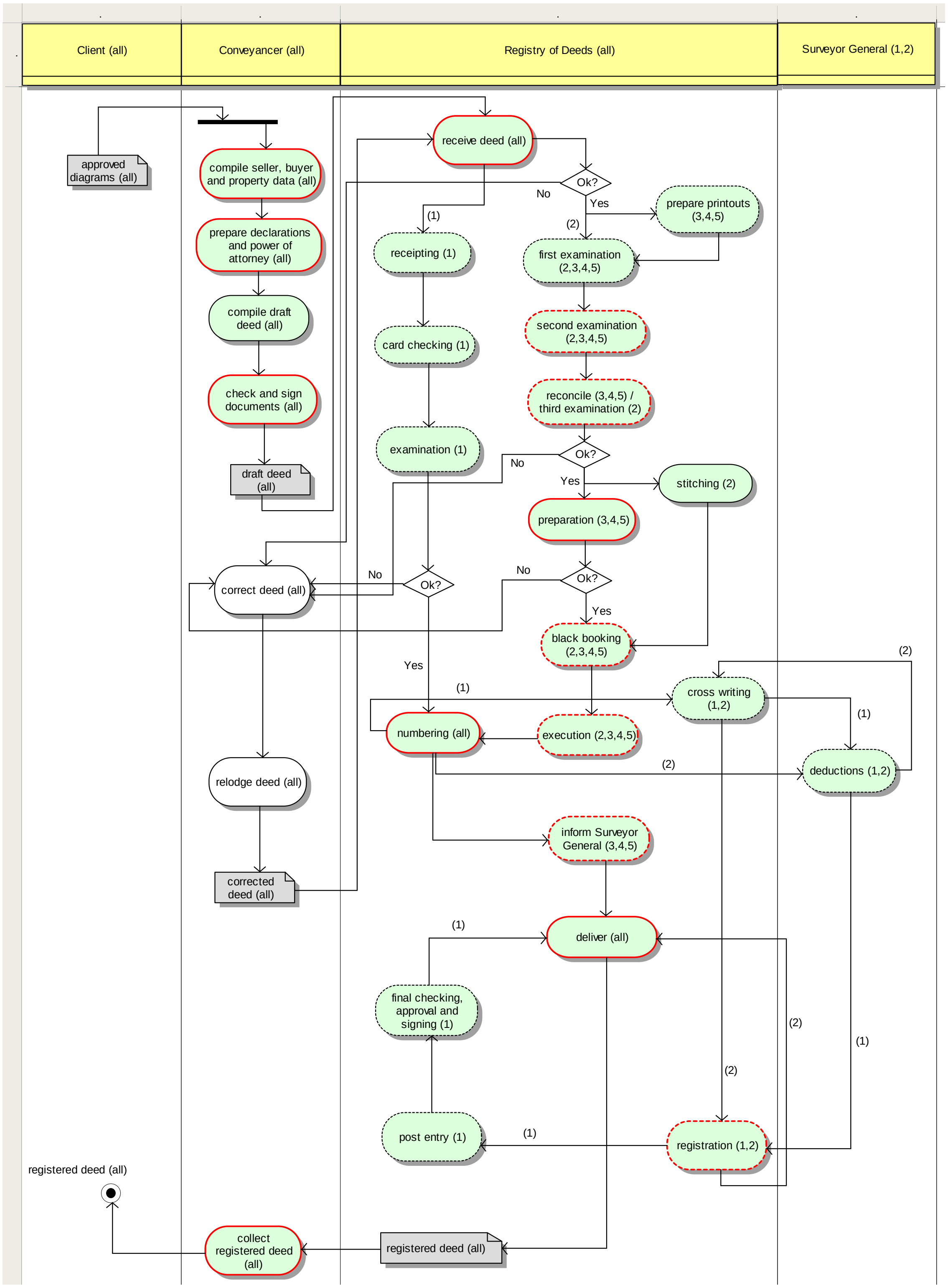

Figure 3.5: Model for deeds drafting, deeds examination and approval

3.4.1.3 Deeds drafting, deeds examination and approval

3.4.1.3.1 Deeds drafting

On receipt of the approved diagrams, fees and any other requirements from the client, the Conveyancer opens a client file where details of the seller and property are captured (figure 3.5). In addition, a deeds search to confirm property description, whether seller is owner and if any interdicts and/or caveats are imposed on the property is often conducted. The Conveyancer then drafts the power of attorney and declarations by seller and purchaser (if same Conveyancer is used). A new deed is then drafted taking into consideration any imposed previous and new conditions. The drafted deeds are checked and signed by all parties before lodgement with the relevant Registry of Deeds.

3.4.1.3.2 Deeds examination and approval

The submitted deeds are received by lodgement Clerks who check that the documentation is complete and consistent (figure 3.5). The Clerks ensure that deeds are date stamped and where necessary related deed sets are linked. Incomplete deeds are rejected.

For case 2, the lodgement Clerks deliver deeds to first Examiners who divide them amongst themselves. First examination includes checking the deeds for interdicts, attachments against property and/or owner, verifying in land registers that seller is the legal owner, checking records on index and cabinets and putting all necessary endorsements. Second Examiners check the deeds in detail to verify if Conveyancer has complied with conditions and if all necessary documents are lodged. They also verify all endorsements made on the deeds by first Examiners. Second Examiners further indicate whether a deed can be registered or rejected. Third Examiners (Chief Examiners) check all endorsements and conditions to ensure that they have been complied with. They decide whether it was justified for deeds to be rejected or passed as recommended by second Examiners. Deeds that are in order are moved to the stitching table for Conveyancers to attend to any notes raised by Examiners and insert required revenue stamps while those that are rejected are placed into Conveyancer’s pigeon holes. After stitching the next step is black booking, which is the checking of new interdicts that came in after the deed was lodged. If no interdicts have been lodged, the deeds are taken to the Execution room, where the Registrar checks the entire deed. Conveyancers appear before the Registrar to sign the deeds and hand them over for execution. After the deeds have been executed they are collected by record Clerks for numbering. Numbering involves stamping of numbers (including date of registration) onto deeds. There are different number series for titles and mortgage bonds and separate number series for each year. After numbering, deeds for new subdivisions are sent to the Surveyor General's noting section for deductions - a process that involves noting the registered portions, endorsing diagrams and computing the area of the remainder. The deducted deeds are then returned to the Deeds office for cross writing. This involves updating of the office copy against the client copy. After cross writing, land registers (farm or erven) are updated with the details of the new owner. This step is termed registration. The client and office copies are then officially separated. The office seal is affixed onto the client copy, which is then stamped and deposited into the Conveyancers' pigeon hole while the office copy is retained and prepared for binding.

For case 3, 4 and 5, the deeds received at the lodgement counter are sent to the Data section where print outs used during examination are prepared and filed in lodgement covers. From Data section, the deeds are dispatched to the Distribution room where they are sorted into batches by Sorters. First Examiners collect their quota from the Distribution room for examination. As in case 2, first examination includes verifying several things, amongst these: endorsing and checking interdicts against persons and the properties concerned. When completed, the first Examiners return deeds to the Distribution room to enable Sorters to sort them for second examination. Second Examiners collect the deeds from the Distribution room and examine them for the second time. Amongst other things, the second Examiners check that provisions of the Deeds Registries Act, other legislation and common law that apply for a given case are complied with. Second Examiners decide whether each deed or batch is registerable and stamp deeds accordingly. When done, second Examiners forward the deeds to a Monitor who is usually an Assistant Registrar. Monitors reconcile the deeds with the sorting slips and check the comments raised by second Examiners to ensure correctness and fairness of rejections (as in case 2). Rejected deeds are sent to the delivery counter from where they are returned to Conveyancers. Those deeds that were passed for execution will be sent to the preparation counter. The preparation counter Clerks sort out the deeds and place them in the relevant firms' pigeon holes. Conveyancers are given a stipulated number of days to comply with any notes raised by Examiners. Deeds unattended to after the stipulated period are automatically rejected. Once all notes have been attended to, the deeds are sent to the data section for black booking. This involves, as in case 2, the checking of any new interdicts received which may prohibit the transaction. Where no interdicts have been received the deeds are then dispatched to the Execution room where they are sorted and placed in the firms' pigeon holes. The Conveyancers will arrange for the execution of the deeds in the relevant batches amongst themselves. Deeds are brought before the Registrar to be executed. After execution the deeds are numbered, dated, sealed and checked to ensure that notes are removed and endorsements are signed. A notice is then sent to the Surveyor General informing them of the registration of the subdivision so that they can update their records. The Delivery Clerks mark each deed out and deposit the client copies into the relevant Conveyancer's pigeon holes for collection. Office copies are retained for filing.

For case 1, incoming deeds received by the Registry are split into new and old cases. The new cases are forwarded to the Chief Examiner who connects the covers, receipts and distributes the draft deeds to Examiners. This activity is called receipting. Examiners, using information from personal index cards and land register folios, check for among other things, caveats, general power of attorney and miscellaneous agreements. This activity is called card checking. After card checking, examination commences. This step involves checking of various documents and sections of a deed. Reference is made to previous deeds. If an Examiner is not satisfied with any sections of the deed or accompanying documents they raise such issue(s) in a query sheet, which is attached to the documents and returned to the Conveyancer for clarification. When examination is complete and acceptable, numbering (as in all other cases) commences. After numbering, the next step is cross writing (as in case 2). After cross writing, deeds for new subdivisions are sent to the Surveyor General‘s Title Registration unit for deductions (as in case 2). Once deductions are completed the records are returned to the Deeds Registry for registration, which involves inserting numbers on personal index cards, endorsing title deed details against respective land folios in the land register and noting caveats, town planning permits and water rights. Next is post entry, which is carried out by the Chief Examiner. This involves checking if registration was done correctly. Final checking, approval and signing of records conclude the registration. This step is carried out by the Assistant Registrar. After approval, office copies are filed and client copies are deposited in the Conveyancer's pigeon hole for collection.

3.4.2. Comparison of similarities and differences between processes

With each CBP described and activity lists captured onto CBP models, our next step was to compute SSDs and compare similarities. Due to the observed close resemblance between private sector controlled sub processes of: permit drafting, cadastral survey and deed drafting, across all cases, our SSD computations shifted to whole CBPs and public sector controlled sub processes. Although SSD values where determined for all possible combinations and are discussed with reference to all cases, due to the limited space, results for cases 1, 2 and 3 only are presented (table 3.1). Activities related to reworks (process back flows) are excluded in the computations. A discussion of the results follows in the next section.

Table 3.1: Similarity scenario degree values for whole CBPs and sub processes

Cases		SSD values			
CBP_1	CBP_2	Whole CBP	Plan examination and approval	Survey examination and approval	Deeds examination and approval
Case 1	Case 2	0.68	0.62	0.50	0.61
Case 2	Case 3	0.69	0.62	0.38	0.78
Case 3	Case 1	0.68	1.00	0.63	0.36

For whole CBPs, SSD values of 0.68 and higher (2/3 or more common activities) are evident across all cases. This signifies a fairly high similarity between the investigated CBPs. The private sector manned sub processes contribute significantly to this value with 8 out of approximately 10 activities being common. The similarities, however, vary between cases and across sub processes of the CBP chains. These are discussed further in the next sections.

3.4.2.1 Comparison of plan examination and approval processes

In plan examination and approval, higher SSD values between cases 1 and 3 (SSD = 1) and cases 2 and 5 (0.89) were reflected, compared to 0.43 for cases 4 and 5 and cases 4 and 2. The lower SSDs can be attributed to the prevalence of unique activities between the cases, e.g. *checking compliance before acceptance* and *presentation of case before Joint Advisory Committee* (in case 4) and *council approval* in case 2. While cases 5 and 2 exhibited high similarity in this segment, the involvement of additional role players, i.e. the DLGTA and Township Board, appear to cause duplication of activities. For example, 3 of 4 activities in case 5‘s town planning division seem to be repeated at the DLGTA. The 2 cases (5 and 2), however, do not have full autonomy to approve subdivision consents. Despite having the same legislative base cases 3 and 4 (SSD = 0.67), cases 3 and 5 (0.62) and cases 4 and 5 (0.43) do not show significantly high similarities amongst themselves. The variations can be linked to local circumstances. For example, due to the high volume of applications received at case 4 (about 6 00 per month), a subdivision help desk has been opened within the customer care centre to advice clients and control quality of BP inflows at the entry point, a reason why *compliance checking* is done before acceptance. Other municipalities do not have such volumes and may therefore choose other options. A strong alignment can however, be observed between activities in the DLGTA, case 3 and case 4 since the 3 have full autonomy over their BPs. In another dimension, specific activities can also be compared. For example, during *circulation*, external opinion is sought in cases 1, 2 and 5, as services like electricity and telephones (cases 1 and 2) and water (case 5) fall under third party control. On the contrary, in cases 3 and 4, almost all circulation is controlled within the municipality. Internal circulation tends to be associated with better coordination and control of activities, which can positively influence CBP flow and delivery.

3.4.2.2 Comparisons of cadastral survey examination and approval processes

In cadastral survey examination and approval, cases 3 and 1 (SSD = 0.63) exhibited higher similarity compared to 0.38 for cases 2 and 3. Major variations in this segment centred on examination related activities. While the Surveyor General departments in Pietermaritzburg and Harare have clustered examination activities around *technical* and *professional*, the Windhoek Surveyor General has spread examination across 4 activities. Such differences can be explained on the basis that there is a shortage of Cadastral Surveyors in the Surveyor General Windhoek office (only 2 during the research period) and hence most examination is done by Survey technicians. It seems reasonable therefore to spread the examination responsibility (for case 2) across many activities to ensure rigorous record checking and minimize risk.

3.4.2.3 Comparisons of deeds examination and approval processes

In contrast to the 0.38 SSD in cadastral survey examination and approval, a considerably higher similarity between cases 2 and 3 (0.78) is apparent in deeds examination and approval as evidenced by 9 common activities. The high similarity is partly due to: (1) use of similar legislation i.e. the South African Deeds registration Act No. 47 of 1937 was also adopted for use in Namibia (2) use of the same training institutions: the South African Justice College and South African Deeds training directorates train registration personnel for both Namibia and South Africa. While cases 1 and 2 come second with an SSD of 0.61, the same cannot be said about cases 1 and 3 which display only 4 common activities between them. This could be due to the constant changes taking place in the Deeds registry in Pietermaritzburg compared to Harare and Windhoek for instance. While activities like *deductions* are still being carried out in Harare and Windhoek these have been replaced in Pietermaritzburg with *Inform Surveyor General* (from March 2009) and *cross writing* has been scrapped altogether.

3.4.3 Development of a reference process model for subdivision

To develop the reference business process model for subdivision, common and those activities viewed as good practices were identified across all sub processes clusters. These were then presented on the models with red boundary outlines.

From the planning cluster of sub processes, six reference activities, three from plan drafting and the other three from plan examination and approval (*check conformity, circulate and approve* and *issue permit*), were suggested (figure 3.3). The *do tacheometric survey* activity was proposed as a good practice step that ensures that all requisite planning data is collected during plan drafting. Plans based on tacheometric surveys were viewed as more consistent with the ground situation. Township Board processes (for Windhoek) and DLGTA (for Newcastle) were both viewed as extra bureaucratic layers that should, with resources permitting, be decentralised to the respective municipalities. For the cadastral survey and cadastral survey and examination process clusters, 10 reference activities were suggested, six of them from survey examination (figure 3.4). There was consensus across the three Surveyor General sites on the candidature of: *preliminary examination*, *noting*, *technical* and *professional examination* as reference activities. While the present examination activities at the Surveyor General Windhoek were argued for from a resources perspective it was acknowledged the spread of activities had other undesired consequences. *Registration* of documents on a land transaction system was viewed as good practice. Within the deeds drafting and deeds examination and approval grouping, 14 activities were proposed for the reference model (figure 3.5). Across the cases however, two examination levels were viewed as satisfactory. *Inform Surveyor General* was viewed as a good practice as all sites faced challenges of misplaced documents under the current deductions activity.

3.5. Conclusions and issues for further research

In an attempt to analyze the CBPs associated with the subdivision of privately owned property within an established township in 5 urban municipalities of Harare, Windhoek, Msunduzi, eThekwini and Newcastle, BP descriptions and models have been developed and presented. Comparisons of CBPs and their sub processes, to assess how similar or different “the same job gets done” in the 5 municipalities, were conducted using the similarity scenario degree concept. Overall, our results showed similarities of above 66% for whole CBPs with mixed high and low results obtained across the different sub processes. By assessing similarity using SSD, we have attempted to understand and explain local variations between

CBPs and their sub processes and suggested possible reasons for their differences. Through comparative analysis of processes a business process reference model for subdivision was developed. However, our work focused mainly on CBP flows. With the BP activities and their sequence defined, other work process perspectives, such as: rules that govern each activity, resources needed to perform activities (including employees and equipment) , flow of data between activities, and data stores that might be involved, can be added. In addition, process measurement attributes can be assigned to the activities defined so that process based performance analysis can be carried out. Some work is already in progress in this regard.

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Chapter 4

Measuring quality performance in cross organizational land administration work processes

*This chapter is based on

Chimhamhiwa, D., Mutanga, O. &van der Molen, P. (In Review-b) Measuring quality performance of cadastral survey and deeds registration work processes, *Journal of Land Use Policy*.

Abstract

When land parcel boundaries are surveyed for purposes of registration in most southern African countries, the cadastral survey records and diagrams prepared have to be examined and approved by the Surveyor General first before they can be registered in the Deeds Registries. For such records to be approved, their quality must conform to requirements stipulated in relevant acts and regulations. Where regulatory requirements are not met, the records are rejected and returned for corrections and resubmission. From a cross organizational context, poor quality documents lodged upstream have the effect of congesting examination processes downstream as records are rejected and returned backwards due to quality failure. The paper proposes a quality performance measurement model to analyze quality performance in land administration work processes. The developed model is tested on 2 cadastral survey examination and approval sites and 3 deeds registration sites in Namibia, Zimbabwe and South Africa. Based on below expected quality results obtained for cadastral survey examination, a root cause analysis was conducted at one of the sites to establish recurring and underlying causal factors upon which quality improvement strategies can be built.

Key words: quality performance, cadastral surveys, deeds, examination, rejections

4.1 Introduction

Cadastral Surveyors in Southern Africa claim professional status and yet in many cases more than half their work is rejected first time round. Imagine doctors having more than half their prescriptions returned for amendments. Not only does this high rejection rate have internal costs but also in the wider picture, it affects the rate of investment and development in the overall national economy. Furthermore, it contributes to the overall costs of cadastral surveys, which can then exceed the market value of the land being surveyed.

When land parcel boundaries are surveyed for purposes of registration in countries such as Namibia, Zimbabwe and South Africa, the cadastral survey records and diagrams prepared have to be examined and approved by the Surveyor General first before they can be registered in the Deeds Registry. For such records to be approved, their quality must conform to requirements stipulated in relevant acts and regulations. Where regulatory requirements are not met, the records are rejected and returned for corrections and resubmission.

A previous study of cross organizational business (work) processes (CBPs) associated with subdivision of property within municipalities in Namibia, Zimbabwe and South Africa, (Chimhamhiwa *et al*, 2009) found the quality of submitted records to be a critical performance measurement dimension for improved end to end delivery of land administration (LA) CBPs. In that study, improved quality of lodged documents was viewed as both an enabler of internal results (reduced costs and time) and external performance (improved customer satisfaction and society). While quality can be viewed as a multi dimensional construct (Garvin, 1987), two perspectives common in most literature are: product and service quality.

From a LA products and work process context, quality can be viewed as the conformance of submitted work to legislative specifications. For example, in parcel subdivision, draft permits lodged with municipalities for permit approval must fulfil planning regulations while cadastral survey records submitted for survey examination to the Surveyor General must conform to land survey acts and regulations. Similarly, draft deeds submitted to the Deeds Registry for deeds examination and approval must comply with deeds registration legislation. The different legislation, in this regard, prescribe the manner in which the various types of LA work (permit drafts or cadastral surveys) are performed as well as the form in which resultant records are prepared for lodgement. Two quality control procedures that can be deduced from the above work processes examples are: self checking of work (by practitioners, before lodgement) and next station (downstream) checking of lodged records by legally designated institutions e.g. Surveyor General or Deeds Registry after lodgement.

Assuming that the cadastral surveys or deed drafts are indeed properly executed and that records are prepared and lodged in accordance with laid out specifications, it seems reasonable to expect the examination of such records at next stations to proceed with high levels of conformance. However, empirical observations from a number of southern African countries and some previous studies, e.g. Chimhamhiwa (2006), suggest that a significant proportion of lodged documents do not, in many cases, meet these requirements first time. Taking this viewpoint, one is often from an operational and process delivery perspective, interested in the volume of acceptable output (process yield) as a measure of the output quality of a given work process versus the fraction of rejected products returned for amendments. Wu and Liao (2009) defined process yield as that proportion of work process product units that conform to requirements. Measurement of process yield enables the determination of current levels of quality performance, which can lay the basis for comparisons against expected (or desired) output. Where results are found to be outside desired ranges, interventions can then be planned.

The objectives of this paper are two fold. First, we aim to develop a quality performance measurement model that can be used to measure and compare quality performance in LA work processes. To test the applicability of our developed model, we used 2 key sub processes of the parcel subdivision CBP common in Southern Africa: survey examination and approval and deeds examination and approval, described in our earlier work (Chimhamhiwa *et al*, 2009). Based on the results obtained for survey examination and our observations from previous studies e.g. (Chimhamhiwa & Lemmen, 2001; Chimhamhiwa, 2006), we proceed in the second objective to investigate root causes of poor quality of lodged cadastral survey records. This was done in order to reveal recurring and underlying causes upon which interventions can be built.

This work returns to the same sites of our previous (Chimhamhiwa *et al*, 2009) study. Survey examination was analyzed using the cases of the Surveyor General Departments of Harare (in Zimbabwe) (site 1) and Windhoek (Namibia) (site 2) while deeds examination used the Deeds Registries of Harare (site 3), Windhoek (site 4) and Pietermaritzburg (South Africa) (site 5). The root cause analysis was conducted using only the case of site 1.

The measurement of quality performance in LA work processes and the systematic identification of root causes of recurring error contributors have not to our knowledge been explored. An illustration of their use with case examples may provide an approach for institutions desiring a method to manage and improve work process quality and/or investigate casual factors associated with the delivery of poor quality in LA.

The rest of this paper is structured as follows. In the next section, we review literature on quality management and measurement. Based on our review, key elements that are relevant for quality performance measurement for LA work processes are derived. A quality performance measurement model is subsequently developed. Furthermore, descriptions of quality control activities at the case study sites are provided. Section 4.3, presents the methodology used to accomplish the objectives of the paper, while in section 4.4, the results for both quality measurement and root cause analysis are presented. Section 4.5 concludes the paper and highlights issues for further research.

4.2 Background and context

In most organizations quality is a central component of strategic plans and management systems. Quality in mainstream industry is viewed as a source of competitive advantage. However, several perspectives of quality can be constructed depending on what is being investigated. This multi - faceted nature makes it difficult to have a universal definition of quality (Sousa & Voss, 2002) hence different definitions are used under different circumstances. In this paper, our focus is explicitly on work product (s) quality, with conformance (through quality control) being a central goal. For product conformance to be managed and improved, it must be defined in ways that can be measured. To our knowledge, studies on quality measurement of LA work processes are however scarce. Thus, our development of a quality performance measurement model is informed mainly by work in mainstream quality management. We review in the next section some key studies that are central in that regard.

The field of quality management (and measurement) is perhaps different compared to other disciplines. It has a few individuals who have dominated theory development and implementation processes in many organizations that they have achieved a “guru” status (Miller, 1996). Some of these experts and their works are discussed here. (Juran, 1986; Juran & Gryna, 1998) suggested that managing for quality is anchored on the trilogy of (1) quality planning, (2) quality control and (3) quality improvement. Quality planning establishes the quality goal (s) desired under given operating conditions while quality control determines what to control, develops measurement criteria and establishes measurement limits. Quality improvement seeks to identify specific areas for improvement, organises for discovery of causes of poor quality and suggests remedies. Shewhart (1939), one of the first to provide insight into data collection, analysis and presentation in the quality discipline, outlined 3 steps in quality control processes (1) the specification of what is wanted, (2) the production of things to satisfy the specification, and (3) the inspection of the things produced to see if they satisfy the specification. Deming (1986), a proponent of Shewhart, developed a 14 point philosophy for effective quality management and what became to be known as the Deming wheel of quality improvement (otherwise known as the PDSA (Plan - Do - Study - Act) cycle. He argued that the PDSA cycle can be used to analyze and measure work process quality in order to identify variations that cause products to deviate from requirements. In addition, the PDSA's continuous feedback loop helps managers identify and change parts of work processes that need improvement. Hales and Chakravorty (2006) describe how Deming's style of quality management is implemented in a plastics company, while Hillmer and Karney (2001) make a case for the usefulness of the theory as a guide for decision making in present day organizations.

From an error cause removal perspective, Crosby (1979) developed and popularized the 'zero defects' quality philosophy, a way of thinking and doing things that reinforces the notion that errors are unacceptable in work activities hence things should be done right the first time. The philosophy represents a change in work perspective where flaws that allow defects to occur in work systems are proactively addressed. Greene and Vent (2008) implemented a cardiothoracic program with a zero defects goal as part of an initiative to improve quality in healthcare services. Their results suggest that zero defects is achievable though work practices must be hardwired into everyday activities to ensure reliability. Shingo (1986) suggested the use of mechanical devices (poka yoke) to eliminate mistakes or defects in work processes. He argued for combining source inspection, where each item is inspected for defects before it is passed onto the next stage with poka yoke (or mistake proofing) devices. He further advocated for the analysis of production processes to detect where faults can occur and where mechanical devices can be used to stop errors becoming defects. The cost of poor quality on production systems against the returns of preventive activities (poka yoke) was recently analyzed by Tsou and Chen (2008).

Ishikawa (1985) championed the use of the cause and effect diagram, otherwise known as the fishbone (or Ishikawa diagram), as a tool for diagnosing root causes of quality problems. Although the original intent of the fishbone was to solve quality related problems in manufacturing (Doggett, 2005), the tool later gained wide spread use in diverse industries and application areas e.g. storage tank accident investigations (Chang & Lin, 2006), health

(White *et al*, 2004; Perkins *et al*, 2005), pharmaceuticals (Kumar *et al*, 2009) and social services (Rzepnicki & Johnson, 2005). In all cases, the cause and effect diagram was used to determine root causes of adverse results and as a reference on which improvements/prevention strategies can be built.

While most of the works discussed above have focused on quality management in manufacturing/production processes, some parallels can be drawn with LA work processes. In both cases products are produced according to specifications and checked through various self, successive and next station controls. While defects in manufacturing can be destroyed or reworked on, LA defects have to be corrected as all work products are expected to meet requirements. For example, if for some reason, a lodged land parcel diagram or deed of transfer is incorrectly approved, a separate process of correction will be instituted immediately once the error is realised. In that regard, one could say the ultimate aim in LA work processes is zero defects. From the above review of literature, a number of fundamental quality performance measurement elements essential for LA work processes emerge. These are listed below.

- Management (and measurement) of quality should be placed within a strategic quality planning and improvement context. In that context, the goal (s) for quality measurement (Crosby, 1979 ; Deming, 1986 ; Juran, 1986) should be determined.
- Since quality is a multi dimensional construct, the dimensions (criteria) that are important for measurement, specifications of what is wanted and inspection mechanisms within the given context and in pursuit of chosen goals (Shewhart, 1939; Deming, 1986; Juran, 1986) must be established.
- Based on the established criteria, the current quality performance levels, desired targets and existing gaps (Deming, 1986; Juran, 1986) can be derived.
- Areas in need of quality improvement (Deming, 1986; Juran, 1986) can then be identified and appropriate methods to diagnose quality problems e.g. cause and effect diagrams (Ishikawa, 1985), or prevent errors e.g. mistake proofing (Shingo, 1986) can then be adopted in pursuit of zero defects (Crosby, 1979).

From a cross organizational context, the above fundamentals should ideally be placed onto a structural framework that supports measurement across organizations. Recent work by Chimhamhiwa *et al* (2009) developed such a framework for LA CBPs. Their study, which incorporates quality as a core LA measurement dimension, did not however go ahead to measure quality performance. As an extension to that previous model, we incorporated the quality measurement elements discussed above. A quality performance measurement model for LA CBPs (figure 4.1) is thus presented.

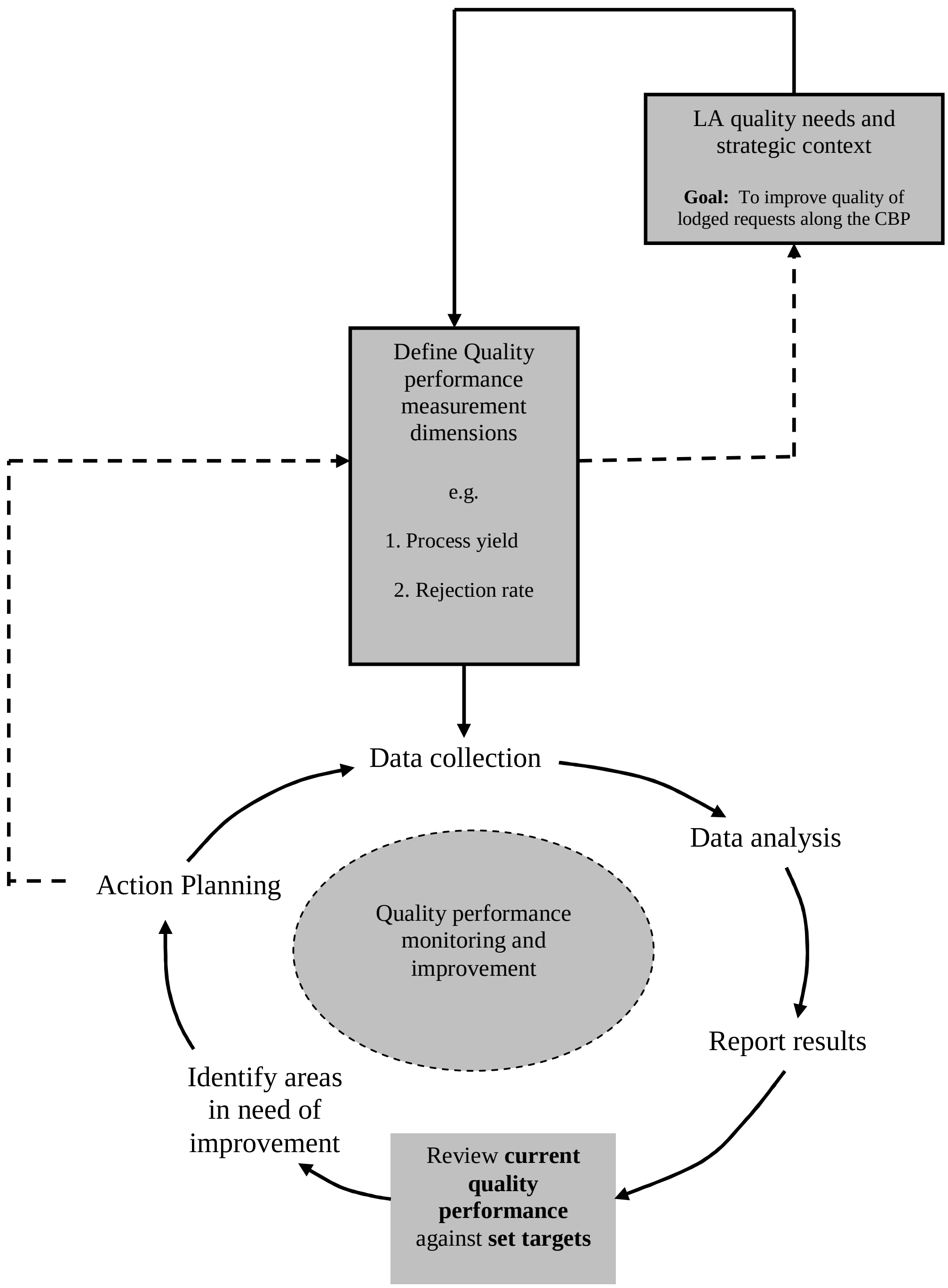

Figure 4.1 Quality performance measurement model (adapted from Chimhamhiwa *et al* (2009))

With our goal set on improving the quality of lodged records, a choice of what to control within the quality dimension of LA processes had to be made. Based on our context, we selected the process yield and rejection rate. Our desired scenario is that all cadastral surveys or draft deeds lodged for approval conform to legislative requirements, first time. In that regard an increase in process yield would suggest that quality of incoming work is improving and consequently the volume of rejections is decreasing. On this basis, current performance levels of process yield can be determined and the disparity between actual output and expected derived. Where the gap is viewed as too wide a diagnosis, using appropriate means can be undertaken to identify problem areas that can be improved.

4.2.1 Description of quality control activities at case sites

4.2.1.1 Quality control under survey examination and approval

The quality of submitted records is a central concern for cadastral surveys carried out for purposes of registration. Under the present Land Survey Act 1993 of Namibia, Land Survey Act 20:12 (Zimbabwe) and Land Survey Act 8 of 1997 (South Africa), the Cadastral Surveyor is responsible to the Surveyor General for the correctness of every survey carried by him/her or under his/her supervision and of every diagram or general plan that bears his/her signature. The land survey regulations for each country further specify the requirements for pre - field work, field work and post - field work activities. For example, prior to field work Cadastral Surveyors are required to search for all available information on previous surveys and survey control around target property and to ensure survey equipment is in proper working order. During field work, requirements are specified for: measurements and observations to be carried out, connection to national control survey system, limits of allowable error and nature of boundary beacons as well as when they are required and when not. Specifications for post field work activities include compilation of various documents such as diagrams, working plans, general plans etc and composition of the survey record for lodgement.

Cadastral Surveyors use numerous quality checking tools during and after field work to ensure that requirements are met and that essential details are captured on each document. For example, to verify that key elements have been included on a drafted diagram in Zimbabwe, a 34 item check list (available from the authors) is used. Furthermore, a signed certificate of correctness that confirms essential diagram and positional information have been cross checked and certified must be enclosed in every lodged survey record for the case of Namibia and Zimbabwe.

To be accepted at lodgement, the survey record must contain all documentation required in accordance with the Land Survey Act. Survey records that are accepted are forwarded for examination. After examination, records deemed to be acceptable are approved while those that require further corrections are returned for amendments. Surveys that are returned are expected to be corrected without delay and be resubmitted for re examination.

4.2.1.2 Quality control under deeds examination and approval

Deeds registration activities in Namibia and South Africa are regulated through the Deeds Registries Act 47 of 1937 while for Zimbabwe, the Deeds Registry Act 20:05 is used. In the 3 countries, for purpose of registration, deeds are prepared by Conveyancers. During data collection and preparation, Conveyancers use several quality checks to ensure every clause in drafted deeds is captured correctly. The drafted deeds are then checked and lodged at lodgement counters of the respective Deeds Registries where lodgement clerks check that all documentation is complete and consistent. Incomplete deeds are rejected right away while those that are in order are forwarded for examination. Deeds that are acceptable are approved while those with errors are returned to Conveyancers for amendments.

4.3. Methodology

4.3.1. Measurement of process yield and rejection rates

4.3.1.1 Selection of records

To measure and compare process yield and rejection rates for survey examination we considered small subdivisional surveys of 4 land parcel units or less, conducted in the municipalities of Windhoek and Harare and subsequently lodged with sites 1 and 2, respectively. We confined our choice to subdivisions because they are a popular transaction. In addition, we established from interviews with Cadastral Surveyors and survey Examiners that small surveys tend to move through the LA CBPs with minimum quality problems. Our selection was limited to (1) all survey records meeting the criteria above, (2) lodged with the respective Department of the Surveyor General between 2003 and 2008, and (3) have been approved. To analyze process yield and rejection rates for deeds examined, we considered all deed documents lodged at sites 3, 4 and 5 from 2003 to 2008.

4.3.1.2 Data collection

Data for both examined cadastral surveys and deeds was collected in 2009. For cadastral surveys, we manually selected all survey records that met our criteria from the approved survey records cabinets at site 2 and confirmed these with the lodgement book. For site 1, our selection was done with the support of the land transaction system, lodgement and diagram books. In total, 340 approved survey records were chosen at site 2 and 1 011 at site 1.

For examined deeds, we collected and reconciled daily, monthly and yearly data on lodged, passed and rejected deeds at sites 4 and 5 (for the period January 2003 to October 2008) and for January 2003 to October 2006 for site 3. 168 900 records were considered for site 4 while 184 355 and 1 621 553 deed records were collected for sites 3 and 5, respectively.

4.3.1.3 Data analysis

Under survey examination, the movement of each selected survey record was analyzed to determine if, at any point, the record was returned to the Cadastral Surveyor for amendments. Survey records found to have been returned were categorised as rejections while those that had not were classified under process yield. Yearly volumes (and percentages) of rejections and process yield were derived and presented in tables. For deeds examined, volumes of lodged, passed and rejected deeds for each site were first compiled into an Excel spreadsheet. Based on these quantities, monthly and yearly ratios of process yield (passed/lodged) and rejected (rejected/lodged) were computed. These were then plotted on graphs for further analysis.

4.3.2 Investigate root causes of poor quality of lodged cadastral surveys

To investigate root causes of poor quality of cadastral surveys lodged at site 1, we used the cause and effect approach (Ishikawa, 1985). In this method, a reviewer identifies the adverse event (effect) to be analyzed. He/she then goes to establish the major and sub causal factors which significantly influence the effect. By identifying the causal factors across a population of occurrences (Rooney & van den Heuvel, 2004) those points in the system where improvements are feasible, can be identified. In our case, the interest of the cause and effect investigation was to uncover common patterns of error that cause survey records to be rejected so as to recommend changes in work procedure, management, supervision of work or policy. To guide our investigation, a 6 step methodological approach, informed by the works of (White *et al*, 2004; Doggett, 2005; Perkins *et al*, 2005) was developed. The respective steps are explained below.

Step 1: Select the problem to review

We selected survey records that had been rejected at least once during survey examination as our problem to review.

Step 2: Select cases to evaluate

Since this was a retrospective analysis, we evaluated rejected survey records filed at site 1. At the time of the investigation 375 survey records were filed in returned surveys cabinets in ascending order of their survey record numbers. We systematically selected for analysis, every third survey record, starting from the lowest survey record number. This generated 124 records. The oldest survey record chosen was carried out in June 1987 while the most recent was done in June 2006. Seventy five (75) of our selected survey records were done in Harare, 65 had 4 land parcel units or less and 32 were bigger surveys of 11 land parcel units or more.

Step 3: Derive possible root causes

We chose our definition of root cause as any condition that could have reasonably contributed to the rejection of a survey record. Examples in this regard included: lack of compliance with an issued permit, use of an incorrect survey procedure, and/or use of insufficient survey control etc. A survey record can be rejected due to multiple causes. Each survey record was evaluated to determine contributing primary and secondary causes that led to its rejection and return. This was done mainly through (1) review of comments raised on examination dockets by senior and final Examiners, and (2) analysis of documentation and correspondences enclosed in the survey record envelopes. Where necessary, interviews to get further insight and clarity on key cases and causes were conducted with final Examiners or Cadastral Surveyors. The causes derived for each case were captured on a template prepared for the exercise.

Step 4: Aggregate causes into categories

Data from the templates were entered into an Excel spreadsheet. Causes, appearing repeatedly were identified, selected and aggregated with similar incidents to create main and sub categories. Descriptive statistics (frequency counts and proportions) were then extracted. A single cause and effect diagram was developed with main categories represented as main arrows and sub causes drawn as minor arrows.

Step 5: Develop quality improvement strategies

The main causes and those viewed as having a significant impact on survey rejections were selected. To fix these, quality improvement strategies for each area of concern were suggested. The strategies were developed taking into consideration the appropriate causal level e.g. policy, management, supervisory, individual.

Step 6: Monitor results

For implementation, it was suggested that selected strategies would be placed within a monitoring and review framework so that the gains could be evaluated quantitatively and where necessary adjustments would then be done.

4.4. Results

4.4.1Measurement and comparison of quality performance

4.4.1.1 Quality performance of survey examination and approval

Table 4.1 shows the process yield and rejections for the survey examination sub process for sites 1 and 2.

Table 4.1: Process yield and rejected survey records for sites 1 and 2 (2003 - 2008)

	2003	**(%)**	**2004**	**(%)**	**2005**	**(%)**	**2006**	**(%)**	**2007**	**(%)**	**2008**	**(%)**
Site 1 (Yield)	107	(46)	119	(60)	47	(24)	45	(20)	53	(38)	14	(61)
Site 1 (Rejections)	126	(54)	81	(40)	147	(76)	176	(80)	87	(62)	9	(39)
Site 2 (Yield)	8	(19)	9	(24)	13	(19)	10	(19)	12	(17)	2	(3)
Site 2 (Rejections)	35	(81)	29	(76)	55	(81)	44	(81)	60	(83)	63	(97)

For site 1, the results were mixed with high process yield recorded for 2004 (60%) and 2008 (61%) while higher rejections were observed for 2005 (76%) and 2006 (80%). Over the 6 year period, 385 survey records were approved first time compared to 626 returned. This translated to a yield: rejection ratio of 2:3. For site 2, process yield ranged between 17 - 24% for 2003 to 2007, compared to rejection volumes of between 76% and 83%. For 2008, only 2, of the 65 survey records submitted went through the system first time. Out of the 340 survey records analyzed across the 6 year period, 54 were accepted and approved first time. This translated to a yield: rejection ratio of 1:5.

4.4.1.2 Quality performance of deeds examination and approval

For deeds examination, process yield and rejection rates were computed as ratios of passed/lodged and rejected/lodged, respectively (figure 4.2). Process yield for site 4 displayed an even pattern across the 70 months duration with a 0.9 maximum posted for Jan 2003 (i.e. 90% of lodged documents were accepted first time).

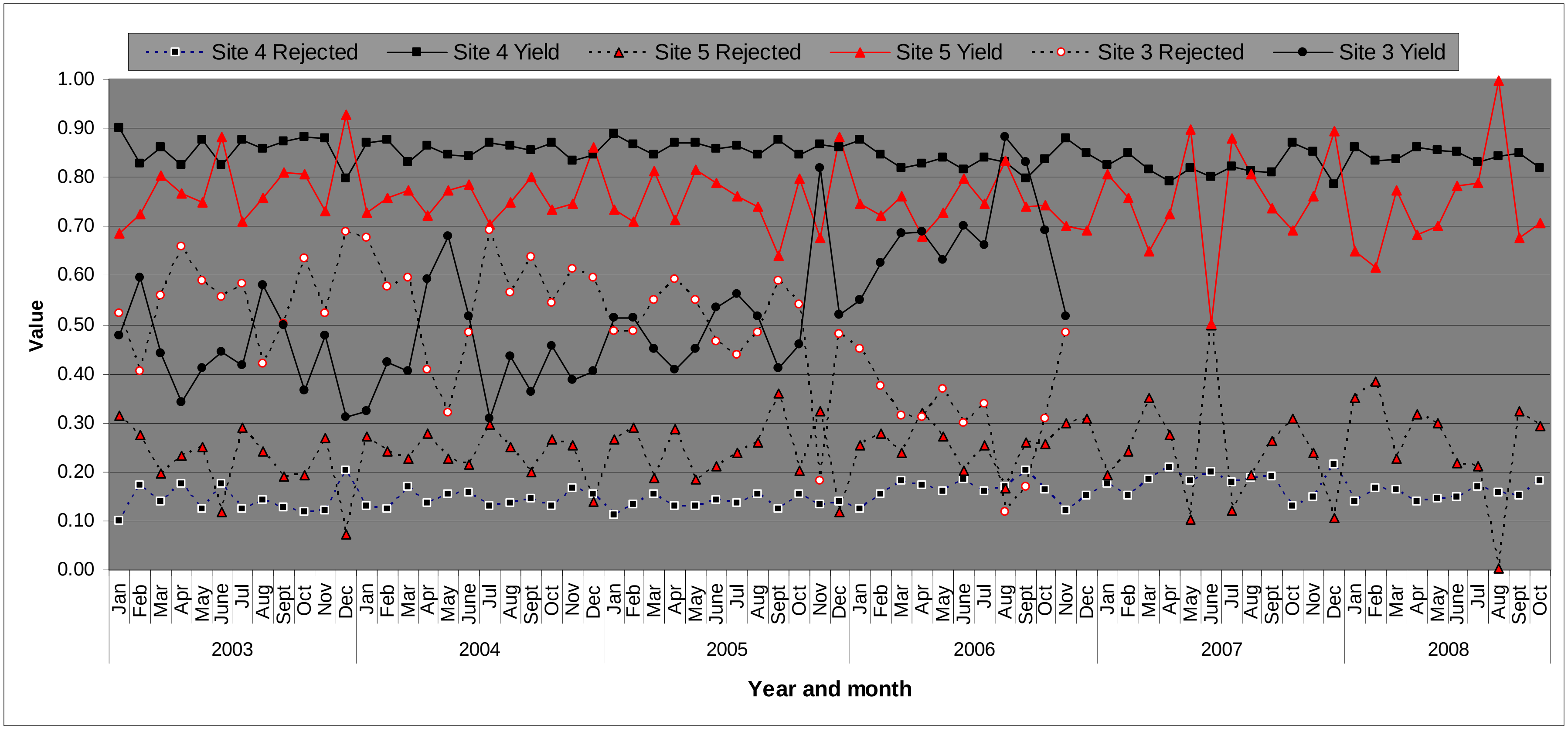

Figure 4.2: Process yield and rejection rates for sites 3, 4 and 5

From year to year (excluding 2008), yield (for site 4) ranged from 0.82 (2007) to 0.86 (2003 and 2005). On the other end, average rejection rate to lodged documents for the 70 month period was 0.15 (i.e. 15% of submitted documents were rejected). This translated to 26 028 out of 168 900 lodged records, or 1 to 6. As for sites 5 and 3, yield and rejection rates varied considerably across the period of study. For site 5, the highest yield was recorded in August 2008 (with almost 100%, i.e. 17 366 of the 17 410 lodged records were accepted) compared to its lowest in June 2007, were rejection and yield had the same value of 0.50. Excluding 2008, year on year rejection rate ranged from 0.22 (in 2003) to 0.26 in 2006 while for the 70 months period, a rejection to yield ratio of 0.24 to 0.76 (or 1 to 3) was derived. This, in absolute numbers translated to 397 738 (rejected) to 1 223 815 (approved). While yield values were generally higher than rejected for sites 4 and 5, for site 3, rejected volumes were higher than yield for 23 of the 46 months recorded. The highest rejection value recorded was 0.69 (for July 2004). Yearly yield averages for site 3 ranged from 0.44 (2003), 0.43 (2004) and 0.51 (for 2005). For the 46 months period, an average yield to rejection of almost 50: 50 was recorded with more records (92 455) being rejected compared to 91 900 (accepted).

4.4.2 Analysis of root causes of poor quality of lodged cadastral survey records

From the analysis of the 124 rejected cadastral survey records, 25 key causal factors were identified. These were subsequently clustered into 6 main causal categories of: permit related errors, field work errors, office work computation/compilation errors, professional irregularities, other technical shortcomings and unclear, as shown in table 4.2 and on the fishbone diagram (figure 4.3).

The most common causal category was office work related inconsistencies/erroneous compilations, a problem found in 63% (or 78) of the rejected cases. Within this category, 2 main primary causes were: (1) wrong or incomplete calculations of coordinated points and/or compilation of coordinate lists, which was associated with 33% of cases, and (2) draughting of diagrams/general plans and working plans, which affected 46 cases. Referencing between documents, which safeguards correct transcription of data between documents (e.g. from field book to calculation sheets) was a problem in 25% of all cases.

Irregularities related to the professional execution of surveys were found in 46 cases. Of the 46, 45 cases had gross irregularities (e.g. some distances were not measured, traverse misclosures too large, no placing data) and/or used wrong cadastral survey approach (e.g. in 1 case of consolidation, survey was compiled in office when field survey was the most appropriate approach). Twenty one (21) of the 45 cases above were small cadastral surveys of 3 land parcel units or less. The other sub cause in this category was inadequate or wrong survey control which affected 10 cases. For example, in one survey, Cadastral Surveyor used only a single base while in 3 other cases survey control, which was within close proximity of area, was not used. Other technical shortcomings were identified in 27% of analyzed cases. Sub causes in this category included 9 cases of surveys with incorrect survey description, 5 cases of surveys based on unapproved surveys and 3 cases in which examination fees were not paid.

Table 4.2: General causal categories and specific causes of survey record rejections at site 1

Cause category	No. of cases (%)
Permit related errors	28 (23)
Encroachment/cancellation	11 (9)
Lack of compliance with permit	3 (2)
No permit	10 (8)
Need for permit changes	6 (5)
No road access	3 (2)
Inconsistent stand numbering	2 (2)
Other layout changes	1 (1)
Field work errors	32 (26)
Instrumentation calibration	13 (10)
Field observations and recordings	24 (19)
Office compilation/computation errors	78 (63)
Computations (calculations, coordinate lists, etc)	41 (33)
Draughting (diagrams, general plan, working plan)	46 (37)
Referencing between documents	31 (25)
Professional irregularities	46 (37)
Gross irregularities/incorrect survey procedure	45 (36)
Use of inadequate/wrong survey control	10 (8)
Other technical shortcomings	34 (27)
Survey based on unapproved survey	5 (4)
Incorrect survey description	9 (7)
Examination fees not paid	3 (2)
Survey withdrawn	3 (2)
Incomplete documentation	4 (3)
Unclear	14 (11)

Specific cases are independent, and their sums may exceed the category total. For instance multiple cases of permit errors were detected in several cases.

Field work inconsistencies contributed to 26 % of cases. Primary causes in this category included observation and booking errors (19%) and instrumentation calibration problems (10%). In the later, equipment used was either not calibrated or calibration data was incorrect. 6 of the cases were linked to 2 Cadastral Surveyors.

Permit related deficits were evident in 28 cases. Of these, 9% had an encroachment and/or needed cancellation (a situation where a land parcel to be surveyed partially or entirely falls onto other surveyed properties). 10% had either no permit to carry out the survey or the survey did not comply with the permit. Other smaller causes were: no road access (3 cases) and inconsistent stand numbering (3 cases). For 14 cases, the real causes of rejection could not be established. For 9 of these, most key documentation was not in the survey record envelopes.

A cause and effect diagram, depicting the main causal categories as well as the primary and secondary causes of survey rejections at site 1, was then developed and presented (figure 4.3).

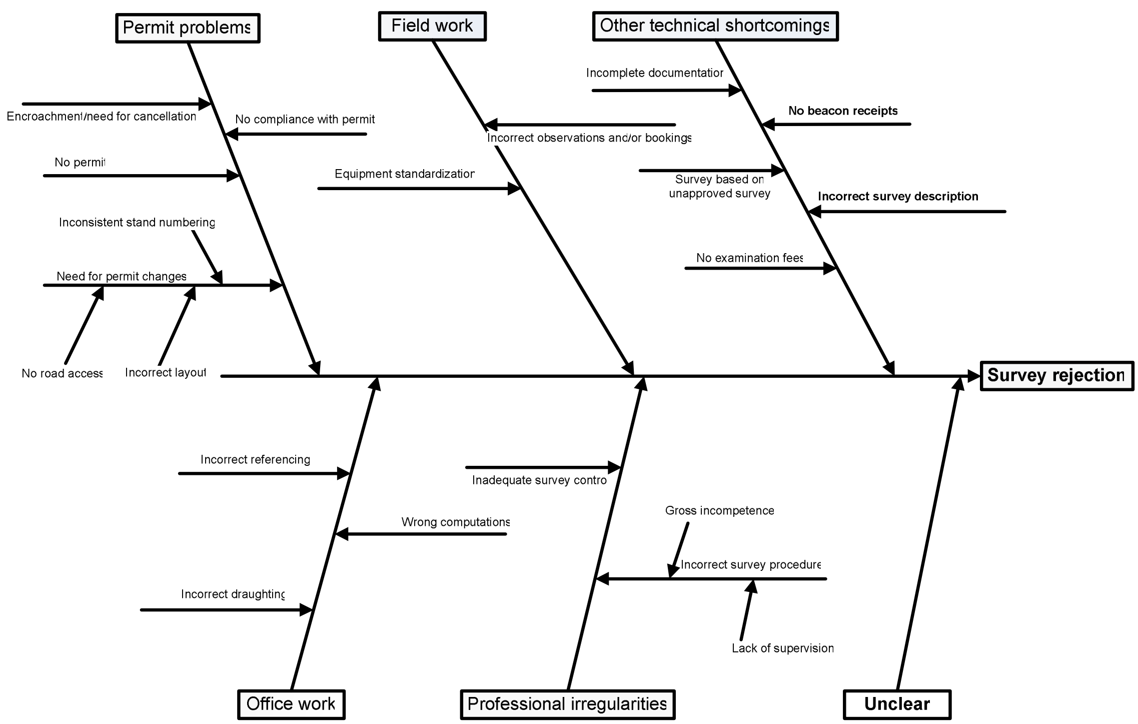

Figure 4.3: Cause and effect diagram for cadastral survey rejections at site 1

4.4.3 Discussion of results

For sites 1 and 2, process yield for survey examination was observed to be generally lower across the 6 year period compared to rejections. With an overall process yield to rejection ratio of 2 to 3 (for site 1) and 1 to 5 (for site 2), the volumes of backward flow in survey examination are obviously higher than forward flows. This tends to create artificial backlogs and productivity distortions in the Surveyor General Departments as a significant portion of incoming survey records are re - examinations. Furthermore, higher backflows compromise throughput and end to end CBP delivery. The higher rates of backflow seem to point to wider systemic problems in cadastral surveying practices. Some of these problems were revealed under the root cause analysis of rejected survey records for site 1.

For deeds examination and approval, process yield was observed to be consistently higher for site 4 with the lowest yield of 0.79 (for April 2007). The high process yield could be attributed to a number of reasons. First, due to the small numbers of practising Conveyancers in Namibia, deeds examination processes are generally ‘open’ to Conveyancers. In many instances the work practices afford Conveyancers a chance to simply walk in and correct work that is in progress, if need be. This reduces returns. Second, the volumes of incoming records are considerably low hence flexible work arrangements (such as above) can be accommodated. The 1 to 3 rejection to yield ratio for site 5 could be explained based on the high volumes of incoming records (approximately 1000 deeds per day) and pressure to deliver. With a response time of 7 working days already set for deeds lodged at site 5, any record that cannot be approved or proceed along the process chain is likely to be ‘thrown’ out. A 1:1 yield to rejection ratio (for site 3) is obviously an issue for concern. With rejection rates higher than yield in 23 of the 46 months studied, several causal factors could be implied. Amongst these is the perception raised by most deeds Examiners (interviewed for this case) that some Conveyancers tend to use examination processes as checking instruments for unchecked work. Since the site is in Zimbabwe, a country emerging from a recent economic melt down, it may be regarded as a special case. A detailed site study could probably bring out more elaborate and specific reasons for such results.

Since cadastral survey examination and deeds examination are lower level sub processes of the subdivision CBP chain discussed earlier in Chimhamhiwa *et al* (2009), sites 1 and 3, and sites 2 and 4 can be considered as consecutive nodes along 2 parallel subdivision CBP chains. In that regard, our results would suggest that: for CBP chain 1 (Zimbabwe), 2 out of every 5 small subdivision surveys done within Harare municipality get approved at the Surveyor General first time and of these, 1 in every 2 will be registered on first lodgement when they get to the Deeds Registry. Similarly, for CBP chain 2 (Namibia): 1 in 5 small subdivision surveys done in Windhoek municipality will get approved at the Surveyor General first time and of these, 5 in every 6 can get registered downstream at the Deeds Registry. For both CBP chains, higher backflows appear in survey examination than in deeds. Some possible causal factors for the high backflows and possible improvement strategies are highlighted, with reference to site 1, in the next section.

Results from our investigation showed that errors in office processing, professional execution, other technical and field work contributed significantly to cadastral survey rejections. Of the 78 cases that had office related errors, 23 of these also had field work mistakes, 36 had professional irregularities and 19 had other technical shortfalls. This appears to suggest that some causal factors are interlinked.

A significant number of the field and office mistakes pointed to numerous gaps related to the collection and recording of field data as well as to how survey records are prepared. Reforms in field work and office procedures can reduce or eliminate most observations and computation problems. At the centre of such reforms is technology. Modernizing field operations through adoption of appropriate technologies such as, Global Positioning Systems (GPS), data loggers, electronic field books, equipment with on board memory and removable data cards, can enhance data acquisition capability and increase data quality. Furthermore, recorded field data can be imported directly into appropriate software, e.g. Surpac, Arc Cadastre etc, for office based processing, computations and draughting, thereby reducing transcription errors. The onus though is on Cadastral Survey management within respective firms to purchase such technologies. Elsewhere, use of these technologies has demonstrated significant improvements in cadastral survey and LA productivity, see for e.g. Cook *et al* (2008). Furthermore, the cost of such technologies has gone down considerably over the years. However, technology use in cadastral survey and LA within a given jurisdiction closely relates to broader technological penetration in other key areas. In the case of Zimbabwe, which ranked 132 on the networked readiness index (a framework that measures the propensity for countries to exploit opportunities offered by information and communications technology) of 2008 - 9 (World Economic Forum, 2009), use of technology is generally lower compared to say, Namibia (ranked 92) and South Africa (ranked 52). In addition, some technologies like GPS are different from traditional surveying equipment (such as theodolites), which makes them difficult to transfer because technical personnel cannot build on an existing knowledge and experience base (Barnes, 2003).

The 46 cases with irregularities in professional execution were linked to 14 Surveyors. In addition, 15 of the cases were related to 2 Surveyors. With over 30 registered Cadastral Surveyors practicing in Zimbabwe, the results suggest that malpractices are not widespread. However, the results do show that sub standard work is regularly submitted by some Cadastral Surveyors to the Surveyor General for examination. This happens particularly when (1) Cadastral Surveyors are under pressure from clients to submit surveys or, (2) have too many ongoing projects that they use short cuts in survey execution, (3) fail to personally supervise survey staff or, (4) do not properly check work in the field and before submission. Where patterns of gross incompetence are observed the Surveyor Generals are empowered through legislation to take appropriate action against such Surveyors. However, to date, no case of refusal of surveys from any Surveyor is on record for site 1.

The fact that quality of submitted work varies across Cadastral Surveyors is not novel. However, recording and monitoring of quality of survey records for each Surveyor is likely to reflect patterns that could influence changes in survey examination activities. Based on such data, the Surveyor Generals could provide incentives for Surveyors whose work is consistently of high quality, such as (1) scaling down examination of high quality work or, (2) facilitating faster processing of high quality survey records. Such data could also be used as a basis to increase checking fees for shoddy work. Such initiatives could potentially influence the quality standards of incoming work. For Namibia, limited examination of cadastral surveys by the Surveyor General was also suggested by deVries and Lewis (2009) who advocated that Surveyors should take full responsibility for their work.

Deficiencies related to issued permits (survey instructions) would be resolved better in an integrated LA framework. In that framework, changes in work procedures and policies that foster coordination and cooperation between various LA institutions are envisaged. For example, when a permit is approved and issued by a local planning authority, a copy could be send to the Surveyor General so that such permit is immediately noted on cadastral maps. This facilitates the identification of (1) permit inconsistencies e.g. cases of permits with no road access and (2) encroachments and / or portions that require cancellation and (3) informs Cadastral Surveyors that some cadastral survey work is planned for a given area. Furthermore, such changes would enable earlier detection of permit shortfalls and facilitate faster amendments (where desired). At present, for site 1, only cadastral surveys on state land are noted as soon as a permit is issued.

A rather worrying trend relates to the 14 cases, whose reason for filing was unknown and documentation for most cases was either missing or possibly misplaced. Such a situation points to a gap in data handling, storage and management. Due to huge volumes of paper based records coming in and out of the Surveyor General, documents can often get lost or misplaced. Through computerization, documents can be captured as they come in and hence back up copies can be generated easily. In addition, document management and tracking systems greatly assist with records management and tracking. At the time of this investigation, conversion of cadastral data to digital was ongoing at both site 1 and 2.

Errors such as equipment calibration and lack of compliance with permits should be dealt directly with the individual Surveyors concerned since these relate more to individual competences. Cadastral Survey management has the responsibility to define work methods and specifications to control processes that produce work. On the other hand, Surveyor General management should refuse surveys with: no examination fees, no permit, incomplete documentation or no beacon receipts, as these are prerequisites stated in the acts, which if not received at lodgement, the Surveyor General has no control over.

In a broader context, the results of the study reveal, from a land policy implementation perspective, some common institutional challenges that often emerge when multiple organizations are involved in LA activities without centralized control, monitoring and coordination. The present institutional arrangement inhibits rapid release of land for development and stalls the execution of land transactions. This potentially leads to inefficiencies in the operations of land markets and breeds opportunities for corruption. Furthermore, lower process yields have time and cost implications for LA customers who have to wait for survey and registration processes to be completed before they can take ownership of new parcels. Private land developers are often discouraged by the long transaction cycle time for subdivision of land (deVries *et al*, 2003) which have cost implications for both government departments examining the documents and property developers who usually operate on borrowed finances.

While the original intention of examination was to ensure integrity of the land registration system (which so far has been achieved and maintained), the adverse implications associated with current practices cannot be ignored. One could view present practices as directly contributing to the dumping of sub standard work onto the LA value chain, as practitioners know too well that work will be rechecked for them downstream. A reform of examination policies that takes cognisance of the bigger picture of quality control and shifts most quality to where work is produced is thus long overdue.

The present study has demonstrated that through performance measurement the quality of lodged records can be assessed, compared and monitored (e.g. biannually or annually) by site or by Surveyor to get an objective assessment of whether quality of incoming work is improving, staying the same, or worsening. With improvements in quality of incoming work and more buy in on quality improvement initiatives, a shift towards quality assurance programs such as those based on survey accreditation (Falzon & Williamson, 2001), where examination of cadastral surveys is shifted out of government to e.g. Cadastral Surveyors could be worth exploring. Other useful quality management directions include Dale and

McLaughlin (1999) ‘s proposal for the adoption of Total Quality Management practices in LA. For the cases explored in this study, such changes would however be better placed in a broader LA reform context where, other challenges such as fragmentation of organizations, coordination of LA activities and legislative reforms are addressed.

4.5. Conclusions and issues for further research

Cadastral survey records and deed drafts that are lodged for examination and approval but fail to meet the stipulated quality requirements are rejected and returned to practitioners for corrections. Such backflows have the effect of congesting downstream processes, reducing CBP throughput and slowing down end to end delivery of CBPs. In this paper, we first developed a quality performance measurement model, which can be used to measure, compare and monitor quality performance in LA CBPs. We tested the applicability of the model at 2 survey examination sites: Surveyor General Windhoek (in Namibia) and Harare (in Zimbabwe) and 3 deeds examination sites: Deeds Registries Windhoek, Harare and Pietermaritzburg (South Africa). The results showed higher backflows in survey examination compared to deeds. Based on the results and previous work, we then conducted a cause and effect analysis of rejected cadastral survey records, filed in rejected survey records drawers at the Harare Surveyor General. This was done to find out recurring and underlying causes of poor quality for rejected surveys upon which improvement strategies could be built. 25 key causal factors were derived and these were subsequently clustered into 6 main causal categories. Based on the main causes and other causal factors that were viewed as having a significant impact on rejections, some quality improvement strategies were proposed. Implications of the results in a broader land policy context were also discussed. In this regard, the paper demonstrates that quality performance measurement and root cause analysis may have applicability in improving cross organizational performance of LA work processes.

However, this work has focused mainly on quality control and conformance of LA work products and processes (internal facing). An equally important external focus of quality that takes cognizance of customer’s requirements was however not explored.

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Chapter 5

Measuring cycle time of a cross organizational cadastral survey examination process

*This chapter is based on

Chimhamhiwa, D., Mutanga, O. &van der Molen, P. (In Review-c) Measuring cycle time of a cross organizational cadastral survey examination process, *Survey Review*.

Abstract

Recent studies in a number of Southern African countries have revealed that a significant proportion of cadastral survey records that are lodged for survey examination and approval at Surveyor General sites are rejected and returned for corrections at least once. This often leads to considerable delays in the approvals of such records and subsequent delay in their registration at the Deeds Registries. The paper analyzes the cycle times for survey records submitted for survey examination at 2 Surveyor General Departments over a six year period, taking their quality into consideration. Our results showed that all survey records with ‘good ‘quality were approved within 40 days at both sites while none of the rejected records was approved within 20 days. Further analysis of cycle time was conducted between sites, Cadastral Surveyors and across the years. The work is important for planning of delivery improvement interventions for survey examination processes.

Keywords: cycle time, survey examination, resubmission

5.1. Introduction

Several challenges associated with lengthy procedures in Land Administration (LA) delivery have been highlighted in a number of studies, e.g.(World Bank, 2003 ; de Soto, 2000). In the case of land registration, lengthy (and often costly) procedures may mean that tens of thousands of land titles could remain pending and can even become obsolete over time. According to Chimhamhiwa *et al* (In Review-b) when land parcel boundaries are surveyed for purposes of registration in many southern African countries, the cadastral survey records prepared have to be examined and approved by the Surveyor General departments first before they can be registered in the Deeds Registry. However, a number of studies have cited significant delays in survey examination and approval by the Surveyor Generals. In the case of southern Africa delays in survey examination have been observed in Namibia (de Vries, 2004), Zimbabwe (Chimhamhiwa & Lemmen, 2001; Chimhamhiwa, 2006), Malawi (Barnes, 2001), Zambia (Mulolwa, 2002) and South Africa (Fourie, 1994). Cases of survey records that are lodged and 'remain stuck' in survey examination for years, records that move back and forth between Surveyor General and Cadastral Surveyors due to errors and backlogs that run beyond several months, have been reported in some of the above cases. Such delays have serious implications for approval of survey records and for customers who have to endure the long wait.

While Surveyor General departments have often been blamed for most delays in survey examination, other external factors outside their control can influence such delays. One such factor is the quality of submitted cadastral survey work. Studies by (Chimhamhiwa *et al*, In Review-b; deVries & Lewis, 2009) have established that around 80% of survey records lodged for survey examination in Namibia and 60% in Zimbabwe are rejected and returned to Cadastral Surveyors for corrections. On the other hand, other previous studies e.g. (Chimhamhiwa & Lemmen, 2001; Chimhamhiwa, 2006) have suggested that cadastral surveys with good quality tend to move through LA cross organizational work processes (CBPs) with fewer delays. From a CBP delivery and external customer's perspective, the time taken from the point a survey record is lodged for examination up to its approval can be considered to be of significant importance since it is only after diagrams have been approved that land parcel registration can occur.

However, with high rejection rates of cadastral survey records evident in survey examination, delays in approval and consequently registration are imminent. In this paper, we analyzed the effect of rejections and resubmissions on the approval time of survey records lodged for survey examination and approval. We referred to such time (from first lodgement to approval) as the cycle time (CT). If a survey record is lodged but rejected (once or many times) due to quality shortfalls, its CT clock continues to tick even during the period (s) when corrections are being effected (by the Cadastral Surveyor), through resubmission (s) up to approval. The aims of this paper were therefore: (1) to measure and compare CT performance for survey examination and approval between different Surveyor General sites over time, (2) to determine and compare how CT varies between sites and Cadastral Surveyors when quality of submitted work is considered, (3) to analyze how internal activities influence CT, and (4) to demonstrate how the different performance measures (including CT and other variables such as quality) can be aggregated into a global performance measure. The first 3 aims focus exclusively on cycle time analysis and constitute the rest of the paper while the fourth aim is only introduced in section 5.6 to show how performance aggregation of CT and other variables (determined elsewhere in this thesis) is carried out. For the time based analysis, we used the cases of the Surveyor General departments in Windhoek Namibia (case 2), and Harare, in Zimbabwe (case 1) and Pietermaritzburg (South Africa) (case 3).

While a number of cadastral and LA investigations have analyzed several dimensions of time, we are not aware of any study that has incorporated rejection and resubmission in deriving cycle time of cadastral work. The current paper is therefore one of the first to incorporate these in the analysis of survey record approval time. Considering such dimensions is important because they reveal the impact of quality on approval delays, an aspect that has often been ignored. Furthermore, including these elements in CT measurement could help both Cadastral Surveyors and Surveyor Generals to set realistic turn around times for survey examination, assess process activities in a holistic manner and plan for appropriate interventions. The rest of this paper is structured as follows. In the next section, we present the background and context of the paper. Based on the context of our investigation key dimensions of CT that incorporate rejections of submitted cadastral survey work are suggested. Section 5.3 presents the methodology followed while section 5.4 highlights the results of the study. A discussion of such results is presented in section 5.5 while section 5.6 presents an illustration of how the aggregated performance index is computed. Section 5.7 concludes and summarizes the paper.

5.2 Background and context

The measurement of time in LA is not new. Work by FIG commission 7 (Steudler *et al*, 1997) presented some early attempt on benchmarking of cadastral systems. Their study, which assessed and compared multiple criteria across 53 countries, included (1) time to transfer land - a measure, which represented the work of the land registry and (2) time to subdivide - a variable that reflected the work of the Cadastral Surveyor. The doing business (www.doingbusiness.com) framework, which is used to track reforms across several countries (183 in 2009) by the World Bank, incorporates: (1) number of steps taken to register property, and (2) time it takes to do so, as critical components for doing business. Countries that have reduced these and other indicator sets have often been categorized as reformers. Recently, Burns *et al* (2006) conducted a cross country evaluation of formal and customary LA systems in a study of 17 countries, 6 of them from the developing world. Numerous time related indicators, amongst them: registration staff days/registration, total staff days/registration, time to complete registration (including dealing with private sector suppliers) and average working days to pay for average transaction cost, were proposed and tested. While each study had its own focus, various dimensions related to time were proposed and applied in all cases. However, none of the above studies considered work process CT in a manner that incorporates work returns and resubmissions.

Elsewhere, rejections and revision of work and how they influence response time were investigated by Azar (2004) with regard to the academic publishing process. Their work, which looked at the time it takes for an academic article from first submission to being published, incorporated the reviewing, rejection(s) and revision time in the analysis of publication delays. Using numerical analysis and evidence on acceptance rates of various journals, they estimated that most manuscripts are submitted between three to six times prior to publication. In an earlier paper, Chimhamhiwa (2009) suggested several time related elements relevant for end to end CBP measurement in LA, which take into account rejection of work along the value chain. The study did not, however, demonstrate the application of the measures. This paper extends that previous work.

5.2.1 Measuring cycle time in cadastral survey examination and approval process

It has often been said that time is money and this is true for most organizations (Hult, 1997). Regardless of the nature of the industry, the CT is a significant key to success. Given the case of a survey record that is lodged for approval in a typical Surveyor General department in southern Africa, a number of time variables are important if one intends to analyze the duration from lodgement to approval. Some of these dimensions are discussed below.

Assuming that the lodged survey record is not rejected, the *processing* time and *waiting* time are central variables that influence the CT. Processing time relates to the time when actual work is performed on a request while waiting (queuing) time represents the time between the arrival and start of work on a request. In the event of a rejection then *resubmission* time becomes equally important. Resubmission time was defined by Chimhamhiwa *et al* (2009) as the time taken to correct and resubmit a previously rejected request. This dimension was viewed as closely related to quality and applies to requests returned for corrections. An elaborate discussion of these and other time variables is presented in Chimhamhiwa *et al* (2009).

5.2.2 Cycle time in the context of the selected case studies

For the cases of Namibia, Zimbabwe and South Africa, most cadastral survey work lodged for survey examination at the Surveyor Generals is carried out by private sector Cadastral Surveyors. The volume of submitted work varies considerably between each Surveyor General office and in time. In all cases, survey work done within a given jurisdiction must be lodged with a particular office of the Surveyor General. Each survey record received by the Department of the Surveyor General is usually recorded in the lodgement book where the lodgement date is captured. The survey record often joins a series of queues as it moves along the survey examination processes. Often, survey records are examined on a first come first served basis and the processing time at each step varies by: survey record size, level of difficulty and efficiency of Examiners. In all cases, there tends to be few final Examiners, which often leads to survey records waiting longer as they approach the approval stages. Since survey examination is a multi stage activity that involves numerous Surveyor General actors checking different elements of a cadastral job, a survey record could be rejected at the start of examination or towards the final stages. While rejection and approval dates are often noted in the lodgement books, in some cases these can be missed. A detailed description of survey examination and approval activities for the case countries is presented in Chimhamhiwa *et al* (In Review-a).

5.3 Methodology

5.3.1 Data collection

To measure and compare CT between different sites and Cadastral Surveyors, small subdivision surveys of 4 property units or less, conducted within the municipalities of Harare and Windhoek and subsequently lodged for survey examination and approval with sites 1 and 2, respectively were analyzed. Only survey records lodged between 2003 and 2008 and had been approved, were considered. This generated 1 011 survey records for Harare and 340 for Windhoek. For each survey record, the lodgement date, approval date and Cadastral Surveyor who carried out the cadastral survey were captured on a template. Furthermore, each survey record was checked to verify if it was rejected at any stage after lodgement. Records that were rejected were classified under rejected surveys while those that had not were categorized as good quality surveys. To determine how internal activities influence CT, a sample of 25 survey records lodged with site 3 between June and November 2009 was randomly selected. Due to the confidential nature of survey record movement data at the site, the 25 survey records was all that could be availed to the research team. The sample is thus used here only for purposes of demonstrating the movement of survey work at the site. Eighteen (18) of these were cadastral surveys of 4 property units or less, 5 were rejected surveys and 3 were not yet approved. Their movements through the different internal stages were tracked and analyzed.

5.3.2 Data analysis

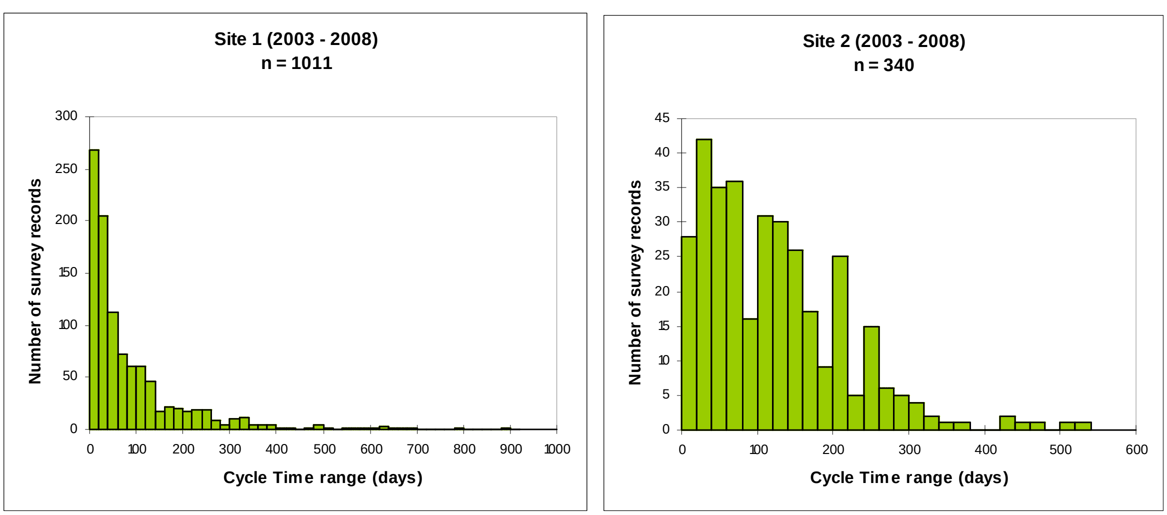
The CT for each survey record was derived by computing the net working days between lodgement and approval dates in Excel. Cycle times were then clustered into 20 day intervals (20 working days is approximately equal to one month). Subsequent analyses were then done using descriptive statistics and tables. To analyze how internal activities influence CT at site 3, the movement of each of the 25 sampled survey records along the different survey examination and approval stages was examined and presented using graphs.

5.4. Results

The results of the study are presented under 3 main sections: (i) comparison of CT between different Surveyor General sites over time (ii) Comparison of CT variation between sites and Cadastral Surveyors when quality is taken into consideration, and (iii) analysis of how internal activities influence CT.

5.4.1 Comparison of cycle time between different Surveyor General sites over time

For the period of study (2003 - 2008), 1 011 and 340 survey records were lodged and approved at sites 1 and 2 respectively (figure 5.1).



(a) (b)

Figure 5.1: Distribution of cycle time for 2003 - 2008 for (a) site 1 and (b) site 2.

473 (or 47%) of records submitted at site 1 were processed in 40 days, with 27% being approved in 20 days. In addition, 71% of all lodged records at the site were approved within 100 days of first lodgement. For site 2, 70 (or 21%) of all records submitted during the study period were processed within 40 days and cumulatively, 46% were processed in 100 days. From year to year, volumes of records approved within different CT ranges fluctuated considerably as shown on figures 5.2 and 5.3. At site 1, 2003 and 2004 displayed higher proportions of survey records that were approved with CTs of within 20 and 40 days: 35% and 57% and 42% and 68%, respectively.

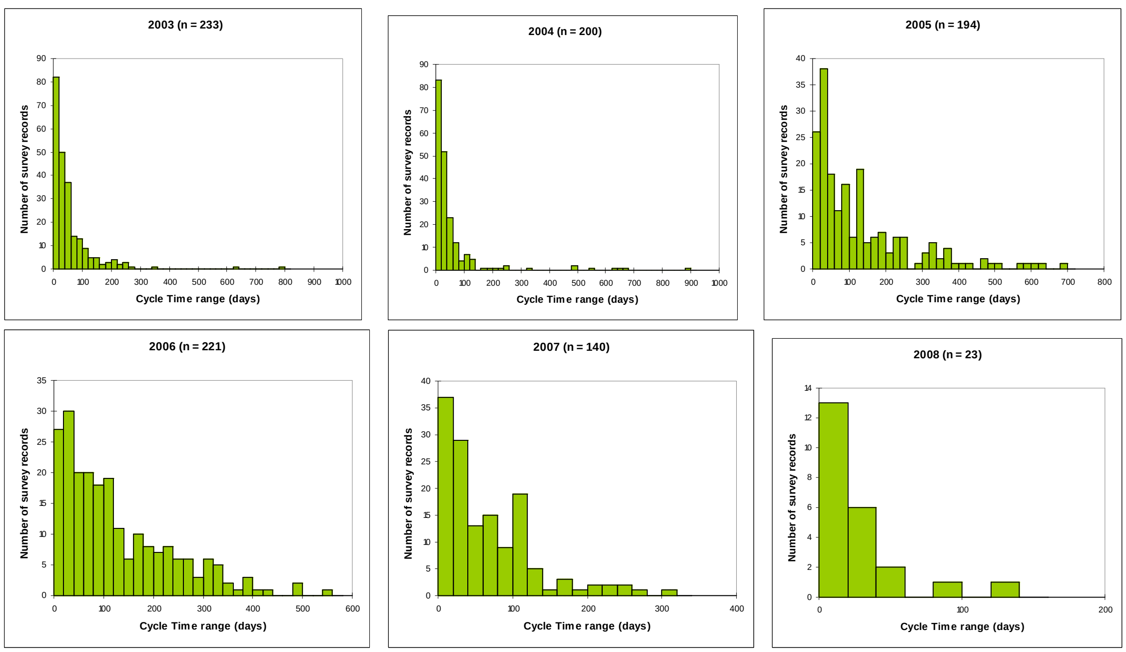


Figure 5.2: Cycle time histograms for the Surveyor General Harare office (by year): 2003 - 2008

One (1) in 2 (in 2004) and 1 in 3 (in 2003) had CT of below 20 days. Lower proportions were however realized for 2005 (13% and 33%) and 2006 (12% and 26%) for the same CT ranges. Two survey records had CTs of beyond 500 days in 2003, 5 (in 2004) and 6 in 2005.

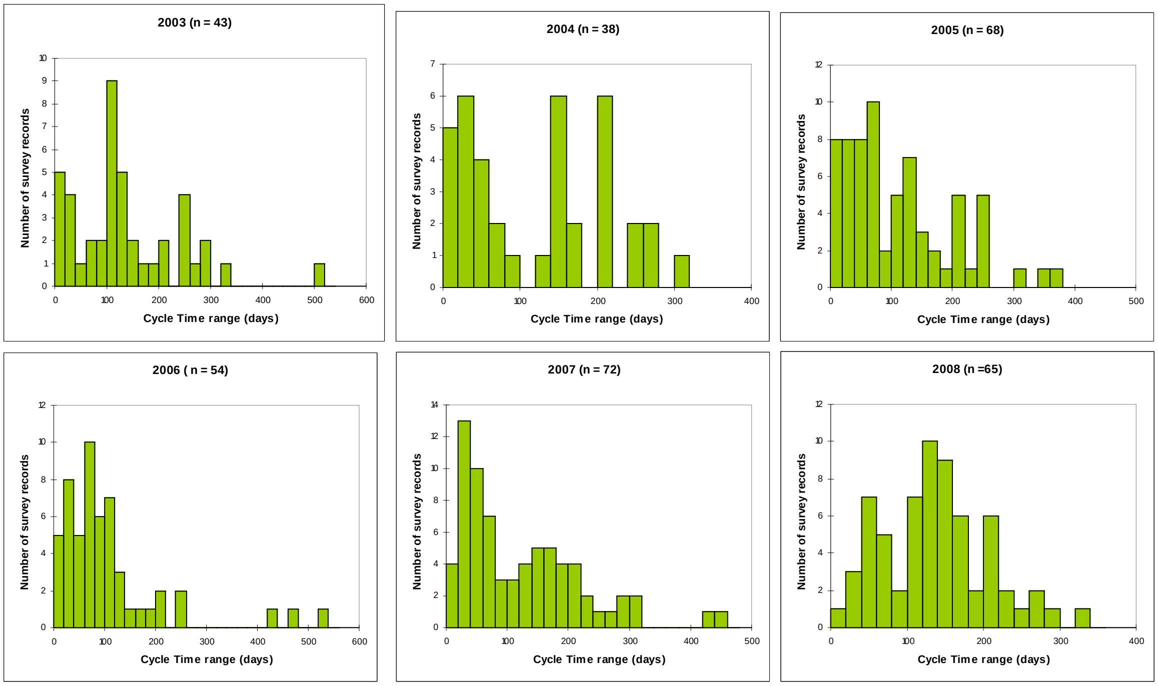


Figure 5.3: Cycle time histograms for the Surveyor General Windhoek office (by year): 2003 - 2008

For site 2 (figure 5.3), the volumes of survey records approved in 20 and 40 days from year to year ranged from: 12%, 21% (2003), 13%, 29% in 2004, 12, 24% in 2005, 9%, 24% (2006), 5%, 23% (2007) and 2%, 6% (in 2008).

5.4.2 Comparison of cycle time variation between sites and Cadastral Surveyors when quality is taken into consideration

Overall, all good quality survey records submitted for survey examination and approval at both sites were approved within 40 days of lodgement (table 5.1).

Table 5.1: Overall cycle time distribution for good quality survey records (2003 - 2008)

CT range (days)		Site 1		Site 2	
		Number of survey records	(%)	Number of survey records	%
0	20	268	70%	28	52%
21	40	117	30%	26	48%
41	and above	0	0%	0	0%
Total		**385**		**54**	

Seventy (70)% of such records were approved in 20 days at site 1 while 28 of the 54 (or 52%) were approved within the same period at site 2. On the other hand, none of the rejected survey records submitted at both sites was approved within 20 days (table 5.2).

Table 5.2: Overall cycle time for rejected cadastral surveys (sites 1 and 2)

		Site 1		**Site 2**	
CT range (days)		Number of survey records	%	Number of survey records	(%)
0	20	0	0	0	0
21	40	88	14	16	6
41	60	113	18	35	12
61	80	72	12	36	13
81	100	61	10	16	6
101	and above	292	46	183	64
Total		**626**		**286**	

32% of these rejected survey records were however approved in 60 working days for site 1, 53% in 100 days and 14 records were approved 500 days after submission. For site 2, 18% of rejected cadastral surveys were approved within 60 days and 103 (or 36%) in 100 days. Two (2) of the rejected survey records were approved 500 days after lodgement.

The average CT from year to year at site 1 (excluding 2008) was considerably low for 2003 (for both good and bad quality survey records) and for 2007 (for rejected records) (table 5.3). At site 2, CT average was lower for rejected records in 2006.

Table 5.3: Cycle time variation between the years considering quality

		Overall for Site	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Site 1	CT for good quality survey records	15	14	16	18	16	17	9
	Total number of good quality survey records	385	107	119	47	45	53	14
	CT for rejected survey records	133	96	127	167	147	94	53
	Total number of rejected survey records	626	126	81	147	176	87	9
Site 2	CT for good quality survey records	19	21	17	17	19	21	19
	Total number of good quality survey records	54	8	9	13	10	12	2
	CT for rejected survey records	142	162	156	134	126	142	142
	Total number of rejected survey records	286	35	29	55	44	60	63

Cycle times were also analyzed between Cadastral Surveyors with highest volumes of submitted survey work at both sites (table 5.4).

Table 5.4: Cycle time variations between Cadastral Surveyors considering quality

	Site 1					Site 2				
	Overall for Site	**CS_1**	**CS_2**	**CS_3**	**CS_4**	**Overall for Site**	**CS_1**	**CS_2**	**CS_3**	**CS_4**
Average CT for good quality survey records	15	16	16	16	15	19	21	20	14	18
Total number of good quality survey records	385	59	68	61	33	54	17	18	4	2
Average CT for rejected surveys	133	132	124	114	132	142	146	153	125	159
Total number rejected surveys	626	122	92	71	60	286	74	68	38	30

At site 1, Cadastral Surveyor 3 (CS_3) displayed considerably good CTs for both good and bad quality surveys compared to the others while CS_2 at site 2 showed good results for both volume and average CT for good quality records. The top 4 Cadastral Surveyors contributed 57% and 55% of good and bad quality survey records, respectively at site 1 compared to 76% and 73%, respectively at site 2. Between the Cadastral Surveyors at site 1, 44% of (181) surveys by CS_1 were approved in 40 days, 67% in 100 days and 2 surveys by the same Cadastral Surveyor were approved beyond 500 days (541 and 677). For CS_2 , 44% (out of 160) were approved in 40 days and 73% in 100 days while 58% (out of 132) and 80%, and 44% (out of 93) and 60% of records, were approved in 40 and 100 days for CS_3 and CS_4, respectively.

At site 2, 22% of submitted records by CS_1 were approved in 40 days compared to 47% (or 43 records) in 100 days. 26% and 46% were approved in 40 and 100 days, respectively for CS_2 while 12% and 38%, and 19% and 41% were approved for CS_3 and CS_4, respectively.

5.4.3 Analysis of how internal activities influence cycle time.

The movement of survey records across survey examination and approval process steps and waiting areas (data sores) at site 3 is shown on figure 5.4. For most survey records, a generally straight and smooth flow of records can be observed from Registry.Drawer (a data store) to Exam.drawer, another data store where records are filed awaiting technical examination. Significant changes in gradient are however observed along most tracks, from: (1) Exam.drawer to Examination, and (2) Prof.Exam Drawer up to Registry.

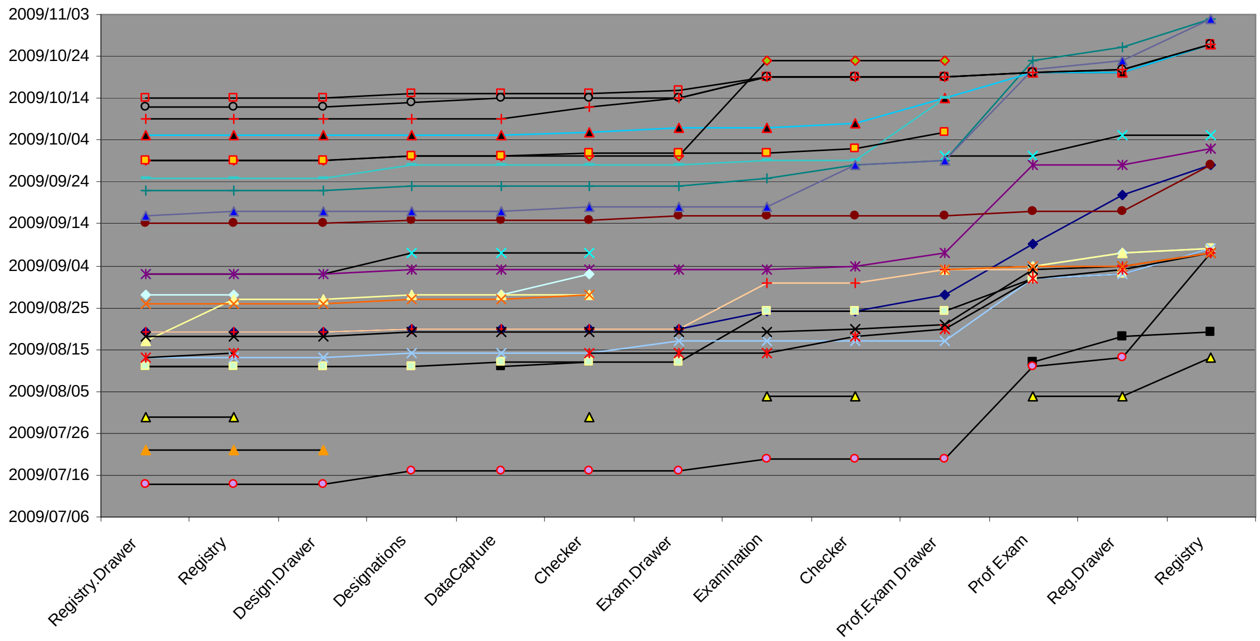


Figure 5.4: Internal movement of survey records across the survey examination and approval stages.

5.5 Discussion

Our results across the 6 year period showed that site 1 had higher proportions of submitted survey records with lower CTs than site 2, with 1 in 2 survey records being approved within 40 days at site 1 compared to 1 in 5 at site 2. A possible reason for the difference could be the fewer number of actual examination steps at site 1 (two) compared to four at site 2 as discussed in Chimhamhiwa *et al* (In Review-a). More examination steps can result in increased CT as survey records take longer to traverse a longer process chain.

Between the years, 2004 and 2003 had higher volumes of records with lower CT for both below 20 and 40 days at site 1. The higher proportions could be because the 2 years had the highest volumes of good quality records lodged, i.e. 46% (2003) and 60% (2004). Furthermore, more final Examiners were available at the site during the same period as a private consortium was contracted (up to end of 2004) to assist with examination. Thus, a combination of good survey records and more examination personnel appear to have led to higher proportions of approvals with lower CT. On the contrary, for 2005 and 2006, a combination of high volumes of poor quality survey records and lower levels of personnel (at a time when Zimbabwe was experiencing its worst economic downturn) could have resulted in the low ratio of 1 in 8 records being approved in 20 days. Realising the gravity of the situation, the Council of Land Surveyors in Zimbabwe and the Surveyor General's office requested all private Cadastral Surveyors to help with survey examination and approval starting in 2007. This appears to have led to the improved result of 1 in 4 survey records being approved within 20 days for 2007. At site 2, the constant pattern of approximately 20% of records being approved within 40 days or less can be explained based on the perennial shortage of Cadastral Surveyors at the Surveyor General in Namibia. For the entire study period, excluding 2004 where 3 Cadastral Surveyor graduates joined the Surveyor General, the Windhoek Surveyor General office has operated mostly with 2 final Examiners, 1 of them doubling up as the Surveyor General. A steady drop in the proportions of survey records being approved within 20 days, from 12% (2005) to 9% (in 2006), 5% (2007) and 2 % (2008) appears to reflect a steady slow down in survey examination processes over the years at site 2. This could partly be attributed to a significant build up in backlog. It was established during this study that 2 survey records and 110 diagrams were carried over into 2006 from 2005, 21 survey records into 2007 and 58 into 2008. This cumulative build up means records queue and wait for longer and hence CT is likely to increase, irrespective of quality, because of backlog.

Our results further showed that for both sites, all survey records with good quality were approved within 40 days of lodgement while none of the rejected records was approved within 20 days. This seems to suggest that survey records with good quality are likely to be approved faster yielding lower CTs compared to bad quality records. Higher CTs e.g. those of over 500 days for the 14 rejected surveys at site 1, can be attributed to a number of reasons: (1) if corrections requested can be done in the office instead of additional field work then the survey record can be relodged for survey examination and approval earlier. CT is likely to be higher in the later cases. (2) many rejections can result in high CT. A related study by Chimhamhiwa (2002) tracked 54 survey records lodged for survey examination at the Surveyor General office in Harare, 44 of which were rejected. Of the 44 rejected the first time, 34 were relodged within a month. 25 of the 44, were further rejected for the second time. 14 of these were returned after 8 weeks. 8 of the 25 were rejected for the third time and none came back within the first month. (3) the customer plays a big part in the CT. A paid up customer who continuously checks on the progress of his/her survey is likely to put pressure on the Cadastral Surveyor and get an early result (leading to lower CT) than one who has not paid up and is not keeping in touch.

Across the Cadastral Surveyors, the top 4 Surveyors contribute 57% and 55% of good and bad quality survey records, respectively at site 1 compared to 76% and 73%, respectively at site 2. This appears to suggest that the contribution of top 4 Surveyors to quality and resultantly lower CT is more significant (and dominant) at site 2 where 3 in 4 good quality records come from them compared to 1 in 2 for site 1.

The flow of the survey records across the various activities display a linear pattern from Registry.Drawer to Exam.Drawer. This suggests faster movement of records along that segment, which reduces CT. The faster movement could be because two copies of the survey record are used in this segment thereby enabling parallel processing of activities as discussed in Chimhamhiwa *et al* (In review-a). Changes in gradient for most tracks particularly from Exam.Drawer to Examination and from Prof.Exam Drawer to Prof Exam, appear to point towards delays and possible queuing before technical and professional examination. This could be attributed mainly to the shortage of Examiners. Furthermore, unlike activities like designations and data capture which are executed in parallel, technical and professional examination are sequential process activities. Further to the measurement and comparison of cycle time, the last aim of the paper was to show how aggregated performance is computed. This is presented in the next section.

5.6 Aggregating performance measures to a global performance index – an illustration

The previous sections have dwelt on CT performance measurement and comparison for survey examination between Surveyor General sites over time and have explored the influence of other variables on CT. However, up to this point the thesis has evaluated multiple performance values for the different dimensions, as expressed by the indicators chosen. It would be impractical for the management of the CBP to keep an eye on several performance indicators that are spread across many dimensions and organizations. In this regard, the individual performance variables should ideally be aggregated into a single global performance index.

To demonstrate how the global performance index (GPI) can be computed, we used the quality and time results obtained for the survey examination and approval sub processes for the Surveyor General offices of Harare and Windhoek. Our calculations are only for survey examination and approval since it is the only sub process that we have multiple indicators computed from different measurement dimensions. In this regard, the performance indicators of process yield (from chapter 4), and cycle time of less than 40 days (from chapter 5) were chosen for the GPI computation. To derive the aggregated performance, three procedural steps, suggested in section 2.3.4.4, were followed. Based on our quality findings (in chapter 5), we allocated a higher weight for quality (0.6) to encourage better quality practices. The global performance index was computed using the aggregation operator below (Deming, 1982).

$$\sum_{i=1}^{n} w_i p_i$$

Where w_i represents the weight of the criteria i in the overall performance and p_i is the performance expression of criteria i.

Overall, global performance indices of 0.42 (42%) for Harare Surveyor General and 18% for Windhoek Surveyor General (table 5.5) were thus derived for the survey examination and approval sub process. Where more than one sub process is involved, the weights of the sub processes (if not similar) can be derived first. The global performance index can then be computed per sub process and then combined into the CBP GPI. Off the shelf software e.g. Macbeth, can be used to assist with such computations.

Table 5.5: Global performance indices for survey examination for the Surveyor Generals offices of Harare and Windhoek

	Process Yield	**Cycle Time under 40 days**	**Aggregated Performance**
Weights	0.6	0.4	*
Harare DSG	0.38	0.47	0.42
Windhoek DSG	0.16	0.21	0.18

Through the GPIs, a baseline for aggregated performance is established upon which new performance targets can then be set. Improvement strategies can then be put in place to meet those targets.

5.7. Summary and Conclusions

The time taken from the point a survey record is lodged for survey examination up to its approval can be considered to be of significant importance from a customer's perspective. However, with high rejection rates of survey records evident in most cases, delays in approval are imminent. The paper aimed at measurement and comparison of cycle time performance for survey examination and approval between different Surveyor General sites over time, and taking quality into consideration. Our results have shown that:

1. Quality directly influences cycle time, as all good quality survey records submitted for survey examination at both sites were approved within 40 days of lodgement while none of rejected survey records submitted was approved within 20 days of first lodgement.
2. How the job is done has a direct effect on the cycle time. For example, over a six year period, 1 in 2 submitted survey records were approved within 40 working days at the Harare Surveyor General compared to 1 in 5 at the Windhoek Surveyor General for the same time range. We attributed the differences to a number of causes amongst these: the fewer number of examination steps at Harare Surveyor General (two) versus four at the Windhoek Surveyor General.
3. Backlogs increase the cycle time. Results from the Surveyor General Windhoek office reflected a steady drop in the proportions of survey records being approved within 20 days: from 12% (2005) to 9% (in 2006), 5% (2007) to 2% (in 2008), a situation we attributed partly to a significant build up in backlog which saw 110 diagrams being carried over into 2006 from 2005, 21 survey records into 2007 and 58 into 2008.
4. Internal activities influence the cycle time. A graphical plot of the survey records movement across the different survey examination and approval activities showed

points along the process chain where delays are imminent and faster movement of records apparent.

5. The aggregated performance index presents a single composite performance value that can be used to monitor overall performance of sub processes or the CBP.

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Chapter 6

Improving land administration delivery - Is end to end performance measurement of processes necessary? A synthesis

6.1 Introduction

Is it necessary to measure performance of land administration (LA) business processes from end to end? Research on the delivery of LA by (World Bank, 2005; de Soto, 2000) has revealed that the current services of most systems in developing countries and in particular, southern Africa, are perceived to be generally slow and bureaucratic. Several reasons, amongst them: the conservatism attached to land-related institutions, lack of institutional reform, fragmentation of LA activities and general lack of cooperation between LA organizations (Dale & McLaughlin, 1999; Burns *et al*, 2006) have often been cited as causal factors for the present situation. Since multiple autonomous and geographically separated organizations are often involved in the end to end execution of key LA cross organizational business processes (CBPs) such as the subdivision of land, measuring performance across the whole chain can help to detect points where significant improvements can be realized. Measuring across the whole system facilitates the 'taking out of waste from the value chain' instead of just moving it elsewhere (Holmberg, 2000). This is often not possible if individual parts (sub processes) are analyzed separately.

However, two critical problems have limited the application of performance measurement in cross organizational LA. First, measurement of CBPs has been bedevilled by the absence of internationally accepted methodologies to measure and compare LA systems across countries (Steudler *et al*, 2004). In particular there is no measurement instrument (consisting of critical success factors) for assessing LA CBPs. This is partly due to the cultural, language, technical and social differences between countries (Rajabifard *et al*, 2007) and because LA systems are in constant reform and represent society's different perceptions of land (Steudler *et al*, 2004).

A second problem has been the absence of a holistic measurement framework, which traverses across organizational boundaries. In the absence of such a framework, different organizations located upstream and downstream of the LA value chain have tended to measure and monitor different things that are independent of each other, a scenario not conducive to the optimal performance of the CBPs (and LA) as a unified whole. Furthermore, it would be difficult, without a unified measurement framework, to assess the downstream impact of certain actions on the part of upstream organizations. In this context, the challenge was therefore to develop a performance measurement system that can be used to measure CBPs to facilitate their improved end to end delivery.

In this thesis the objectives were: (1) to develop a performance measurement system (PMS) that can be used to measure, monitor and compare LA cross organizational business (work) processes, from end to end, and (2) to test the applicability of such a PMS in a regional context.

This chapter documents the major findings from this research based on the objectives. The discussion is presented in four main sections. The next two sections focus on the development of the performance measurement system and testing of the applicability of the proposed PMS system. In section 6.4 we present some concluding remarks based on the objectives of the thesis. Section 6.5 highlights further research issues arising from this thesis.

6.2 Development of a performance measurement system

The development of the CBP performance measurement system was conducted in two main phases. The first phase focused on determining what to measure whilst the second part developed an integrated structural framework that facilitates measurement of the different variables across organizational boundaries. For reasons discussed in sections 1.6 and 2.3.1, we used subdivision as our CBP to investigate. A multi site case study of the subdivision CBP in six pre - dominantly urban municipalities in South Africa, Namibia and Zimbabwe was therefore carried out. Based on the study, a six dimensional measurement instrument (scorecard) was developed and presented in Chapter 2. The instrument, which was developed and refined progressively through, key informant interviews, stakeholder workshops and conference presentations, attempted to provide a balance between measures of CBP external success (customer satisfaction and society) and internal performance (quality, technological innovation, cost and time). Technological innovation and quality were suggested as enablers of results that give an early indication of future success while time and cost were chosen to measure what has been achieved. The customer facing measures were proposed to gauge CBP effectiveness, which then provides essential feedback that influences internal practices and efficiency (organization facing).

To integrate the proposed measurement areas across the distributed sub processes of the CBP, a structural model was developed in Chapter 2 where linkages between activities, sub processes and the CBP were proposed. The linkages facilitated measurement of end to end outputs at CBP level, intermediate outputs at sub processes level and activity outputs at activity levels. In this regard, the performance of activities was suggested as the base to build sub processes and CBP performance. Thus in summary, the key contribution of Chapter 2 to the thesis' main objectives was: the construction of the performance measurement system, which comprises key measurement areas and a structural measurement framework that facilitates actual measurement of LA CBPs across organizational boundaries.

To lay the foundation for CBP performance measurement, an end to end analysis of business process activities associated with the subdivision into 4 units or less, of privately owned property within an established township was conducted for 5 of the 6 municipalities investigated in Chapter 2. Based on a closer examination of the flow of subdivision activities across the more than 20 institutions in the 5 municipalities, 6 core sub processes of: (1) plan/permit drafting, (2) plan examination and approval, (3) cadastral surveying, (4) cadastral survey examination and approval, (5) deeds drafting, and (6) deeds examination and approval, were identified, modelled and presented for each case, in Chapter 3. The six sub processes formed the basis for subsequent analysis of the CBPs in other parts of the thesis. Comparisons of the CBPs and sub processes similarities and differences across the five jurisdictions were then carried out and a business process reference model was proposed based on common activities and best practices. Thus, the main contributions of Chapter 3 were:

1. Development of structured representations and descriptions of CBPs, their sub processes and activities across the five municipal cases. These provided a basis upon which measurements and comparisons, through the proposed PMS, could be conducted.
2. Comparisons of CBP and sub process similarities and differences based on how the 'same things' are done in different jurisdictions, which helped to select comparables for subsequent analysis and highlighted good practices from different cases (section 3.4.2).
3. Development of a subdivision business process reference model which is important for learning and improvement, standardization and development of software and IT infrastructure support.

6.3 Testing the applicability of the performance measurement system

After developing the PMS in Chapter 2 and CBPs and sub processes models in Chapter 3, the second part of the study focused on testing the applicability of the different PMS dimensions. Quality (an enabler of results) and time (a measure of results) were analyzed based on the cadastral survey examination and deeds examination and approval sub processes presented in Chapter 3.

The quality perspective was investigated based on the premise that if high volumes of poor quality records were lodged onto CBPs then end to end delivery would be compromised due to backflows of rejected records. To test the applicability of the quality dimension (chapter 4) we first developed a framework for measuring quality performance by extending a procedural measurement model suggested in Chapter 2. Two critical quality performance indicators of: process yield and rejection were proposed and used to measure and compare quality at 2 survey examination sites: Departments of Surveyor General in Harare (in Zimbabwe) and Windhoek (in Namibia) and 3 deeds examination sites: Deeds Registries of Windhoek, Harare and Pietermaritzburg (in South Africa), for the period 2003 to 2008. Lower process yield of 2 in 5 records for Surveyor General Harare and 1 in every 6 submitted records for Surveyor General Windhoek were derived for survey examination sub processes compared to 1 in every 2 for Deeds Registry Harare, 5 in 6 for Deeds Registry Windhoek and 3 in 4 for Deeds Registry Pietermaritzburg. Since from a CBP context all subdivisions pass through survey examination first and then deeds examination and approval, as presented in Chapter 3, our results implied that: 2 out of every 5 small subdivision surveys conducted in Harare municipality get approved at the Surveyor General Harare office first time and of these, 1 in every 2 will be registered on first lodgement when they get to the Harare Deeds Registry. Similarly, 1 in 6 small subdivision surveys done in Windhoek municipality gets approved at the Windhoek Surveyor General first time and of these, 5 in every 6 can get registered downstream at the Windhoek Deeds Registry. Based on the rather poor results obtained for survey examination and approval, we conducted a cause and effect analysis for poor quality of cadastral surveys at the Surveyor General Harare, through a retrospective analysis of 124 returned cadastral survey records. Twenty five (25) causal factors were derived upon which several improvement strategies mostly related to technological innovations (our other PMS dimension), were proposed. In this regard, the chapter demonstrated that: Quality, a dimension often ignored in LA improvement, is critical for LA CBP performance improvement since quality performance results such as process yield influence forward flow, ‘artificial’ backlogs and throughput - all key elements of CBP delivery.

In chapter 5, we tested the time dimension of the proposed PMS. Cycle time (a metric that captures total time from first lodgement to approval) was measured and compared for 1 011 and 340 survey records lodged for survey examination at the Surveyor General offices of Harare and Windhoek, respectively. Cycle time measurements and comparisons were done: (1) between the sites (in general), and (2) between sites and Cadastral Surveyors (considering quality). In addition, the influence of internal activities on cycle time was analyzed at the Pietermaritzburg Surveyor General and an illustration of how different performance values of the multiple dimensions are aggregated into a global performance index was presented. Our results showed that:

1. Quality directly influences cycle time. All good quality survey records submitted for survey examination at both sites were approved within 40 days of lodgement while none of rejected survey records submitted at both sites was approved within 20 days of first lodgement.
2. How the job is done has a direct effect on the cycle time. For example, our results showed that, over a six year period, 1 in 2 submitted survey records were approved within 40 working days at Harare Surveyor General compared to 1 in 5 at the Windhoek Surveyor General for the same time range. We attributed the differences to a number of causes amongst these: the fewer number of examination steps at Surveyor General Harare (two) versus four at Surveyor General Windhoek, as discussed in Chapter 3.
3. Backlogs increase the cycle time. Our results further showed that if backlogs emerge in the CBP, higher cycle times are likely to be reported irrespective of the quality of the submitted records. Results from Windhoek Surveyor General reflected a steady drop in the proportions of survey records being approved within 20 days: from 12% (2005) to 9% (in 2006), 5% (2007) to 2% (in 2008), a situation we attributed partly to a significant build up in backlog which saw 110 diagrams being carried over into 2006 from 2005, 21 survey records into 2007 and 58 into 2008. Backlogs mean that incoming records join a longer queue and wait longer to be processed and hence cycle time is likely to increase, irrespective of quality.

4. Internal activities influence the cycle time. A graphical plot of the survey records movement across the different survey examination and approval activities over time (figure 5.4), for the Pietermaritzburg Surveyor General showed points along process chain where movement of records is faster (which affect cycle time positively) and sections where slow downs are evident (which influence cycle time negatively). The faster and slower pace of movement was explained based on our descriptions of how the job is done that is presented in Chapter 3. In this case the main differences were due to serial and parallel processing of work across activities.

In addition, an illustration of how the different performance indicators are aggregated into a composite value - the global performance index is also presented.

Thus, in summary the contributions of this chapter to the overall study were that:

1. Time (cycle time) is a core dimension of CBP delivery.
2. The cycle time is influenced by the quality of a submitted record, i.e. good quality lowers cycle time and bad quality increases it.
3. Quality and time goals of the CBP measurement instrument can be designed to complement each other.
4. Irrespective of quality, other variables such as: backlogs and internal movements of work influence the cycle time.
5. A mapping of internal movements of cadastral survey records across activities over time provides a basis to pin point those activities and stations where improvement is required. Such improvements can be planned taking into consideration how the job is done (chapter 3).
6. Since multiple measures are evaluated in accordance with the PMS developed in Chapter 2, a global performance index that aggregates these individual measures into one value can be derived. In this regard the global performance index provides the basis for CBP planning, control, improvement and comparison at the highest level.

6.5 Conclusions

Through the results of the thesis (discussed above), it can be noted that the aims of the thesis have been achieved. This thesis (1) developed a performance measurement system that can be used to measure, monitor and compare LA cross organizational business processes, from end to end, and (2) tested the applicability of some dimensions (quality and time) of such a PMS in a regional context.

This thesis has discussed and shown how LA can be improved through CBP measurements facilitated by the developed PMS. The comparison of CBP results with other municipalities in a holistic manner was a very helpful instrument. The research thus fills a gap in the understanding of land administration delivery and provides a basis for future research.

6.6 Issues for further research

The future lies in further understanding the delivery challenges and improvement options for LA systems, especially those with activities that are fragmented and mandated to different organizations. In this regard, a number of research issues emerge from the present study.

1. The work presented in this thesis has tested the dimensions of quality (an enabler of results) and time (a measure of results) - dimensions that belong to the internal facing side of the performance measurement system. Measurements on the external facing side of customer satisfaction and society were not explored in the present study.
2. Since CBPs have distributed and decentralized process management structures with member organizations only controlling a partial area, an approach that enables the cooperative management, implementation and control of the entire chain across the participants needs to be developed.
3. With the business process descriptions laid out, several process based evaluations such as: simulations of what if scenarios for time and quality, can be conducted to explore the envisaged impact of proposed changes before resources are committed.
4. From the BP models developed, other work process perspectives, such as: rules that govern activities, resources needed to perform activities (including employees and equipment), flow of data between activities, and data stores that might be involved, can be added and investigated.
5. Exploration of the process infrastructure that supports sub process interactions is also important for CBP improvement. This area was not investigated in the present study.

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