The Workflow of Maintenance of Cadastral Data as based on Land Administration Domain Model (LADM)
A case study in Indonesia

Kurnia Wulan Sari

March, 2010

The Workflow of Maintenance of Cadastral Data as based on Land Administration Domain Model (LADM)
A case study in Indonesia

by

Kurnia Wulan Sari

Thesis submitted to the Faculty of Geo-information Science and Earth Observation in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation, Specialisation: Land Administration

Thesis Assessment Board

Chairman	: Prof. Dr. J.A. Zevenbergen
External examiner	: Dr. Ir. M.J.P.M. Lemmens
Supervisor	: Ir. C.H.J. Lemmen
Second supervisor	: Dr. Ir. H.T. Uitermark

FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION
UNIVERSITY OF TWENTE
ENSCHEDE, THE NETHERLANDS

Abstract

Keywords: Maintenance, Cadastral Data, LADM.

To provide valid and up-to-date data and information related to land administration activity is a major challenge, faced by many land administration organizations. Therefore, the maintenance of cadastral data is needed. In order to have a standard of maintenance of cadastral data in Indonesia, the standardized domain model LADM, with its Indonesian country profile, based on user requirements, are used to design and validate the workflow for the maintenance of cadastral data.

This research design is conducted within the frame of a case study , where literature concerned with (a) cadastral systems, (b) land administration, (c) domain model LADM, (d) maintenance data strategy by ArcGIS (as comparison) and (e) Unified Modelling Language (UML)-Activity Diagrams are reviewed. Documents about land administration in Indonesia and the existing land administration procedures are assessed. Mail and online questionnaires and online interviews are administered to respondents for data collection. Participating respondents are customers and land officers /administrators from areas which are relatively representatives of all areas of Indonesia.

These data assumed/analyzed as representations of user requirements and were categorised into eleven aspects, which are: (1) procedure, (2) time, (3) fee/cost, (4) information, (5) human resources, (6) services, (7) technology, (8) data, (9) archives, (10) obstacles and (11) suggestions. Each aspect is analysed, considering the existing conditions, which were already defined through online interviews with some land officers. Based on these user requirements and LADM Indonesia country profile with its classes and attributes, the workflow of maintenance of cadastral data is designed and proposed.

To validate the proposed workflow, two methods are selected: (1) the creation of an application simulation program for validation of the suggested classes and attributes in LADM, and to prove the feasibility of the maintenance of the cadastral data base with class VersionedObject from LADM, (2) the use of Assessment Questions, which are formulated for each user requirement. With those kinds of questions, the assessment defines whether each user requirement is dealt with and how it is addressed.

The result of the validation shows that the proposed workflow of maintenance of cadastral data, based on LADM converges into steps and procedures, that accelerate process time and reduces fee/cost. The result of the simulation shows that the proposed workflow can realise valid and up-to-date data and information and traceable documents. Therefore, the implementation of LADM Indonesian country profile, with this proposed workflow of maintenance of cadastral data, in integrated system is recommended.

Acknowledgements

Table of contents

List of figures

List of tables

List of acronyms, special terms and abbreviations

.NET	:	a software component that is a part of several Microsoft Windows operating
Administrator	:	Land officer who has responsibility in IT/computerized system
Bakosurtanal	:	National Coordinating Agency for Surveys and Mapping
BAL	:	Basic Agrarian Law
BPHTB	:	Tax on Acquisition of Land and Building
BT	:	Copy of Land Certificate
CAD	:	Computer Aid Design
Counter 2	:	Front office staff who has responsibility to receives and checks document
Counter 3	:	Front office staff who has responsibility to receives the payment
Counter 4	:	Front office staff who has responsibility to give and send product
DI203	:	The list of registered land
FGDC	:	Federal Geodetic Data Committee
GCP	:	Geodetic Control Point
GPS	:	Global Positioning System
GU	:	Field Sketch
HoLLO	:	Head of Land Local Office (First Officer)
HTTP	:	Hypertext Transfer Protocol
ISO	:	International Organization for Standard
IT	:	Information Technology
IPPT	:	Land use permit
JAVA	:	Name of programming language developed by Sun Microsystems
Kasubsi	:	Third Officer
Kasi	:	Second Officer
Kabupaten	:	Regency
Kecamatan	:	Sub-district
Kelurahan	:	Village
Kotamadya	:	City
LADM	:	Land Administration Domain Model
LAS	:	Land Administration System
LOC phase 2B	:	Land Office Computerize phase 2B
NIB	:	Parcel Number Identification
NIH	:	Right Number Identification
NLA / BPN	:	National Land Agency / Badan Pertanahan National
OGC	:	Open Geospatial Consortium
PB	:	Parcel Map
PGT	:	Management of Land Use Section
PHI	:	Register of Right Section
PHP	:	PHP: Hypertext Preprocessor
PNBP	:	Tariff for Type of Non Tax State Revenue
PPAT	:	Notary / Pejabat Pembuat Akta tanah
PPK	:	Staff of Survey and Mapping
P&PT	:	Register of Land Section

RRR	:	Right, Restriction, Responsibility
RTRK	:	Technical Plan of Municipal Space / Rencana Tehnik Ruang Kota
RTRW		Area Land Plan / Rencana Tata Ruang Wilayah
RDTRK		Detailed Municipal Land Plan / Rencana Detail Tata Ruang Kota
SOAP	:	Simple Object Access Protocol
STTD	:	Receipt of Document
SPS	:	Request/bill for payment / invoice
SPOPP	:	The Standard Operational Procedure
SQL	:	Structure Query Language
SU	:	Letter of measurement survey
UML	:	Unified Modelling Language
TM3	:	Transverse Mercator 3°
XML	:	Extensible Markup Language

1. Introduction

1.1. Background

Profile of Indonesia

Indonesia is a large archipelagic country of more than 17000 islands of which about 6,000 are inhabited. The five main islands are Sumatera, Kalimantan, Java, Sulawesi, and West Papua. Sumarto, *et al.,* (2008) declares that total area of Indonesia is about 9.8 million km^2 that are consists of land mass area of 1.9 million km^2 (20 per cent of total area) and marine area of 7.9 million km^2 (80 per cent of the total area)—including the exclusive economic zone. Administratively, the country comprises of 33 provinces, 349 districts and 91 cities. In 2009 Indonesian population was estimated to be 231 million. Density is uneven with most people in Java (58 per cent). Average population density is 1.21 people per km^2, but it reaches 134.16 people per km^2 of land area in Java island (Winoto, 2009).

As an agrarian country, the important resource for Indonesia is land. Land-based economy has given significant contribution to the prosperity of the society. Therefore the government gives serious attention to land development and management. Badan Pertanahan Nasional (National Land Agency) of Republic Indonesia as government institution has a mandate to develop and manage the land for welfare of the people.

Maintenance of cadastral data in Indonesia

Badan Pertanahan Nasional (BPN, the National Land Agency) of Indonesia has 21 functions and 11 policies in order to build land administration system. Some of these functions and policies are:

- to manage all data and information related to land
- to build a data base of land ownership in a large scale; and
- to build National Land Management and Information System, and document security system nationally.

According to those functions and policies, BPN has a big responsibility to provide up-to-date cadastral data. It is related to the maintenance process of cadastral data.

Winoto (2009) mentioned that new infrastructures that support reform of BPN are essential, including large scale land mapping, a land ownership database for spatial and textual data, a national land management information system and a land document security system. Winoto (2009) also stated that building and improving land mapping and land information system will lead to process of establishing spatial data and latest information to support services conducted by BPN. To let better access and up-to-date data, land maps and other information should be managed within a computerized land information system.

In Indonesia, BPN local offices conduct process of updating and maintaining cadastral data with supports from central and province offices. Nevertheless, in fact the conditions of maintenance of cadastral data in Indonesia are still far from the objectives. Some of maintenance processes are still being conducted with manually processes because of no standard process of maintenance data, using

of various software for maintenance, no infrastructure (especially in local offices), limited human resources, high cost in managing cadastral data, and no centralized database.

Manual systems however will be replaced by digital systems because of its lack of data security, difficulties in maintaining/updating data, inefficient in terms of data storage, slower information extraction, and an increased workload for land administration services (Ary Sucaya, 2009). Taking experiences from disastrous Tsunami in Aceh on 2004, Winoto (2005) urges the utilization of digital information technology to back up all land data and information.

1.2. Problem statement

With the existing condition of the maintenance of cadastral data in Indonesia as mentioned above, BPN is the national agency responsible for the provision of cadastral data to all local governments in Indonesia. As an organization with limited human resources to deal with a vast amount of cadastral data, BPN needs a solution to both support and speed up their cadastral data processing and maintenance.

As part of the cadastral data, BPN's line mapping did not meet the high data quality standards required by their stakeholders, meaning that for five years BPN has not been able to provide completely accurate line mapping services to local government departments. The manual correction of errors such as common geometric problems with spikes, gaps and overlaps within the line mapping data proved that it is very difficult for BPN due to lack of available human resources. The manual data cleaning process was very time consuming, meaning that the limited BPN staffs performing data cleanup, were not able to work on other more significant projects. This problem was compounded by the fact that the data was previously stored within various flat file formats, and it was so difficult to manage and maintain.

BPN is currently in the early stages of migrating their existing spatial data to an Oracle Spatial Database (Relational Database Management System–RDBMS) from the existing flat file based system. BPN has a large amount of 'unclean' data; approximately 30,000 map sheets with few human resources to process and manage the data quality improvement. The migration to a central Oracle Database 10g will provide a robust and scalable repository, enable data sharing between departments, but at the same time highlights a need for improved data quality to support the dependant processes across all departments.

Based on those conditions it is necessary to design the standard model of workflow of maintenance cadastral data as based on LADM as the standard data model which has been standardized and proved to be valid for Indonesia.

1.3. Research objectives

The main objective of this research is to design the workflow for the maintenance of cadastral data based on standardized LADM in Indonesia which has so many various LAS. The workflow of maintenance of cadastral data is expected to become the most proper model to be implemented in land

administration system that can accommodate user requirements in land administration system. In addition to this objective, the benefits from this research are as follows:

1. With the workflow of maintenance of cadastral data based on LADM, BPN can provide high quality cadastral data to their customers with a high level of confidence in the accuracy of its data.
2. With the workflow of maintenance of cadastral data based on LADM, BPN also can provide actual and transparent of data and information that also can be used to support decision-making process to improve the development of LAS in Indonesia.
3. The workflow can be treated as a technique that is used for maintaining cadastral data which are processes that have obstacles regarding to cost and limited human resources.
4. The workflow can be treated as a supporting consideration for BPN in further developing system, especially system of maintenance of cadastral data.

1.4. Research questions

Based on the problem statement, research questions of this study can be stated as follows:

1. What are the user requirements for the maintenance process of cadastral data?
2. Who has the responsibility to maintain cadastral data based on Land Administration Domain Model (LADM)?
3. What is the workflow of maintenance of cadastral data based on LADM?
4. How is the validation method for the proposed workflow of maintenance of cadastral data as based on LADM?
5. What are the conditions that should be prepared in implementation of the proposed workflow of maintenance of cadastral data?

1.5. Thesis structure

Chapter 1 : Introduction
This chapter defines research background, problem statement, research objectives, research questions and thesis structure.

Chapter 2 : Literature review
This chapter defines the context of literature about land administration, cadastral system including cadastre, components of cadastral system, cadastral data, editing and maintaining cadastral data, transaction of data and the strategic way to maintain cadastral data. It also reviews literatures regarding to Land Administration Domain Model, Cadastre 2014 and Unified Modelling Language

Chapter 3 : Research Methodology
In this chapter, the methodology applied in this research is described. In the beginning the description of study area is presented followed by a description about the unit analysis. Then the methods of collecting primary and secondary data are presented.

Chapter 4 : Land Administration System in Indonesia

This chapter presents about land administration system in Indonesia which is described in historical background, the legal framework (State Constitution, Basic Agrarian Law, Government Rule and Regulations) and about existing subdivision process in Indonesia.

Chapter 5 : Data Analysis

In this chapter, analyses about the results of online and mail survey about subdivision process in Indonesia are presented. Many aspects are discussed; also the results of the open questions about suggestions and obstacles perceived during the subdivision process are defined. Finally the user requirements are concluded.

Chapter 6 : The Design, Validation and Conditions for Implementation of The Workflow

In this chapter, it is identified the classes and attributes through the existing subdivision process with aim to define the relation between the activities in subdivision process and classes or attributes in LADM data model, especially in the LADM Indonesia Country Profile. User requirements are discussed in order to have the overview about LADM that can accomplish the user requirements with some ideas. As based on those ideas, some classes and attributes in LADM are added.

The proposed workflow of maintenance of cadastral data as based on LADM Indonesia country profile and user requirements using certain idea is designed. The suggestion classes and attribute that already implemented in proposed workflow are validated by using the Assessment Questions and simulated with a demonstration of the maintenance database in case of subdivision process. The conditions for implementation of the proposed workflow are presented. Finally, conclusion is described.

Chapter 7 : Conclusion and Recommendations

This chapter defines the conclusion from the study and some recommendations for further research.

2. Literature review

This chapter reviews some literatures regarding the basic concepts of cadastral system with details about cadastral data, process edit and maintain data, transaction cadastral of data, the strategic way to maintain data. It also reviews about archiving data, land administration with its model, the Unified Modelling Language and the research framework.

In Section 2.1, the concept about cadastral system is provided. In Section 2.2, the concept about land administration is reviewed and its models are described n Section 2.3. Brief review of literature about Unified Modelling Language and activity diagram are presented in Section 2.4. Based on the background, literature review and referring the purpose and methodology of the study, it is also designed the framework of this research in Section 2.5. In the end of this chapter a conclusion of a whole chapter is presented in Section 2.6.

2.1. Cadastral System

The literature and the models presented often use the terminology of cadastre, cadastral systems, cadastral data interchangeably. It is not always sufficiently clear whether the authors are referring to the entire cadastral system or specific cadastral components (Effenberg, 2001).

Therefore it makes sense to talk about cadastral systems or cadastral infrastructures rather than just a cadastre. These systems or infrastructures include the interaction between the identification of land parcels, the registration of land rights, the valuation and taxation of land and property, and the present and possible future use of land (Enemark, 2005a).

2.1.1. Cadastre

However, the concept of "cadastre" is relatively difficult to identify. It may be designed in many different ways, depending on the origin, history and cultural development of the country or jurisdiction. Therefore it makes sense to talk about cadastral systems or cadastral infrastructures rather than just a cadastre. These systems or infrastructures include the interaction between the identification of land parcels, the registration of land rights, the valuation and taxation of land and property, and the present and possible future use of land (Enemark, 2005a).

The cadastre is most simply described as a methodically arranged public inventory of data concerning properties within a jurisdiction, based on a survey of their boundaries (Henssen, 1995). From a database perspective, this is a land information system where information is referenced to unique, well-defined units of land, normally referred to as land parcels. The outlines of these land parcels are normally shown on large scale maps, are linked to textual land title registers and provide a spatial reference for other spatial or aspatial, parcel related data (Effenberg, 2001).

Basically, a cadastre is just a record that identifies the individual land parcels/properties. The purpose of this identification may be taxation (as was the original reason for establishing the European cadastres) or it may be security of land rights (as was the case in Australia). Today, most cadastral registers around the world are linked to both land valuation/taxation and to the securing of legal rights in land (Enemark, 2003).

More specifically the International Federation of Surveyors (FIG) published statement on the cadastre (FIG, 1995) defines the cadastre as:

> *"A Cadastre is normally a parcel based and up-to-date land information system containing a record of interests in the land (e.g. rights, restriction and responsibilities). It usually includes a geometric description of land parcels linked to other records describing the nature of the interests, and often the value of the parcel and its improvements."*

A Cadastre may be established for fiscal purposes (valuation and taxation), legal purposes (conveyancing), to assist in the management of land and land-use control (planning and administration), and enables sustainable development and environmental improvement" (Enemark, 2003).

The cadastre is an information system consisting of two parts: a series of maps or plans showing the size and location of all land parcel together with text records that describe the attributes of the land. It is distinguished from a land registration system in that the latter is exclusively concerned with ownership (United Nations Economic Commision for Europe, 1996).

2.1.2. Cadastral System (Process/Activities and Data)

The cadastral process of any country can be viewed as a system; in fact the literature inevitably refers to a jurisdiction's cadastre as a cadastral system. These cadastral systems are depicted as having textual and spatial information; a geometric description of the land parcels, linked to the textual records or registers describing the nature of interests and ownership of the land parcel (Effenberg, 2001).

The role and purpose of cadastral systems is shown in Figure 2-1 below (Enemark 2004 in (Enemark, 2005b)).

Throughout the world different organisations of cadastral systems are apparent, especially with regard to the land registration component. Basically, two types of systems can be identified: the deeds system and the title system. The differences between the two concepts relate to the extent of involvement of the state, and to the cultural development and judicial setting of the country. The key difference is found in whether only the transaction is recorded (deeds systems) or the title itself is recorded and secured (title systems). Deeds systems provide a register of owners focusing on "who owns what" while title systems register properties presenting "what is owned by whom". The cultural and judicial aspects relate to whether a country is based on Roman law (deeds systems) or Germanic or common-Anglo law (title systems). This of course also relates to the history of colonization (Enemark, 2005a).
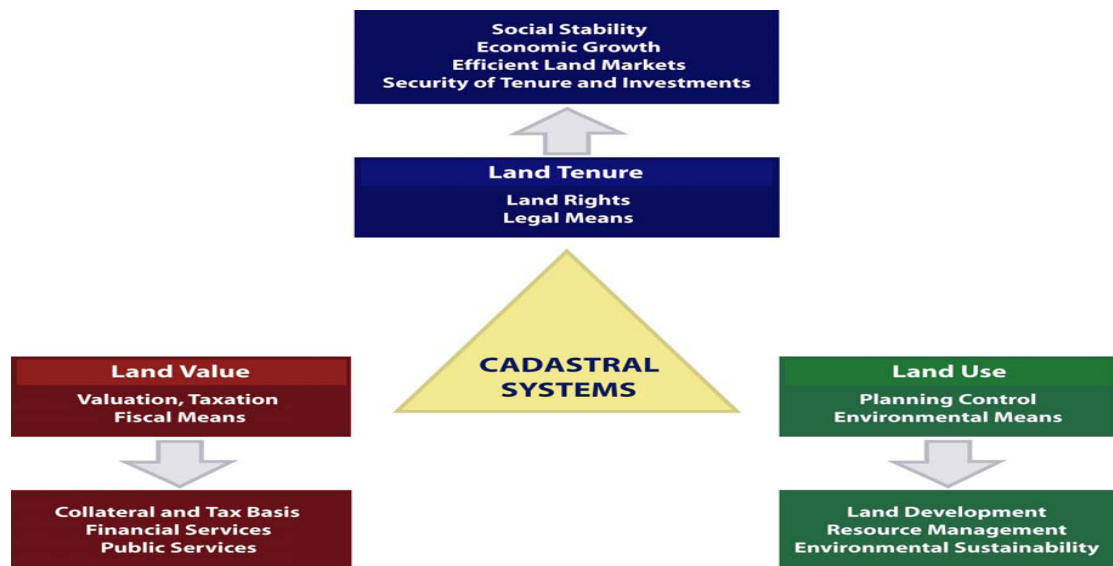
Figure 2-1 Cadastral systems facilitate administration of three main areas: Land Tenure, Land Value and Land Use (Enemark, 2005b**)**

Deeds registration is rooted in Roman culture and is, therefore, common in Latin cultures in Europe (France, Spain, Italy, Benelux), in South America, and parts of Asia and Africa which were influenced by these cultures. The concept is also used in most of the United States. Deeds systems are found in different forms, with significant variations in the role of cadastral identification and surveyors (Enemark, 2005a).

Title registration originated in the German culture and is found in central European countries (Germany, Austria, Switzerland). Different versions of the German system are found in Eastern European and Nordic countries. The various versions relate to the use of the property concept and the organization of the cadastral process including the use and the role of private licensed surveyors. A special version of the title system is found in UK, where the concept of general boundaries is used to identify the land parcels on the large scale topographic map series (Enemark, 2005a).

Effenberg (2001) states that the cadastre has the components of register and maps. The FIG statement on the Cadastre (FIG, 1995) describes a cadastral system as containing a record of legal interest in a land parcel and a geometric description of that land parcel. Eden (1988) describes these two components of a cadastral system using the terminology of spatial data, and textual data.

In defining the domain of cadastral systems, Henssen (1995) uses the term land recording to describe the two complimentary components of land register and the cadastral map in (Effenberg, 2001).

The register of parcel information contains amongst other textual data the property number, the area, and plot details if the parcel consists of more than one plot (Effenberg, 2001).

Cadastral systems around the world tend to be categorised according to their method of land title registration. Henssen (1995) defines land registration as the process of officially recording rights in land through deeds or as title on property. Based on this definition, Henssen gives an arbitrary

classification of cadastral systems based on the differences in the laws relating to land registration and the subsequent spatial cadastral information that supports these land registration laws.

Henssen (1995) cites three land registration groups as listed below. Not surprisingly the method of land registration will impact on the supporting or resultant spatial cadastral product. The spatial data generally associated with each group is included in the following land registration grouping:

- The English Group: England, Ireland, Nigeria. This group makes use of large scale topographic maps to assist where necessary with the textual description of the property consistent with General Boundaries.
- The Torrens Group: Australia, New Zealand, some parts of Canada and the USA, Morocco, Tunisia and Syria. In the land registration process individual or island surveys of the parcels or subdivisions are utilised without the specific requirement for a map. Cadastral maps are however utilised for charting and indexing purposes.
- The German/Swiss Group: Germany, Switzerland, Austria, Sweden, Denmark, Alsace-Lorraine, Egypt, Turkey Thailand and Korea. These have the parcel based cadastral maps as an inherent component of the cadastral system.

Henssen (1995) makes the point that these groups have the same land registration principles but differ mainly in procedure. This procedural difference is significantly demonstrated by the difference in the associated spatial cadastral data. In addition Williamson and Hunter (1996) have differentiated spatial cadastral data on the basis of accuracy and level of integration of the spatial data with the jurisdiction's entire cadastral system. This means that a classification of cadastral maps cannot be based solely on the land registration grouping, since there is a variation in the accuracy of the map within each of the land registration groups listed above.

The data must be collected, stored, maintained and updated economically and efficiently. Data should be registered only once, kept up-to-date in one place (the most suitable institution) and offered for public use (United Nations Economic Commission for Europe, 1996).

2.1.3. Cadastral Data

The core of cadastral domain models developed in the European context include (Van Der Molen, *et al.,* 2004) :

- The subject: personal or group ownership with non-defined membership
- The rights: the recognition of types of non-formal and informal rights
- The object: units other than accurate and established parcels.

Cadastral data refer to these three components above. Cadastral systems include items such as data modelling, database design, data capture, data exchange, and data catalogue (Roux, 2004). Cadastral data must be able to be updated and kept current (FGDC Subcommitee, 2004). Cadastral data models reveal nowadays that three main data elements are included: land parcels (spatial units), rights (with restrictions and responsibilities) and persons (parties) (Kalantari, *et al.,*2006); (ISO TC 211 N, 2009a).

2.1.4. Editing and Maintaining of Cadastral Data

The availability of a complete, reliable and up to date land administration system is a necessary condition in order to make land transactions possible, for transparency of government, for

environmental protection, and it enhances the taking of credit and mortgages which in turn promotes investment and development, while reducing disputes related to land and results in improving human relationships with a reduction of legal action in courtroom. Land taxes can be collected on a fairer basis. Public control and measures related to land policies and land use planning can be more effective, and support emergency response. Conversely the lack of well maintained data causes additional expenses for society, as there will be more land disputes. Maintenance/maintaining and updating are parts of land administration services that should be organized efficiently and at low cost. Users can rely on cadastral data if it is well maintained and supplying reliable data is critical also (ArcGIS 9.2 Desktop Help, 2008c).

In ArcSDE term of cadastral database is mentioned as geodatabase. A geo database stores geographic data organized in datasets. A geo database can maintain both spatial and non spatial data. Examples of the types of datasets that may be maintained in a cadastral database include object and feature classes, relationship classes, topologies, networks, terrains, raster datasets and raster catalogs. An ArcSDE geo database stores data in a relational database and utilizes the capabilities of the relational database to support storage of large datasets and efficient multiuser access to data. A typical life cycle for an ArcSDE geo database involves the following steps:

- Geo database design
- Geo database creation
- Initial data loading
  During this phase, data are loaded for an area of interest. The data being loaded can come from existing corporate databases, existing map libraries, or may be purchased.
- Editing and data maintenance/maintaining
  During this phase, existing data are modified and new data is added to the database as required. Edits are made against the database corresponding to application-defined units of work or transactions such as the addition of a new sewer or an update to a parcel boundary (ArcGIS 9.2 Desktop Help, 2008c).

The editing and data maintenance phase can also include incremental data loading, which further expands the boundaries of the database. Such incremental data loading may occur when a company acquires new territories or when the spatial extent of a study area expands. Examples of changes that might be made to a geo database during editing and data maintenance include:

- Updating the address of a customer in a utility database
- Subdividing a parcel to reflect a sale in a cadastral database
- Adding a service to a new customer in a utility database
- Updating a forest block to reflect a planned cutting operation
- Designing a new substation in a utility database
- Checking out a section of a utility database, modifying it in the field to reflect storm-related damage, and checking the work back in to the central database
- Planning a new subdivision in a land planning database
- Performing a what-if scenario for a disaster recovery simulation (ArcGIS 9.2 Desktop Help, 2008c).

Each of the above changes corresponds to an application-defined unit of work or transaction that is performed against a geodatabase.

2.1.5. Transactions of Cadastral Data

What is a transaction?

A transaction is an application-defined unit of work performed against a database. A transaction starts, modifications are made against the database, then the transaction is committed or rolled back. Once the transaction is committed, the changes made by the transaction become visible to other users and applications.

Transactions have the following standard "ACID" properties on which users and applications have come to rely:

- **A**tomic—A transaction exhibits "all or nothing" behavior. If it is committed, all of its changes apply to the database. If it is rolled back, none of its changes apply.
- **C**onsistent—A transaction leaves the database in a consistent state.
- **I**solation—A transaction can isolate its changes from other transactions until it commits them. Other users do not see the work internal to the transaction while it is in progress.
- **D**urable—Once a transaction commits, its results are persistent (AcGIS 9.2 Desktop Help, 2008d)

To achieve these properties, Database Management System (DBMSs) use a variety of locking mechanisms to ensure that multiple concurrent transactions are shielded or isolated from each other.

2.1.6. Data Maintenance Strategic With ArcGIS

Transactions against geographic data can vary widely in duration and complexity. The geo-database supports two data maintenance strategies—maintenance with and without versions—which balance the needs of users and applications to perform short and long transactions on data that are simple or complex. Each strategy can be applied on a feature class-by-feature class or table-by-table basis, so it is possible to make use of both of them in the same geo-database.

The way of data editing in each of these strategies is similar—data are edited within an edit session and worked with many of the same tools. What differs is how the underlying data sources are maintained. There are also some differences in which data can be edited and the type of workflows that can be performed. This topic explains these differences.

Data maintenance without versions

This strategy does not involve working with multiple versions—it simply makes use of the underlying DBMS transaction model. Non-versioned edits are equivalent to standard database transactions. To edit data, the steps are enabling non-versioned editing from the Editor Options dialog box, starting an edit session, and performing the required operations, such as adding, deleting, or moving features and updating attributes. The first edit in the edit session begins the transaction. When it is saved, the individual edit operations then are performed committing to the database as a single transaction. After saving, the next edit begins a new transaction. This editing can be saved as few or as many operations at a time as required during the edit session, though frequent saving is recommended to avoid locking the data that means that blocking other users from accessing or editing the data. Once saved, the changes are available to all other users and applications accessing the data.

If this editing process does not want to commit to the database, it needs to stop editing without saving. All the edits in that transaction—all edits since the last save or, if this editing process do not yet saved, all edits since the edit session began—will be rolled back and will not be committed to the database.
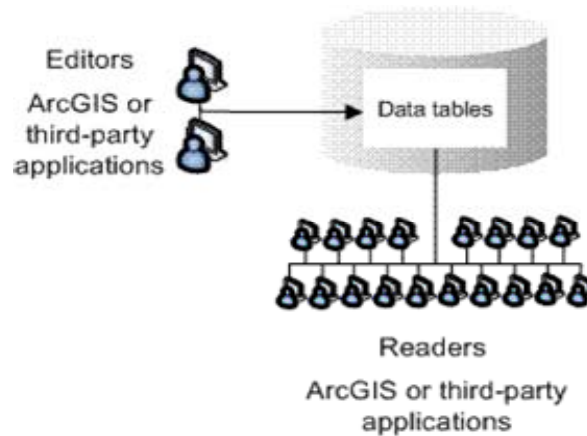
Figure 2-2 ArcSDE Data Maintenance without Version (AcGIS 9.2 Desktop Help, 2008a)

As being edited, any unique indexes, constraints, and triggers defined on the data with the DBMS apply. All of the same locking behaviour applies as if transactions on the data with the DBMS were being performed directly. Therefore, there is the potential for users or applications that access or modify the same data to block one another.

Data maintenance with versions

The geodatabase extends the standard DBMS transaction by allowing multiple concurrent states of the databases, known as versions, to exist at the same time. Each version can represent ongoing work, such as a design or a group of work orders, work that can span multiple connections to the database and extend over a period of weeks or months if necessary. Versions allow to manage past, present, and proposed changes to the data—all in the same geodatabase.

To manage current changes, editors can modify their private version of the geo-database so that other users cannot see incomplete work. When editing a version of the data, one should not apply locks. Therefore, it is suggested to maximize concurrency because other users can read and edit the same data that modified; one also should not block one another from accessing the database. Once an editor has finished his or her changes, he or she can integrate them into the published version.

To manage proposed changes, the editor can develop a scenario or perform a what-if analysis within a version of the database. The scenario can be managed as a single unit of change, spanning multiple edit sessions and days, weeks, or months. The editor can freely add proposed features, perform geographic analysis, and produce maps—all without affecting the database other users are accessing. Once the changes are complete and have been approved, then they have to be integrated into the rest of the geo-database.
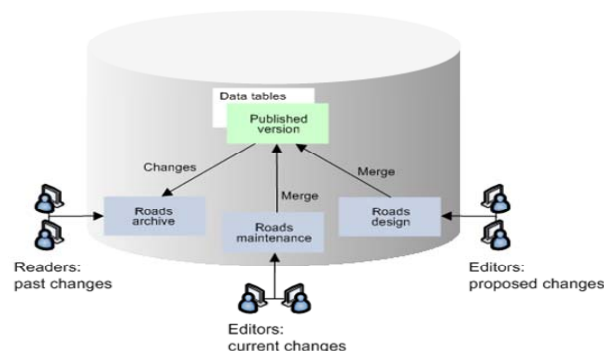
Figure 2-3 ArcSDE Data Maintenance with Version (AcGIS 9.2 Desktop Help, 2008a)

There is no limit to the number of versions a geodatabase can have. Versions can be arranged in various configurations and support a wide variety of workflows.

To support these capabilities, ArcGIS does not duplicate data. Instead, it leaves each feature class and table in its original format but records any changes in tables known as delta tables. Delta tables consist of an adds table for inserts and updates and a deletes table for deletes. Each time a record is updated or deleted in any version, rows are added to one or both of these tables. When the editor query or display a feature class or table in a version, ArcGIS assembles the relevant rows from the delta tables and the original table to present a seamless view of the data.

Versioned tables require periodic maintenance by a database administrator. As a geodatabase is edited over time, delta tables increase in size, affecting display and query performance. To maintain performance, the database administrator can periodically compress a versioned database, an operation that removes redundant information from the delta tables. Versioned databases should be compressed whenever a period of high database activity has ended, for example, at the end of a shift or after loading new data. The compression process can be run while other users are connected and using the database .
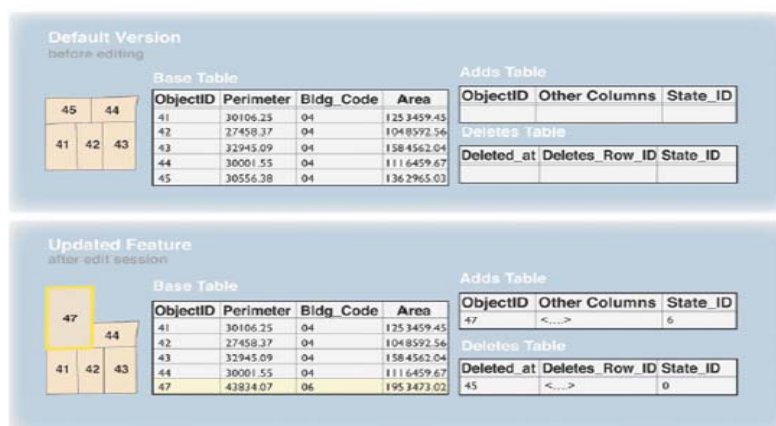
**Figure 2-4 Schema of the record of ArcGIS database before and after editing process
(AcGIS 9.2 Desktop Help, 2008a)**

ArcGIS can manage the underlying delta tables that support versions in one of two ways:

- By saving all changes, regardless of what version, to the delta tables
- By saving all non-DEFAULT version edits to the delta tables but saving all DEFAULT version edits to the base tables

The first way is designed to support ArcGIS applications exclusively. The second way is useful if editor needs to maintain the data with both ArcGIS and third-party applications.

2.1.7. Archiving Data With ArcGIS

Archiving in ArcGIS provides the functionality to record and access changes made to all or a subset of data in a versioned geodatabase. Geodatabase archiving is the mechanism for capturing, managing and analyzing data change. Organizations need to preserve the changes made to their data in order to answer common questions, such as:

- What was the value for a specific attribute at a certain moment?
- How has a particular feature or row changed through time?
- How has a spatial area evolved over time? (AcGIS 9.2 Desktop Help, 2008b).

Geodatabase archiving assists the organization in answering these types of questions by preserving data changes. It is important to understand that geodatabase archiving maintains change from the moment archiving is enabled until archiving is disabled (AcGIS 9.2 Desktop Help, 2008b).

Previous geodatabase archiving solutions relied on the creation of versions to capture historical snapshots of the entire database. However, once the data is unversioned or the version deleted, the historical representation of the data is lost (AcGIS 9.2 Desktop Help, 2008b).

Geodatabase archiving introduces an historical version in addition to the existing transactional version. Users connect to either a transactional version or an historical version. A transactional version allows users to edit the data. An historical version represents the data at a specific moment in time and provides a read-only representation of the geodatabase. One can connect to an historical version using an existing historical marker or a specified moment. An historical marker is a named moment in time that you create, for example 'Completion of Subdivision 158' referencing the date '2:13 PM July 11, 2006' (AcGIS 9.2 Desktop Help, 2008b).

The archiving model supports the complete geodatabase data model. Standalone feature classes, feature datasets, tables, relationship classes, networks, topologies and terrains can all participate in archiving. Archiving requires the data to be registered as versioned. Once archiving is enabled, all changes saved or posted to the DEFAULT version are maintained in the corresponding archive class. The archive class is a complete copy of the archive enabled class plus all of the edits that have been saved or posted to the DEFAULT version (AcGIS 9.2 Desktop Help, 2008b).

Tools available in ArcGIS offer users the ability to easily investigate change to the data. The History Viewer tool allows users to quickly navigate to specific moments in time for displaying how the data appeared at that moment. Additionally, adding the archive class directly to ArcMap allows users to perform queries to explore how the data has evolved over time. For example, view all the edits that have occurred to a specific road between Jan 18, 2006 and July 1, 2006.

2.2.   Land Administration

Land administration is related to land management. These two concepts are often used interrelated and sometimes interchangeably. Some authors/writers put land administration as a process in implementing land management while others state the former as a series of activities of the latter. Land administration is also described as a tool of land management.

Land management is the process by which the resources of land are put into good effect. It covers all activities concerned with the management of land as a resource both from an environmental and from an economic perspective. It can include farming, mineral extraction, property and estate management, and the physical planning of towns and the countryside. It embraces such matters as : (1) property conveyancing, including decisions on mortgages and investment; (2) property assessment and valuation; (3) the development and management of utilities and services; (4) the management of land resources such as forestry, soils, or agriculture; (5) the formation and implementation of land-use policies; (6) environmental impact assessment; and 97) the monitoring of all activities on land that affect the best use of that land (United Nations Economic Commission for Europe, 1996, p. 5).

Land management encompasses all activities associated with the management of land and natural resources that are required to achieve sustainable development. The concept of land includes properties and natural resources and thereby encompasses the total natural and build environment (Enemark, 2005b).

The organisational structures for land management differ widely between countries and regions throughout the world and reflect local cultural and judicial settings. The institutional arrangements may change over time to better support the implementation of land policies and good governance. Within this country context, the land management activities may be described by the three components: land policies, land information infrastructures, and land administration functions in support of sustainable development. This land management paradigm is presented in Figure 2-5 below in (Enemark, 2005b).

The operational component of the land management paradigm is the range of land administration functions that ensure proper management of rights, restrictions, responsibilities and risks in relation to property, land and natural resources. These functions include the areas of land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and land development (implementing utilities, infrastructure and construction planning) (Enemark, 2005b).

Figure 2-5 Land management paradigm (Enemark, 2005b)

The land administration functions are based on and are facilitated by appropriate land information infrastructures that include cadastral and topographic datasets and provide access to complete and up-to-date information about the built and natural environment (Enemark, 2005b).

Land administration is the process of determining, recording and disseminating information on the ownership, value and use of land when implementing land management policies (United Nations Economic Commision for Europe, 1996). There are other definitions of 'land administration', mainly caused by a different understanding of the word 'administration'. Therefore 'land administration' is sometimes understood as the administration (management) of land, like '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 land' (Dale and Mclaughlin, 2000) (Van Der Molen, 2002).

The implementation of a land policy (e.g. by land management activities) will be a joint responsibility of private and public parties; however, it is the government's task to set a binding framework: 'the rules of the game' (Van Der Molen, 2002).

This puts an emphasis on institutional matters, such as the adoption and enforcement of laws and the organisation of the public sector, preferably based on the concepts of the 'rule of law' and 'good governance'. A government normally has quite a few instruments for implementing land policy, the most important of which are: (1) providing security of land tenure and security of credit; (2) regulating for the land market; (3) urban and rural planning development and maintenance; and (4) land taxation (Van Der Molen, 2002).

This is where land administration comes in. Land administration is to be seen as a tool for facilitating these land management instruments. That means that when the definition of 'land administration' refers to '... implementing land management policies', land administration is not synonymous with land management. In our view, however, land management, being 'the management of all aspects of land including the formation of a land policy' (Dale and Mclaughlin, 2000) forms a context for land administration. In consequence, the private and public parties involved in land policy and land management are the users of information on ownership, value and use as it is determined, recorded and disseminated by the organizations responsible for land administration (Van Der Molen, 2002).

Land administration, defined as the process of determining, recording and disseminating information on the ownership, value and use of land when implementing land management policy, provides security of tenure. That is to say, only under certain conditions. Case studies show that land administration systems are to fail if they are not supported by an appropriate institutional framework, which is effectively enforced. The benefits of good land administration can only be realised in a context of effective (land) law making processes, mechanisms for mobilising public support, effectiveness of the public administration, effectiveness of enforcement of the law, and the existence of appeal procedures. Not to mention the need for a concerted development of society: after all, what is the benefit of a title to land if you cannot use your title as collateral for a mortgage because of the lack of a formal credit system? Why issue a title when at the same time a moratorium is valid for land transfer? (Lemmen and Van Oosterom, 2001).

That makes the nature of land administration systems so different from all other kind of information systems. Thinking about land administration systems is equivalent to thinking about the `rule of law', `good governance', institutional matters like land tenure systems, development policy, land markets, planning and development, management of the environment, history and culture of people! This is especially true in countries with a post-colonial situation, which face the existence of all kinds of indigenous tenure and western individualised tenure in an overlapping and competing relationship, these issues represent a thrilling challenge (Lemmen and Van Oosterom, 2001).

Land administration systems, and particularly their core cadastral components, are important infrastructure, which facilitate the implementation of land policies in both developed and developing countries. Land administration system are concerned with the social, legal, economic and technical framework within which land managers and administrators must operate (United Nations Economic Commission for Europe, 1996). These systems support efficient land markets and are, at the same time, concerned with the administration of land as a natural resource to ensure its sustainable development (Enemark, 2005b). This global approach to modern land administration systems is shown in Figure 2.6 below.
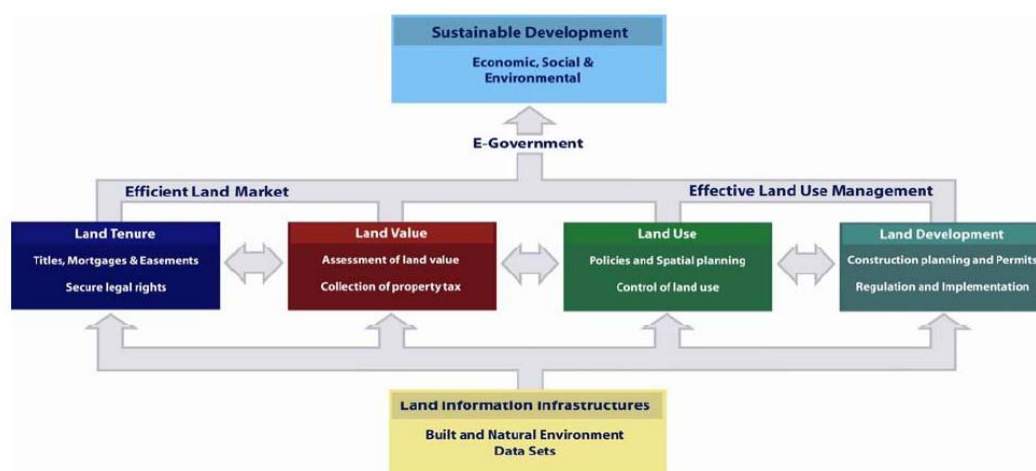
Figure 2-6 A Global Land Administration Perspective (Enemark, 2005b)

2.3. Models of Land Administration

There are many efforts to provide good quality of land administration system and in order to successful implementation of land administration all over the world with guidelines and some models such as the Land Administration Guidelines (United Nations Economic Commision for Europe, 1996), The Cadastre 2014 (Kaufmann and Steudler, 1998) and The Core Cadastral Domain Model (Van Oosterom, *et al.,* 2006).

2.3.1. Land Administration Domain Model

The Core Cadastral Domain Model (CCDM) which is now called Land Administration Domain Model (LADM) was introduced to provide a reference model for the land administration domain. It was submitted to International Organization for Standardization (ISO) and expected to be released in 2011. The Land Administration Domain Model is a revised version of Core Cadastral Domain Model. It has been renamed since the term 'cadastral' was not perceived by everyone to cover both legal administrative and the geometric side whereas the term 'land administration' better covers to full scope of the model (Hespanha, *et al.,* 2008).

The Land Administration Domain Model is submitted as a New Working Item Proposal for International Organization for Standardization (ISO) certification by FIG. The developing/development of this model was started in the year of 2002. In FIG Congress at Washington D.C. in 2002 the first introduction of Core Cadastral Domain Model was launched and series of different versions of this model are published after then. As proposed by Oosterom and Lemmen in version 1.0, Core Cadastral Domain Model contains three mayors of classes that are legal or administrative and person classes, different types of immovable object classes and the geometry, topology and some related packages. In the version 1.1 of Core Cadastral Domain Model some of the sub-classes like natural and non-natural person of the person class, and ShareUnit and IndividualUnit of BuildingUnit have been removed and a new class named legalNetwork is added as specialization of OtherRegisterObject.

Land Administration Domain Model establishes the relationship between person (natural/non natural) and land (object) via right, restriction and responsibility. It is specified in UML class diagrams and how this UML model can be covered into a XML scheme is indicated, which can be used for actual data exchange in the networked society (interoperability) (Van Oosterom, *et al.,* 2006). The purpose of this model is to support an extensible basis for efficient and effective cadastral system based on a model driven architecture and to enable involved parties, both within one country and between different countries, to communicate based on the shared ontology implied by the model (Hespanha, *et al.,* 2008). The investigation of the previous research proved that most of LADM classes, associations, and constraints are valid for Indonesia and LADM also accommodates the user requirements in almost all cases (Ary Sucaya, 2009).

2.3.1.1. Core Classes of LADM

ISO TC 211 N (2009a) describes four classes as core classes of LADM as the following:
- Class LA_Party. Instances of this class are parties (persons or organizations), or group parties (groups of persons or organizations).

- Class LA_RRR. Instances of subclasses of LA_RRR are rights, restrictions or responsibilities.
- Class LA_LAUnit. Instances of this class contain administrative information concerning spatial units with equal rights, restrictions or responsibilities.
- Class LA_SpatialUnit. Instances of this class are spatial units, parcels, subparcels, buildings or networks.
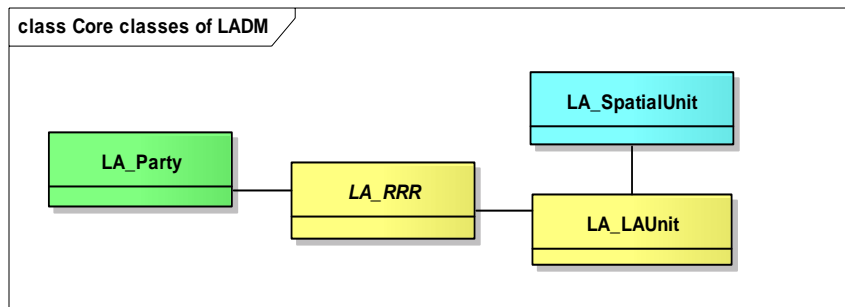
Figure 2-7 The Core Class of LADM (ISO TC 211 N, 2009a)

2.3.1.2. Packages of LADM

ISO TC 211 N (2009a) states that LADM contains five packages. This facilitates the maintenance of different data sets by different organizations. Each package has arranged set of classes that intended to be able to implement LADM by one or more maintenance organizations operating at national, regional or local level. This means the packages are not necessarily implemented as a whole in one organization. It allows different organizations to implement and maintain of each package according to their own responsibilities. Each package is explained as below:

1. Party Package

Party package maintains LA_Party, LA_GroupParty and LA_PartyMember classes. Person can be natural person or non natural person such as company, government organization, foundation, etc. Moreover, two or more natural persons can constitute group of party. LA_GroupMember is an association class of LA_Party and LA_GroupParty class. Each group member hold shared information.
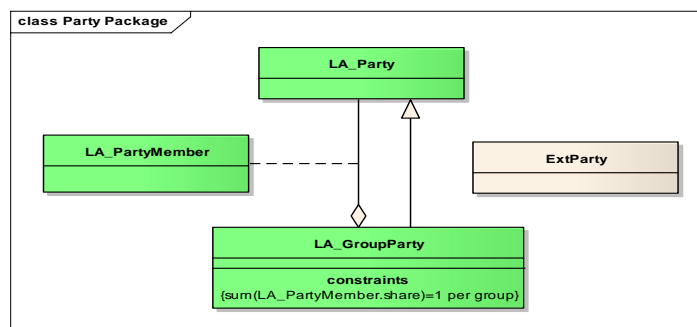
Figure 2-8 Party Package (ISO TC 211 N, 2009a)

2. Administrative Package

This package has the main class which is the abstract class LA_RRR, with its specialization LA_Right (with rights), LA_Restriction (with restrictions) and LA_Responsibility (with responsibilities). The main principle of this package is all the rights, restrictions and responsibilities are based on an administrative source document (from clas LA_AdminSourceDocument). LA_LAUnit class is a launit,

and subject to registration (by law), or recordation (by informal right, or customary right, or another social tenure relationship). And LA_Mortgage is associated to class LA_Right (the right that is the basis of the mortgage).
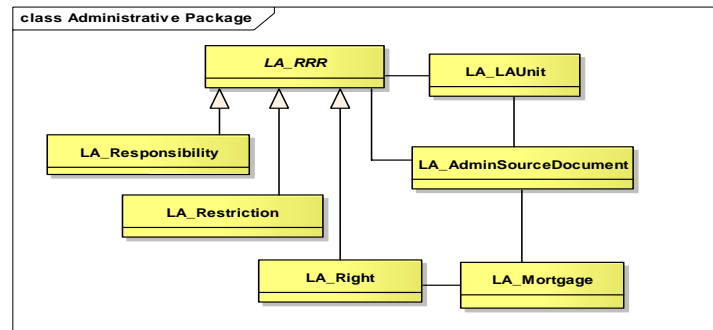
Figure 2-9 Administrative Package (ISO TC 211 N, 2009a)

3. Spatial Unit Package

LA_SpatialUnit is the main class of this package with 2D or 3D spatial units as instances. And LA_SpatialUnit has three subclasses which are: parcels or subparcels; buildings or building units; and networks. Spatial unit set is a group of spatial unit for instance: a municipality and a planning area. Spatial unit set can be a grouping of other spatial unit set. A Level is a collection of spatial unit with a geometrical/topological or thematic coherence and is used for the implementation of the notion of legal independence, for instance a level with rights or restrictions, urban area, rural area and mining area, etc.
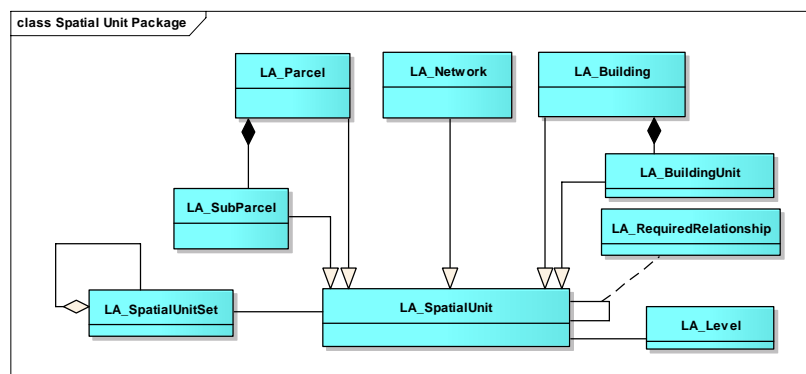
Figure 2-10 Spatial Unit Package (ISO TC 211 N, 2009a)

4. Surveying Package

A spatial source document (from class LA_SpatialSourceDocument) is/are document(s) of a land administration survey, a final or can be a formal document that related to the survey. A set of measurements with observations (distances, bearings, etc.) to points is an attribute of LA_SpatialSourceDocument. The individual source points are instances of class LA_SourcePoint, which is associated to LA_SpatialSourceDocument. A spatial source document may be associated to several source points. One of the attributes of class LA_SourcePoint is 'pointType', which indicates the type of source point—for example this can be a Geodetic Control Point (GCP). Further, there may be reasons for changing coordinates—for example a map revision, or for moving to a different coordinate reference system, or for a new computation of the existing coordinate reference system. Geodetic control points, including multiple coordinates for source points and supporting multiple reference systems, are all supported in LADM.
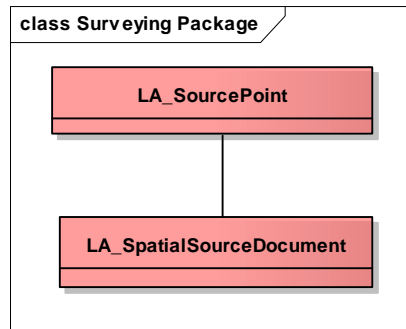
Figure 2-11 Surveying Package (ISO TC 211 N, 2009a)

5. Spatial Description Package

The key concepts of 2D and 3D descriptions of spatial units are face strings and faces. The two classes of this package are LA_FaceString and LA_Face. Coordinates themselves are rooted in source points of the Surveying Package. All types of spatial units share the same description structure. Existing 2D data, whether topologically structured or not, or polygons, or unstructured boundaries, or simply point or textual descriptions, can be included. The model supports the increasing use of 3D descriptions of spatial units, without putting additional burden on the existing 2D descriptions.
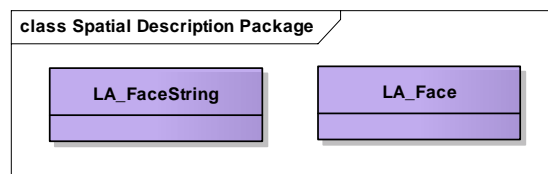
Figure 2-12 Spatial Description Package (ISO TC 211 N, 2009a)

2.3.1.3. Classes of LADM

The LADM class consists of small set of attributes, methods and constraints. LADM allows user-defined elements to be added. Such as additional attributes, operators, associations, or perhaps new classes as based on the need of a specific region or country. In order to make a difference from other ISO classes, LADM classes are given name with LA_ as a prefix. Following are default classes and attributes for LADM:

- LA_Party
- LA_GroupParty
- LA_PartyMember
- LA_RRR
- LA_Right
- LA_Restriction
- LA_Responsibility
- LA_LAUnit
- LA_Mortgage
- LA_AdminSourceDocument
- LA_SpatialUnit
- LA_SpatialUnitSet

- LA_Parcel
- LA_SubParcel
- LA_Building
- LA_BuildingUnit
- LA_Network
- LA_Level
- LA_RequiredRelationship
- LA_SourcePoint
- LA_SpatialSourceDocument
- LA_FaceString
- LA_Face

2.3.1.4. Special Classes and External Classes

1. Versioned Object Class

This class is re-use from ISO 19108. In LADM this class is introduce in order to manage and maintain historical data in database. In this class request that inserted and deleted data are given a *time-stamp* (ISO TC 211 N, 2009a). This class has a function as a *mother* class because all classes in LADM are subclasses of VertionedObject. The attributes of this class are:

- beginLivespandVersion : start time of a specific instant version
- endLivespandVersion : end time of a specific instant version
- quality : quality of specific instance version
- source : source (responsible organization) of specific instance version.
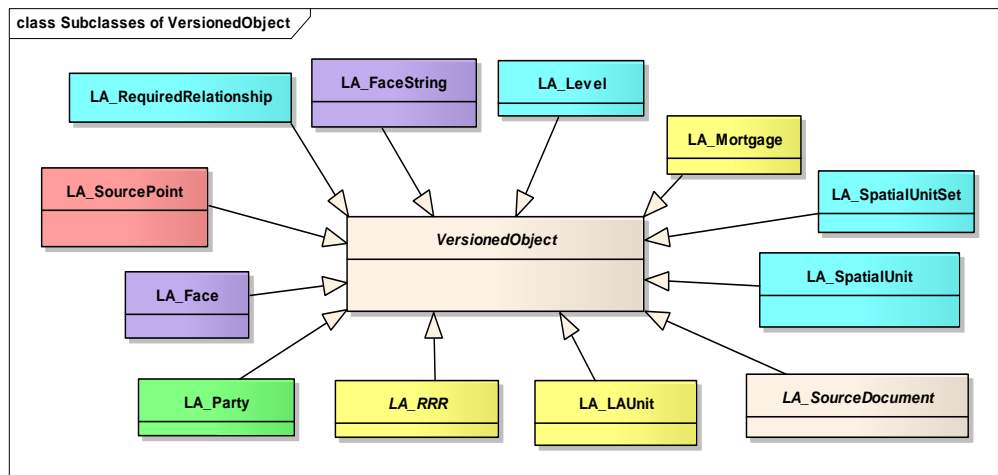
Figure 2-13 Subclasses of VersionedObject (ISO TC 211 N, 2009a)

2. LA_SourceDocument

In LADM, source documents are modelled, starting with an abstract class LA_SourceDocument. An instance of a subclass of class LA_SourceDocument is a source document. The attributes of LA_SourceDocument are:

- acceptance: date of force of law of the source document by an authority

- electrSignature: data in electronic form which are attached to, or logically associated to other electronic data and which serve as a method of authentication
- maintype: type of document
- recordation: date of registration (recordation) of the source document by registering authority
- sdID: an identifier of the source document
- submission: date of submission of the source document by a party.

```
class LA_SourceDocument

        «FeatureType»
        LA_SourceDocument

 +   acceptance: DateTime
 +   electrSignature: Binary [0..1]
 +   maintype: CI_PresentationFormCode [0..1]
 +   recordation: DateTime
 +   sdID: Oid
 +   submission: DateTime
```
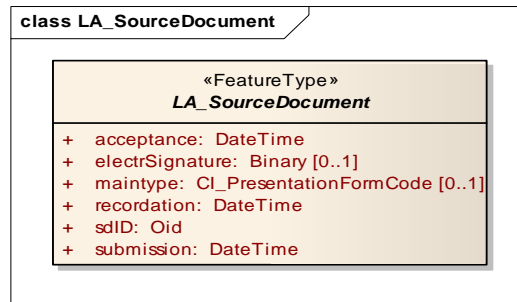
Figure 2-14 LA_SourceDocument class (ISO TC 211 N, 2009a)

3. External Classes

The construction of external databases with party data, address data, valuation data, land use data, land cover data, physical network data, and taxation data is outside the scope of LADM. However, LADM provides 'blueprint' stereotype classes for these data sets that indicate what data set elements LADM expects from these external sources, if available (ISO TC 211 N, 2009a). For example: Extparty, ExtLandUse, ExtTaxation, ExtLandCover, ExtAddress, ExtValuation, ExtPhysicalNetwork.

2.3.2. Cadastre 2014

The Cadastre 2014 provides a vision on the cadastral system of the future. It was developed in 1994 and created a vision of how cadastres might work and look like in 2014, twenty years after it was developed (Kaufmann and Steudler, 1998). In order to establish an agenda for the evolution of current cadastral systems Commission 7 of FIG reviewed very carefully institutional, economic, social and technologies changes affecting cadastral systems, partly in terms of developing a vision for the future. This vision was present in "Cadastre 2014" (Kaufmann and Steudler, 1998) that formulated six statements for the development of cadastral systems. In summary, the statements are:

Statement 1: Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions;

Statement 2: The separation between 'maps' and "registers' will be abolished;

Statement 3: The cadastral mapping will be dead. Long live modelling;

Statement 4: "Paper and pencil" – cadastral will be gone;

Statement 5: Cadastre 2014 will be highly privatized. Public and private sectors are working closely together;

Statement 6: Cadastre 2014 will be cost recovering.

2.4.   Unified Modelling Language

Tuladhar (2002) stated that UML is a modelling language created by Grady Booch, James Rumbaugh, and Ivar Jacobson, and later standardized by the Object Management Group (OMG) in 1997. It consists of several concepts and notations used at different levels of abstraction throughout the system development and maintenance. It can be used for many purposes such as:

- visualizing and documenting workflows and processes, databases and information system in an organization
- specifying system requirements
- designing and developing information system i.e. the user analysis, system analysis, system design and system implementation.

Since it uses a same language in all phases of the system development and operation, it allows the users, customers, developers and members of the projects to communicate effectively and efficiently.

Arvanitis and Eleni (2004) stated that UML is principle graphical language in the designing of mainly object–oriented applications, offering at the same time the possibility of visualization and documentation of flow charts, of database processes within an organization, as well as the planning of systems requirements

2.4.1.   Activity Diagram

In UML, an activity diagram is used to display the sequence of activities. Activity diagrams show the workflow from a start point to the finish point detailing the many decision paths that exist in the progression of events contained in the activity. They may be used to detail situations where parallel processing may occur in the execution of some activities. Activity diagrams are useful for business modelling where they are used for detailing the processes involved in business activities. It is used to explore and describe activities or workflows in the organization. Tuladhar (2002) mentioned they are basically flow charts that are used to show the workflow of the system. It provides a graphical way to document a business workflow in a simple and intuitive illustration of:

- What happens in a workflow,
- What activities can be done in parallel, whether there are alternative paths through a workflow.

Activity diagram also describes the roles and areas of responsibilities in the business, in other words who is responsible for doing what in the business. Roles and areas of responsibilities are documented as columns in the activity diagram. Swimlanes show which business workers participate in the realization of the workflow.

The activity diagram is used to describe activities or workflows in a system, such as the activities that take place in order for the cadastral transaction to be realized. In other words, through the activity diagram the way in which the cadastral objects interact is presented. The cadastral objects are the property rights, the actors of the transaction (active or passive), the land property and the legal documents (Arvanitis and Eleni, 2004).

2.5.   Research Framework

The framework of this research depicted in <u>Figure 2.15</u>. This research begins with defining research problem and formulating research objectives and research questions. The second step reviewing literature about land administration, cadastral system included cadastre, components of cadastral system, cadastral data, cadastre 2014 also literature regarding Land Administration Domain Model, Unified Modelling Language. With includes collection and analysis of primary and secondary data, the case study of the workflow maintenance of cadastral data through subdivision process in Indonesia is conducted in fourth step. Then discuss and model the workflow of maintenance of cadastral data in subdivision process in Indonesia based on the user requirements, existing condition, the LADM and also validate the workflow with comparison method. Finally, conclusion is drawn from the whole study, for further research recommendations are also presented.

2.6.   Conclusion

The literature regarding the basic concept of cadastral system with details about cadastral data, process edit and maintain data, transaction cadastral of data, the strategic way to maintain data and review about archiving data are important theories to build a good maintenance database.

Those maintenance database theories can be apply in the land administration system (which have many concepts) with the standard data model which is the LADM from ISO version 19152 2009 as the data model; also the concept of Cadastre 2014, together with theory of conceptual modelling which is UML- Activity Diagram as a tool to define the workflow of maintenance of cadastral data.
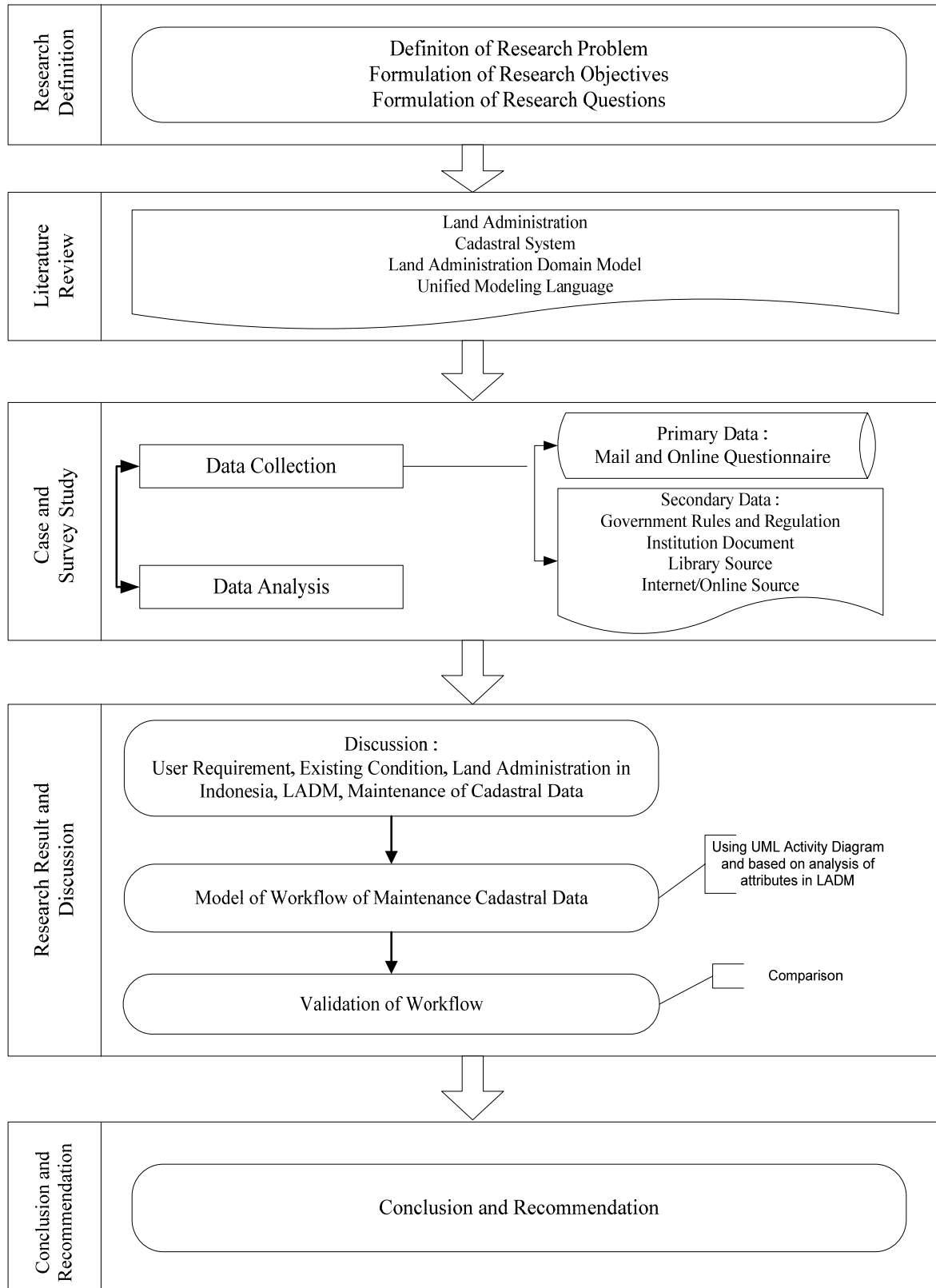
Figure 2-15 Research Framework

3. Research Methodology

This chapter provides an overview of the methodology used in this study. The methodology includes research design in <u>Section 3.1</u>, the area of the research that explained in <u>Section 3.2</u>, unit of analysis which is described in <u>Section 3.3</u>, the data collection method mentioned in <u>Section 3.4</u> and the sequence of data analysis procedures are presented in <u>Section 3.5</u>. Finally in <u>Section 3.6</u> the conclusion is defined.

3.1. Research Design

Williamson and Fourie (<u>1998</u>) argue that the studies, reviews or investigations undertaken to date by consultants such as land surveyors, lawyers and others working in the area of cadastral reform have often been termed case studies. This term has come to mean an examination of the cadastral system of a particular jurisdiction, both at a broadly descriptive level and at a more focused level, where specific problems have been identified.

Often, but not always, the consultant enters the field with a picture in his/her head (a cognitive model) of their own cadastral system or some component of a cadastral system (such as a Torrens system of title registration), and they attempt from the outset to draw direct comparisons between their picture of how the entire cadastre operates and what they see in the field. They then proceed to recommend changes to the system being investigated by drawing from their own picture or experience (<u>Williamson and Fourie, 1998</u>).

Hammersley and Atkinson (<u>1983</u>) state that the field of investigation consists of firstly the setting and secondly the case study. In cadastral terms, the setting would be the entire cadastral system and the case study would be a particular problem area being examined in more detail.

The approach of design of this study is mainly study case referring above explanation. Land administration in Indonesia is considered as a case study. Existing land administration—more precise that is land subdivision process/procedures—and user requirements are identified from this research. The user requirements will be discussed based on cadastral principles and prior knowledge. Existing land subdivision processes/procedures will be flowcharted. A workflow will be designed regarding to user requirements and effective land administration principles. The proposed workflow will be validated.

3.2. Research Area

The area of the current case study were planned to cover 33 provinces in Indonesia. There are 440 branch offices of National Land Agency of Indonesia in these 33 provinces. In this research, two branch offices from each province are planned to involve for data collection. Customers from these 33 provinces will be randomly chosen to participate through mail and online questionnaires. After being

sent questionnaires, administrators (land officer who has responsibility in IT/computerized system) and customers from some areas had not responded. Islands and/or areas from which administrators and customers participated in this study are listed below.

Table 3-1 Summary Result of The Survey

Clasification	Respondent	
	Customer	**Land Officer**
Period	2 - 30 November 2009	2 - 30 November 2009
Total Started Survey	174	80
Total Completed Survey	77 (44.2%)	78 (97.5%)
Method	Online Survey	Post Mail

Table 3-2 Areas of Participating Administrator (Land Officer)

No.	Provinces	Respondents from local office	Islands
1	West Sumatera	1	Sumatera
2	Bengkulu	2	
3	Riau	1	
4	Riau Kepulauan	2	
5	Jambi	3	
6	South Sumatera	1	
7	Lampung	1	
8	Bangka Belitung	1	
9	North Sumatera	1	
10	West Java	11	Jawa (Java)
11	Central Java	15	
12	DIY Yogyakarta	4	
13	East Java	11	
14	Bali	3	**Bali**
15	Nusa Tenggara Barat	1	Kepulauan Nusa Tenggara
16	Nusa Tenggara Timur	7	
17	Kalimantan Barat	2	Kalimantan
18	Kalimantan Tengah	1	
19	Kalimantan Timur	2	
20	Kalimantan Selatan	1	
21	Sulawesi Tengah	1	Sulawesi
22	Sulawesi Selatan	3	
23	Gorontalo	1	
24	Maluku	1	Kepulauan Maluku
25	Maluku Utara	1	
26	Papua	2	**Papua**
Total		**80**	

Table 3-3 Areas of Participating Customers

No.	Provinces	Respondents from local office	Islands
1	West Sumatera	6	Sumatera
2	Bengkulu	1	
3	Nangroe Aceh D.	1	
4	Batam	2	
5	South Bengkulu	1	
6	South Sumatera	2	
7	Lampung	1	
8	North Sumatera	2	
9	West Java	21	Jawa (Java)
10	Central Java	62	
11	DIY Yogyakarta	12	
12	East Java	10	
13	DKI Jakarta	25	
14	Banten	7	
15	Bali	2	Bali
16	Nusa Tenggara Timur	1	Kepulauan Nusa Tenggara
17	Kalimantan Timur	3	Kalimantan
18	Central Sulawesi	2	Sulawesi
19	South Sulawesi	8	Kepulauan Maluku
20	North Sulawesi	1	
21	Gorontalo	1	
22	Papua	2	Papua
Total		**174**	

3.3. Unit Analysis

According to Frankfort-Nachmias and Nachmias (1996) in their book Research Methods in Social Sciences (fifth edition), when a social scientist formulates a research problem, he or she must give serious consideration to the unit of analysis, the most elementary part of the phenomenon to be studied. The unit (or level) of analysis influences the research design, data collection, and data analysis decisions. Abraham Kaplan in Frankfort-Nachmias and Nachmias (1996) called selecting the units of analysis the "locus problem".

According to Babbie (2003), in social research, there is virtually no limit to what or whom can be studied, or the units of analysis. Unit of analysis is the 'what' or 'whom' being studied. In social science research, the most typical units of analysis are individual people. The unit of analysis of this study is land administration/cadastral system in Indonesia with the focus on subdivision processes/procedures. These processes/procedures will be studied in the context of cadastral data maintenance.

3.4. Data Collection

Data collected in this research are both primary and secondary data. Primary data are user requirements and the real practices on land administration namely subdivision. The sources/instrument applied to the primary data collection are mail/online questionnaires and interviews (Kurnia on SurveyMonkey.com, 2009a) (Kurnia on SurveyMonkey.com, 2009b).

Primary data collected, instrument(s) utilized, and sources of primary data are described in the following Table 3-4.

Table 3-4 Primary Data, Instruments, and Sources

Kind(s) of Data	Instrument(s)	Source(s) of Data
Existing land subdivision process perceived by customer and user (customer) requirement(s): • Procedure • Time • Fee/cost • Information • Human resource • Service • Technology • Data • Archive • Obstacle(s) • Suggestion(s)/recommendation(s)	• Questionnaire(s) sent and/or conducted through Survey Monkey online survey application/software (Kurnia on SurveyMonkey.com, 2009a) • Questionnaire(s) sent through e-mail (such as: to forum discussion of notary group) • Questionnaire(s) sent through Facebook network • On-line interviews and/or chatting	**Customers** from representative areas of Indonesia
Existing land subdivision process perceived by administrator/land officer from BPN and user (customer) requirement(s): • Procedure • Time • Fee/cost • Information • Human resource • Service • Technology • Data • Archive • Obstacle(s) • Suggestion(s)/recommendation(s)	• Questionnaire(s) sent and/or conducted through SurveyMonkey online survey application/software (Kurnia on SurveyMonkey.com, 2009b) • Questionnaire(s) sent through e-mail and air-mail (via post) • Questionnaire(s) sent through Facebook network • On-line interviews and/or chatting	BPN **land officer** from representative areas of Indonesia

Secondary data mainly refers to land administration in Indonesia. Some of this kind of data also includes external and internal user requirements. The resources of the secondary data are books and other library sources, government documents, and online sources.

Secondary data collected, instrument(s) utilized, and sources of secondary data are described in following Table 3-5.

Table 3-5 Secondary Data, Instruments, and Sources

Kind(s) of Data	Instrument(s)	Source(s) of Data
Existing land administration in Indonesia: • Historical background • Legal framework • Land registration in Indonesia • Subdivision in Indonesia	• Note(s) • Internet • Search engine(s)	• Library sources • On-line sources (web sites and blogs) • Documents of BPN
Existing land subdivision process perceived by customers and administrators/land officer from BPN and user requirement(s): • Procedure • Time • Fee/cost • Information • Human resource • Service • Technology • Data • Archive • Obstacle(s) • Suggestion(s)/recommendation(s)	• Note(s) • Internet • Search engine(s)	• Library sources • On-line sources (web sites and blogs) • Documents of BPN

3.5.   Data Analysis Procedure

Data collected in this research will be/are analyzed descriptively. They will be/are analyzed in concordance with the research questions. Data analysis covers following procedures:

- **Firstly**, reviewing existing land administration in Indonesia. Data are collected from library and online sources.
- **Secondly**, identifying user requirements. They are both external and internal user requirements. External users are customers/residents who have knowledge and experiences in subdivision. Internal users are officials of national land agency ―BPN RI ―in branch offices and central office.

- **Thirdly**, reviewing existing land subdivision in Indonesia. Data are collected from mail and online questionnaires. Online interviews also support this kind of findings. Data and findings about existing land subdivision will be treated as reference to design a workflow.
- **Fourthly**, designing a workflow to be proposed. The workflow is designed based on both user requirements and the results of the review of the existing condition.
- **Fifthly**, validating the proposed workflow. The proposed workflow will be validated by using the simulation with a prototype programming and the Assessment Questions referring Carr and Balci (2000).

3.6. Conclusion

This research is methodologically conducted in the frame of a case study. In this research, literature concerned with cadastral system, land administration, Land Administration Domain Model (LADM), and Unified Modelling Language (UML) are reviewed. Documents about land administration in Indonesia and the existing land administration procedures are assessed. Mail and online questionnaires and online interviews are administered to respondents for data collection. Participating respondents are from areas which are relatively representatives of all areas of Indonesia.

4. Land Administration System in Indonesia

Land administration system in Indonesia is provided in this chapter respectively and detail. The historical background and general overview of BPN–the government institution that have a mandate to develop and conduct the land administration system in Indonesia–are drawn in <u>Section 4.1</u>. The legal framework of as the basic regulations to conduct LAS is mentioned in <u>Section 4.2</u>. <u>Section 4.3</u> describes the whole aspects related to the land registration process as a part of LAS in Indonesia. The last part of this chapter also explains about the existing subdivision process part of maintenance of cadastral data in Indonesian land registration. Finally the conclusion of this chapter is defined in <u>Section 4.4</u>.

4.1. Historical Background

Total area of Indonesia is about 9.8 million square kilometre; consists of 1.9 million square kilometre of land and around 7.9 million square kilometre of marine area including the Exclusive Economic Zone (<u>Heryani, 2004</u>). As the largest archipelago country in the world, Indonesia has more than 17.000 islands and only 6.000 islands are inhabited. The area is administrated into 33 provinces, 349 districts and 91 cities. The population in Indonesia was estimated to be 231 million in 2009, it is an uneven spread population because most of the people (58% of population) live in Java island (<u>Winoto, 2009</u>).

During a period of 350 years before independence in 1945, Indonesia was under some form of colonial rule. Therefore the land law became a dualism between western system and the traditional unwritten land law. The western system applied to meet the interests of colonial government and the traditional unwritten law existed as based on the customs of various regions (<u>Heryani, 2004</u>). This consideration is important to Indonesia because people are extremely diverse in ethnic and culture. There are more than 200 ethnics and sub ethnic groups. This diverse made the existence of varying degree of customary system of land administration and various kind of relationships with land. This dualism in land law was intended to end in 1960 with the enactment of The Basic Agrarian Law (BAL) (<u>Heryani, 2004</u>). As a national land law, The Basic Agrarian Law is created in order to use of traditional concepts, principles, systems and institutions.

4.1.1. General Overview of National Land Agency (BPN)

According to the Undang-Undang No.17/2007 about the long term development plan of the state, the state gives mandate to Badan Pertanahan Nasional (BPN) to implement an efficient and effective land management; enforce law dealing with land rights through democratic, transparent and just principles; reconstruct regulations of land reform for betterment of occupation, right, use and utilization of land; identify incentives and disincentives in the tax system according to size of area, location, and land use; improve access to land by the poor; improve the land law system through an inventory; enhance land regulation taking into consideration customary (adat) rules; improve resolution of land conflict through administration, justice, and alternative dispute resolution; and develop human resources

(<u>Presiden Republik Indonesia, 2007</u>). Therefore BPN has four main principles in reformulating land policy, namely:

1. Improvement of the welfare of people;
2. Distributive justice;
3. Fostering of a just and peaceful sustainable system of Indonesian society; and
4. Creation of social harmony (resolved land conflicts and disputes).

These principles were translated into eleven land policy objectives, known as eleven BPN prioritized agendas as follow:

1. Building of public trust;
2. Improvement of land services and land registration;
3. Improvement of people's rights on land;
4. Resolution of land problems in areas affected by natural disasters and ethnic conflicts;
5. Systematic handling and settlement of land lawsuits, disputes and conflicts;
6. Development of a national land management information system and land document security system;
7. Address of corruption, collusion, nepotism and improvement of people participation and empowerment;
8. Establishment of large scale land mapping and a land ownership database;
9. Consistent implementation of all land laws and regulations;
10. Strengthening of the NLA organization;
11. Development of land laws and policies.

Badan Pertanahan Nasional was established by referring Presidential Decree number 26/1988 after many years of existence as Directorate General Agraria under Ministry of Home Affair. BPN was mandated to conduct legal cadastre. As centralized organization, BPN has several regional offices and local offices. Regional offices are located at province level while local offices are located at district/municipal level (<u>Presiden Republik Indonesia, 1988</u>). Main duties of local office are as following:

- Surveying land
- Registering land
- Issuing certificate
- Maintaining land data
- Storing land archive
- Establishing geodetic control order four
- Resolving dispute over land

Regional offices mainly function to oversee local offices which are under their authorities. Despite of oversee, regional offices have some other duties namely:

- Establishing geodetic control order three and two
- Limited human resources management (promotion and mutation)
- Surveying land whose size more than five hectares
- Coordinating local offices to central office
- Technical support to local offices

Central BPN tasks and functions are as follows:

- Budgeting and financial administration
- Human resource management (recruitment, education, promotion, and mutation)
- Developing policies
- Issuing guidelines for internal organization (standards for equipments, information technology, accuracy, methods, fees, etc)
- Revoking certificate
- Surveying land whose size more than 200 hectare
- Research and development
- International cooperation
- Technical support to regional or local offices
- Preparing large scale base map

Nowadays the hesitation of people to register the land is mostly caused by the lengthy process (very complicated and time consuming process) of registration and high cost. The time consuming in process registration is also as indicator that volume of activity/work is not equal with amount of available human resource/staff, the lack of human resource. Informal fees—one of them comes from the brokerage system—are the causes of high cost. The other cost component is land right achievement tax (Bea Perolehan Hak Atas Tanah dan Bangunan—in short BPHTB). BPHTB—calculated by 5% of parcel value—can be really unaffordable for/by the poor especially for those who live in urban areas where the land value is very expensive.

Land dispute and conflict are other problematic issues in Indonesia (Ary Sucaya, 2009). The large numbers of land disputes and conflicts cause social un-rest, security disturbances, and poverty. Land disputes and conflicts also produce economic loss because they prevent land being used to produce goods and services (Winoto, 2009).

Since 2007 the number of land disputes reaches 7491 cases covering almost 608 thousand hectare of land and until 2009 only 4.578 cases had been solved, and the rest 2931 cases are waiting for solution (Basuki, 2010). Disputes not only reduce land productivity but also damage social relationship among interested parties and cost highly. Another cause of increase land dispute and conflict is that 45% of the 85 million existing parcels are registered, but most of them are not yet mapped, even if these parcels are mapped the archive of document and map is not well maintained. The existing archives in land offices are still managed in manual and unstructured system. This condition can also create other problems such as: mistaken and overlooked document, even document(s) lost through fire and moist, and also time consuming.

Disparity in access to land is influenced by the unnecessarity, complexity and confusion in the legal framework. Winoto (2009) stated that a study on land laws and regulations found 585 of legal documents—comprising 12 laws, 48 government regulations, 22 presidential decrees, 4 presidential instructions, 243 head of BPN regulations, 209 circular letters of head of BPN, and 44 instructions of head of BPN, these all include the overlapping, contradictory and unimplemented regulations. Legal conflict and confusion produce problems and bring impacts on disparity of land holding, land ownership, land use and utilization, slow implementation of agrarian reform, land disputes and conflicts, abandoned land, etc.

BPN has a duty to establish geodetic control order two, three and four. Technically, conditions related to survey and measurements in the field are such as the geodetic controls do not cover whole country. National Coordinating Agency for Surveys and Mapping (Bakosurtanal) has responsibility to build geodetic control order zero and one. The lack of geodetic control availability adversely affect cadastral mapping since no reference can be found to unify cadastral map among local offices to build a national land information system. For instance in thematic map, the current condition is that most of the maps are in inappropriate scale and out of date, therefore this maps can not support formulation of land policy, land administration, space allocation, land-use planning, agrarian reform purpose, community empowerment and development, and land conflict resolution.

Reconstruction of cadastral boundary in case of dispute relies on field sketch (Gambar Ukur). The Gambar Ukur represents data of measurement, parcel boundary and other information related to parcel. Also in the case of subdivision of a parcel; the surveyor had difficulty to find the subdivided parcel because of the data and information of measurement in Gambar Ukur are not precise as in the field (flying parcel). For information system, cadastral index map is created from various sources. Cadastral index map represents parcel boundaries, street, river, building and often building. The main problem of creating cadastral map is consistency of data. Ary Sucaya (2009) stated that the data entry project of cadastral data in Jakarta province showed that almost 60% of parcels plotted in cadastral index map did not match to the textual registration data. Validation of data in deed needs to be done to provide better accuracy data.

The capacity building of BPN organization needs to be improved as a regard to the high society demand of land administration service. Continuous staff trainings—related to improving the skill of staffs in operating computer(s) and survey and mapping activity—are conducted in BPN central office. In fact the staff trainings have limited time in duration, and do not make a good improvement in staff ability.

In general, textual information and graphical information were physically separated. Textual information was stored in database management system either desktop database or client server architecture. Some offices tried to automate office duties by combining database with word processor to type certificate(s) and generate monthly report. In order to deal with graphical data, most of local offices make use of CAD program to draw cadastral map. The problem arose when the file size become larger and larger. Often, mapping staff(s) split the file and work on several files to keep faster performance. As the result, there are duplication files in one area.

4.2.   Legislative Framework

The legal framework of land administration system in Indonesia as describes in these following:

4.2.1. State Constitution

State policy dealing with land is in the Constitution (Majelis Permusyawaratan Rakyat, 1945). Article 33 provides that land (earth), water and natural richness inside are controlled by State and must be utilized for welfare of the people. Implementation is primarily through the Basic Agrarian Law (BAL). The BAL was put into practice through many government regulations, presidential decrees, ministerial decrees, etc.

4.2.2. Basic Agrarian Law

The Basic Agrarian Law (Presiden Republik Indonesia, 1960) as a national land law is the basis of land administration system in Indonesia. It is introduced to end the situation of dualism between western system and the traditional (adat) law with utilizing the traditional concepts, principles, system and institutions. The main intensions of Basic Agrarian Law are to build the foundation in order to:
Arrange national agrarian law which will be a tool to bring wealth, happiness and just for the state and citizens especially farmer, to realize just and wealth for the citizens.

- Unify and simplify land law.
- Give tenure security to all citizens.

Related to the land registration, BAL stipulates it in Article 19. This article specifies that:

- In order to guarantee legal security, Government shall conduct land registration throughout the territory of the Republic of Indonesia according to provisions laid by Government Regulation.
- The land registration covers;
    1. The measuring, mapping and recording of land;
    2. The registration of the rights on land transfer of these rights;
    3. The issue of certificates of rights on land, which will be valid as strong evident.
- The registration of land shall be conducted, with due consideration to the condition of the States and the society, the needs of social and economic activities and its implementation possibilities according to the consideration of the National Land Agency (BPN).
- The expenses related to the land registration shall be regulated by Government Regulations, with the provision that those who are without meant shall be exempted from those expenses.

4.2.3. Government Regulation Number 24/1997

Government of Indonesia enacted this regulation with consideration about: to accelerate the process of sustainable national development, the support of legal certainties in the area of land is required; land registration and administration of which is assigned to the Government in line with Undang-Undang Number 5 of 1960 (The Basic Agrarian Law), is a way of providing such legal certainties (Presiden Republik Indonesia, 1997).

4.2.4. Head of BPN Regulation Number 3/1997

Head of BPN enacted this regulation with the aim to build a good land registration (Kepala Badan Pertanahan Nasional, 1997). This regulation is about provision of implementation of Government Regulation number 24/1997 about Land Registration in Indonesia. Mostly in each article of this regulation is stipulated about technical explanation about all related to land registration. As a source of legal document, this regulation also explains the main principles of subdivision process.

4.2.5. Conception of Occupancy Land by the State

Undang-Undang Number 5 of 1960 (Basic Agrarian Law) was enacted to implement Article 33 of Indonesian Constitution. In Article 1 of BAL, it is stipulated that: the entire territory of Indonesia is a unified motherland of the whole of Indonesian people who are united as the Indonesian Nation; the entire earth, water and airspace, including the natural resources contained therein, in the territory of the

Republic of Indonesia as the gifts of God Almighty are the earth, water, airspace of Indonesian nation and they constitute the wealth of the nation. In article 2 of BAL, it is stipulated that: The earth, water and airspace, including the natural resources—contain therein—are in the highest instance controlled by the State and authorized of the whole people. The right of controlled by the State provides authorities:

- To regulate and implement the appropriation, the utilization, the reservation and the cultivation of that earth, water and air space as mentioned above;
- To determine and regulate the legal relation between person concerning the earth, water and air space;
- To determine and regulate the legal relation between person and legal acts concerning the earth, water and air space (Presiden Republik Indonesia, 1960).

Therefore the state gives the right of land. The right of land is a right belongs to the owner (natural person and non-natural person) to occupy the land. Based on the Article 6 of BAL the land right have a social function. In Indonesia there are several unique tenures. Article 16 of the Basic Agrarian Law creates the following tenures:

- the right of ownership (hak milik);
- the right of exploitation/cultivation (hak guna usaha);
- the right to use buildings (hak guna bangunan);
- the right of use (hak pakai);
- the right of lease (hak sewa);
- the right to clear land (hak membuka tanah); and
- the right to collect forest produce (hak memungut-hasil-hutan).
- Article 16 also provides for the creation of rights other than those mentioned above which just be stipulated by way of an act and also refers to "the rights of temporary nature which are mentioned in Article 53.

Rights which have been stipulated by way of an Act are:
- the right of ownership of apartments (hak milik atas satuan rumah susun);
- the security right (hak tanggungan); and
- the right of management (hak pengelolaan).

In addition, the Act creates the following additional rights to water and airspace:
- the right to use water (hak guna-air);
- the right to cultivate and catch fish (hak pemeliharaan dan penangkapan ikan); and
- the right to use airspace (hak guna-ruang-angkasa).

Among those rights Hak Milik is the highest and nearest to freehold tenure. According to article 17 of BAL, there are requirements in order to occupy a land, this meant that people have limitation area in occupying the land, as the following:

- in any kind of land tenure there is certain rule to manage the maximum and minimum area of land that can be occupied
- the land which excess of the maximum area limit will be taken by the government with compensation and will distribute among the people who need it according to the provisions provided by further government regulation
- also the minimum area limit will be ruled by the government regulation.

The most common type of rights in Indonesia with each characteristic are regulated in Government Regulation Number 40/1996 (Presiden Republik Indonesia, 1996) (*see in Annex 1*).

4.3.   Land Registration in Indonesia

4.3.1. Definition of Land Registration

Based on Article 1 of Government Regulation number 24/1997, land registration is all kind of activities simultaneously and continuously conducted by government related to collecting, processing, recording, displaying and managing *physical* and *juridical* data such as map and list concerning land parcel and apartment, including issuing the land certificate for the land which has a right as evidence of land tenure also for the right of ownership of apartment and other encumbrances (Presiden Republik Indonesia, 1997).

In Article 1, it is also defined physical data and juridical data. *Physical data* are information about the location, boundaries, and area of a certain registered land parcel or apartment with the building or parts of the building standing on it. *Juridical data* are information about the legal status of a registered land or apartment, about the right holder, about the rights of other parties on it, and about the other encumbrances.

As mentioned in article 5 and 6, Land registration is mandated to Badan Pertanahan Nasional (BPN)—National Land Agency. BPN is assisted by Pejabat Pembuat Akta Tanah (PPATs). A PPAT is a notary who only conducts process for issuing the deed(s) related to lands. A PPAT can be a notary appointed by BPN or head of sub-district in absence of notary in a particular area.

The objects of land registration—as defined in Article 9—are lands with right of ownership, right of cultivate land, right of building, right of use, or right of management, waqf land, apartment unit, mortgage, and state land. According to article 10, an administrative area of land registration—defined as land registration unit—basically is village. For particular rights which are: right of cultivate land, mortgage and state land, it is district. The registration unit is interpreted as numbering system of parcels and right is based on village or district depending on its unit.

4.3.2. Principles and Purposes of Land Registration

According to Government Regulation number 24/1997, more precise in Article 2, the basic principles of land registration should be simple, secure, affordable, up-to-date, and open. The purposes of land registration are stipulated in Article 3 as the following:
1. To provide tenure security to the land right holder, apartment unit right holder and other rights in order to make them easy to prove their ownership.
2. To provide information to the interested parties including government in order to easily get required data to conduct legal action about registered land and apartment unit.
3. To establish good land administration (Presiden Republik Indonesia, 1997).

4.3.3. Activities Related to Land Registration

Land registration activities in Indonesia are ruled with regard to the Government Regulation number 24/1997 and technically managed based on Head of BPN Regulation number 3/1997. According to Article 11 and 12 of Government Regulation number 24/1997, these land registration activities are:
1. The first registration (adjudication), this activity include:
    - Collecting and processing of physical data

- Right verification and booking.
- Certificate issuance.
- Physical and juridical data presentation.
- Storing public register and document.
2. Maintenance of land registration data
    - Registration of transfer and encumbrances
    - Registration of other land registration data changes (Presiden Republik Indonesia, 1997).

Maintenance of land registration data should be done in case of physical and juridical data changes on registered land. The land owners are obligated to register the changes. Land registration data changes include right transfer (trading, granting, swapping, capital participation, bidding, inheritance, and merger), extension of right, sub-division, and amalgamation.

Based on Article 13 in the same regulation, it is stipulated/understood that the first registrations can be done in two ways, there are (Presiden Republik Indonesia, 1997):

1. Systematic land registration
   Systematic land registration is the activity of land registration which is conducted simultaneously and which covers all unregistered land in all or part of the territory of a village (kelurahan).
2. Sporadic land registration
   Sporadic land registration is the activity of land registration which is conducted on one land-registration object or more in the territory of a village (kelurahan) or in part of the territory of a village (kelurahan), either on an individual basis or on a mass basis.

In order to collect the physical data of the land therefore surveying and mapping should be done as stipulated in article 14 of government regulation number 24/1997.

4.3.4. Surveying and Mapping

As stipulated in Article 14 of Government Regulation number 24/1997, surveying and mapping include the activities as the following (Presiden Republik Indonesia, 1997):

1. Making cadastral base map of registered land
2. Land/parcel boundaries investigation
3. Surveying and mapping the land/parcel and making the registered parcel map
4. Making the Daftar Tanah (list of registered land/parcel)
5. Making the Surat Ukur (survey document)

4.3.4.1. Making Cadastral Base Map of Registered Parcel

According to Article 1 of Government Regulation number 24/1997 the cadastral base map of registered parcel is a base map that is used to make the map of registered parcel. Map of registered parcel is a map which is contains of the registered parcel for land record purpose. In the cadastral base map of registered parcel there are geodetic control points and geographic feature such as road, river, building, and boundaries of parcel. A geodetic control point is a point whose coordinates are obtained from measurement and computation under a certain system and which functions as a control point or a reference point for boundary survey and reconstruction purposes (Presiden Republik Indonesia, 1997).

As defined in Article 15 and 16 of Government Regulation number 24/1997, the cadastral base map is built based on the national geodetic control point. Therefore BPN build the national geodetic control points in district level. In case of the national geodetic control points are not available, the making of cadastral base map can be built temporarily based on the local geodetic control points and afterward can be converted or transformed into the national geodetic control points (Presiden Republik Indonesia, 1997).

Based on technical regulation of land registration the Head of BPN Regulation number 3/1997 Article 2, 4 and 5, the geodetic control points are classify in order 0, 1, 2, 3, 4 and a fourth point. These all geodetic control points are described in details as the following (Kepala Badan Pertanahan Nasional, 1997):

Table 4-1 The Indonesian National Geodetic Control Points

Order	Points Distance	Description
0 and 1		built and managed by Bakosurtanal
2	within 10 km	with order 0 and 1 as a reference control points
3	within 1- 2 km	with order 2 as a reference control point
4	within 150 m	with order 3 as a reference control point
A fourth point		as a result of fourth control point with order 4

Concluded from : Head of BPN Regulation Number 3/1997 (Kepala Badan Pertanahan Nasional, 1997)

Table 4-2 Numbering System of National Geodetic Control Points

Order 2		Order 3	
Administrative Area Level 1	Code	Administrative Area Level 2	Code
(1)	(2)	(3)	(4)
Center Java	**12.xxx**	**Semarang (city)**	**12.13.xxx**

Concluded from : Head of BPN Regulation Number 3/1997 (Kepala Badan Pertanahan Nasional, 1997)

Article 3 of Head of BPN Regulation number 3/1997 defines that the national coordinate system in Indonesia is Transverse Mercator 3° (TM3). This projection system is built from projection TM and UTM. In BPN mapping purpose, TM3 projection is more accurate and precise especially in large scale of map. Therefore TM3 projection system has principles to keep accurate and precise as the following (Kepala Badan Pertanahan Nasional, 1997):

- Cylinder cross to the earth with certain meridian (symmetric with the meridian central)
- Width of projection zone is 3° meridian
- The scale factor along the central meridian is 0.9996
- The scale factor of meridian limit zone is 1.0001
- Ellipsoid model is WGS84, with a = 6.378.137 and f = 1/298.25722357
- False origin is East(X) = 200.000 m and North(Y) = 1.500.000 m
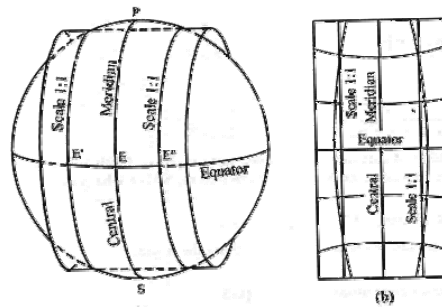
Figure 4-1 Cylindrical Cross to the Earth

4.3.4.2.   Land/parcel Boundary Determination

The parcel boundaries defined by interested parties and should be accurately surveyed. According to Article 17, 18 and 19 a parcel boundary demarcation is conducted by surveyor or Adjudication Committee (for systematic land registration) in order to have the parcel boundary and points with regard to the agreement among the parties who are involved (Contradictoire Delemitatie). An owner of the land has a duty to take care the boundary sign/monument. The boundary demarcation includes technical activities in the field such as (Kepala Badan Pertanahan Nasional, 1997):

- Defining the boundaries of the parcel with the neighbouring parcel
- Marking the boundaries with monuments
- Surveying and mapping the parcel.
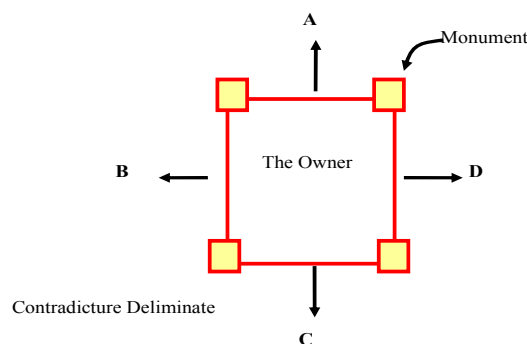
Figure 4-2 Illustration of Parcel Boundary Determination

If there is a dispute in the boundary demarcation, surveyor or Adjudication committee send the letter about the dispute conditions to the conflicting parties. Based on this letter the conflicting parties can make/send claims to the court.

In case of the absence of one of the parties who are involved in the field or there is no agreement between parties, (so then) a temporary boundary is taken as based on the existing condition of boundary parcel in the field, and a notation is put in the survey document (Gambar Ukur) that explain about temporary boundary had taken until the parties meet the boundary agreement or until the parties can be present in the field. Beside of Gambar Ukur as measurement data, the results of boundary demarcation are also reported in a form of juridical data (Risalah Penelitian Data Yuridis). The juridical data are about legal aspects related to land such as: information about the owner, the evidence

of the ownership, tax payment, historical data about the land, land status, land sketch, and land boundaries (Kepala Badan Pertanahan Nasional, 1997).

4.3.4.3. Surveying and Mapping for the Making of Map of Registered Parcel

Referring to the technical regulation of land registration—stated in Head of BPN Regulation number 3/1997 (Kepala Badan Pertanahan Nasional, 1997) —more precise in article 12—methods used for surveying and mapping the cadastral base map are : terrestrial, photogrammetric, and other methods. Terrestrial method is a method of surveying and mapping on above earth surface. Photogrammetric method is a method of surveying and mapping with capturing photo in the air/areal photo, mostly done/taken from a plane.

The cadastral base maps are made in scale of:
- 1 : 1000 or higher for urban
- 1 : 2500 or higher for rural
- 1 : 10.000 or smaller for plantation/crop

The cadastral base map can be formed as line map or photo map, and this map will be split in sheet of map based on its scale and TM3 zone. According to Article 15 of Head of BPN Regulation number 3/1997, the sizes of paper/sheet that are used to draw the maps are as in the following table:

Table 4-3 The Map Scale with the Paper Size

Scale	Drawing Map (cm)	Paper Size (cm)
1 : 1000	50 x 50	70 x 70
1 : 2500	60 x 60	80 x 80
1 : 10000	60 x 60	60 x 60

Concluded from : Head of BPN Regulation Number 3/1997 (Kepala Badan Pertanahan Nasional, 1997)

Based on Article 17 of Head of BPN Regulation number 3/1997, making of map of registered parcel can be done with using other maps with some certain conditions of maps:
1. map scale is bigger or equal to 1:1000 for urban, bigger or equal to 1:2500 for rural, and bigger or equal to 1:10000 for crop.
2. accuracy of planimetric is bigger or equal to 0.3 millimetre on scale of map—to measure this accuracy, surveyor should check distance of a point which is identified in the field.
3. the map should have the same coordinate system—if it is not then it needs to be transformed into currently coordinate system.

4.3.4.4.   Making the Daftar Tanah (list of registered land/parcel)

Government Regulation number 24/1997 stipulates that list of registered parcel (Daftar Tanah) is a list of registered parcel with (a) numbering system of the parcel number identification. In Article 23 of the the regulation, it is defined about parcel number of identification (NIB). This number of identification is given to the parcel which already has fixed boundaries and mapped in the map of registered parcel. The numbering system of NIB is created based on the administrative area. According to this Article, the way of numbering of parcel identification is described as 13 digits numbers—8 of the digits represent the name of province (provinsi), regency (kabupaten) or city (kotamadya), sub-district

(kecamatan), village (desa/kelurahan) and 5 digits represent the parcel number. The parcel that has had a parcel number of identification (NIB) is recorded in the list of registered parcel (Daftar Tanah) (Presiden Republik Indonesia, 1997).

$$\boxed{}\boxed{} \cdot \boxed{}\boxed{} \cdot \boxed{}\boxed{} \cdot \boxed{}\boxed{} \cdot \boxed{}\boxed{}\boxed{}\boxed{}\boxed{}$$

A   B   C   D   E
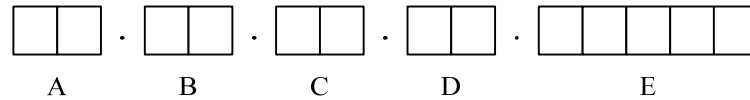
The numbering system of parcel number of identification (NIB) is explained as the following:

- A (1 - 99) :   2 digits code of Province
- B (1 - 99) :   2 digits code of Regency/City
- C (1 - 99) :   2 digits code of Sub-district
- D (1 - 99) :   2 digits code of Village
- E (1 - 99999) :   5 digits code of parcel number

Here is an example of parcel number identification (NIB):

$$0\,9 \cdot 0\,3 \cdot 0\,5 \cdot 0\,2 \cdot 0\,0\,1\,0\,2$$
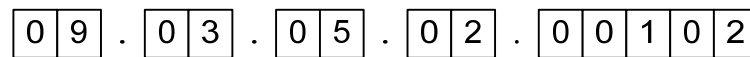
- 09 : the code of DKI Jakarta Province
- 03 : the code of West Jakarta City
- 05 : the code of Kebon Jeruk Sub-district
- 02 : the code of Duri Kelapa Village
- 00102 : the code of parcel number

4.3.4.5.   Making the Surat Ukur (survey document)

Article 1 of Government Regulation number 24/1997 describes that Surat Ukur (survey document) is a document which contains the physical data on a land parcel in the form of a map and some description.

And according to Article 14 in the same regulation, in order to record the right of land/parcel, Surat Ukur is created. Surat Ukur contains sketch of the land parcel which is depicted based on map of registered parcel. This survey document is made in 2 copies: one for archive purpose, and the other is a part of land certificate—as a evidence that this right of the land parcel is already recorded in Buku Tanah and registered (Presiden Republik Indonesia, 1997).

Based on Article 22 of Government Regulation number 24/1997—that in case of the map of registered parcel is not available, surat ukur can be created as based on survey/measurement data that are mapped in cadastral base map of registered parcel, or based on the map of the parcel (Presiden Republik Indonesia, 1997).

4.3.5. Proofing and Recording Land Right

Intended to proof the land ownership, the owner of land has to have the evidence document. This document is a legal document which is issued by the authority or notary (PPAT). Article 24 to 30 stipulate about the evidences for ensuring the possession of land and the record of the right of land. The evidences are: (1) decision letter from government (regarding to state land), (2) transfer deed

issued by PPAT (regarding to transfer right from *right of ownership* to *right of use building* or *right of use*), (3) decision letter of cultivation issued by the authorised (regarding to the agriculture land), waqf deed from PPAT (regarding to the waqf land), (4) separation deed issued by PPAT (related to apartment unit ownership right), (5) mortgage deed issued by PPAT (regarding to the mortgage land). In case of there is no evidence that can be proved, statement from the parties or information from the witnesses (persons who are the neighbours, who occupy the land for many years) can be used as the evidence of ownership if the land has been occupied continuously within twenty years (Presiden Republik Indonesia, 1997).

Land registration in Indonesia is a negative system. To protect the real owner from the risk of registration of the wrong one is the purpose of this system. The real owner can claim his/her ownership through court proceedings and the new ownership will be registered if it is confirmed and decided by the court. It means that the key factor is the accuracy and the completeness of the documents including maps to show the boundaries as the basis of the initial registration. Registration is not compulsory and currently there is no guarantee in security tenure by the state, because it is regarded as the highest and best evidence of ownership, but also does not preclude a claim from other parties (negative system). Beside intended to provide security tenure, land registration in Indonesia can also be used as collateral to get credit from bank. Land with certificate of land usually has better value compare to non-register parcel.

In Indonesia land rights are recorded in to two kinds of systems which are:
- Private conveyancing, is not regulated but it is accepted by the court as 'informal transfer', is based on legal principle that the title is transferred at the time of payment in cast, whether it is registered or not and based on agreement among the parties.
- Registration of deeds; the evidence of ownership or all kinds of agreement as a proof to posses the land must be registered in a land office as a 'formal transfer'.

Land right is records in the book of land (Buku Tanah). As stated in Article 1 of Government Regulation number 24/1997, the book of land (Buku Tanah) is a document which contains the list of juridical and physical data of the land with the certain right. And based on Article 29, information about the land owner and the right of land are booked in the book of land (Buku Tanah), and information about the land itself are described and depicted in the survey document (Surat Ukur). After the land right was booked, then the land certificate is issued (Presiden Republik Indonesia, 1997).

4.3.6. Issuing the Land Certificate

According to Government Regulation number 24/1997 Article 31, the land certificate is issued in order to fill the parties need about ownership of the land as based on physical and juridical data that recorded in the book of land (Buku Tanah). Issuing land certificate will be delayed until the annotation (about land dispute) is erased which means that the land dispute is solved. The land certificate only will be directly given to the owner or another person as the representative of the owner with the letter of attorney. For right ownership of apartment unit which is belongs to many persons or non natural person (company), one land certificate will be given to the representative of many person or company. But it is also possible that land certificates are issued as many as the persons who own the land and each certificate is given to each of them (Presiden Republik Indonesia, 1997).

4.3.7. Maintenance of Land Registration Data

According to Government Regulation number 24/1997, the definition of maintenance of land Registration data is the activity of land registration which aims to updating the physical data and juridical data which are determined in cadastral maps, list of registered land/parcel (Daftar Tanah), list of the owner (Daftar Nama), survey documents (Surat Ukur), book of the land (Buku Tanah), and land certificate from the changes subsequently. In Article 36 of government regulation define that the land data maintenance covers two main activities are (Presiden Republik Indonesia, 1997):

1. Registration of transfer and encumbrances
2. Registration of other land registration data changes.

Maintenance of land registration data should be done in case of physical and juridical data changes on registered land. The land owner obligates to register the changes. Land registration data changes include:

1. Juridical data changes are : right transfer (trading, granting, swapping, capital participation, bidding, inheritance, and merger) and extension of right
2. Physical data changes are : subdivision, and amalgamation.

This research will focus on one of process maintenance the land registration data in Indonesian land registration which is pure subdivision process—only subdividing a parcel. In Indonesian land registration, for instance, after customer subdivided the land, he/she wants to sell the other part of parcel (buying and selling), or to transfer right (heritance, mortgage, leasing) he/she has to apply for other procedures (Presiden Republik Indonesia, 1997).

4.3.7.1. Subdivision in Indonesia

Parcel subdivision in Indonesia is one of activities in maintenance of land registration data which is relate to physical data changes. Therefore the changes should be maintained in order to keep land registration data (physical data) up-to-date. Subdivision process is aimed to subdivide a parcel into one or more parcels. Practically based on user needs, subdivided parcels in Indonesia are divided into two types related to the area of parcels. These types are:

- Parcel(s) which is/are subdivided into two or more parcel for the whole area of the parcel (no more left in area size)
- Parcel(s) which is/are subdivided partly of the whole area of the parcel, for instance from 500 square metres area parcel only 200 square metres that will be registered.

An owner subdivides his/her parcel in order to sell, heritance, and build a house (in case of rural area), etc. Considering land use change (from rural to urban; rural to commercial land use; etc), a subdivision process needs a land use change permission (Ijin Perubahan Penggunaan Tanah – IPPT). With this permission the information of the land use can be provided in order to other related activity such as land use planning, space allocation, agrarian reform, land consolidation, and support in land policy decision, etc. The legal frameworks related to subdivision process are as mentioned below:

- **The Basic Agrarian Law / Undang Undang Number 5/1960**
  BAL is the main regulation for land administration in Indonesia (Presiden Republik Indonesia, 1960).
- **Government Regulation Number 24/1997**
  In Article 48 of this regulation it is informed that: based on the owner demand, land subdivision can be done in the entire area (completely area) of the registered parcel, divided

from one parcel into many parcels where each of the subdivided parcel is a new parcel with the legal status same as before subdivided. With regard to the new parcel, the current physical data (such as: the boundaries and the area size) of the land has changed. In this Article, it is also stipulated that if the subdivided parcel is a rural area therefore the minimum limit area should be concerned by the owner. Therefore the land subdivision has suitable with the land use planning or city planning to support other program such as land reform and land consolidation. And government enacted Regulation number 56/1960 in order to manage the minimum and maximum limited area of rural land. Mentioned in this regulation, maximum limited area for rural is twenty hectares and minimum limited area is two hectares (Presiden Republik Indonesia, 1997).

Considering the mortgage of the land, this article also describe that land subdivision should give a good benefit for mortgagor (bank which gives the credit) therefore in this case, the agreement letter about land subdivision from the bank is needed.

- **Head of BPN Regulation Number 3/1997**

  In the thirteenth part, Article 133, it is stipulated that (Kepala Badan Pertanahan Nasional, 1997):

  1. the owner or his/her representative applies for subdivision process of registered parcel with mentioning the purpose of applying subdivision process, and attaches the required documents (the owner ID, the original land certificate, letter of agreement from mortgagor- in case of the parcel has a mortgage);
  2. in order to have an area volume of subdivided parcel, survey is a must;
  3. legal status of the new parcel after subdivision process is the same as before subdivision and for registration of the right in each parcel the new right ID number, the new Surat Ukur (letter of measurement), the new Buku Tanah (copy of land certificate) and the new land certificates' are generated in order to replace the old ones;
  4. if there is an annotation about mortgage and other encumbrances, it must be written down in the new Buku Tanah and land certificates; in the old/previous documents, it must be written the annotation that stipulates '*this document is no longer valid because its right has been booked through subdivided parcels in the new right name: … … … right number ID: … -…(looked at Buku Tanah number …- …)*' and it should be verified and signed by the head of land office or by the mandated officer;
  5. the new land right is also booked in other blank list and in the map of registered parcel and other maps with erasing the existing land parcel and replacing/updating/creating the new depict of the new subdivided parcels and also giving the new right ID number and the new number of Surat Ukur.

- **Government Regulation Number 46/2002**

  This regulation regards to Tariff for Type of Non Tax State Revenue (PNBP) applicable within BPN (Presiden Republik Indonesia, 2002). Based on article 3 in this regulation, the types of non tax state revenue from land registration activities are:

  o service of surveying and mapping
  o service of the first land registration
  o service of maintenance of land registration data.

  All details of these tariffs related to the land registration in BPN will be explained in Annex 2.

  In Annex 2 Table of Tariff mention that for Subdivision process customer has to pay the

amount of application fee of 25,000 IDR, equals to 1.89 Euro (1 Euro = 13,000 IDR, source : (Universal Currency Converter, 2010).

This fee is only as administrative fee. The total/complete fee includes: fee for surveying and fee for transportation. Based on this regulation, there is a formulation to count the fee for surveying. The fee for surveying is made in the range of area (based on the gradation area) and based on the minimum wage (salary) per month in the city. This made the differences in cost for surveying from one city to another because each city also has its own Minimum Wage (salary) (Presiden Republik Indonesia, 2002).

For instance: in Surabaya City to surveying and mapping the land which has area size 750 m2 (metre square) the customer have to pay 403,000 IDR equals to 31 Euro (1 Euro = 13,000 IDR, source : (Universal Currency Converter, 2010) (*see also Annex 3: in case of Surabaya City, East Java, Indonesia*). The formulations to count the survey and mapping tariff are (Presiden Republik Indonesia, 2002) :

$$T = 0.55 * To/Xo * (X + (X*Xo)^{1/2})$$

Before coming to this formulation, To (tariff in certain range area size as reference) must be counted first with the following formulation :

$$To = (Xo/Ab) * 10.5 * Mw/day * (10/6)$$

Xo	:	area reference = 2500 m2 (metre square)
Ab	:	Surveyor ability to survey per day = 2000 m2 (metre square)
Mw	:	Minimum Wage (salary) for Surabaya City per month = Rp 948,500 IDR;
		1 month = 24 days work so Mw/day = 948,500 IDR/24 days = 39,520 IDR/day
X	:	the existing parcel area, for example 750 m2,

However the calculation of surveying and mapping will be:
To = (2500/2000) * 10.5 * 39,520 IDR/day * (10/6)
    = **864,518** IDR/day

T = 0.55 * (864,518 / 2500) * (750 + (750*2500)^1/2)
  = **403,079** IDR

Therefore the all total cost that customer has to pays for subdivision process in this example case are:

1.	Application fee (administrative fee)	:	25,000 IDR
2.	Transportation fee for Surveyor	:	80,000 IDR ***)**
3.	Surveying and Mapping fee	:	403,079 IDR
	Total cost	:	**508,079** IDR = **39.083** Euro

1 Euro = 13,000 IDR, source : (Universal Currency Converter, 2010).

*) The transportation fee is based on the distance from land office to the parcel location for instance within 1 – 5 km from land office.

4.3.7.2.   Existing Workflow of Subdivision

In order to apply the regulations and regard to the standard operation procedure (SPOPP) as depicted in Figure 4-3, the subdivision process will be described as the steps of these following phases:

A. Application

This is the starting phase of subdivision process. This phase is about applying for subdivision process by the owner (customer) in local land office. The activities of this phase are described below:

Step 1 : Submitting application

A land owner submits application to the concerned local land office with attaching the required documents such as: filled application form/document of subdivision including the explanation about the reason to subdivide the land; owner or represent identification card; letter of attorney (if this process is represented); the original land certificate; site plan (for real estate developer); land use permit (IPPT) if there is land use change—for instance from paddy field to plantation filed or to non-agriculture. Site plan can be obtained in the Board of City Planning (Municipal-City Administration).

Step 2 : Checking and verifying document

Land officer in front office (in counter 2) checks and verifies the submitted documents, if required documents are complete then the officer in counter 2 processes the applicant form, generates STTD and SPS, and then gives them to customer (the owner or his/her representative, or it is also possible a notary as the representative). In case of there is difference in land use change with the previous land use, (then) it needs a land use permit (IPPT). So if the owner does not include the IPPT, (then) the officer in counter 2 suggests the customer to apply for IPPT first (the workflow to apply for IPPT describe in Figure 4-4 below). The officer in counter 2 gives the submitted documents to the counter 3. Ijin Perubahan Penggunaan Tanah (Land Use Permit/ IPPT) is a planning permit and/or planning recommendation for land use based on Rencana Tata Ruang Wilayah (Area Land Plan/ RTRW), Rencana Detail Tata Ruang Kota (Detailed Municipal Land Plan/ RDTRK) and/ or Rencana Teknik Ruang Kota (Technical Plan of Municipal Space/ RTRK). RTRK contains formulation about site plan of the city hall, pre-engineering plans of the utility network, pre-engineering plans of the road network, pre-engineering plans of the building, pre-engineering plans of non-building and projects indicator.

Step 3 : Payment of application fee

As receives the STTD and SPS, the customer should pay the application fee to the officer in counter 3. The officer in counter 3 receives the payment from customer and gives the receipt to customer. After the application fee paid by the customer, the officer in counter 3 gives the documents to the PPK staff(s) and asked the archive staff to prepare the archive of document and map related to document(s) submitted by the applicant.

Step 4 : Preparing archive document

As asked from counter 3, archive staff searches and prepares archive documents related to the submitted document such as: SU, GU and Buku Tanah. Archive staff gives the SU and GU to PPK staff for surveying and mapping purpose and gives Buku Tanah to PHI staff in order to register the right after the subdivided parcel is done. Archive staff makes the manual transaction book for archive

documents which are borrowed and returned. This transaction book contains the date, the borrower, the archive identification number and its descriptions. Aim to the good archive administration system.

B. Surveying and Mapping

This phase is the main process of parcel subdivision, that is about preparation and conduct the survey and map of the subdivide parcel in the field. This phase includes activities as the following:

Step 5 : Checks the archive document

After PPK staff receives SU and GU from archive staff, then checks them. If the archive document is suitable with the submitted document then the PPK staff input the data as request for survey. Based on this data, PPK staff creates the letter of survey assignment. *Kasubsi* PPK mandate the chosen surveyor to conduct the survey. PPK staff also informs the owner to come to the field as a guide for boundary determination.

Step 6 : Prepare document and equipment for survey

As based on the Letter of Survey Assignment, surveyor conducts the field inspection. Before that surveyor must prepare, brings all the documents and survey equipments that used in order to obtain the new survey data. From the previous GU, surveyor decided what survey equipment should be prepared and brought, and what transportation should be taken to reach the location of the parcel.

Step 7 : Boundary determination

Together with the owner, surveyor determined the new boundary of subdivided parcel and makes the agreement of that. After the agreement is reachable, surveyor marks the new boundaries with some monuments then surveyor measure and survey the area of the new parcels. This means that after the area is determined, the new parcel number identification (NIB) also generate for each new parcel. Based on the survey, surveyor makes the new field sketch (include the new NIB) and all the measurement data in GU. The making of GU can be done directly in the field (roughly sketch field) or in the office later after the process boundary determination is finished.

Step 8 : Processing the data Measurement

Surveyor makes the GU more complete and suitable for the next process. *Kasubsi* PPK validate the new GU. The data processing staff used the completed GU with all measurement data to calculate the area and make the SU for each new parcel. Finally, the new parcels record in the list of land (DI 203).

Step 9 : Mapping the subdivided parcel

Actually before the new parcels are recorded in the list of land (DI 203), surveyor should makes the parcel map (PB) for each new parcels. After the new parcel is mapped as PB then surveyor has to map it into the map of registered parcels. And the last process is surveyor also have to update the base map of registered parcel with mapped the new parcel into it. Afterward PPK staff gives the new SUs' and Gus' to the PHI staff for register the right.

C. Register the right

Although in Head of BPN regulation number 3/1997 stipulate that there is no changes in the ownership and status of the right in subdivision process, but the new right number identification (NIH) still be generate for this ownership and right. This phase is related to these activities are:

Step 10 : Generate the right number identification

So after the new parcels are mapped, PHI staff receives the SU and GU of the new parcels and generates the right number identification (NIH) for each new parcel. With the new NIH, these new parcels also record in list of right. Based on the new NIH, PHI staff prepares the making of land certificate and *Buku Tanah.*

D. Issuing the new land certificates and archiving the new *Buku Tanah*

The important phase of this subdivision process is issuing the land certificates for the new parcels. This process is replacing the old land certificate into the new land certificates, and put the annotation on the old one. The copy of land certificate (Buku Tanah) should be archive as a archive document. Briefly the issuing land certificate phase will include these all activities, which are:

Step 11 : Create the new land certificate and the copy of land certificate (Buku Tanah)

Before PHI staff create the new land certificate and *Buku Tanah,* PHI staff put the annotation about "*this document is no longer valid because its right has been booked through subdivided parcels in the new right name: … … … right number ID: … -…(looked at Buku Tanah number …- …)"* in the old land certificate. Afterward PHI staff generate the new land certificates and *Buku Tanah* as based on the SU. *Kasubsi* PHI, *Kasi* P&PT validate of land certificates and *Buku Tanah* and checks the annotation in the old certificate whether it is right or wrong. If there is no error, *Kasubsi* PHI, *Kasi* P & PT give the initial on the documents, to show that the documents are verified.

Step 12 : Issuing land certificates

The final validation comes from the Head of Local Land Office. The head of local land office signs, issues the new land certificates and *Buku Tanah.* And make sure that the old one is no longer valid. The owner has the new land certificate as many as he/she subdivide the parcel.

Step 13 : Archiving documents

Before the new land certificate is delivered to the owner, the archive staff should archive all the documents such as *Buku Tanah,* GU, the map of registered parcel and other important documents relate to the ownership.

Step 14 : Giving the land certificate

The latest step is giving the land certificate to the owner. It can be represented or give directly to the owner. PHI staff gives the new land certificates to the counter 4 who has responsibility to gives and deliver the land certificate to the owner. The owner should sign the delivery receipt after he/she receives the land certificate. Also the counter 4 should make the annotation that the subdivision process is done.

Aim to make clear explanation, these above descriptions of the existing subdivision process also depict in activity diagram as based on the standard operation procedure (SPOPP) in land registration service in Indonesia. See Figure 4-3.

4.4.   Conclusion

Historical background and general overview about NLA as a started introduction to describe the existing condition of land administration system in Indonesia then the legal framework as an umbrella law for the LAS activities also mention in this chapter. Land registration include the subdivision process is part of activities in land administration system in Indonesia. In land subdivision process, physical data has changed; therefore the existing workflow of subdivision process is described in the end of this chapter in order to know how the maintenance should be taken to manage the change.
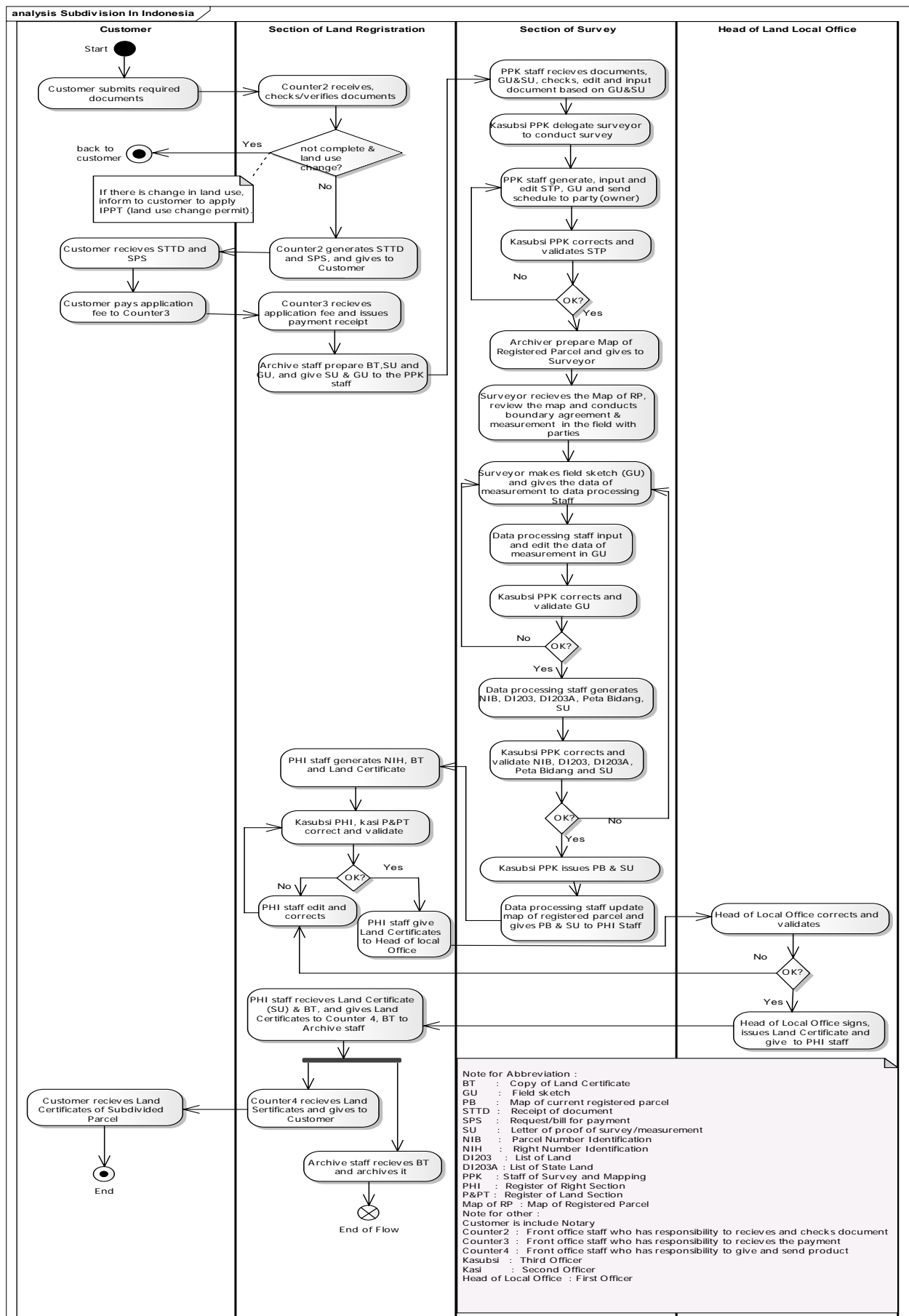
Figure 4-3 Activity diagram of the existing subdivision process
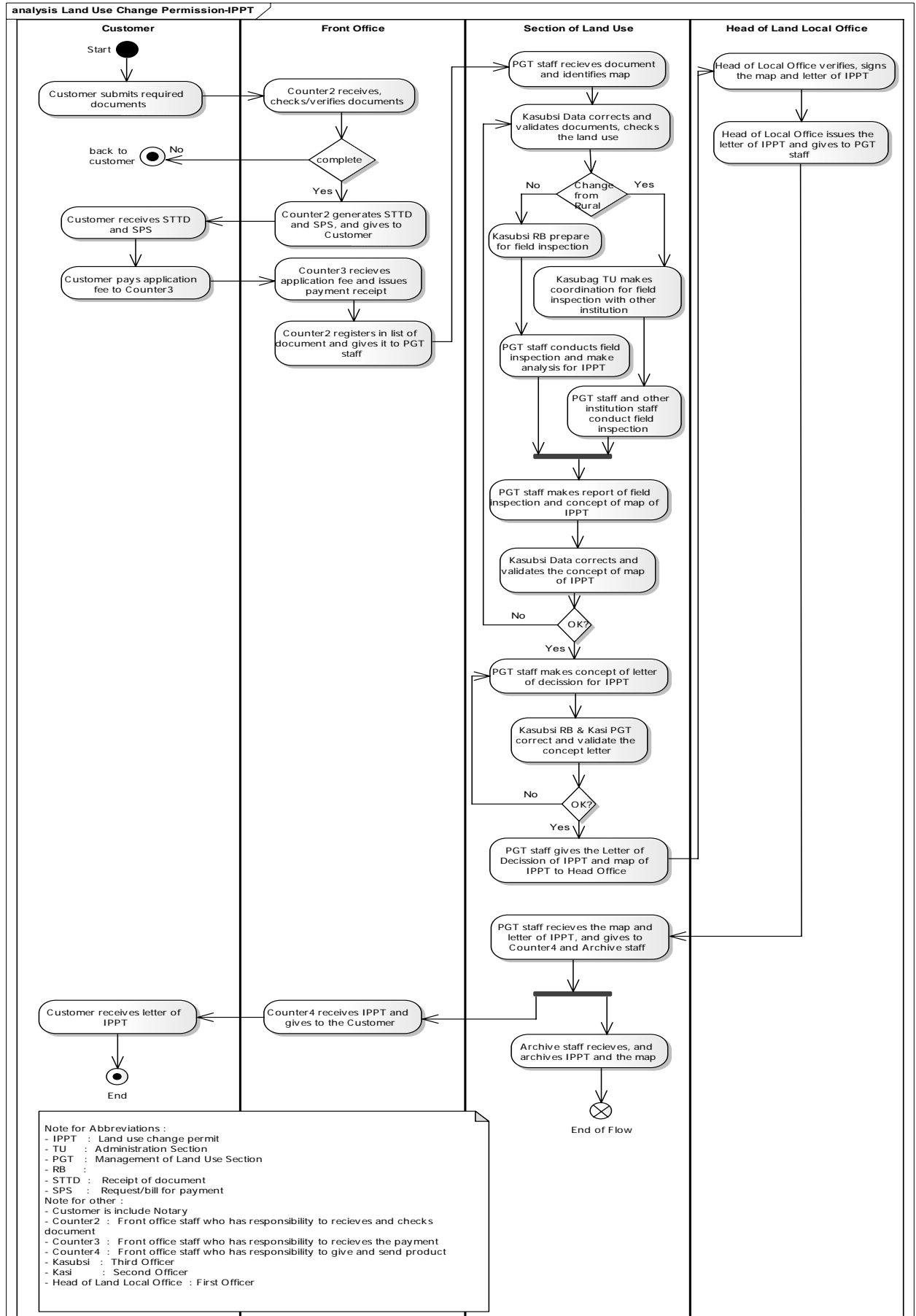
Figure 4-4 Activity diagram of the existing process of getting IPPT

5.   Data Analysis

This chapter presents the analysis of the data as the result of surveying about the subdivision process in Indonesia. In <u>Section 5.1</u> describes the result of survey with detail about data presentations that are classified into eleven aspects which are represented with the charts and analysis descriptions. From these analyses, then user requirements can be defined precisely. Finally the conclusion of this chapter is mentioned in <u>Section 5.2</u>.

5.1.   Result of Survey

The general objective of this survey is to obtain responses from customers/people about the land administration process that conducted by BPN. With regard to this research about maintenance of cadastral data, the survey about subdivision process is taken as a case study to evaluate the procedure, time, cost, information and user requirements relate to parcel subdivision process. Following are descriptions about the results of the survey:

5.1.1. Data Presentation

Data presentation is the display of respondents' answers in the survey about the parcel subdivision process in Indonesia. As explained in chapter 3, this survey has two kinds of respondents: (1) customers who have ever applied for subdivision processes at BPN as the representatives of the society and (2) administrators/land officer who conduct the process of parcel subdivision as the representatives of the BPN officer. In order to obtain the existing parcel subdivision process(es), the main aspects reviewed in this survey are:

1. Procedure
2. Time
3. Fee/cost
4. Information
5. Human resource
6. Service
7. Technology
8. Data
9. Archive
10. Obstacle(s)
11. Suggestion(s)/recommendation(s)

Based on those aspects, a kind of questionnaire had been built with variation in such a way to get more data and information related to the parcel subdivision process in Indonesia. Technical process in doing the survey is explained in chapter 3. In duration of time of one month, the survey received 174 responses from customers (*see in* <u>Table 3-3</u>) and 80 responses from the local land officers of 25 provinces in Indonesia (*see in* <u>Table 3-2</u>). The analyse of these data presentation is also discussed with
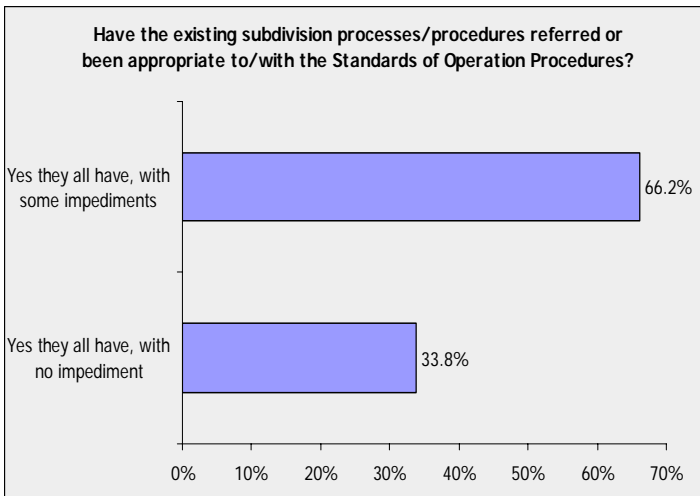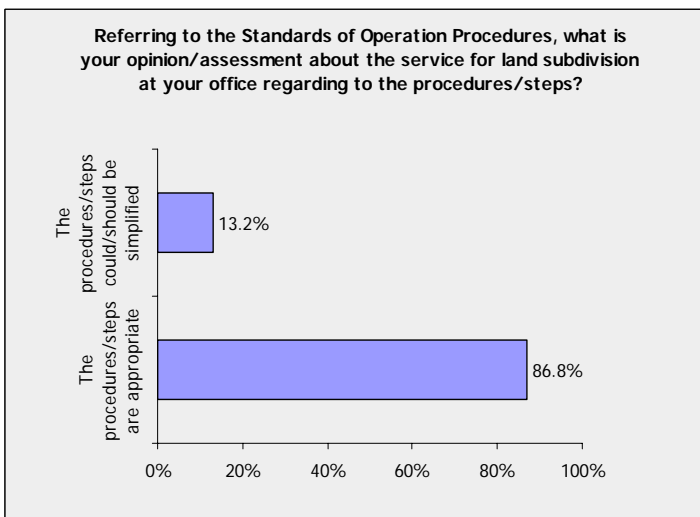
land officer by online interview. Detail analysis of data presentation as the results of the survey will be described as the followings:

1. Procedure

Following are the results from the survey about the procedures of parcel subdivision process in Indonesia. Land administration in Indonesia has had standard operation procedures (SPOPP)—which are aimed to manage all the process related to the land registration including the parcel subdivision process. The existing workflow/procedure of the parcel subdivision conducted by land offices in detail is depicted in <u>Table 5-1</u>.

Types of questions below were developed to obtain information and/or facts about how the procedures in the SPOPP accommodate the process of parcel subdivision and to obtain information about what kind of impediments or obstacles occurred/perceived in referring and operating this existing procedures. For clear explanation, this data presentation is split again as based on the two kind respondents (customers and land officers). The detail analysis is in <u>Table 5-1</u> below:

Table 5-1 Responses of Respondents about/on Referring SPOPP, Number of Visited Departments, and Information about/on Subdivision Procedure
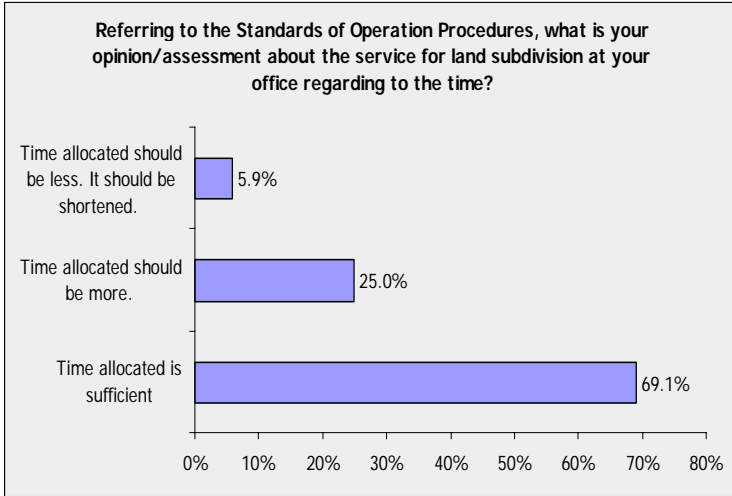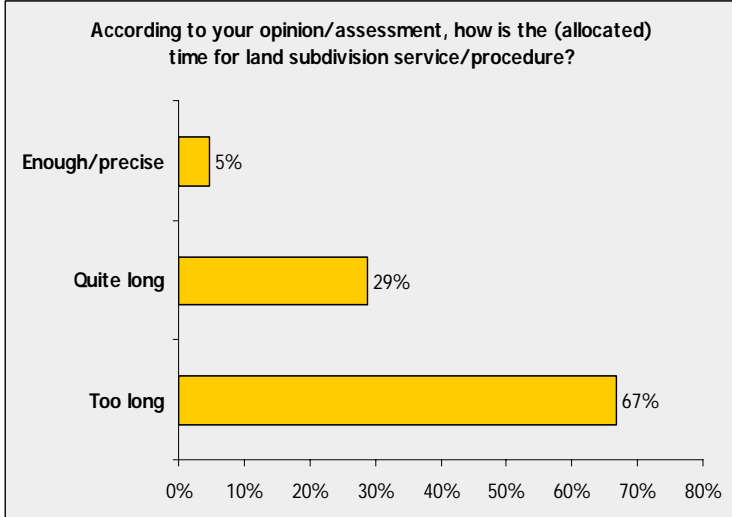
From Land Officer

Have the existing subdivision processes/procedures referred or been appropriate to/with the Standards of Operation Procedures?

- Yes they all have, with some impediments: 66.2%
- Yes they all have, with no impediment: 33.8%

Referring to the Standards of Operation Procedures, what is your opinion/assessment about the service for land subdivision at your office regarding to the procedures/steps?

- The procedures/steps could/should be simplified: 13.2%
- The procedures/steps are appropriate: 86.8%

Based on these two results, it is understood that most officers (66.2%) told that in conducting the process of parcel subdivision, they (the officers) had already referred and used the standard operation procedures (SPOPP) in subdivision process with having some impediments or obstacles such as: the lack of staffs who know about the SPOPP and the inconsistency in process.

The second chart shows the respondents' opinions and assessment of the SPOPP subdivision process. Most of the respondents (86%) told that the steps in SPOPP were appropriate.

From Customer	
According to your experience/knowledge, how many parts/departments did you have to meet in a land subdivision service/procedure? more than 4 — 35% 4 — 9% 3 — 23% 2 — 33% (0% 5% 10% 15% 20% 25% 30% 35% 40%) **According to your opinion/assessment, how are the procedures for land subdivision process?** Clear and simple — 8% More complicated, need to be more accelerated — 39% Complicated, need to be accelerated — 53% (0% 10% 20% 30% 40% 50% 60%)	From these two charts, it is known that: (1) most respondents (35%+33%+23%) had to come to several departments or parts in having land subdivision process/service. Visiting more than 4 departments means that this procedure practically still has many steps to follow; (2) Most respondents (53%+39%) thought that the procedures were relatively complicated and needed to be accelerated.

2. Time

The table below describes respondents' responses on the aspect of allocated time in SPOPP of parcel subdivision process. There was a contradiction in the assessment/perceptions of land officers and customers. Land officers (69.1%) responded and thought that time allocated in SPOPP was sufficient to process parcel subdivision while, on the other hand, customers (66.7%) responded and thought that allocated time in the procedure was too long for a parcel subdivision process. The allocated time for a subdivision process in SPOPP is 32 days. These 32 days have assumption: 1 (one) day equals to 8 (eight) working hours, therefore 32 days equals to 258 working hours.
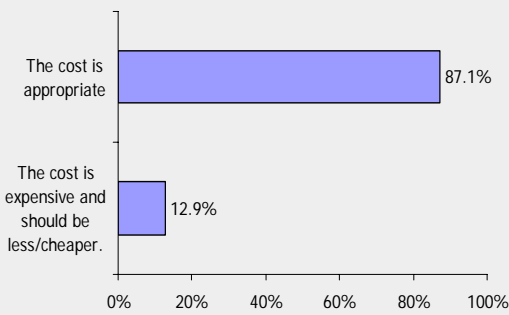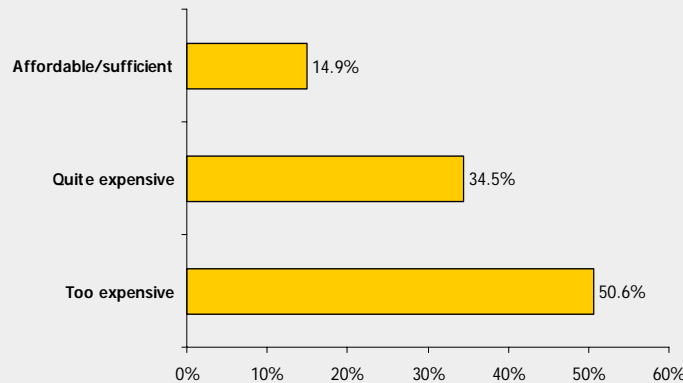
Table 5-2 Responses of Respondents about/on Time for Land Subdivision Referring SPOPP

From Land Officer	
Referring to the Standards of Operation Procedures, what is your opinion/assessment about the service for land subdivision at your office regarding to the time? Time allocated should be less. It should be shortened. — 5.9% Time allocated should be more. — 25.0% Time allocated is sufficient — 69.1% 0% 10% 20% 30% 40% 50% 60% 70% 80%	Most land officers (69.1%) thought the allocated time in procedure (SPOPP) of subdivision process was sufficient. This mean that according to their opinion 32 days was sufficient for officers to conduct a subdivision process.
From Customer	
According to your opinion/assessment, how is the (allocated) time for land subdivision service/procedure? Enough/precise — 5% Quite long — 29% Too long — 67% 0% 10% 20% 30% 40% 50% 60% 70% 80%	Most of the customers (67%+29%) responded that the allocated time in subdivision process was relatively long. This means that the steps/services in this process need to be accelerated/shortened.

3. Fee/cost

This aspect is about cost or fee the customers have to pay in a parcel subdivision. Referring to Government Regulation number 46/2002 about Tariff for Type of Non Tax State Revenue (PNBP)—applicable in BPN (*see in* Annex 2), the cost of an application of a parcel subdivision process is 25.000 IDR, not including the fee for surveying and mapping. According to this regulation, as stipulated in Article 13, the transportation cost for surveyor who conducts the survey in the field is charged to customer, and this cost is based on the local regulation on transportation (Presiden Republik Indonesia, 2002).

Table 5-3 Responses of Respondents about/on Fee/Cost for Land Subdivision Referring SPOPP

From Land Officer	
Referring to the Standards of Operation Procedures, what is your opinion/assessment about the service for land subdivision at your office regarding to the cost? The cost is appropriate — 87.1% The cost is expensive and should be less/cheaper. — 12.9% (0% 20% 40% 60% 80% 100%)	Most of land officers (87.1%) perceived that the cost is appropriate. It means that according to their opinion the tariff of subdivision process was appropriate with regard to Government Regulation number 46/2002.
From Customer	
According to your opinion/assessment, how is the cost for the land subdivision service/procedure referring to the defined rule? Affordable/sufficient — 14.9% Quite expensive — 34.5% Too expensive — 50.6% (0% 10% 20% 30% 40% 50% 60%)	Most customers (50.6%+34.5%) perceived that the tariff of subdivision process in complete was relatively expensive. Referring to the regulation the tariff is clear. In practice, the tariff can be duplicated because of the customers asked the brokers to help or to be their representatives. The brokers have their own tariffs in helping customers to register the land.

4. **Information**

Information related to the procedures of parcel subdivision process is one of the important aspects to be considered because from the information, customers know and/or understand about what they should do when they want to apply for a parcel subdivision process. Some of land offices already have the information centres located inside the offices. Most of the information centres are customer services or computer/online-information centres. Customers also can access the website of BPN to get the information about the services. Considering customer satisfaction, some land offices also provide information via SMS through mobile phone.

These kinds of information services still need to be implemented in other land offices and socialized to the society by the land officers. Transparent and valid information should be given to the customers such as the steps of the procedure(s), the application tariff/fee for the certain service (for instance subdivision process), duration time of subdivision process, and the regulation related to the certain procedure, etc. From following charts at table of result, it can be seen that most of the customers did not understand about the procedures, the cost, and duration time in subdivision process.

Table 5-4 Responses of Respondents about/on Information/Knowledge on Land Subdivision

From Customer	
Did you know about the procedures/steps in land subdivision? No — 23.0% Yes, a few — 37.9% Yes, most — 25.3% Yes, all — 13.8% (0% 5% 10% 15% 20% 25% 30% 35% 40%)	A few customers (37.9%) knew about the procedures/steps of land subdivision process.
From who did you get the information about land subdivision application and procedures? Broker — 12.6% Real Estate Company — 4.6% Notary — 46.0% BPN site — 18.4% BPN staffs — 43.7% (0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%)	Most of customers (46%+43.7%) got the information about subdivision process from notary and BPN officers/staffs.

5. Human Resource

Human resource is the most important aspect in supporting the activities in land registration. Based on interviews with the land officers, the lack of human resource is still the main problem in Indonesian land offices. Most of the land offices have to manage the availability of human resource by itself. So in practice there are not many staffs who have the appropriate/right capabilities in doing their jobs. In the case of subdivision process, land officers also gave responses about the lack of survey staffs/surveyors and IT staffs. In order to increase the staff abilities/competences, the Human Resource Department of BPN conducts annual staff trainings related to surveying skills and computer skills. Table below shows the responses from land officers about the technical trainings that they ever had.

Table 5-5 Responses of Respondents about/on Administrators' Education and Training

From Land Officer	
As an Administrator (Admin), have you had/obtained all required educations and trainings which provide you appropriate and sufficient backgrounds for your responsibility in your job? No, I have not had. — 16.1% Yes, I have had a few of them. — 46.8% Yes, I have had most of them. — 30.6% Yes, I have had them all — 6.5% (0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%)	Most land officers (46.89%) perceived that they had obtained a few education and trainings which are appropriate and sufficient to their responsibilities in their jobs.

6. Service

Regarding to the customer satisfaction on land office services related to land, it is important to look into respondents' opinions about customers' satisfaction in land office services especially in subdivision process. As depicted in chart below, both respondents (land officers and customers) were asked about customer satisfaction on services conducted by land offices. This evaluation of service is also aimed to propose improvements in BPN performance.

Table 5-6 Responses of Respondents about/on Customer Satisfaction

From Land Officer	
According to your opinion/assessment, how is customer satisfaction on land subdivision service/procedures? Low satisfaction. — 11.1% Medium satisfaction. — 42.9% Relatively high satisfaction — 46.0% (0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%)	Most of land officers (46.0%+42.9%) thought that customers had relatively high and medium satisfaction on the BPN services, especially in parcel subdivision process.

From Customer	
According to your opinion/assessment, how is the service of BPN staffs? Not good/satisfied — 11.5% Less good/satisfied — 43.7% Quite good/satisfied — 43.7% Very good/satisfied — 1.1% 0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%	As depicted in the chart, it was more customers (43.7%+11.5%) who perceived "no and less satisfaction" than those (43.7%+1.1%) who perceived "good satisfaction". This means that the customers still need the improvement(s) in quality of services in general and in subdivision process in specific.

7. Technology

This aspect is about technology that land offices used to support the process of land subdivision. This technology is related to hardwares (computers, survey equipment, other office equipment, etc) and softwares (programs installed inside the computers—for operating the system or to support the land office activities—such as: office software(s), mapping software(s), archive software(s), accounting software(s), land registration software(s), and networking software(s)).

In 1997 Government of Indonesia had collaborated with Spanish Royal Government to build Land Office Computerized System and it is called LOC phase 2B (the latest version software) and still in use until now. LOC 2B softwares are used and implemented in 52 land offices to support land registration activities. In the table below are the results of the survey related to the technology that is used in Indonesian land office to support land registration activities.

Table 5-7 Responses of Respondents about/on User-Friendliness of Software and Availability of Supporting Infrastructures
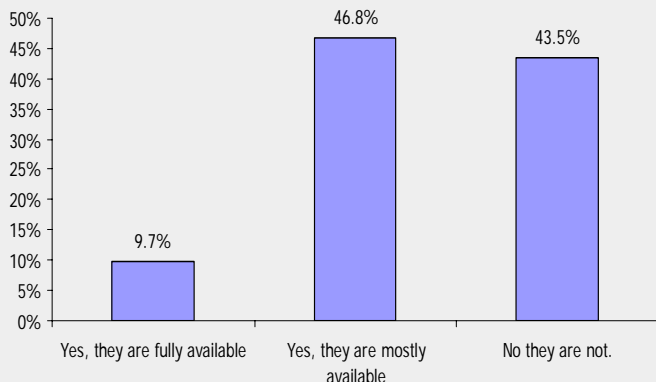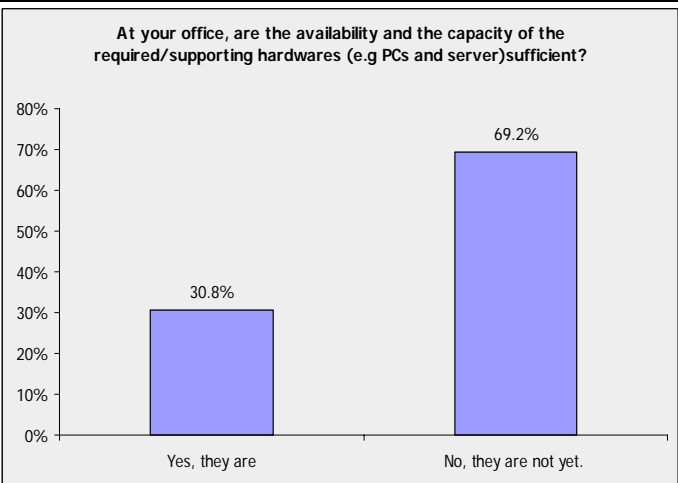
From Land Officer	
According to your opinion/assessment, is the sofware application used for land administration services at your office easy to operate/to be operated or user friendly?	Most officers from land offices that had utilized a computerized system (66.1%) responded/perceived that the software used in land registration was user friendly. Most of them (46.8%+9.7%) reported the availability of good infrastructures— such as internet and networking (LAN) —at the land offices where they worked but some of them (43.5%) perceived that the infrastructures are not available at their offices.
At your office, are required supporting infrastructures for computerized services (e.g internet, LAN) sufficiently available?	

Table 5-8 Responses of Respondents about/on Availability and Capacity of Supporting Hardwares and Online Transaction

From Land Officer	
At your office, are the availability and the capacity of the required/supporting hardwares (e.g PCs and server)sufficient?	As shown in the charts, most land officers (69.2%) reported the insufficiency of availability and capacity of supporting hardwares such as computers and servers in their offices.

From Land Officer	
At your office, how are the availability and the adequacy of the storage devices (harddisks)? 50% 46.0% 45% 40% 35% 30% 28.6% 25.4% 25% 20% 15% 10% 5% 0% They are sufficiently available and adequate / They are available but not adequate / They are not available	The chart beside depicts that most land officers (46.0%) perceived that the storage devices (hard disks)—for saving cadastral database—were available but not adequate in capacity, some (28.6%) reported that they was fully available and adequate, but others (25.4%) perceived that they was not available.
From Customer	
According to your opinion, how if the land application and transaction conducted on-line? 50% 45% 43.1% 43.1% 40% 35% 30% 25% 20% 15% 13.9% 10% 5% 0% Good, effective, efficient, safe/secured / Good, effective, efficient, unsafe/unsecured / Not good, inefficient, ineffective, unsafe/unsecured	Responses/opinions from the customers about land registration conducted on-line were: 'good, effective, efficient and safe' (43.1%), 'good, effective, efficient but unsafe' (43.1%), and 'not good, inefficient, ineffective, and unsafe (13.9%). This means that some of customers still hesitate in doing on-line transaction, but on the other hand most of them thought that online land registration system will be more effective, efficient, and safe/secured.

8. Data

Some of cadastral data are growing in size and validity because they always change. It is important to keep the data up-to-date, therefore the changes in data need to be maintained. In parcel subdivision processes, physical data such as the areas, the maps, the parcel number identifications, etc. is changed. Land officers have responsibilities to maintain these changes. The charts below represent respondents' responses on/about data maintenance.

Table 5-9 Responses of Respondents about/on Data Backing-Up

From Land Officer	
At your office, are data periodically and automatically backed up? No. They are sometime backed up and sometime not — 51.8% Yes, they are periodically but not automatically backed up. — 28.6% Yes, they are. — 19.6% (0.0% 10.0% 20.0% 30.0% 40.0% 50.0% 60.0%)	Most land officers (51.8%) reported that the data at their offices were sometimes backed-up and sometimes were not. Some (28.6%) told that they were periodically but not automatically backed-up. These responses are really unexpected because backing-up data is one of the important parts of data maintenance activities. This fact means that if errors or damages happened, the data were not restored.

Table 5-10 Responses of Respondents about/on Causes of Data Damage/Corruption/Invalidity and Fixing Efforts

According to your opinion/assessment, what is/are causing the condition of the database is not valid / corrupted / damaged? - The options can be more than one -- No back up database — 43.5% The electricity shut down suddenly — 78.3% Error/crush/damage hardware. — 26.1% High in data transaction — 15.2% To frequent in editing database with database tool editor — 17.4% There is error with the application/software. — 47.8% (0% 10% 20% 30% 40% 50% 60% 70% 80% 90%)	Land officers gave responses about the technical possibilities that caused data damages or errors or corrupted: the electricity shut-down suddenly (78.3%); error(s) in using the application software(s) (47.8%) and no back-up database(s) (43.5%).
According to your opinion/assessment, how often the database at your office get damage (which are caused by editing, inputting, updating, and deleting) therefore you should fix it with database tool editor? Always or frequent — 20.0% Sometime — 66.0% Never — 14.0% (0% 10% 20% 30% 40% 50% 60% 70%)	The effect of having mistake in using the application software is the data can be corrupted or damaged. In order to fix it, the database administrator must edit the data with database editor tool. Regarding to that condition, most land officers (66%) responded that they sometimes edited the database by using database editor. This means that data conditions are relatively good.

9. Archive

Archiving data or document(s) is a part of data maintenance activities. Data archiving can be in digital system or manual system. The archiving system is aimed to make the steps in searching, retrieving and maintaining the data or document and map easy. This system should have: an order-based or a sequenced numbering system, careful treatments in archiving old documents, sufficient and appropriate spaces or rooms, transaction card(s) (kind of *'borrow and return'* documents). With regard to this aspect, the results below give an explanation about the archiving in Indonesian land offices.

Table 5-11 Responses of Respondents about/on Good and Standardized System of Archiving

From Land Officer

Based on the chart, it s known that some land officers (38.1%) reported that there were good and standardized system for archiving documents and most documents were well archived. Some/others (38.1%) told that the offices where they work had had such system but only a few documents were well archived. The secondly reported-condition can happen because in some land offices there are no room for document archiving and also because of the lack of staffs to maintain the archived documents.

10. Obstacle(s)

Table 5-12 Responses of Respondents about/on Impediments/Hindrances/Obstacles Perceived by Land Officers
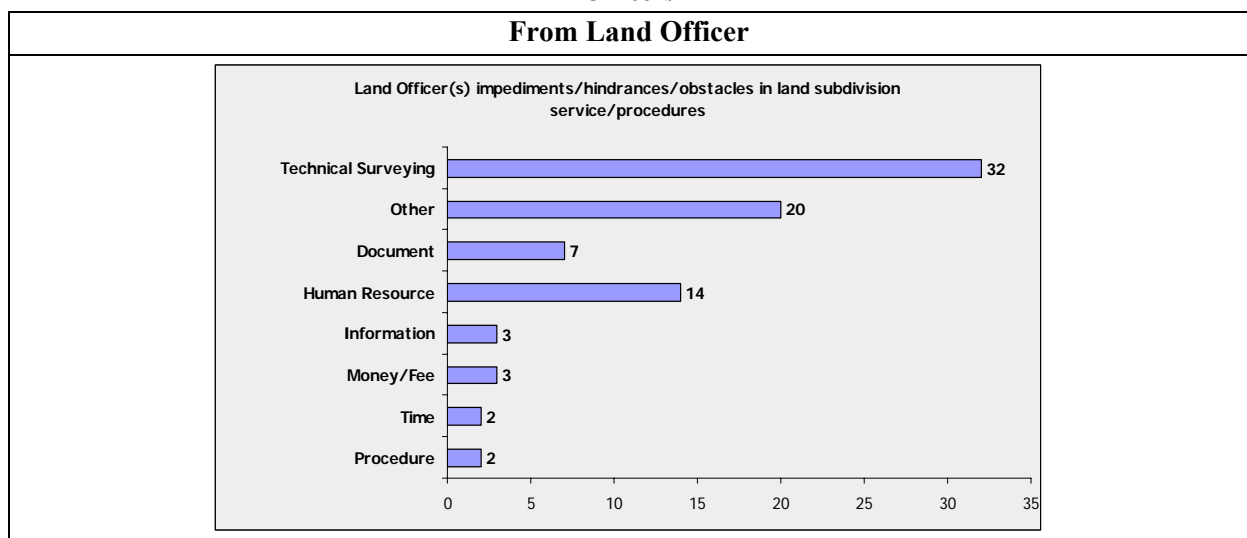
From Land Officer

As shown in the charts depicted above, the classifications or categories of obstacles perceived by the land officers/administrators—respectively/descendingly from the most frequent—are :

- **Technical surveying;** (perceived by 32 respondents); The answers of respondents in this classification/category were: limited surveyors, lack of survey equipment, unreachable locations of the parcels, no financial support and/or fund for transportation, no boundary point in the field, different data of measurement between in documents and in the fields (they were called "flying parcels") so the surveyors could not find the locations of the parcels. This could happen because survey data was not valid and because of the absences of the owners in the field inspections.

- **Other obstacles;** (reported by 20 respondents); Mentioned in this category were : poor infrastructures, facilities (office rooms, computers, softwares); current mapping softwares that is not user friendly; land dispute(s) in subdivided land(s); the owner(s) who disobey the regulation about minimum area that can be subdivided; brokers who were asked to help by the customers or to be representatives of them; authorized staffs who could not come when the time/schedules for signing the land certificates came.

- **Human resource;** (thought by 14 respondents); what respondents mentioned in this category were: the lack of staffs (surveyors, archive staffs, and IT staffs) and the poor/insufficient quality of staffs (skill and ability); low salaries. These obstacles also caused time consuming in finishing subdivision process for instance. Technical trainings for staff were too short in duration.

- **Document;** (reported by 7 respondents)**;** Included to this category of obstacles were : much/long time consumed to find archives of documents, no archiving system, only a few offices that had archiving system, missing documents, documents that were too old, documents having texts which were difficult to read, and they were not valid anymore, etc.

- **Procedure, Fee/cost, Time, Information**; (perceived by 10 respondents); According to land officers, the obstacles related to these aspects were: many land officers did not understand the steps in the workflow of subdivision process (SPOPP); land officer(s) needed additional transportation fee/cost especially for unreachable parcel locations; the allocated time were relatively not enough to subdivide more than 10 parcels moreover with the lack of human resource; the customers did not have knowledge about blue print of city planning (RTRK).

Table 5-13 Responses of Respondents about/on Impediments/Hindrances/Obstacles Perceived by Customers

From Customer

Customer's impediment(s)/hindrance(s)/obstacle(s) in the land subdivision service/procedures?

Category	Value
Document	2
Human Resource	2
Survey	8
Other	10
Time	19
Money/Fee	22
Information	23
Procedure	30
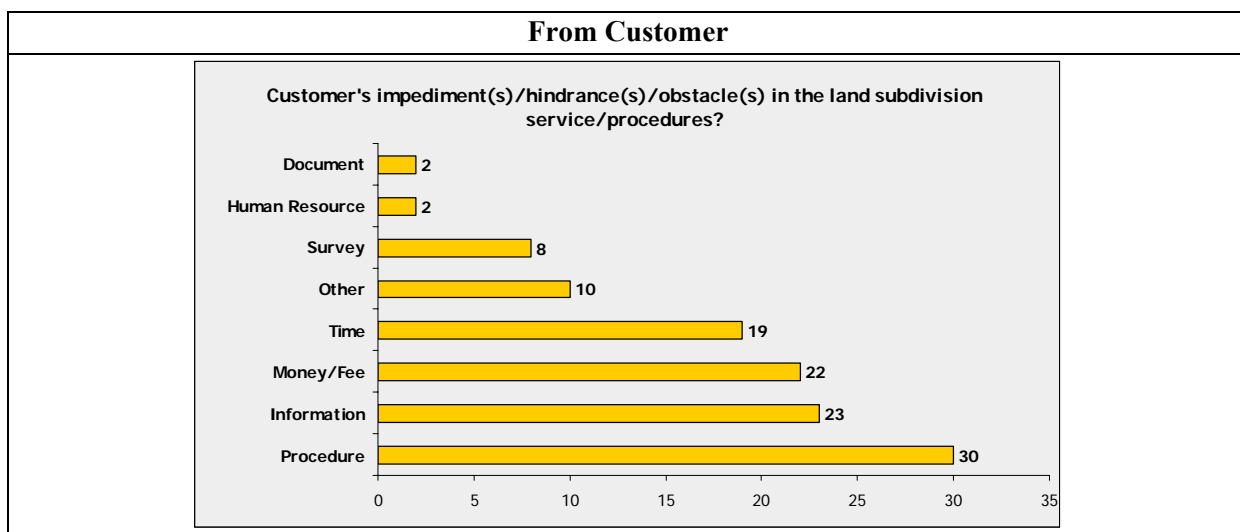
As displayed in the chart depicted above, classifications/categories of obstacles perceived by customers ―respectively/descendingly from the most frequent―are :

- **Procedure**; (reported by 30 respondents); customers' responses on this category of obstacles included : procedure was too complicated and needed to be accelerated, this obstacle means that the customers had to meet many desks or rooms, follow a long bureaucracy.
- **Information**; (perceived by 23 respondents); customers' answers in this category were : having difficulty in getting the clear information about procedure, time, cost and what they should do in subdivision process; there was no transparency.
- **Fee/Money**; (reported by 22 respondents); customers told following problems/conditions : the application fee was too expensive, the poor owners often had to postpone to subdivide their parcels until they had enough money to pay, there were so many informal costs or needed/asked extra money for unpredictable costs.
- **Time**; (perceived by 19 respondents); customers reported that the duration time to subdivide land was too long.
- **Other obstacles**; (reported by 10 respondents); other obstacles mentioned by customers were: unclear regulations, too many required documents, the subdivided parcels were disputed parcels.
- **Survey;** (perceived by 8 respondents); customers told that they had to wait for a long time for surveyor to conduct the survey of their parcel, sometime the written data of measurement were different from those are filed.

11. Suggestion(s)

Table 5-14 Suggestions of Land Officers on Land Subdivision Service/Procedures
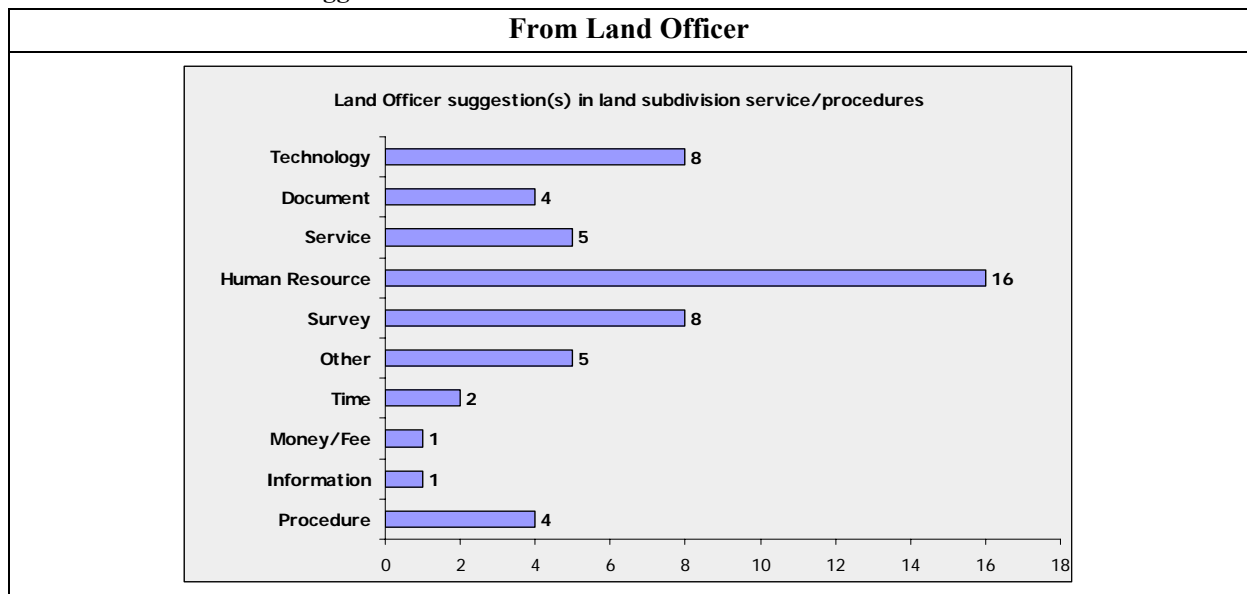
As shown in the chart above, the suggestions from land officers related to land subdivision process―respectively/descendingly from the most frequent―are:

- **Human resource;** (suggested by 16 respondents) land officers suggested : (1) BPN must add staffs who have appropriate educational background related to certain jobs, (2) to increase the capability of the current staff, BPN must organize an annual (continuously) and good quality staff training related to their job responsibilities, (3) BPN has to give rewards for the staffs

who create good innovations in their jobs and the punishment for the staffs who break the regulation.

- **Technology**; (suggested by 8 respondents); Land officers' suggestions on this category were (1) BPN have to increase the capability of hardwares (servers, computers, harddisks, and printers) and utilized softwares (land register application softwares must be valid, dynamic, strong, not easy to fail; (2) upgradeable mapping softwares and security softwares; (3) strong database administrator softwares; (4) immediate implementation/utilization of land registration software/Land Office Computerize (LOC) in other land offices.

- **Survey**; (suggested by 8 respondents); Land officers suggested that BPN have to : (1) increase the technical facilities relate to survey activities, that facilities such as: appropriate survey equipment, (2) increase the making of order control point also base map, and (3) provide transportation facility for surveyor to reach the filed location.

- **Service**; (suggested by 5 respondents); Land officers gave suggestion about: considering customer satisfaction, BPN offices need to apply *"one stop shopping"* (land registration service will start and end with the same door). This type of service is quite effective to reduce the informal fees.

- **Other suggestion**; (suggested by 5 respondents); Land officers suggested about: (1) deleting the taxation; (2) making the rule in subdivision process more clear; (3) reducing difficulties met in applying land subdivision, for instance by removing 'site plan document' in required documents; (4) customer/society should be more active and interactive with the land officers in order to have good communications.

- **Procedure**; (suggested by 4 respondents); Land officers gave the suggestion about procedures namely : (1) it needs to accelerate and implement *"one stop shopping"* (land registration service will start and end at the same door); (2) it needs to merge and reduce steps in procedures to make the procedure more simple and being conducted by only one Section; (3) BPN should review the SPOPPs; (4) subdivision process should begin with the survey and so then be followed by the registration process.

- **Document**; (suggested by 4 respondents); Land officers suggested that BPN need to apply computerized archive systems for manual and digital document.

- **Time, Fee/Cost, Information;** (suggested by 4 respondents); Land officers suggested that : (1) duration time for finishing the subdivision process need to be reviewed―in some land offices the duration time given is to short because of limited employee not comparable to the volume of work eminence; (2) information that given to the customer about fee/cost, time and procedure related to subdivision process need to be clear and transparent.

Table 5-15 Suggestions of Customers on Land Subdivision Service/Procedures

From Customer

Customer suggestion(s) in the land subdivision service/procedures
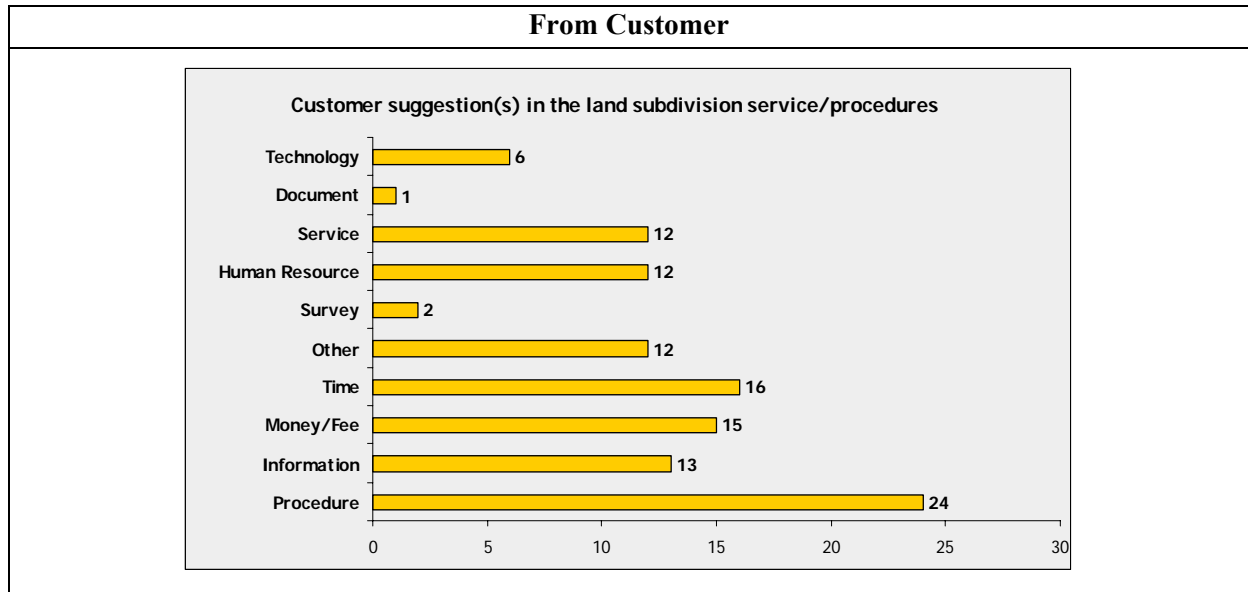
The chart above depicts the suggestion from customers. They―respectively/descendingly from the most frequent―are :

- **Procedure**; (suggested by 24 respondents); Most of the customers gave the suggestion that procedures in land subdivision need to be accelerated and better socialized to society.
- **Time**; (suggested by 16 respondents); Customers suggested that duration time in process subdivision need to be reduced (with the simplified procedure which automatically reduce duration of time), standardized, accurate and strict.
- **Fee/Money**; (suggested by 15 respondents); Customers suggested that : (1) they need cheaper and clear worth/appropriate/sufficient fees/tariffs in application of land subdivision; (2) need for more transparent procedure; (3) punishment for land officers who asked for informal/extra fees; (4) need for more strict regulation on tariff; (5) elimination of the brokerage system that makes duplication fee/cost in land registration process;
- **Information**; (suggested by 13 respondents); Suggestions from customers were : (1) sufficient information related to the rule/regulation, procedure, cost and time of subdivision process; (2) need for socialization in clear and transparent ways;
- **Service, Human resource and Other**; (each suggested by 12 respondents); Suggestions from customers regarding to service were : (1) BPN have to empower "front desks" to promote customer satisfaction; (2) regarding to human resource(s), customers suggest the improvement of staff professionalization; and (3) As other suggestion, BPN have to assess its performance to obtain the better performance.
- **Technology, Survey and Document;** (suggested by 8 respondents) customers gave suggestions and opinions about technology that: (1) BPN should have "online land registration"; (2) customers suggest that surveyor have to consider about time to finish the survey field in obtaining the data of survey/measurement.

5.1.2. User requirements

Based on the data presentation above, user requirements about parcel subdivision process are simplified in the table below:

Table 5-16 User Requirements on Land Subdivision Service/Procedures

Aspect	User Requirements
1. Procedure	• Need to be accelerated • Referring to standard operation and procedure • One stop shopping • Merging and removing unnecessary steps
2. Time	• Need to be shortened/simplified • The quicker the better
3. Fee/cost	• Need to be reduced • Transparent • Need for agreement rule within the broker, notary and another person who makes
4. Information	• More transparent information about procedure, fee/cost, duration time and the regulation
5. Human resource	• Need for employees/officials with the appropriate background knowledge in accordance with the required tasks in job • Need for the increase of the ability and capability of staffs (with training and workshop)
6. Service	• Customer satisfaction oriented
7. Technology	• Online land registration system • Increase of the capacity of hardwares and softwares • Need for good facilities (survey equipment, upgraded digital and manual map)
8. Data	• Need for good data maintenance to keep the cadastral data up-to-date • Reduced possibility for data to get damaged/corrupted (by technical problems) • Continuous database backing-up (automatically)
9. Archive	• Need for well-built archiving system (manual and digital) with good facilities (appropriate rooms and equipment)

5.2. Conclusions

This chapter is describes and analyzes all the data as the result of survey (online survey and mail survey) about subdivision process in Indonesia that was conducted by the local land office with the customer and land officer as the respondent. These results of survey are categorised as eleven aspects which are: procedure, time, fee/cost, information, human resource, service, technology, data, archive, obstacle and suggestion. Each aspect has an analysis with considering the existing condition that already defined through the online interview with some land officer. Finally the user requirements can be describe as conclusion of the results of the survey.

6. The Design, Validation and Conditions for Implementation of the Workflow

In Section 6.1 of this chapter, it is identified the classes and attributes through the existing subdivision process with aim to define the relation between the activities in subdivision process and classes or attributes in LADM data model, especially in the LADM Indonesia Country Profile. User requirements (defined in sub Section 5.1.2.) are discussed in Section 6.2 in order to have an overview about LADM that can accomplish the user requirements with some ideas. As based on that ideas, it is added some classes and attributes in LADM explained in Section 6.3.

In Section 6.4 the proposed workflow of maintenance of cadastral data as based on LADM Indonesia country profile and user requirements using certain idea is designed. In Section 6.5 the suggestion classes and attribute that have already been implemented in proposed workflow are validated using the Assessment Questions and simulated with a demonstration of the maintenance database in case of subdivision process. In Section 6.6 the conditions for implementation of the proposed workflow are presented. Finally, conclusion is described in Section 6.7.

6.1. Identification of Classes and Attributes of LADM in Existing Subdivision Process

As explained in sub Section 4.3.7., based on Government Regulation number 24/1997 Article 36, the subdivision process is a part of the maintenance of land registration data (cadastral data) which is about physical data changes, besides amalgamation (Presiden Republik Indonesia, 1997). This analysis is aimed to have the workflow of the maintenance of cadastral data changes (physical data changes) in the case of subdivision based on LADM.

The LADM is a standardized cadastral data model which consists of classes and attributes; it provides an abstract, conceptual schema with five basic packages related to: parties (people and organizations); rights, restrictions, responsibilities (ownership rights); spatial units (parcels, buildings and network); spatial source (surveying) and spatial descriptions (geometry and topology). So the connection between the workflow and LADM is in what kind of maintenance of cadastral data activities in case of subdivision process which are touching or having transaction with LADM data model by means of its classes and attributes.

As adapted from Action G9 of the COST (Co-ordination in the field of Scientific and Technical Research) ways to model real property transaction around the European countries are in performed from 2001 to 2005. COST Action G9 explains about how to model the property transaction using the UML diagrams which are: use case and activity diagram (Cost Action G9, 2003). Based on this theory, in the beginning of determining the user (actor), class and attribute related to the activities are described in textual explanation about the activity and then the actor, class and attributes are

differentiated in many kinds of text colours. For instance, in this analysis these formal descriptions have different text colours to present such as:

- the meaning of **Class** with text colour blue
- the meaning of **Actor** with text colour green
- the meaning of **Activity** and **Sub-activity** with text colour red
- the meaning of **Attribute** with text colour magenta

Following are formal descriptions of subdivision process in Indonesia adapted from Action G9 of COST (Co-ordination in the field of Scientific and Technical Research) :

Table 6-1 The description of subdivision process to find the relation with LADM

Activity	A **subdivision** of **parcel** into one or more new parcels that submitted, verified, approved, carried out and registered in the Indonesian Land Administration System (**registry section, survey section** and **land use section**)
Trigger event	Depending on the intention of the subdivision (land use change)—for instance : from rural area (paddy field) to agriculture or to non-agriculture therefore additional permissions are needed. The **owner (customer)** has to get a **letter of land use permit** which is provided by the **land use section** and the **board of city planning.**
Preconditions	The **customer** (**owner**), who is registered in the **land office** or provable by former registered purchase contracts, decides to make a **subdivision**.
Actors (active)	1. **Customer/ customer** : Owner, Notary, Company Note: the owner, notary and company (customer) have two functions as an '**Actors'** in this approach and as a '**Class'** in LADM (LA_Party class) 2. **Front Officer** : Counter 2, Counter 3 and Counter 4 3. **Registry section** : PHI and PPT staff, Registry authority (Kasubsi PHI, Kasi PPT) 4. **Archive staff** 5. **Survey section** : Surveyor, Data processing staff, PPK staff, Survey authority (Kasubsi PPK) 6. **Land use section** : PGT staff, Kasubsi Data, Kasubag TU, Land use authority (Kasubsi & Kasi PGT) 7. **Head of Land Local office**
Other systems	**Board of city planning** (Municipal – City Administration Section)
Classes	**Application**, **Boundary**, **Boundary point**, **Documents :** (the original Land Certificate, owner ID, Letter of Attorney, Site Plan, land use permit–IPPT, field sketch–GU, letter of measurement–SU, copy of land certificate–BT, parcel map–PB, Invitation Letter, Letter of Survey Assignment, Field Investigation Report, Map of Registered Parcel–cadastral map), **Owner**, **Parcel**, **Report**, **Right**, **Subdivision**, **Surveyor**
Collateral activities	If there is a change in land use of subdivided parcels from paddy field to other plantation field (agriculture) or to non agriculture area therefore here the steps to get **land use permit** (IPPT) : 1. The **owner submits** an **application** for **land use change permit** (IPPT) with required **documents** including the **sketch field** of intended **subdivision** on the

proper copy of detailed **site plan map**

2. The **front officer** (counter 2) **receives**, **checks** the **documents**—if they are not complete then the **front officer gives** them back to the **owner**(**customer**) (status **'rejected'**) **and** if the **documents** are complete then **the officer verifies** the **documents** (status '**accepted**'), after accepting then the **front officer makes** the STTD, SPS and **gives** them to the **owner** (**customer**).

3. The **owner pays** the application **fee** as stated on the SPS (as invoice).

4. The **front officer** (counter 3) **receives** the payment from the **customer** (status '**paid**'), **gives** back the copy of SPS (as payment receipt) to the **customer** and **gives** the **documents** to the **land use section.**

5. The **land use section receives documents** and **verifies** it (status ' **accepted**')

6. The **land use section prepares** and **makes** coordination with the **board of city planning** for **conducting** a field inspection. The **land use section invites** the **board of city planning** for meeting coordination by **invitation letter** (status '**requested**').

7. The **board of city planning receives** the **invitation letter** and **accepts** the invitation.

8. The **land use section** and the **board of city planning** (the **team**) **investigate** the case and **prepare** for field inspection.

9. The **team conducts** field investigation and **makes** a **report** that is signed by the **team** (status '**approved**') and **gives** the report to the **PGT staff**.

10. Based on the **field investigation report**, **PGT staff creates** a concept of **map** of IPPT and **gives** it to **Kasubsi Data**.

11. **Kasubsi Data receives**, **corrects** and **validates** the **concept of map** of IPPT referring to **land use map**. If it is fine or correct then **the officer** approves it (status '**approved**') and **updates** the **land use map** (status '**plotted**'), if it is not correct then **the officer** gives it back to the **team** to make a re-investigation (status **'rejected'**).

12. After **Kasubsi Data approved** the **map** of IPPT, **PGT staff creates** a concept **letter of land use permit** (IPPT), and **gives** it to the **Kasubsi RB** and **Kasi PGT** (**land use authority**).

13. The **land use authority validates** the **concept letter**, if it is not correct then the authority **sends** it back to the **PGT staff** for correction (status '**rejected**'), if it is correct then **the authority approves** the **concept letter** of IPPT (status '**approved**') and **gives** it back to the **PGT staff**.

14. **PGT staff receives** the **concept letter** of IPPT and **gives** it to the **Head of local Land office**.

15. The **Head of Local Land Office receives**; **signs**—to approve—and **issues** the **letter of land use permit** (IPPT) and the **map** of IPPT (status '**issued**') and **gives** the **map** and **letter** of IPPT to the **PGT staff**.

16. The **PGT staff receives** the **map** and the **letter** of IPPT and **gives** them to the **front officer**.

17. The **front office receives** and **archives** copy of the **land use permit** (IPPT) and the **map** of IPPT, then **sends** the **invitation letter** to the **customer** to take the

	land use permit (IPPT).
	18. **Customer receives** the **invitation letter** and **comes** to the land office. The **front officer** (counter 4) **gives** the **land use permit** (IPPT) to the **customer** (status '**finished**').
Sequential Sub activities	Based on the existing parcel subdivision procedure as described in sub Section 4.3.7.2. therefore the sequential sub activities can be simplified as the following:
	A. Application phase
	1. The **customer submits** the **application form** (**identification, date**) for subdivision with required **documents**.
	2. The **front officer** (counter 2) **receives**, **checks** the **application** and the **documents**, if they are not complete then **the officer gives** them back to the **owner**(**customer**) (status '**rejected'**) **and** if the **documents** are complete then **the officer verifies** the **documents** (status '**accepted**'), after accepting then the **front officer** (counter 2) **makes** the STTD, SPS and **gives** to the **owner** (**customer**). If there is a land use change from rural (paddy field) to other agriculture or to non-agriculture, then **customer** has to apply for **Land Use Permit** (IPPT) first.
	3. The **customer pays** the application **fee** (administrative fee) as based/stated on SPS (as invoice) to the **front officer** (counter 3).
	4. The **front officer** (counter 3) **receives** the payment from the **customer** (status '**paid**'), **gives** back the copy of SPS (as payment receipt) to the **customer** and **gives** the **documents** to the **survey section.**
	5. The **archive staff prepares archive documents** (GU, SU and BT), and **gives** GU and SU to the **survey section**, and **brings** BT to the **registry section** (status '**borrowed**').
	B. Surveying and Mapping phase
	6. The s**urvey staff receives** required **documents** from **front officer** and **archive documents** (GU & SU) from the **archive staff**, then **checks** them all (status '**accepted**').
	7. Based on the **document** acceptance, the **survey authority mandates surveyor** to conduct the boundary determination and survey and then **asked** the **survey staff** to create a **letter of survey assignment.**
	8. The **survey staff creates** the **letter of survey assignment** signed by **survey authority** (status '**approved**') and **gives** it to the **delegated surveyor** and also **informs** the **customer**—through/by an **invitation letter**—to come to the field for boundary determination.
	9. The **delegated surveyor accepts** the **letter of survey assignment** and **prepares survey document** including cadastral map—which is **borrowed** from the archive—and equipment for boundary determination; before going to the field **surveyor** reviews the **cadastral map**.
	10. The **surveyor conducts measurement** and **boundary** agreement in the field with the **customer**. The **surveyor carries out** the process of **subdivision** with boundaries marking, measurements and the arrangement of **boundaries** in the field as based on **customer**'s agreement.

11. After measurement, **surveyor creates** a **field sketch** (GU) and **puts** the data of survey measurement on the **filed sketch documents** (status '**measured**').

12. The **surveyor elaborates** a **detailed report** about the **subdivision** execution (boundaries and **lots** established, measured and in the national coordinate system defined definitive **boundary points**, agreements etc.). The **surveyor gives** the **field sketch** and the **data of measurement** to **data processing staff**.

13. The **data processing staff edits** and **processes** the **data of measurement** and **inputs** them into the GU then **gives** it to the **survey authority**.

14. The **survey authority receives** and **validates** the GU, if the data of measurement in GU are accurate and valid then **survey authority** approves them (status '**approved**') but if they are not accurate and valid then **survey authority send** them back to the **data processing staff**, and also possible back to the **surveyor** to conduct the re-measurement (status '**rejected**').

15. The **data processing staff receives** the approved GU and—based on it—**generates** new **parcel number(s) of identification** (NIB), new Peta Bidang, new SU, and **gives** them to the **survey authority** to validate those new **documents**.

16. The **survey authority receives**, **accepts** the new **documents** and **validates** the new PB and SU. If those **documents** are valid so then **survey authority** approves them (status '**approved**') and then **gives** them to the **data processing staff** to update **cadastral map**, but if they are not valid, then the **survey authority sends** them back to the **data processing staff** to correct them (status '**rejected**').

17. The **data processing staff receives** and **accepts** the approved **documents** (new PB and SU) and then **updates** them to **cadastral map** (Map of Registered Parcel) (status '**mapped**') and **gives** new PB & SU to the **registry section**.

C. Register the Right phase

18. The **registry section receives** and **accepts** the new PB and SU (status '**accepted**').

19. Based on the required **documents** (original land certificate), archive of BT (copy of the original land certificate) and New PB & SU, **PHI staff generates** new **right number(s) of identification** (NIH), and new **land certificates** and new BT. **PHI staff puts** an **annotation** in the old **land certificate**.

20. **PHI staff verifies** the case related to the land right (registration of new parcels, new ownership, easements and encumbrances, other obligations, etc.) and then **gives** them to the **registry authority**.

21. The **registry authority receives** and **validates** the new **land certificate** and new BT, if the those **documents** are correct then **registry authority** approves them (status '**approved**') and then **gives** them to the **Head of local Land Office**, but if they are not so then **registry authority sends** them back to the **PHI staff** to correct them (status '**rejected**').

D. Issuing Land Certificate and Archiving phase

22. The **Head of Land Local Office receives** and **accepts** the new **land**

	certificates and new BT then **validates**, **verifies** and **issues** the new **land certificates** and BT (status '**issued**'), and then **gives** them to the **PHI staff**. 23. **PHI staff receives** the new **land certificates** and BT, then **gives** the new **land certificates** to the **front officer**, **gives** the new BT and other **documents** (SU and PB, Map of registered parcel) to the **archive staff** (status '**returned**'). 24. The **front officer** (counter 4) **receives** and **accepts** the new **land certificates** and then **gives/ delivers land certificates** to the **customer** (status '**finished**').
Variations (alternative scenarios)	In the case of changes in land use from rural area (for instance: paddy field) to urban area, before surveyor subdivides the parcel, the **owner** of parcel has to dry off the field from irrigation.
Post Activities	The archive staffs archives the maps and documents.

Based on the analyses above therefore table below gives the conclusion of translation classes and attributes between the classes in subdivision process (as adapted from COST Active G9) and classes in LADM of Country Profile Indonesia (ISO TC 211 N, 2009a), as the following:

Table 6-2 The relation between LADM and subdivision process

Class in LADM:	Class in existing Subdivision:
LA_SourceDocument LA_AdminSourceDocument, LA_SpatialSourceDocument,	▪ **Application** : application document, owner ID card, letter of attorney, STTD (document given receipt) ▪ **Documents** : 1. land certificate, site plan, land use permit (IPPT), Invitation Letter (LA_AdminSourceDocument) 2. GU, SU, BT, PB, Letter of Survey Assignment, Field Investigation Report, Map of Registered Parcel-cadastral map (LA_SpatialSourceDocument) ▪ **Report :** field investigation report
ExtArchive (ISO TC 211 N, 2009b)	▪ **Archive**
LA_Party, LA_GroupParty, LA_PartyMember	▪ **Customer / Owner**
LA_LAUnit, LA_SpatialUnit, LA_FaceString, LA_SourcePoint,	▪ **Boundary** ▪ **Boundary point** ▪ **Parcel**
LA_RRR, LA_Right, ID_Right, LA_Mortage	▪ **Right**
ID_AdminDocumentType	The list of all types of **documents** (as mention above) that are used in land registration.
ID_RightType	The list of types of kind **right**

6.2. Disscussion on User Requirements

By using the case study on maintenance of cadastral data in subdivision process, the user requirements are defined as in Table 5-16. In order to accommodate those user requirements with LADM, therefore

relation between user requirements and LADM needs to be discussed. Having an easy formulation to make relation between LADM and the user needs, those nine aspects of user requirements will be classified into two main aspects that are:

1. Technical aspect

This aspect is related to: procedure, time, service, fee/cost, data, information, technology, archive. These user requirements are the implication of the obstacles/barriers/impediments in subdivision process that need to be answered/solved. Because of this study is to design how the workflow of maintenance of cadastral data based on LADM data model with its classes and attributes that can be used to accommodate these user requirements (technical aspects) (see Table 5-16 for detail) therefore this discussion is more detail in the cadastral database level.

However, it needs to be more specific in analysing the user requirements that really influence the data model. And based on the detail user requirements, they are: (1) need for *one stop shopping* of process registration (procedure); (2) need for more accelerated/quicker process (time); (3) need for up-to-date, accurate, valid, transparent data and information and system archive (data, information and archive); (4) need for *online registration process*; *customer satisfaction and reduce fee* (technology, service and fee/cost) that these requirements can be answered by LADM data model. These user requirements are representatives of those all technical aspects. Referring to the analysis about LADM classes and attributes, then the answers from LADM data model to accommodate those user needs are as explained below:

- **For the need about :** *one stop shopping; online registration process and customer satisfaction*

LADM is a product of ISO Technical Committee of Geographic Information/Geomatics that have two important goals : (1) to avoid reinventing and re-implementing the same functionality over and over again, but rather to provide an extensible basis for the development and refinement of efficient and effective land administration systems, and (2) to enable involved parties, both within one country and between different countries, to communicate, based on the shared vocabulary implied by the model (Van Oosterom, *et al.,* 2006) (ISO TC 211 N, 2009a). With these goals, LADM made the conceptual model with classes and attributes as the representative of a legal meaningful relationship among people and between people and land (ISO TC 211 N, 2009a).

Organizations are now increasingly confronted with rapid developments in technology, a technology push (internet, spatial data bases, modelling standards, open systems, GIS), as well with a growing demand for new services and a market pull (e-governance, sustainable development, electronic conveyance, integration of public data and systems). Modelling is a basic tool facilitating appropriate system development and reengineering and, in addition, it forms the basis for meaningful communication between different (parts of the) systems (ISO TC 211 N, 2009a). By means in these statements that in LADM, it is possible with the conceptual model (by its classes and attributes) to develop *one stop shopping* system; *online registration system and reduce fee.* Furthermore Kalantari, *et al.* (2005b) stated that the internet and other information and communication technologies (ICT) are increasingly being heavily utilised by land administration organizations. These technologies provide opportunities for better service delivery, customer satisfaction and reduction in operating costs.

For other proves is that Van Oosterom, *et al.* (2006) stated the model (LADM) has been developed in a set of versions, which were each time adjusted based on the discussions at workshops with

international experts and the experience from case studies in several countries of the world (Netherlands, El Salvador, Bolivia, Denmark, Sweden, Portugal, Greece, Australia, Nepal, Egypt, Iceland, and several African and Arab countries). Ary Sucaya (2009) proved through his research that most of LADM classes, associations, and constraints are valid for Indonesia and LADM also accommodates the user requirements in almost all cases.

- **For the need about : more accelerated/*quicker in process; up-to-date, accurate, valid, and transparent in data and information and system archive(digital archive)***

The idea to accommodate these user requirements is that all transaction in land administration system should be *electronic document based.* This idea also needs the integration among subsystem. Kalantari *et al.* (2005a) explained, for example, the electronic conveyancing system should be developed in conjunction with the land taxation subsystem and land registry subsystem to ensure that all land transfer requirements are met in one simple process. In order to integrate among subsystems, Fgdc Subcommitee, (2004) stated that the core data (cadastral data) must standardized so information across jurisdictional boundaries can be shared. Therefore LADM can be used as standard data model to build the core database. These also have indicated that the idea of *electronic document based system* is possible to be developed.

Moreover, by looking into detail classes and attributes of LADM which give support the *electronic document-based system,* there were found those classes and attributes such as defined in:
1. class LA_SourceDocument with attribute that is:
    - electrSignature : data in electronic form which are attached to, or logically associated to other electronic data and which are served as a method authentication (having online integration with notary) (ISO TC 211 N, 2009a).

2. class LA_SpatialSourceDocument with attribute that is:
    - measurement; this attribute to capture the data in file format (from electronic device like GPS and Total Station) about field observations, and measurements, as a basis for mapping, and as a basis for historical reconstruction of the location of (parts of) the spatial unit in the field. (ISO TC 211 N, 2009a).

The conclusion is that LADM implements the *electronic document-based system* by having those two classes and its attributes. In order to answer the user requirements related to this aspect, it can be stated that the advantages of applying *electronic document-based system* in land administration system (Van der Molen, 2001) are:
- coping with a growing amount of digital documents on the land market
- faster procedures for submission and reaction
- perspective of lower costs (procedures, archives etc)
- fast and remote access to digitally stored deeds and title files
- faster clearance for transmission of purchase prices

2. Organizational aspect
This organizational aspect is related to the user requirements about human resource and regulation to support the activity of land administration. In detail the requirements in human resource are: lack of availability of staff and capacity building. With LADM data model, a land administration system can

apply integrated system, online registration system, and electronic document-based system. The integrated and automatic system made the possibility to reduce the amount of human resource. This integration of system will be helped by personal computer with network system.

Capacity building and regulation to control the land administration system are out of LADM scope. Capacity building and regulation are managerial aspects that need further discussion.

6.3. Modification in LADM Indonesia Country Profile

Based on discussion above, the assumption about the *one stop shopping*, *online registration system* using *digital/electronic document based system* will be applied in the subdivision process. Moreover, referring to the analyzed identification class and attribute inside the steps/activities in subdivision process―as adapted from COST Active G9―above, adding some classes and attributes in LADM Indonesia country profile is needed. These suggestion classes and attributes have purpose to give reliable support of the maintenance of cadastral data in subdivision process to achieve/meet the user requirements.

The additional idea is to support the accomplishment of the user requirements about: (1) actual, valid and transparent data and information; (2) more accelerated/quicker process (support data for decision-making process in time aspect).

As described in Table 6-3 below, there are the suggestion and addition classes and attributes related to the analyses above as the following:

Table 6-3 The suggested classes and attributes

Suggested Classes	
ID_LandUse	A class to accommodate the land use changes from paddy field to plantation field, paddy field to non agriculture
ID_LandUseType (code list)	A code list class that contain attributes of land use types
ID_HistoryStatusDocument	A class to accommodate the historical status given
ID_DocumentStatusType (code list)	A code list class that contain attributes of status documents such as: accepted, approved, rejected, paid, requested, borrowed, plotted, measured, mapped, issued, finished and returned.
Suggested Attributes	
actualStatus	An attribute in LA_SourceDocument class to represent the actual/current status of document
annotation	An attribute added in LA_SourceDocument class to represent the additional information given in the old land certificate
executeTime	An attribute in ID_HistoryStatusDocument class to represent a date and time that a status is given
rID	An attribute added in LA_Right class to represent right number of identification
responsibleID	An attribute in ID_HistoryStatusDocument class to represent the person who has responsible with the given status
statusDocument	An attribute in ID_HistoryStatusDocument class to represent the given status in a certain time

The explanation about these proposed classes and attributes are described as follow:

1. Class **ID_HistoryStatusDocument**

Descriptions	:	Class ID_HistoryStatusDocument is suggested to support maintenance of the data status given in document. Also by this class, the time stamp of given status is recorded. This class has association with the LA_SourceDocument. A document can have one or more status [1…*]. It means that a document can have one or more status from the beginning until the end of process (in case of subdivision process).
Purpose	:	This class is suggested in order to safe/maintain historical data relate to the last given status of document in certain time. Separate class for normalisation purpose.
Attribute	:	• executeTime: An attribute to represent a date and time when a status is given. And by this attribute, in the history of status document, it can be seen the duration time of document with given status. (this information about duration time is useful to support decision-making process)
		• responsibleID: the identifier of responsible person (land officer who has the responsibility with the given status of document)
		• statusDocument: An attribute to represent the given status in a certain time

class Profile D3. Indonesia

«FeatureType»
ID_HistoryStatusDocument

+ executeTime: DateTime
+ responsibleID: Oid
+ statusDocument: ID_DocumentStatusType
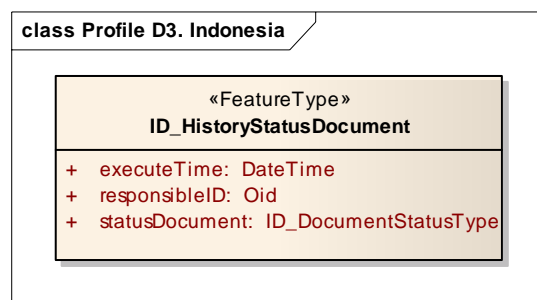
Figure 6-1 ID_HistoryStatusDocument class

2. Class **ID_DocumentStatusType**

Descriptions	:	Class ID_DocumentStatusType is a code list class as reference/lookup for attribute statusDocument in class ID_HistoryStatusDocument
Purpose	:	Class ID_DocumentStatusType is added in order to define the types of status document.
Attribute	:	• status related to land registration activity : accepted, rejected, paid, approved, issued and finished
		• status for archiving activity : available, requested and borrowed
		• status related to survey and mapping activity : measured, plotted, mapped.
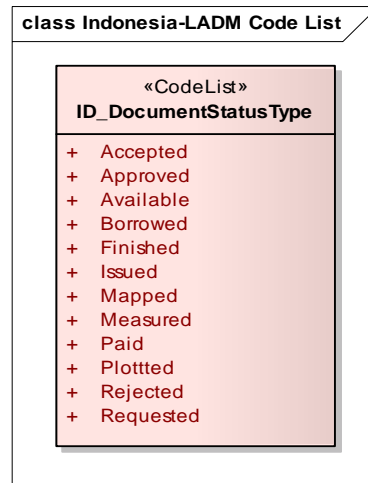
Figure 6-2 ID_DocumentStatusType Class

3. Class **ID_LandUse**

Descriptions : ID_landUse class is generalization of LA_SpatialUnit class by means that the type of land use is already included in data of spatial unit/land.

Purpose : This class is suggested in order to accommodate the land use of a land.

In land subdivision, information of land use is important related to the government permission. As mentioned before, if land usage of the existing subdivided land is changed from the paddy field to plantation field (agriculture) or to commercial land (non-agriculture), therefore it needs a land use permit (IPPT) from BPN. However this class is used.

Attribute : • type : is an look up attribute, that the types of land use are in the code list class ID_LandUseType
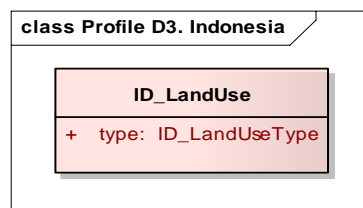
Figure 6-3 ID_LandUse Class

4. Class **ID_LandUseType**

Descriptions : ID_LandUseType class is a code list class that contains all types of land use. This class represents all types of land uses

Purpose : This class contains the list that refers to attributes: *type* in ID_LandUse class.

Attribute : • agriculture, housing, industry, nature, PaddyField, PlantationField, recreation

Figure 6-4 ID_LandUseType Class

5. Class **ExtArchive**

Descriptions	:	This class is not available in LADM version ISO/CD19152, because this class is adapted from the latest version of LADM namely version ISO/CD 19152.1. Class ExtArchive is a 'blueprint' class for the external registration of sources (ISO TC 211 N, 2009b).
		This class has association with class LA_SourceDocument. A document can have no archive or maximum have one archive [0..1] and also in the opposite.
Purpose	:	This class is re-used in order to accommodate the archiving electronic/digital and physical document.
Attribute	:	• acceptance: the date of force of law of the source issued by the authority
		• data: the content of the source
		• recordation: the date of registration (recordation) of the source by registering authority
		• sID: the identifier of the source
		• submission: the date of submission of the source by a party.
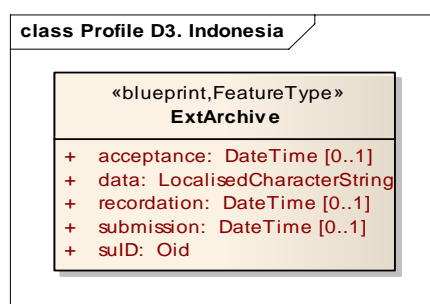
Figure 6-5 External class of Archive

As based on the suggestion attributes and classes above, the complete class diagram of LADM Indonesia country profile are changed as depicted below:

Figure 6-6 Class Diagram of Modified LADM of Indonesia Country Profile

And the class diagram below (in Figure 6-7) is about the code list class; data type class and external class that are used in LADM Indonesia country profile (including the new suggested class):
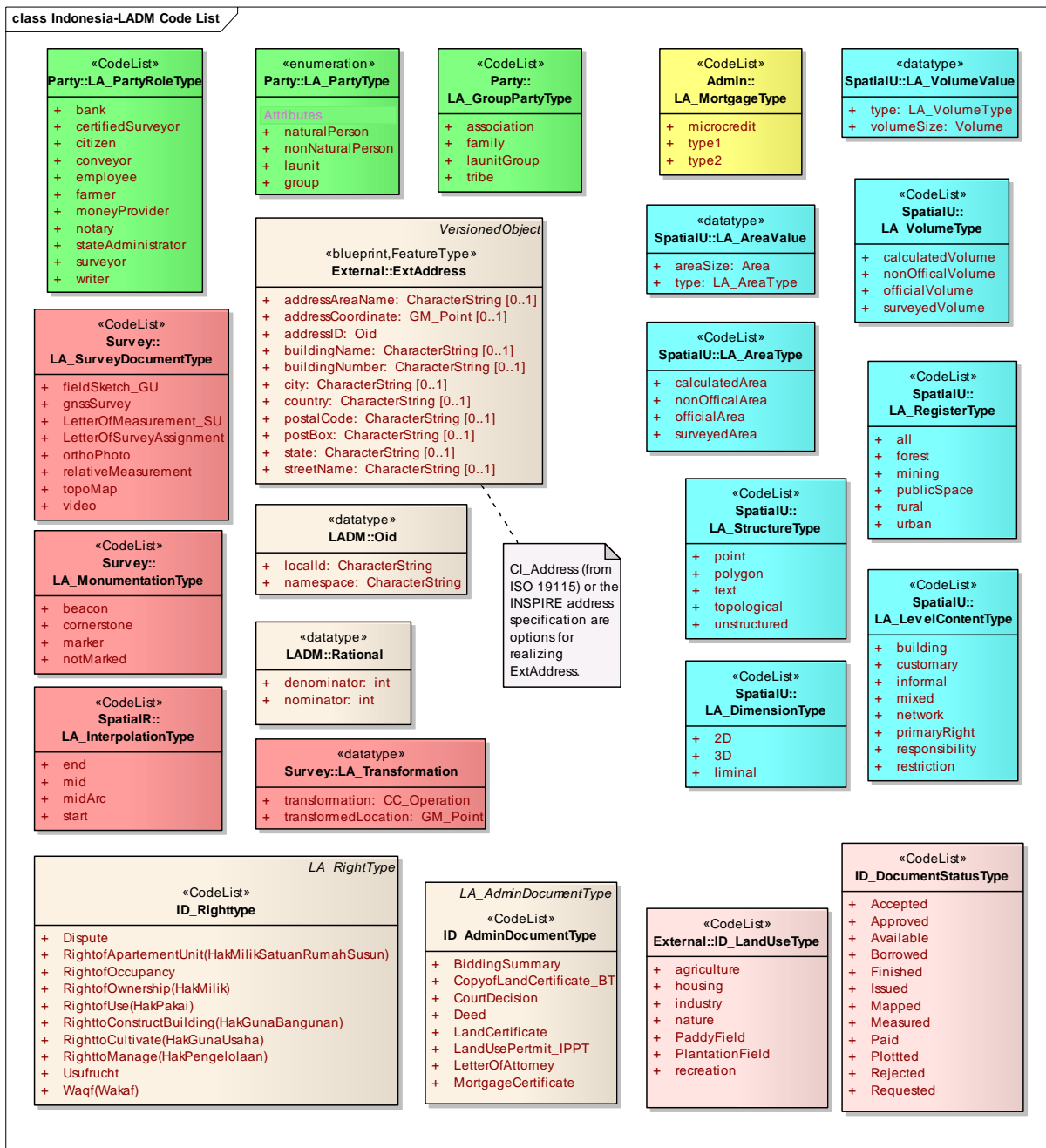
Figure 6-7 LADM Code list, Data type and External Class of Indonesia Country Profile

6.4. The Proposed the Workflow of Maintenance of Cadastral Data (in Subdivision Process) based on LADM and User Requirements

This proposed workflow of maintenance of cadastral data through subdivision process will assume and suggest about: *the electronic/digital document* and *one stop shopping* in the integrated land administration system to accommodate all user requirements. Land offices apply/promote *one stop shopping* by means of the customer will meet only one room or path when he/she wants to apply for a land service (not only for subdivision but for all kinds of services). So the customer only needs two times to come to the land office: the first for submitting required documents and the second when customer wants to take/obtain the issued land certificate. Land office also apply *the electronic/digital*

document by means of all document relate to the land administration process are form in digital/electronic data.

As the result of the analysis of the existing subdivision process with LADM, the new classes and attributes are added in LADM of Indonesia country profile that are: ID_DocumentStatusType, ID_HistoryStatusDocument, ID_LandUse, ID_LandUseType. The next analysis is about how the workflow maintain the cadastral data (physical data) based on LADM with its classes and attributes (including the new classes and its attributes). These maintenance activities are related to inserting/inputting/adding, updating/editing and deleting the attributes in LADM classes in the case of subdivision process. The description below will explain—in detail—the activities of maintenance of cadastral data in case of subdivision process which are touching/touched with LADM classes and attributes. Therefore the activities of the proposed workflow are as the following:

A. Application phase

LADM mother class	:	VersionedObject
LADM classes	:	LA_SourceDocument, LA_AdminSourceDocument, LA_Party, LA_GroupParty, LA_PartyMember, LA_Mortgage, ID_HistoryStatusDocument
LADM code list	:	LA_AdminDocumentType, LA_GroupPartyType, LA_PartyRoleType, LA_PartyType, LA_MortgageType, ID_StatusDocumentType

Step 1 : Customer applies for subdivision

A land owner or customer comes to the local land office and submits an application with attaching the required documents such as: filled application form/document of subdivision including the explanation about the reason to subdivide the land; owner or representative identification card; letter of attorney (if this process is represented); the land certificate; site plan (for real estate developer), land use permit (IPPT) if there is a land use change. If the land officer approves the application and the documents, the customer then pays the application fee.

Step 2 : Front Officer approves the application

Front officer receives and checks the submitted documents, and if they are complete so the officer then generates and inputs them into the system (application software) and approves the application (status 'approved'). Based on the application number, the front officer generates all the costs related to the subdivision process and then asked the customer to pay the fee. After receiving the payment, front officer generates the payment receipt and gives it to the customer (status 'paid'). This payment receipt also states that: the finishing date and the schedule of boundary determination (survey) will be informed through/by an invitation letter within certain time before finish (for instance: within 15 days or two days after submit the application).

Database analysis: When the front office generates and inputs the application, it means that these activities are touched with the classes and attributes such as:
- Owner data touched with classes: LA_Party class or LA_GroupParty class, in attributes: name (name of the party/owner), the type of party (natural person/individual person, non natural

person/company/legal body in class LA_PartyType) and the type of group (family, tribe or association-LAGroupPartyType see the lookup code list in <u>Figure 6-7</u>)

- Attached/required documents touched with LA_AdminSourceDocument class, all kinds of required documents can be added in the list of administrative documents (ID_AdminDocumentType, see the lookup code list in <u>Figure 6-7</u>) for example: land use permit (IPPT), original land certificate, letter of attorney, etc—as mentioned above in step 1.
- LA_SourceDocument and VersionedObject are used to record the acceptance, submission time and date of the application. In VersionedObject class, the attribute beginLifespanVersion will record about the date and time for the first time the data being inserted/added. LA_SourceDocument also records the complete information about the owner as based on identification card with the attribute: text, and attribute type is the status given based on the certain action such as: accepted, approved, paid, issued, mapped, measured, etc (ID_DocumentStatusType).

B. Survey and Mapping phase

LADM mother class	:	VersionedObject
LADM classes	:	LA_SpatialSourceDocument, LA_SpatialUnit, LA_FaceString, LA_Level, LA_SourcePoint, ID_LandUse, LA_SourceDocument, ID_HistoryStatusDocument, ExtArchive
LADM data type	:	LA_AreaValue, LA_VolumeValue
LADM code list	:	LA_SurveyDocumentType, ExtAddress, LA_AreaType, LA_VolumeValue, LA_DimensionType, LA_InterpolationType, LA_MonumentationType, LA_Transformation, ID_LandUseType, LA_StructureType, LA_LevelContentType, ID_DocumentStatusType

This phase is the main process of parcel subdivision, that is about conducting the survey and mapping of the subdivide parcel. The outputs of these activities are: the letter of measurement (Surat Ukur) for each parcel which contains the polygon, the area size, the number of identification and other additional information related to the parcel. This phase includes the activities as the following:

Step 3 : Surveyor investigates the case

When status 'approved' has been given by the front officer so then the flow of document and physicals document goes to the survey section. After the survey section receives the flow of document, it is given the status 'accepted'. By the time the survey section accepted the flow, a request for archive document to archive section is sent. And based on the request, the archive section prepares the archive documents (including the hardcopy of the map) and gives them to the survey section (status 'borrowed'). Then the survey section investigates the case as based on the submitted documents and the archive documents and also reviews the map. The survey section makes a conclusion of the case covering information such as: the address (location of the parcel); existing area of parcel; the availability of surveyor and the time/schedule to conduct the measurement (status 'approved'—this means that the survey section will conduct the measurement).

Step 4 : Preparation for measurement

Based on the conclusions, the survey section inputs the name of surveyor who will conduct the measurement and generates a letter of survey assignment, also creates/arranges a schedule to invite the customer to come to the field. After the survey authority approves the letter of survey assignment and the schedule, the authority gives the letter of survey assignment to the surveyor and sends the invitation letter (schedule) to the customer. After receiving the assignment letter, the surveyor prepares the equipment and documents that should have to be brought in the field.

Step 5 : Boundary determination and measurement
Together with the owner, the surveyor comes to the field with the measurement equipments and the related documents. After the owner pointed the boundary of his/her land (including the subdivided boundary), the surveyor marks it with a type of monument such as stone or beacon. The measurement has to be started with finding the reference point as a reference to obtain other points that already marked. Then from these points, the surveyor can draw the polygon of each subdivision the parcel, and put the sketch of the parcel in the field sketch documents together with the data of measurement such as: coordinate points/GCP, angle, distance, the surrounding condition on each parcel. After finished with field sketch documents, the surveyor then asked the owner to check and sign the document if there is no objection (status 'approved/measured').
Note : if the surveyor use GPS or Total Station to obtain the coordinate points, so the surveyor has to set up an interpolation method, transformation, the accuracy standard, Geodetic Control Point, etc, before the measurement is taken.

Step 6 : Data processing and mapping
From the boundary determination, the surveyor gets the data of measurement as the coordinate points of the parcel and the field sketch. If the surveyor uses GPS or Total Station so then he/she downloads these coordinate points from GPS or Total Station into the system. After downloading those coordinate points of the parcel then surveyor must transform those points into Transverse Mercator 3° (TM3) as the national coordinate system for Indonesia. The surveyor generates the point identifications for each coordinate point.

After the transformation is complete, the surveyor draws the polygon of the parcel based on the point identifications. For example, it is supposed that or if the identification points are: A, B, C and D so then the surveyor has to draw the line to connect each point such as : A to B, B to C, C to D and D to A until having a closed polygon of the parcel (using the field sketch as reference) and then with the same principle, the surveyor draws the line that subdivides the parcel.

So far, the drawing parcel is complete. For each parcel, it is generated the parcel number of identification and calculated the area size and also inputted additional information related to the parcel such as addresses, dimension type, land use type and the level type (related to the land cover of the parcel). Finally, the surveyor generates the letter of measurement (Surat Ukur) for each parcel (given status document from: 'measured' and 'plotted')—that depict the parcel with complete information—and then maps these parcels to the Map of Registered parcel. From the Map of Registered Parcel, the surveyor updates the base map—but before updating the map; the surveyor must validate the drawing parcel with the topological checks (status document 'mapped). After having an approval from the survey authority, the surveyor sends the letter of measurement (Surat Ukur) to the registry section for right registration process. Then the flow of documents goes to the registry section.

Database analysis: Surveying and mapping phase is the most important part of subdivision activities that is related to the survey in the field until processing data of measurement from the field. Here are the analyses through the classes and attributes of LADM:

- Letter of survey assignment, field sketch, letter of measurement (Surat Ukur), Map of Registered Parcel are the types of LA_SurveyDocumentType, see the lookup code list in Figure 6-7.

- After conducting boundary determination in the field, the surveyor downloads the coordinate points from the GPS or Total Station. These activities are touched with LA_SourcePoint class in attributes:
  a. originalLocation – data type GM_point (the coordinate points of the parcel)
  - pointType – data type LA_MonumentationType (the type of monument that is used to mark the point/boundary of the parcel, see the lookup code list in Figure 6-7)
  - transAndResult – data type LA_TransformationType (the process of transforming point to TM3 and the result points of transformation, see the lookup code list in Figure 6-7)

- After transforming all the coordinate points then the surveyor must draw a line to define the polygon of the parcel. This activity is related to LA_FaceString class and its attributes such as:
  a. fsID – data type Oid (the points identification such as: point A, B, C etc)
  b. geometry – data type GM_MultiCurve (after the line for each point is connected then a polygon is defined, therefore the geometry is Polygon)
  c. estimateAccuracy – data type Length (the accuracy of drawing the polygon must be defined)
  d. locationByText – data type CharacterString (the description about the location of the point, also the explanation of the sequence of how to draw the line—for instance form point A to B then B to C, etc.)

- The polygon of the parcel is defined. After that, for each parcel, the surveyor calculates the area and generates the parcel number of identification and also inputs all the additional information related to these parcels. These activities are touched with class LA_SpatialUnit and its attributes such as:
  a. suID – data type Oid (the parcel number of identification/PNI)
  b. address – data type ExtAddress (the address of the parcel in complete administrative area level, see the lookup code list in Figure 6-7)
  c. landUse – data type ID_LandUseType (the existing land use of the parcel such as paddy field, plantation, housing, industry, etc, see the lookup code list in Figure 6-7)
  d. area – data type LA_AreaValue (the calculation of area size with the type of area LA_AreaType – calculated area, official area, etc., see the lookup code list in Figure 6-7);
  e. dimension – data type LA_DimensionType (the dimension of parcel which is 2D or 3D, see the lookup code list in Figure 6-7)
  f. referencePoint – data type GM_point (in this attribute all the reference points which used to obtain the coordinate points of the parcel are described.

- Finally, after having the polygon of the parcel including the related information, then for each parcel the surveyor generates letter of measurement (Surat Ukur) including plotting the polygon of the parcel on it. In this activities, the new survey document is generated and accommodated with LA_SurveySourceDocument class with its attributes: type – data type LA_SurveyDocumentType (for instance the name of document : LetterOfMeasurement_SU, see the lookup code list in Figure 6-7)

- At the end, the surveyor maps the polygon of parcels to the Map of Registered Parcel and also updates the base map.
- When the surveyor processes the data of measurement in doing subdivision of parcel, the surveyor creates/generates two new parcels with new parcel numbers of identification (PNI-suID) and new description for each parcel. This means that the old parcel has been deleted and replaced/added by/with the new one(s). Consequently this also makes the VersionedObject class recording the historical data, recording the deleted data.

C. Register the right phase

LADM mother class	:	VersionedObject
LADM classes	:	LA_SourceDocument, LA_RRR, LA_Right, LA_LAUnit, ID_Right, ID_HistoryStatusDocument
LADM code list	:	LA_RightType, ID_DocumentStatusType

Step 7 : Registry section register the right

Registry section receives the flow of documents from the survey section (including the new letter of measurement—Surat Ukur). After all the documents are checked and then the status of documents is 'accepted' by the registry section so it is ready for the next step. After verifying the related documents, the registry section generates right number(s) of identification for each parcel. In case of pure subdivision (only subdividing parcel), the owner and the right are actually still the same as before. Then flow of documents comes to the registry authority for approval. After that, the authority checks and verifies the new right number(s) of identification (NIH) referring related document(s). If everything in the documents is correct, the authority approves them and gives them back to registry staff for making the new land certificates (status 'approved').

Step 8 : Making land certificate

Based on/regarding to the approval from the registry authority, registry staff generates the new land certificate and new Buku Tanah (copy of land certificate) for each right(s) or each right number(s) of identification (NIH). The right number(s) of identification (NIH) represent(s) the number(s) of right(s) and the type(s) of right(s). Before asking for approval, the registry staff restores the old land certificate that has been replaced with the new one, (and then) inputs an annotation inside the old land certificate (through the application and manual) as/namely: "***this document is no longer valid because its right has been booked through subdivided parcels in the new right name: … … … right number ID: … - …(looked at Buku Tanah number …- …)***". Then sends them to the registry authority (with the new letter of measurement—Surat Ukur—as an attachment) for approval. The registry authority checks and validates the new land certificates and also reviews the old ones. If everything is correct so then the authority gives the initials on those documents (status 'approved'). Then these documents are given/sent by the registry section staff to the Head of Land Office for the last/final verification and approval.

Database analysis : the register right phase is touched with the LA_RRR class, LA_Right class and ID_right class that refers to the code list class ID_RightType. The explanations are:
- When the registry section generates the right number(s) of identification (NIH)-rID, this means that the table of right is inserted with new record in numbers of (as many as) created

new letter(s) of measurement (Surat Ukur). In this case, there are two records added in table of right. Even if the owner's name and the type of right still the same, the right has to be registered.

- These activities also use the LA_LAUnit class because this class has a function as index of 'list of registered right' and connects to the spatial unit data/data of the parcel.

Based on the new right, the registry section creates a new land certificate and its copy (Buku Tanah). This means that table of administrative document is added by the new record—with the type of documents are land certificate and Buku Tanah (copy of land certificate)—and that an annotation is put/stated on the old document. In the case of subdivision process, when registry section generates the new land certificate, the old land certificate will be shown up first (to ask for the '*no longer valid*' annotation). After being edited, the old land certificate will be deleted or non active in table administrative document but will still remain in the database as historical data. This deleted data will be managed with the class Versioned Objected that records all the historical data in the beginning time of inserting data and the time when data were deleted from the database.

D. Issuing the land certificates

LADM mother class	:	VersionedObject,
LADM classes	:	LA_AdminDocument, LA_SpatialDocument, LA_SourceDocument, ExtArchive, ID_HistoryStatusDocument
LADM code list	:	ID_AdminDocumentType, LA_SurveyDocumentType, ID_DocumentStatusType

The final phase of the subdivision process is issuing the new land certificates and making the archive on it. This final phase is related to the activities as the following:

Step 9 : Issuing and archiving land certificates

Head of local land office receives physical/hard documents: the land certificates, Buku Tanah and letter of measurement (Surat Ukur) from registry section. If the physical/hard documents are complete so then the head of local land office accepts the flow of documents (status 'accepted'). After verifying and validating the new documents and making sure that everything is correct—including checking that the annotation is written in the old document, then head of local land office approves those documents with/by signing it (status 'issued'). By the giving status 'issued' on the flow of document(s), the archive staff takes the physical/hard documents and archives: the Buku Tanah (copy of land certificate) and copy of letter of measurement (status 'returned'), and then brings the original new land certificates and letter of measurement (Surat Ukur) as attachment to the front officer.

Step 10 : Customer receive land certificate

Front officer receives the new land certificates and the letter of measurement (Surat Ukur)—as attachment—and checks them on/about the completeness. Then the front officer puts the customer ID—with those documents—into the manual 'list of document to deliver' book and also puts an date of acceptance from the archive staff. When coming to obtain/take his/her land certificates as scheduled in the payment receipt, the customer only have to show the payment receipt to the front officer. Referring to the payment receipt, the front officer searches the related documents, puts the delivery

date and then gives them to the customer after the customer signed on the manual delivery book. The front officer then gives the status 'finished' on the flow of document.

Database analysis: The final phase uses the classes of LA_SpatialSourceDocument, LA_AdminSourceDocument, and ExtArchive. For the management database purpose, class VersionedObject and LA_SourceDocument are still used.

- When land certificate, Buku Tanah and Surat Ukur are generated, the table of administrative and spatial document were added with the new record(s) for each type.
- The important is that the track of status of the flow of document is still complete from the beginning and in the end of the workflow (as shown in attributes: ID_StatusDocumentType)―also in the historical class (VersionedObject), and the data that has been inserted and already deleted are still kept/remained.
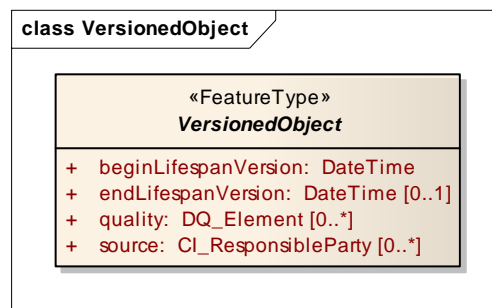

Figure 6-8 VersionedObject Class is the mother class

Referring to the descriptions of the steps and activities about maintenance of cadastral data (in subdivision process) as based on LADM above, the activity diagram can be depicted as the following:
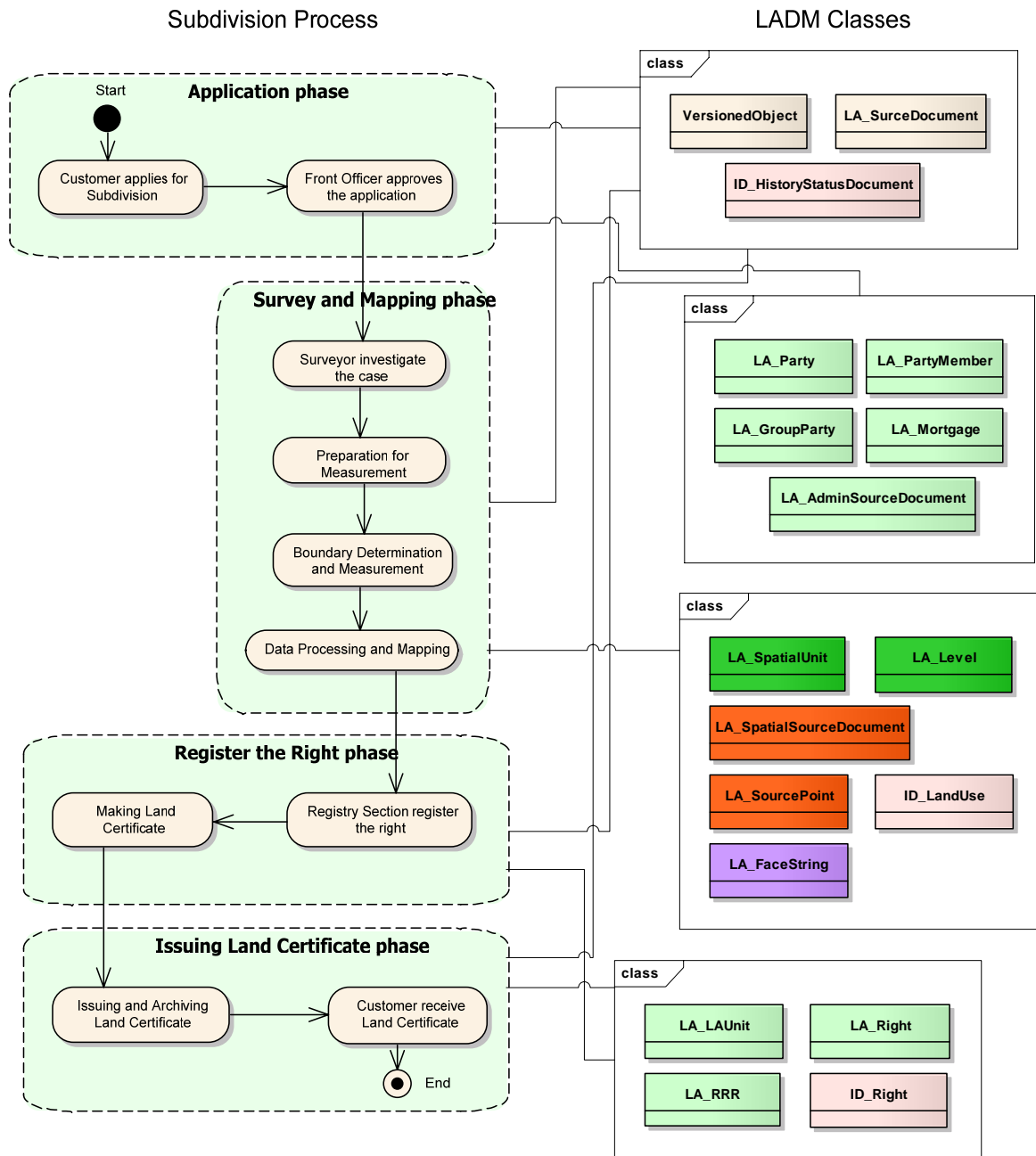
Figure 6-9 Activity diagram of proposed workflow of maintenance of cadastral data (in subdivision process) and its relation with LADM classes

6.5.   Validation of the Proposed Workflow

Validation occurs in every stage of a research cycle as a continuous process. To establish the quality of any empirical social research four tests have been commonly used which are: construct validity, internal validity, external validity and reliability validity (Yin, 2003).

Sargent (1999) has classified the validation into three models as: conceptual model validation, computerized model validation and operational model validation. According to Sargent, the essential of each model of validation is data validity. Referring to what he has defined, the description about those three models is as follows. The conceptual model validation is defined as determining that the

theories and assumption underlying the conceptual model are correct and the model representation of the problem is reasonable. The computerized model validation is defined about ensuring that the computer programming and implementation of the conceptual model is correct. The last model—that is operational validation—is defined as checking that the output of the model has enough accuracy for its applicability.

The proposed workflow of maintenance of cadastral data based on LADM data model—in case of subdivision process—is simulated with a computerized model validation using a prototype of management database application and to test the quality of empirical social research of the workflow. Assessment Questions for each user requirement are applied and modified from the principles of Verification, Validation and Accreditation (VV & A) developed by Balci (1998).

6.5.1. Simulation

The proposed workflow is simulated with prototype application software which is created with PostgreSQL database version 8.4 and Delphi 7 programming language. This prototype is built based on the suggestion new classes and attributes in LADM data model of Indonesia country profile with the aim to verify this data model in case of subdivision process. The purposes of this simulation are:

- To validate the principle of maintaining data–in case of subdivision process–by VersionedObject class about giving a time-span—it means that for each data that has been created, there has been a created time (beginLivespanVersion) and for each data that has been deleted, there has also been a deleted time (endLivespanVersion). Note: The version maintenance data system designed by ArcGIS is another approach that then followed by versioning in LADM. The concept is the same maintenance of historical data.
- To validate the suggestion class which ID_HistoryStatusDocument. The idea of tracing document by giving 'actual status document' has purpose to trace the document. Tracing document can give up-to-date, actual, and valid data and information to the customer(s).

The explanation of the story of the simulation:
As explained above, this simulation will record the *time stamp* of the data that are "deleted" (not exist) and "created" (*exist*) in order to know the history of the data. In a case of subdivision in Indonesia, old data parcel(s) (before subdivision process) will be deleted and new data parcel(s) will be created. It also gives the 'status' on document (accepted, approved, issued, measured, plotted, mapped, etc). Detail explanation of this simulation is as follows:

Step 1 : **Input data about *party* or owner in Party tab.**
- click button '＋' at the bottom of the windows, then click in the column of **Party ID**, input six digit number in the empty cell
- click in the next cell under column **Name**, input the name of the owner
- click the next cell under column **Type,** click the sign '▼' to choose type of the owner (natural person, non-natural person, group or launit)
- click the next cell under column **Role,** click the sign '▼' to choose type of the role (citizen, notary, employee, farmer, bank, etc)

- finish this step with button commit '$\sqrt{}$'. By clicking the button commit, the column **Begin Lifetime** is filled with record *time stamp* (exactly the same as the time in the windows system) and the column **Status** is filled with "exist" (created).

Step 2 : **Input data spatial unit or parcel in Spatial Unit tab**

- click button '+' at the bottom of the windows
- click in the column of **SU ID**, input six digit number in the empty cell
- click in the next cell under column **Area Size**, input the digit number of area size
- click in the next cell under column **Area Type** click the sign '▼' to choose type of the area (such as: calculated area, surveyed area, official area, non official area)
- click in the next cell under column **Land Use** click the sign '▼' to choose type of the land use (agriculture, housing, industry, nature, paddy field, plantation field, recreation)
- click in the column of **Address**, input the owner's address of the empty cell
- finish this step with button commit '$\sqrt{}$'. By clicking the button commit, the column **Begin Lifetime** is filled with record *time stamp* (exactly the same as the time in the windows system) and the column **Status** is filled with "exist" (created/exist).

Step 3 : Input data right in Right tab.

- click button '+' at the bottom of the windows
- click in the column of **R ID**, input six digit number in the empty cell
- click in the next cell under column **Description**, input the information about land use the same as the type of land use in the spatial unit.
- click in the next cell under column **Type** click the sign '▼' to choose type of the right (such as: Right of Ownership, Right of Use, Right of Cultivate, Right of Construct Building, etc click in the next cell under column **Party ID** click the sign '▼' to select ID of the owner the same as in the step 1, then automatically column **Owner** is filled the owner name that the same as input in step 1.
- click in the next cell under column **SU ID** click the sign '▼' to select ID of the owner the same as in the step 2.
- finish this step with button commit '$\sqrt{}$'. By clicking the button commit, the column **Begin Lifetime** is filled with record *time stamp* (exactly the same as the time in the windows system) and the column **Status** is filled with "exist" (created/exist).

Step 4 : Create the Admin Document (for instance: Land Certificate)

- click button '+' at the bottom of the windows
- click in the column of **sdid**, input six digit number in the empty cell
- click in the next cell under column **maintype**, click the sign '▼' to choose type of the document select 'document',
- click in the next cell under column **representedBy** click the sign '▼' to select the name of represent (for example: notary)
- click in the next cell under column **conveyor** click the sign '▼' to select the name of conveyor

- click in the next cell under column **right** click the sign '▼' to select ID of the right the same as in the step 3, then the right owner column filled with the name of the right owner,
- click the next cell under column **actual status doc**, click the sign '▼' to select the type of status: accepted, approved, measured, plotted, mapped, issued, finish, etc)
- input the annotation in the next column **annotation** if needed.
- finish this step with button commit '√'. By clicking the button commit, the column **Begin Lifetime** is filled with record *time stamp* (exactly the same as the time in the windows system) and the column **Status** is filled with "exist" (created/exist).

Step 5 : Create the Spatial Document (for instance: Letter of Measurement/SU)

- click button '╋' in the bottom of the windows
- click in the column of **sdid**, input six digit number in the empty cell
- click in the next cell under column **maintype**, click the sign '▼' to choose type of the document select 'document',
- click in the next cell under column **representedBy** click the sign '▼' to select the name of represent (for example: notary)
- click in the next cell under column **surveyor** click the sign '▼' to select the name of conveyor
- click in the next cell under column **SU ID** click the sign '▼' to select SU ID the same as in the step 2,
- click the next cell under column **actual status doc**, click the sign '▼' to select the type of status: accepted, approved, measured, plotted, mapped, issued, finish, etc)
- input the annotation in the next column **annotation** if needed.
- finish this step with button commit '√'. By clicking the button commit, the column **Begin Lifetime** is filled with record *time stamp* (exactly the same as the time in the windows system) and the column **Status** is filled with "exist" (created/exist).

After the steps above, now all data have been filled (party/owner, spatial unit/parcel, right, land certificate, letter of measurement/SU). After the surveyor conduct the measurement, then the next steps are as follows:

- create/input the new parcels (spatial unit)
- create/input the new letter of measurement/SU (spatial document)
- create/input the new land certificates (admin document)

Therefore, below are the explanations of those steps, as follows:

Step 6 : Input the new data parcel/spatial unit

- as mentioned above, before a new data parcel is created, the old data parcel must be deleted first. Select the old **SU ID**, then click button '**Delete**' in the right side to delete the data. By clicking that button then column **End Lifetime** is filled with a *time stamp* (exactly the same as the time and date in the windows system) and the column **Status** is filled with "not exist" (deleted/not exist),
- repeat step 2 in order to create the new data parcel from subdivision process. This step is the same as step 2, but insert different number in area size (according to the result of survey for each subdivided parcel)

- now there are two new data parcels with **Status** is/are filled with "exist" means that the data are the existing data with the column **Begin Lifetime** is/are filled with a new *time stamp*.

Step 7 : Input the new data right

- as mentioned above, before a new data right is created, the old data right must be deleted first. Select the old **R ID**, then click button '**Delete**' in the right side to delete the data. By clicking that button then column **End Lifetime** is filled with a *time stamp* (exactly the same as the time and date in the windows system) and the column **Status** is filled with "not exist" (deleted/not exist), after that
- repeat step 3 in order to create the new data right from subdivision process. This step is the same as step 3, but insert column **SU ID** with the new SU ID (according to the new SU ID that inserted in step 6)
- now there are two new data rights with **Status** is/are filled with "exist" means that the data are the existing data with the column **Begin Lifetime** is/are filled with a new *time stamp*.

Step 8 : Create/Input the new Letter of Measurement (Spatial Document)

- as mentioned above, before a new letter of measurement/SU is created, the old letter of measurement must be deleted first, but before that input '*no longer valid*' in column **annotation**. Select the old **sdid**, then click button '**Delete**' in the right side to delete the data. By clicking that button then column **End Lifetime** is filled with a *time stamp* (exactly the same as the time and date in the windows system) and the column **Status** is filled with "not exist" (deleted/not exist),
- repeat step 5 in order to create the new letter of measurements for the new parcels
- now there are two new land certificates with **Status** is/are filled with "exist" means that the data are the existing data with the column **Begin Lifetime** is/are filled with a new *time stamp*.

Step 9 : Create/Input the new Land Certificate (Admin Document)

- as mentioned above, before a new land certificate is created, the old land certificate must be deleted first, but before that input '*no longer valid*' in column **annotation**. Select the old **sdid**, then click button '**Delete**' in the right side to delete his data. By clicking that button then column **End Lifetime** is filled with a *time stamp* (exactly the same as the time and date in the windows system) and the column **Status** is filled with "not exist" (deleted/not exist), then
- repeat step 4 in order to create the new land certificates for the new parcels
- now there are two new land certificates with **Status** is/are filled with "exist" means that the data are the existing data with the column **Begin Lifetime** is/are filled with a new *time stamp*.

In **Maintenance** tab there are histories of the spatial unit, admin document tracking and spatial document tracking. In the bottom part of admin and spatial document tracking there are **History of Status Document** to show the process of document from status 'accepted' until finished/issued (admin document) and from status 'plotted' until 'mapped' (spatial document).
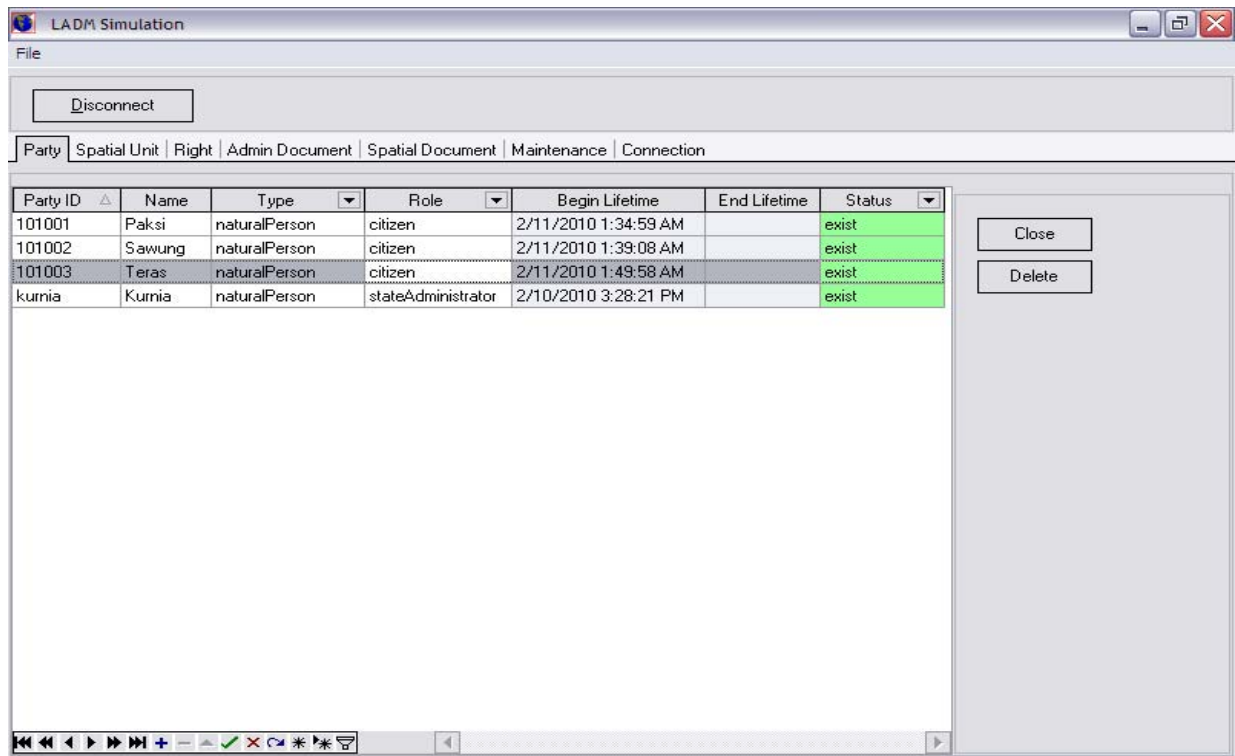
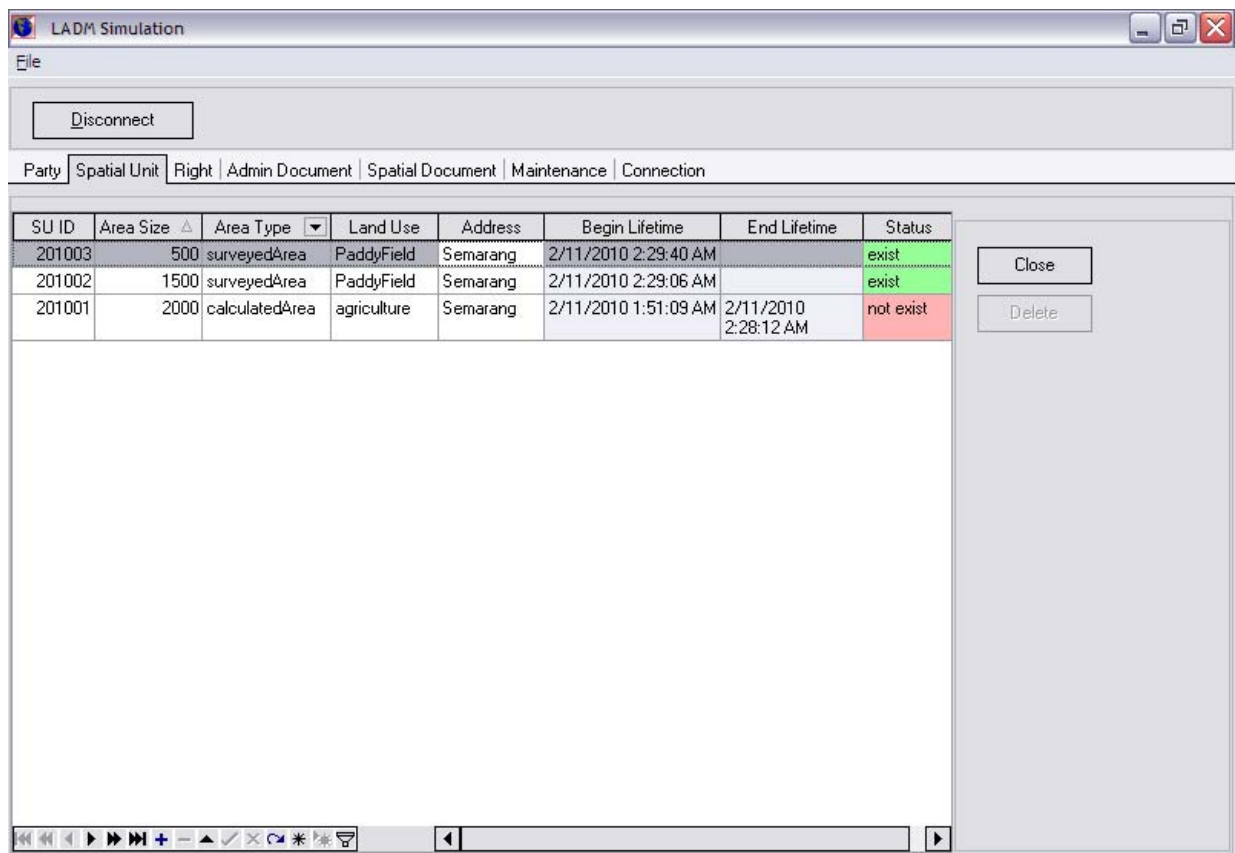**Figure 6-10 Input and Delete Party/Owner Data**

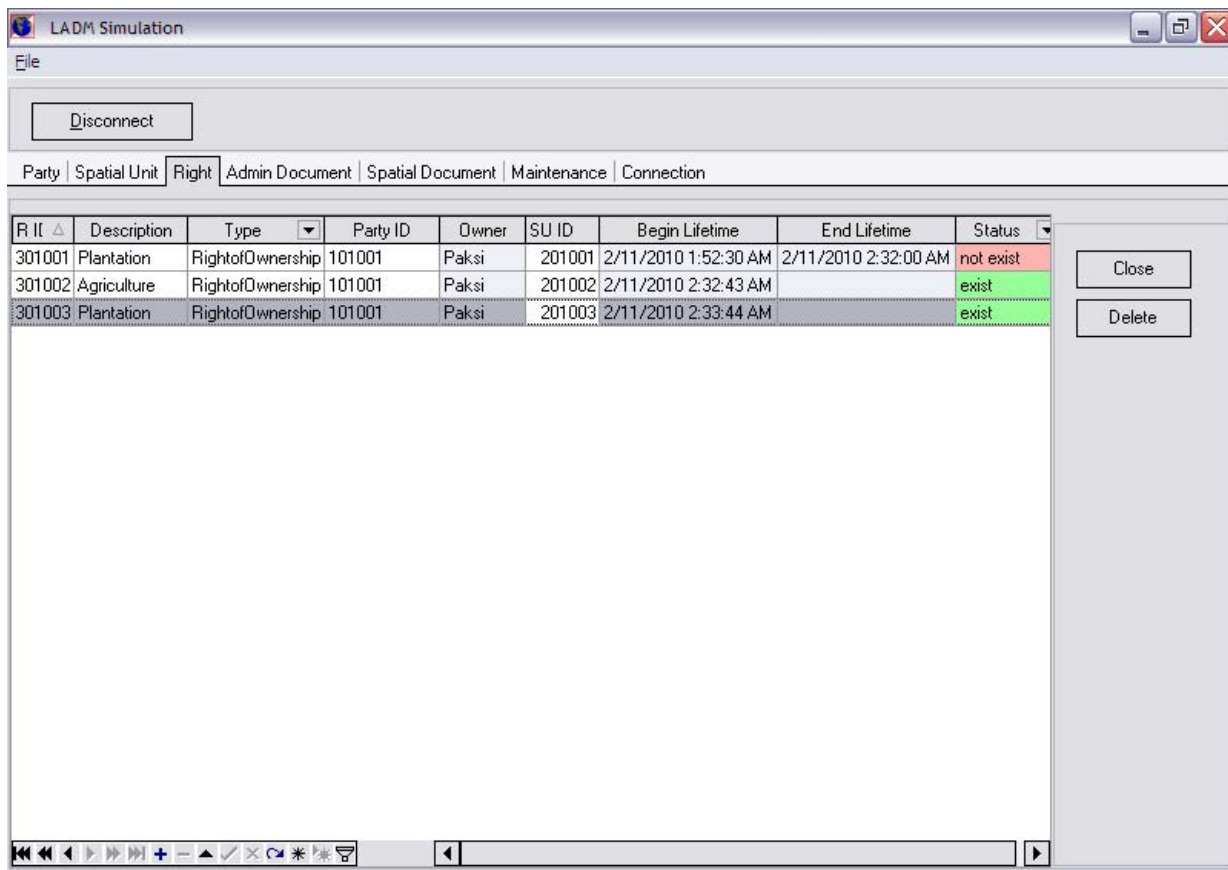**Figure 6-11 Input and Delete Parcel/Spatial Unit Data**

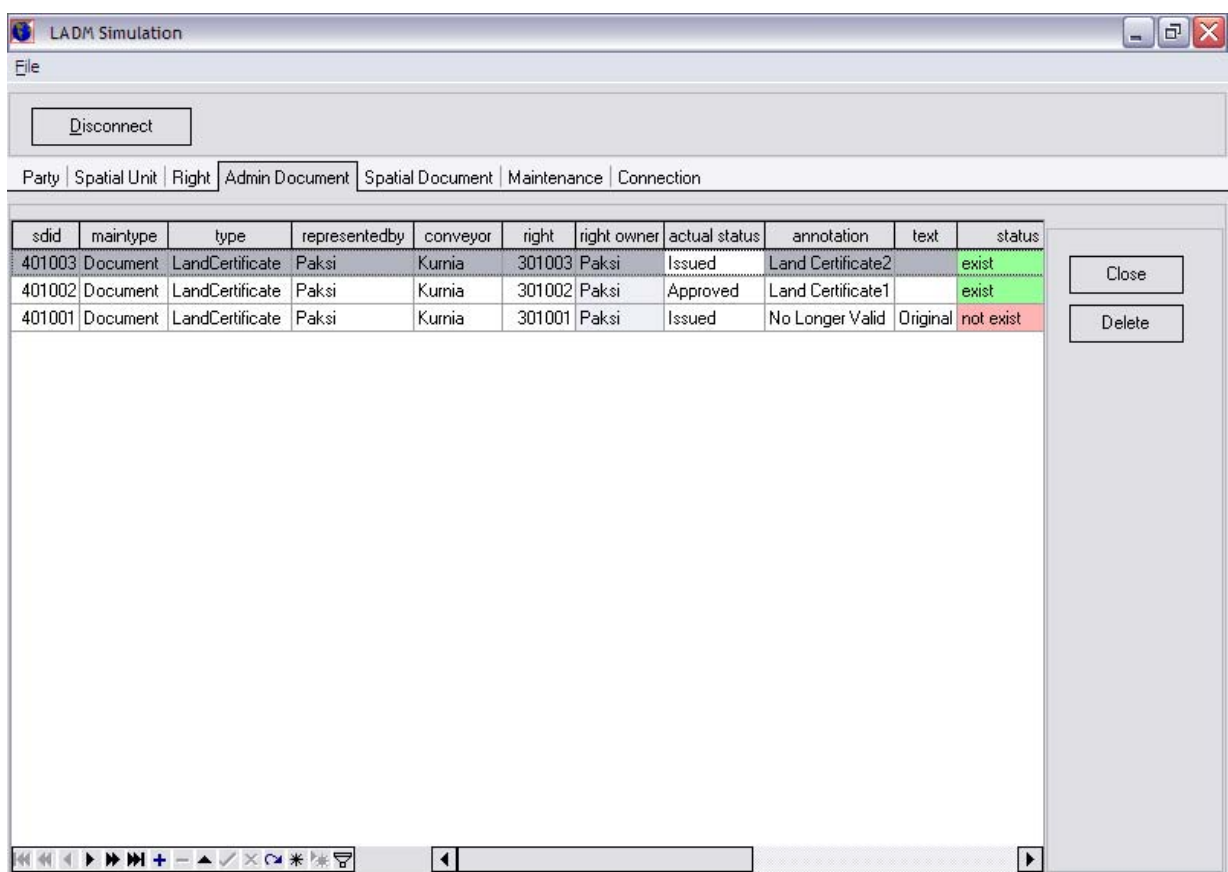**Figure 6-12 Input and Delete Right Data**

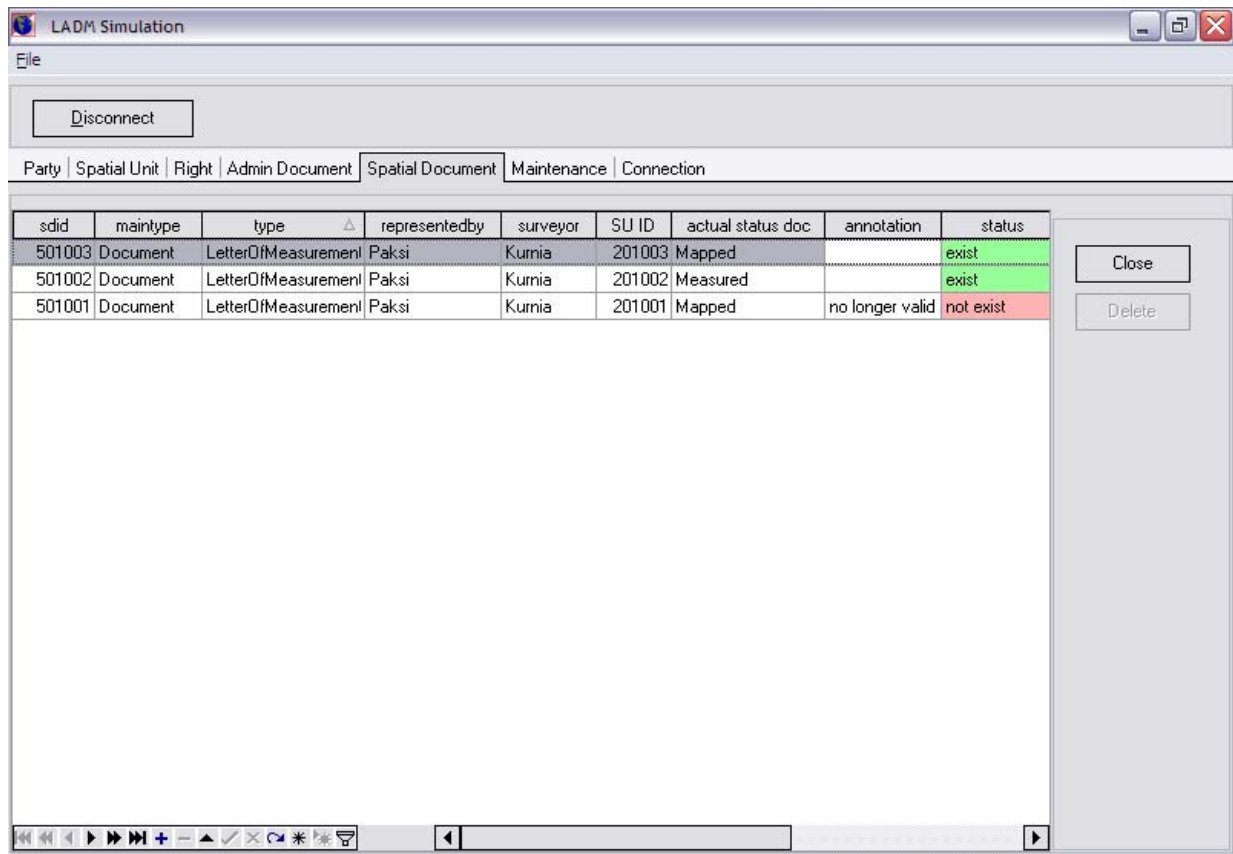**Figure 6-13 Input and Delete Land Certificate (Admin Document)**

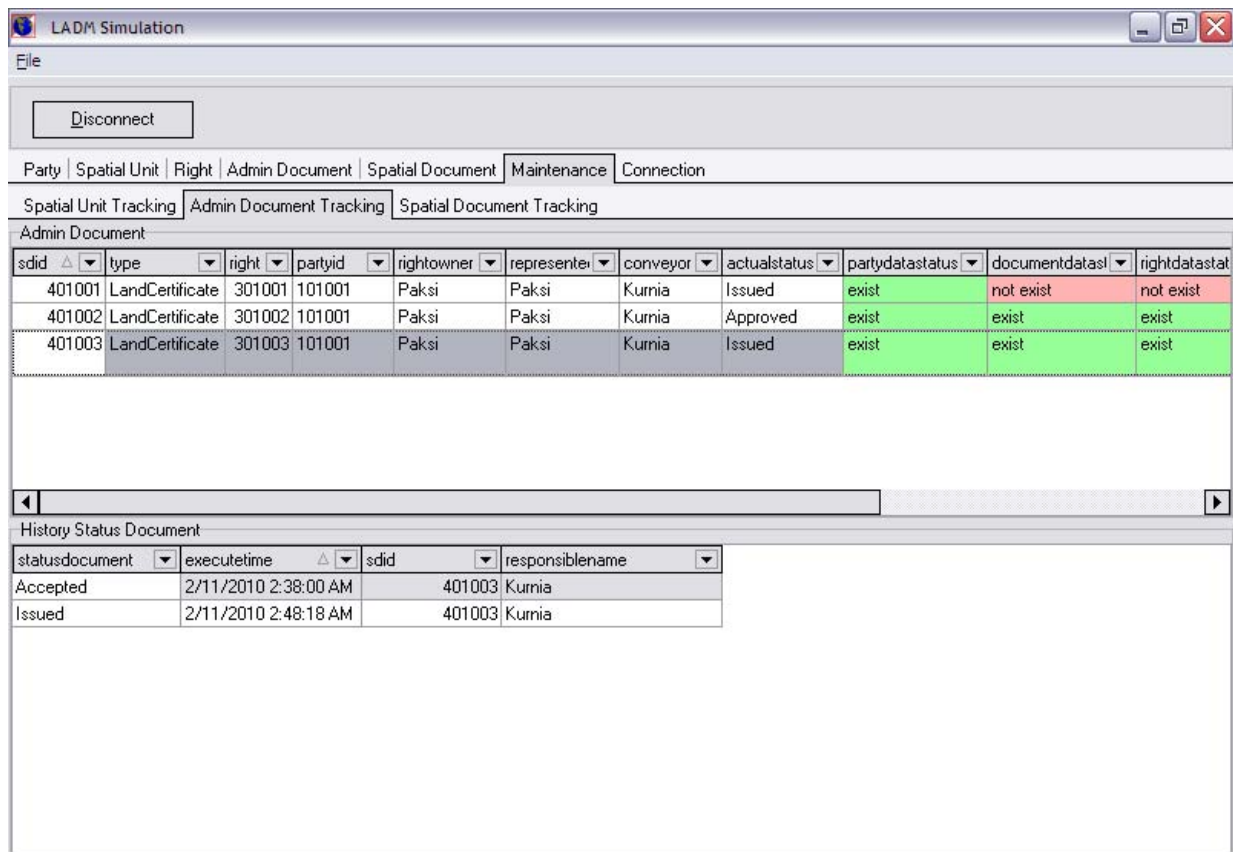**Figure 6-14 Input and Delete Letter of Measurement/SU (Spatial Document)**

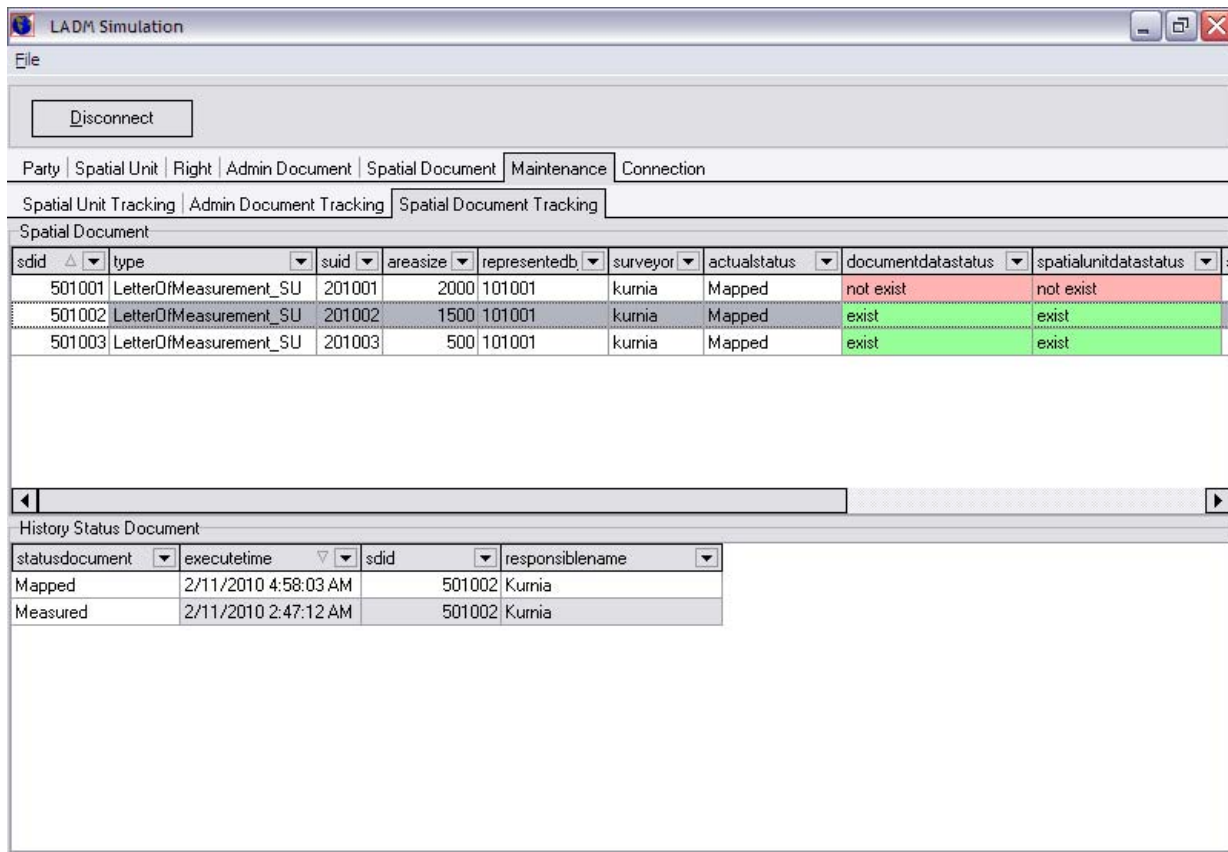**Figure 6-15 Maintenance and History of Status (Admin Document)**

Figure 6-16 Maintenance and History of Status Document (Spatial Document)

6.5.2. Assessment Questions

The Assessment Questions presented by Carr and Balci (2000) is used to validated this proposed workflow. This approach has been used by Yun (2008) and Subedi (2009) to validate the business process designed in class diagrams, use case diagrams and activity diagrams. They had described that "the question are applied and modified from the principles of Verification, Validation and Accreditation (VV & A) developed by (Balci, 1998)".

Assessment Question is an instrument that consists of assessment questions which are formulated in regard with user requirements. The questions are assessed whether they are dealt with the user requirements and how they are addressed. The results of the assessment of the proposed workflow are displayed in Table 6-4 below and explained in the following subsection.

Table 6-4 Assessment of User Requirements

Assessment Questions	Assessment
Technical Aspect	
Are cadastral data as based on LADM can be maintained?	Yes, they are. In Figure 6-9 depict the relation between maintenance cadastral data (in subdivision process) with LADM that they are touch.
Are attributes on LADM Indonesia country profile placed in the correct class?	Yes, they are. Almost all attributes are place in the correct class with regard to their purpose.

Assessment Questions	Assessment
Technical Aspect	
Are attributes on LADM Indonesia country profile representing the actors and activities in subdivision process?	Yes, they are. With recommended of the new suggested of attributes.
Are classes in LADM Indonesia country profile representing the actor and activities in subdivision process?	Yes, they are. Also with recommended of the new suggested classes. See Table 6-2
Are the associations/relations between classes in LADM Indonesia country profile representing the actors and activities in subdivision process?	Yes, they are. Almost all the associations between classes in LADM are representing the actors and activities in subdivision process.
Is the propose workflow of maintenance of cadastral data (in subdivision process) as based on LADM?	Yes, it is. It can be seen that every activities in subdivision process are touch with LADM Indonesia country profile. See Figure 6-9.
Is the proposed workflow of maintenance of cadastral data as based on LADM can accommodate the user requirements in subdivision process?	Yes, it is. Because of it also designs using the analysis of the existing subdivision process with regard to the user requirements.
Is the proposed workflow of maintenance of cadastral data can accommodate user requirement in subdivision process about the *simple procedure*?	Yes, it is. There is merge on the step in front office. The customer only needs two times to come to land office. The simplifying also can be seen from the comparison of the existing process in Section 4.3.7.2 and the proposed workflow in Figure 6-9.
Is the proposed workflow of maintenance of cadastral data can accommodate user requirement in subdivision process about the *reducing cost*?	Yes, it is. Because of the proposed workflow is designed as based on the idea of integrating system and online system.
Is the proposed workflow of maintenance of cadastral data can accommodate user requirement in subdivision process about the *reduced in processing time*?	Yes, it is. With the idea of online system and using electronic/digital document.
Is the proposed workflow of maintenance of cadastral data can accommodate user requirement in subdivision process about the *transparent information and traceable*?	Yes, it is. The purpose of adding ID_HistoryStatusDocument class is to made the information can shown in certain time and can be trace for each status.
Is the proposed workflow of maintenance of cadastral data can apply *electronic/digital document*?	Yes, it is. It represent in attribute electrSignature in LA_SourceDocument class.
Is the proposed workflow of maintenance of cadastral data can apply *online registration process*?	Yes, it is. With LADM data model the workflow of maintenance of cadastral data can be online registration process because LADM is a standard data model for land administration system.
Is there any provision to increase the ability of	Yes, it is. It is very important thing to support the

Assessment Questions	Assessment
Technical Aspect	
hardware and software?	implementation of proposed workflow.
Is there any provision to build the networking system?	Yes, it is. The networking system is the basic part in integrating system.
Is there any provision concerning using GPS and Total Station in survey activity?	Yes. It is. Because those equipments are support in digital data measurement.
Is there any provision in establish the local order point to support survey activity?	Yes. it is. In order to support the good quality of data acquisition activity.
Organizational Aspect	
Is the proposed workflow can accommodate the user requirement about *lacking human resource?*	Yes, it is. Because of the proposed workflow is built with regard to computerized and integrated system so there is no need many human resources.
Is the any provision in reviewing the SPOPP?	Yes, it is. Because some of the steps are merge.
Is there any provision in defining new regulation to support the implementation of the proposed workflow?	Yes, it is. In order to give legal protection in land administration activities especially in electronic document.
Is there any provision of hiring trained staff?	Yes, it is. It is proposed either train existing staff and also hires trained staff.

6.6. Conditions for Implementation

The aim to implement the proposed workflow of maintenance of cadastral data as based on LADM Indonesia Country Profile seeks changes in the some existing conditions. Those conditions are discussed in some classification aspects which are:

1. System Development aspect

In order to implement the proposed workflow, an integrated LADM based system is needed. Therefore it is suggested to change conditions of the existing system. The steps to develop the system are:

- Appointment with *task force*
- Specify and design integrated system
- Decision on out-sourcing the development of the integrated system
- Select system integrator
- Test the system
- Accept the system
- Roll out in the pilot office
- Educate staff in pilot office
- Test all transaction (performance test)
- Roll out in the other offices
- To the next analyse need for organizational re-structuring, new procedure and regulation. This could be considered as part of the decentralisation of BPN.

2. Technological aspects

Considering about the system development as proposed above and about the decentralisation in BPN organization, it is strongly recommended to have a standard data model and interoperability between

offices and later with SDI. The proposed workflow is built as based on the standardised data model for land administration –the LADM Indonesian Country Profile– therefore in order to implement the proposed workflow, with using electronic/digital document and applying one stop shopping, BPN needs endorsement of other related technologies. Therefore it is recommended that BPN consider:

- to design a system architecture which is sufficient for the organization's needs.
- To specify the hardware that will be needed to built the system. For instance: secure networking, powerful server storage (that can support the database size), upgraded or new personal computers, and increased capacity of the survey equipment with support digital system like GPS and/or Total Station.
- the licence software such as: data protection software, automatic back-up database software, reliable operating system software for PC and Server, tough database management system (DBMS) software, and other software to support the land administration activities such as: standard mapping software, standard Geographic Information System.
- The examples of standards are: (1) GIS (Geographic Information System) standards (OGC, ISO, FGDC Metadata Content, ISO Metadata Content, ISO 19152 LADM); (2) IT standards such as: Web Programming (XML, Web Service/ArcXML, SOAP, HTTP) Open DBMS (Spatial types in Oracle, Informix, SQL/Server, PostgreSQL), Open Programming (C++, PHP, JAVA, .NET, etc), Open Platforms (Windows, Unix, Linux), Direct IS interfaces (Bentley, GPS, Image, Survey, Government Data formats, CAD, and more).

3. Infrastructure aspects

As stated above in number 1, for the implementation of the proposed workflow, an integrated system is needed. Therefore consideration about the impact of integrated land administration system it is proposed. This concerns connection, integration and accessible networking systems.

In order to provide online services (referring to one of customer satisfactions), BPN could build a wider networking connection. If the LAN can be built in local area of BPN, then the wider area connection-(WAN) is possible to create. But it is not easy task for BPN to integrate in the wider scale of network because of the conditions in Indonesia. Cooperation with government, national telecom and the service provider private company may be needed. With the WAN infrastructure, the NSDI (National Spatial Data Infrastructure) is possible to develop.

Other infrastructure aspect concerns the development of local order point to support the surveyor in data acquisition in the field. This is also the basic aspect to get accurate and valid data measurement.

4. Organizational aspects

In order to provide and implement accelerate or simple procedure, for instance: the proposed workflow, BPN is recommended to review and redesign the existing standard operational procedure (SPOPP), and may be implement a new regulation/law. In the middle of July 2008, Head of BPN has enacted the regulation Number 6/2008 about simplification the 14 procedures in land administration system including the subdivision process. According to this regulation, the procedure of the subdivision process should be completed within 15 days (Kepala Badan Pertanahan Nasional, 2008).

In the case of implementing the proposed workflow this simplified procedure maybe most efficiently implemented in re-structured organization. In order to provide one stop shopping, means that the

existing counters in front office (counter 1 until 4 with each different function) are no longer needed. One counter in the front office could provide a multifunction of services. Therefore re-arranging the structure of the organization is could be considered in relation to the implementation of the new workflows. This may include precise job descriptions for each position. A ICT (Information and Communication Technology) is also important in order to study, design, development, implementation, support or management of computer-based information system, particularly software applications and computer hardware.

In order to increase the capacity of the existing IT staff and surveyor, BPN has to conduct the training staff periodically such as:

- For IT staff: training about database management, programming language, networking training skill, training about design website and internet, technical training relate to the troubleshooting about hardware PC, server, networking storage , etc.
- For staff survey/surveyor: training about the usage of GPS or Total Station, usage of the mapping software, etc.

For implementation electronic/digital document, the Government of Indonesia enacted Undang-Undang Number 11/2008 this regulation about electronic transaction and information (Presiden Republik Indonesia, 2008). Noor (2008) stated that this regulation provides a clear direction for the National Land Agency/BPN in utilization and development of information and communication technologies in improving the effectiveness and efficiency of public services and enhanced national economic growth and welfare. Noor also said that this regulation provides legal breakthroughs related with the use of electronic data, electronic transactions and safety and legal procedures and data through electronic signatures (digital signature).

6.7. Conclusion

In this chapter the workflow of existing subdivision process is analyzed (adapted from COST Active G9 modelling way) to find the relation with the LADM data model. Then suggestions for new classes and attributes in LADM Indonesia Country Profile are defined. Based on the existing and new classes and attributes (and considering the user requirements), the proposed workflow of maintenance of cadastral data in case of subdivision process has been designed.

The proposed workflow then has been validated with two methods. Those methods are: *firstly*, creation of an application simulation program in order to validate the extended LADM; *secondly* using Assessment Questions, those assessment questions are formulated for each user requirement. With those kinds of questions, the assessment defined whether it is dealt with and how it is addressed. Version maintenance data system designed by ArcGIS is another approach then versioning in LADM. The concept is the same maintenance of historical data. See Figure 2-4 and Figure 6-11 for comparison.The conditions for implementation are defined in order to know what kinds of preparation could be held in BPN organization.

7. Conclusions and Recommendations

The conclusion of this research is drawn and also recommendations for further research are presented in this chapter. They are explained in <u>Section 7.1</u> and <u>Section 7.2</u> in detail.

7.1. Conclusions

Until now, most countries have developed their own land administration system. Land administration systems are not just managing geographic information, they represent the legally meaningful relationship between people and land. The land administration activities on one hand are a huge amount of data which are of a very dynamic nature; those data needed to be maintained.

The main objective of this research is to model the workflow for the maintenance of cadastral data based on LADM and on user requirements to validate it. The Indonesian situation (country profile LADM, questionnaire and interview in BPN, etc) is used as a case study in this research. As based on the case study, a workflow of maintenance of cadastral data is designed with focus on subdivision process.

In this case study, various users who are customers and land officers form BPN local land offices have been interviewed about subdivision process. This has been done by sent the questionnaire to them via online (SurveyMonkey.com, e-mail, Facebook, Notary forum online) and via post mail/ air-mail. Within one month the researcher had the feedback result/responses: 174 customers from 22 provinces and 80 land officers from local land offices in 26 provinces.

The next step of this study is to describe the existing workflow of the subdivision process and made the relation with the LADM Indonesia Country Profile in order to define the classes and attributes that are touch with the subdivision process. The result of this analysis was that it is necessary to add classes and attributes in LADM Indonesia Country Profile. Then a new LADM based workflow is designed using UML-Activity Diagram.

To validate the proposed workflow, two methods are used: the first method is simulation in order to show that the LADM Indonesia Country Profile (with new classes and attributes) is verified, also having a purpose to prove the principle of maintenance data using class VersionedObject, this approach is different from maintenance data version designed by ArcGIS. The second method is assessment; for each user requirement there have been formulated in a assessment question in order to define whether it is dealt with and how it is addressed.

This study has main research objective and four additional objectives. In order to accomplish the four additional research objectives, five research questions are formulated. From these study the conclusions drawn for each research questions are as follow:

1. What are the user requirements for the maintenance process of cadastral data?

Two users are defined, who are: customer and land officer. Customer of BPN local land office can be represented by all the society in any level of occupancy, gender, and city they lived. Customers can be land owner, companies or notaries. Land officer is a staff member in BPN local land office. In fact they also use BPN data and are customers from that perspective.

This study is focusing on the subdivision process. the user requirements relates the subdivision process asked to the users which are customers and land officers by questionnaires. Based on the responses from those users, eleven aspects were defined and classified as procedure, time, fee/cost, information, human resource, service, technology, data and archive. And the main requirements from those aspects are: simple procedure, one stop shopping, the quicker the better/accelerate time, transparency in cost and information, increase the ability staff, customer satisfaction, online system of land registration, database validity, and digital/electronic archive.

2. Who has the responsibility to maintain cadastral data based on Land Administration Domain Model (LADM)?

Cadastral data is provided by the BPN land office as the National Land Agency, and the Government of Indonesia gives a mandate to BPN to manage all data and information related to land; to build a data base of land ownership in a large scale and to build National Land Management and Information System, and document security system nationally. Therefore BPN has the responsibility to conduct the maintenance process for cadastral data as based on LADM.

3. What is the workflow of maintenance of cadastral data based on LADM?

The main objective of this study is to design the workflow of maintenance of cadastral data based on LADM in order to achieve this objective the subdivision process has been selected as a case to design a new workflow. According to Indonesian Government Regulation number 24/1997 subdivision process is a part of maintenance of cadastral data activity. See Figure 6.9.

4. How is the validation method for the proposed workflow of maintenance of cadastral data as based on LADM?

Based on this study there are two methods being used to validate the proposed workflow of maintenance of cadastral data. First method of the validation is to create a simulation in order to show that data model LADM Indonesia Country Profile (with new classes and attributes) is verified, also having a purpose to prove the principle of maintenance data with using versionedObject class and suggested classes : ID_HistoryStatusDocument, ID_StatusDocumentType, ID_LandUse, ID_LandUsedType with its attributes. From this simulation it can be seen how cadastral data are maintained with records the time of each document/data flow and give a certain status on it. And from this simulation can be concluded that LADM has gives a good maintenance of the cadastral process.

The second method is assessment questions, for each user requirement is formulated in a assessment question in order to define whether it is dealt with and how it is addressed. As the result of the assessment shows that the user requirements are sufficiently addressed in the proposed workflow.

5. What are the conditions that should be prepared in implementation of the proposed workflow of maintenance of cadastral data?

As finding of this research, in order to implement the proposed workflow of maintenance of cadastral data, there are some aspects should be prepared. Those aspects are related to: system development aspects, technological aspects, infrastructure aspects, organizational. The main conditions for each aspects are: developing a system, reviewing the standard operation and procedure, re-structure the organisation, define the new regulation to support the implementation, design the system architecture, prepare the sufficient hardware and software, develop the networking infrastructure, develop the local order point to support surveyor in data acquisition, recruitment and training for IT staff and surveyors, increase the capacity of human resource with training skill.

7.2.   Recommendations

This study is about how to design the workflow of maintenance of cadastral data based on LADM country profile Indonesia with its focus on the subdivision process. According to the finding, the user requirements and the proposed workflow, some tasks still need to be accomplished and hence are recommended for the future work:

1. To develop the new system based on LADM then it is needed to: establish a LADM *task force* (a team to prepare the development and implementation); to specify and design the integrated system; to test the system; decide the pilot project office; roll out in the pilot office; educate the staff in the pilot office; test all the transactions (performance test); roll out in another office; analyse the need for re-structuring the organization, new procedures and regulations.

2. To model workflow for all transactions. The maintenance of cadastral data has to be done in other processes (besides the subdivision process) in Indonesian land administration system. All transactions for maintenance are proposed to be modelled as the subdivision transaction in this thesis.

3. To specify and design the integrated system and the system architecture in order to apply online registration system using electronic/digital documents in Indonesia. This is a research challenge, considering the new government regulation about technology and information.

4. To implement this proposed workflow, to investigate the need to restructure of organization to better implement the new workflows and to review the standard operational procedure (SPOPP) is needed. Therefore a study required to re-arrange the structure of the organization and each task and re-design the whole processes and operational procedures.

References

Arcgis 9.2 Desktop Help. (2008a). *Data Maintenance Strategies*. Available: http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Data_maintenance_strategies [Accessed 18 October 2009].

Arcgis 9.2 Desktop Help. (2008b). *Geodatabase Archiving*. Available: http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=Geodatabase_archiving [Accessed 18 October 2009].

Arcgis 9.2 Desktop Help. (2008c). *An Overview of Editing and Maintaining Data*. Available: http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=An_overview_of_editing_and_maintaining_data [Accessed 18 October 2009].

Arcgis 9.2 Desktop Help. (2008d). *Transactions and Geographic Data*. Available: http://webhelp.esri.com/arcgisdesktop/9.2/print.cfm?TopicName=Transactions%20and%20geographic%20data [Accessed 18 October 2009].

Arvanitis, A. & Eleni, H. (2004). *Modelling Cadastral Transactions in Greece Using UML.*FIG Working Week 2004. Athens, Greece. 22-27 May 2004.

Ary Sucaya, I. K. G. (2009). *Application and validation the land administration domain model in real life situation : a case study in Indonesia.* Enschede, The Netherlands, ITC. MSc Thesis, 92

Babbie, E. (2003). *The Practice of Social Research + the research writer CD - ROM,* Victoria etc., Wadsworth.Tenth edition.

Balci, O. (1998). *Verification, validation, and accreditation.*Proceedings of the 30th conference on Winter simulation. Washington, D.C., United States.

Basuki, O. 2010. *2.913 Sengketa Tanah Menunggu Penyelesaian. KOMPAS.com*, 15 January 2010 http://nasional.kompas.com/read/2010/01/15/12170537/2.913.Sengketa.Tanah.Menunggu.Penyelesaian, Accessed on: 17 January 2010.

Carr, J. T. I. & Balci, O. (2000). *Verification and Validation of Object-Oriented Artifacts Throughout the Simulation Model Development Life Cycle.*Proceedings of the 2000 Winter Simulation Conference in Orlando, Florida.

Cost Action G9. (2003). *WG Law and Modelling: UseCase descriptions of Subdivision Procedures* Available: http://costg9.plan.aau.dk/UseCases/UseCasesSubdivision.html [Accessed 31 October 2009].

Dale, P. F. & Mclaughlin, J. (2000). *Land administration,* Oxford, Oxford University Press

Eden, R. J. (1988). *Modelling for land information system development in Australia and in particular Queensland.* Queensland, Australia., University of Queensland. Ph.D. Thesis,

Effenberg, W. (2001). *Spatial Cadastral Information Systems: The Maintenance of Digital Cadastral Data.* The University of Melbourne. Doctor of Phylosophy,

Enemark, S. (2003). *Underpining Sustainable Land Administration Systems for Managing the Urban and Rural Environment.*Paper presented in Plenary Session 3, 2nd FIG Regional Conference in Marrakech, Morrocco. 2-5 December, 2003.

Enemark, S. (2005a). *The Land Management Paradigm for Institutional Development.*Paper presented in Expert Group Meeting on Incorporating Sustainable Development Objectives into ICT

Enabled. Center for Spatial Data Infrastructure and Land Administration, University of Melbourne, Australia. 9-11 November 2005.

Enemark, S. (2005). *The Land Management Perspective: Building the Capacity.*Paper presented in ITC Lustrum Conference Spatial Information for Civil Society Capacity Building for The International Geo-Information Society., Enschede, The Netherlands. 14-16 December 2005.

FGDC Subcommitee. (2004). *Cadastral Core Data Draft Report – October 2004 Version 5*. Available: http://www.nationalcad.org/data/documents/Cadastral%20Core%20Data%20Version%205.pdf [Accessed 28 August 2009].

FIG. (1995). *FIG Statement on the Cadastre. FIG Publication No. 11 The FIG Statement on the Cadastre 1995 E* [Online]. Available: http://www.fig.net/commission7/reports/cadastre/statement_on_cadastre.html [Accessed 26 October 2009].

Frankfort-Nachmias, C. & Nachmias, D. (1996). *Research methods in the social sciences,* New York, St. Martins Press.Fifth edition.

Hammersley M. & Atkinson P., (1983). *Ethnography: Principles and Practice.,* London, Tavistock

Henssen, J. L. G. (1995). *Basic Principles of The Main Cadastral Systems in The World*. Available: http://www.fig.net/commission7/reports/events/delft_seminar_95/paper2.html [Accessed 20 August 2009].

Heryani, E. & Grant, C. (2004). *Land Administration in Indonesia.*In 3rd FIG Regional Conference. Jakarta, Indonesia. 3-7 October 2004.

Hespanha, J., L. Van Bennekom-Minnema, P. V. Oosterom & Lemmen, C. (2008). *The Model Driven Architecture Approach Applied to The Land Administration Domain Model version 1.1 - with Focus on Constraints Specified in The Object Constraint Language.*Integrating Generations, FIG Working Week 2008. Stockholm, Sweden 14-19 June 2008.

ISO TC 211 N (2009a). **ISO/CD 19152** *Geographic Information - Land Administration Domain Model (LADM).* Lysaker, Norway, Standard Norway.87 p.

ISO TC 211 N (2009b). **ISO/DIS 19152.1** *Geographic Information - Land Administration Domain Model (LADM).* Lysaker, Norway, Standard Norway.118 p.

Kalantari, M., Rajabifard, A., Wallace, J. & Williamson, I. (2005a). *The Role Cadastral Data Modelling in e-Land Administration.* Coordinates Magazine. September 2005. p.26-29

Kalantari, M., Rajabifard, A., Wallace, J. & Williamson, I. (2005b). *Toward e-Land Administration: Australian Online Land Information Services.*Proceedings of SSC 2005 Spatial Intelligence, Innovation and Praxis: The national biennial Conference of the Spatial Sciences Institute,. Melbourne: Spatial Science Institute. September 2005.

Kalantari, M., Rajabifard, A., Wallace, J. & Williamson, I. (2006). *A New Vision on Cadastral Data Model.*Shaping the Change, XXIII FIG Congress., Munich, Germany. 8-13 October 2006.

Kaufmann, J. & Steudler, D. (1998). *Cadastre 2014: A Vision for a Future Cadastral System.* Switzerland. Working Group 1, Commision 7, FIG

Kepala Badan Pertanahan Nasional. (1997). *Peraturan Menteri Negara Agraria/Kepala Badan Pertanahan Nasional Nomor 3 Tahun 1997 tentang Ketentuan Pelaksanaan Peraturan Pemerintah Nomor 24 Tahun 1997 tentang Pendaftaran Tanah*

Kepala Badan Pertanahan Nasional. (2008). *Peraturan Kepala Badan Pertanahan Nasional Nomor 6 Tahun 2008 tentang Penyederhanaan dan Percepatan SPOPP untuk Jenis Pelayanan Pertanahan Tertentu*

Kurnia on Surveymonkey.Com, (2009a),Subdivision Process in Indonesian Land Office (BPN), http://www.surveymonkey.com/s.aspx?sm=SXQGkQOL73QtUIY6KKbLQw_3d_3d,

Kurnia on Surveymonkey.Com, (2009b),Subdivision Process in Indonesian Land Office (BPN)-Land Officer, http://www.surveymonkey.com/s.aspx?sm=o1QHvvVAyjTBeH8koYFUkw_3d_3d,

Lemmen, C. & Van Oosterom, P. (2001). *Cadastral Systems. Computers, Environment and Urban Systems,* 25(2001)319-324

Majelis Permusyawaratan Rakyat. (1945). *Undang Undang Dasar Negara Republik Indonesia Tahun 1945*

Noor, M. R. (2008). *Aspek Hukum Teknologi Digital dan Dokumentasi Pertanahan.*Seminar I Institutional Pertnership for Strengthening Land Administration (IPSLA). in STPN College Yogjakarta. 8-9 May 2008.

Presiden Republik Indonesia. (1960). *Undang-Undang No.5 Tahun 1960 tentang Peraturan Dasar Pokok-Pokok Agraria.*

Presiden Republik Indonesia. (1988). *Keputusan Presiden No.26 Tahun 1988 tentang Badan Pertanahan Nasional Republik Indonesia.*

Presiden Republik Indonesia. (1996). *Peraturan Pemerintah Republik Indonesia Nomor 40 Tahun 1996 tentang Hak Guna Usaha, Hak Guna Bangunan dan Hak Pakai atas Tanah.*

Presiden Republik Indonesia. (1997). *Peraturan Pemerintah Republik Indonesia Nomor 24 Tahun 1997 tentang Pendaftaran Tanah.*

Presiden Republik Indonesia. (2002). *Peraturan Pemerintah Republik Indonesia Nomor 46 Tahun 2002 tentang Tarif atas Jenis Penerimaan Negara Bukan Pajak (PNBP) yang Berlaku pada Badan Pertanahan Nasional.*

Presiden Republik Indonesia. (2007). *Undang-Undang No.17 Tahun 2007 tentang Rencana Pembangunan Jangka Panjang Nasional Tahun 2005-2025.*

Presiden Republik Indonesia. (2008). *Undang-Undang No.11 Tahun 2008 tentang Informasi dan Transaksi Electronik*

Roux, P. L. (2004). *Extensible Models and Templates for Sustainable Land Information Management Intent and Purpose.*Proceeding of Joint FIG Commision 7 and COST Action G9 Workshop on Standardisation in the Cadsatral Domain., Bamberg, Germany. 09-10 December

Sargent, R. G. (1999). *Validation and verification of simulation models.*Proceedings of the 31st conference on Winter simulation: Simulation - a bridge to the future - Volume 1. Phoenix, Arizona, United States.

Subedi, G. P. (2009). *Designing a user oriented business process for land registration : a case study of Nepal.* Enschede, The Netherlands, ITC. MSc Thesis, 123

Sumarto, I., W. R. Idrus, Virgo, E. J., R. Eko, D. K. Gindow, B. Adhi, E. Putranty, E. Pintadi, P. Hadi, Y. Aziz, A. Giyanto, Raharjo, I. Herawati, Firman As & S. Yusra. (2008). *Cadastral Base Mapping Activity in Indonesia.*Integrating Generations, FIG Working Week 2008. Stockholm, Sweden 14-19 June 2008.

Tuladhar, A. M. (2002). *Why Is Unified Modelling Language (UML) for Cadastral systems?*Proceedings of the 3rd Workshop and 4th MC Meeting of the COST G9: Modelling Real Property Transaction., in Delft, The Netherlands.

United Nations Economic Commission for Europe (1996). *Land Administration Guidlines,* New York, Geneva, United Nations (UN), 81 p.

Universal Currency Converter, (2010), URL: http://www.xe.com/ucc/, 18 January 2010

Van Der Molen, P. (2001). *Data Comunication: A Lifeline Between Land Administration Organization and Society.*New Technology for a New Country, International Conference, FIG Working Week 2001. Seoul, Korea. 6-11 May 2001.

Van Der Molen, P. (2002). *The Dynamic Aspect of Land Administration: Often-forgotten Component*

in System Design. Computers, Environment and Urban Systems, 30(2002)361-381

Van Der Molen, P., P. Van Oosterom & Lemmen, C. (2004). *Remarks and Observations related to the further development of the Core Cadastral Domain Model.*Joint 'FIG Commission 7' and 'COST G9' Workshop on Standardization of the Cadastral Domain., Bamberg, Germany. 9-10 December, 2004.

Van Oosterom, P., C. Lemmen, T. Ingvarsson, P. Van Der Molen, H. Ploeger, W. Quak, J. Stoter & Zevenbergen, J. (2006). *The Core Cadastral Domen Model. Computers, Environment and Urban Systems,* 30(2006)627-660

Williamson, I. & Fourie, C. (1998). *Using the Case Study Methodology for Cadastral Reform. Geomatica,* 52(1998)283-295

Williamson, I. P. & Hunter, G. J. (1996). *The Establishment of a Coordinated Cadastre for Victoria.*A Report for the Office of Surveyor General and the Office of Geographic Data Coordination, Department of Treasury and Finance., February 1996.

Winoto, J. (2005). *Recontruction of Land Administration System in Nanggroe Aceh Darussalam (NAD) and Nias.* .Expert Group Meeting on Secure Land Tenure: New Legal Frameworks and Tool in Asia and Pasific., Bangkok, Thailand.

Winoto, J. (2009). *Taking Land Policy and Administration in Indonesia to The Next Stage and National Land Agency's Strategic Plan.*Workshop in International Federation of Surveyors Forum., Washington D.C. March 2009.

Yin, R. K. (2003). *Case Study Reaerch: Design and Methods.,* Thiusand Oaks, California, etc:, SAGE Publications.

Yun, J. H. (2008). *Designing a cadastral business enhancement system for the system integration of cadastral information services in KCSC.* Enschede, The Netherlands, ITC. 125

Annexes

Annex 1 The Type of The Most Common Right in Indonesia

No	Name of Right	Duratoin of Accupation	Description
1.	Right of Ownership (Hak Milik)	Unlimited	- the powerful and strongest right - Occupied by : the Indonesian citizen, the legal corporation that being choose by the Government, religious organization (for church, tample and mosque) - Inherited by the owner - can be a collateral in the bank (mortgage) - must be registered as a evidence of ownership
2.	Right of Cultivation (Hak Guna Usaha)	35 years, extended for maximun 25 years	- Occupied by : Indonesian citizen, legal corporation that established by Indonesian Law and its locate in Indonesia - for agriculture, plantation, fishery and ranch company purpose - Inherited by the owner - can be a collateral in the bank (mortgage)
3.	Right of Use Buildings (Hak Guna Bangunan)	30 years, extended for maximun 20 years	- right to build a building on the land in a certain time - Occupied by : Indonesian citizen, legal corporation that established by Indonesian Law and its locate in Indonesia - Inherited by the owner - can be a collateral in the bank (mortgage)
4.	Right of Use (Hak Pakai)	25 years, extended for maximun 20 years (or as long as still in used)	- Occupied by : the Indonesian citizen, the legal corporation that being choose by the Government, social and religious organization (for church, tample and mosque), foreigner who lived in Indonesia, Central and Local Government, International Organization and Embassy in Indonesia

Concluded base on : Government Regulation Number 40/1996 about Hak Guna Usaha, Hak Guna Bangunan and Hak Pakai

Annex 2 Tariff for Type of Non Tax State Revenue (PNBP) applicable in BPN

No	Type of Non Tax Revenue	Unit	Tariff
I	First registration service	parcel and area	IDR 25,000
II	Maintenance of land registration data service	parcel and area	IDR 25,000
III	Information of land service:		
	1. Surat Ukur (survey document) paper based	parcel	IDR 25,000
	2. Geodetic control point Order 2	point	IDR 45,000
	3. Geodetic control point Order 3	point	IDR 30,000
	4. Map of land registration (blue print)	sheet	IDR 400,000
	5. Map of registered parcel (digital)	sheet	IDR 500,000
	6. Base map/Base map of registered parcel/ Line map/Topoghrapic map (blue print)	sheet	IDR 30,000
	7. Base map/Base map of registered parcel/ Line map/Topoghrapic map (shepia)	sheet	IDR 60,000
	8. Base map/Base map of registered parcel/ Line map/Topoghrapic map (drafting film)	sheet	IDR 120,000
	9. Base map/Base map of registered parcel/ Line map/Topoghrapic map (digital)	sheet	IDR 120,000
	10. Areal photo (blow up)	sheet	IDR 200,000
	11. Areal photo (digital)	sheet	IDR 100,000
	12. Photo map (drafting film)	sheet	IDR 200,000
	13. Photo map (digital)	sheet	IDR 200,000
	14. Land use map (paper based)	sheet	IDR 120,000
	15. Land use map (paper based)	sheet (per distric area)	IDR 150,000
	16. Land ability map (paper basaed)	sheet	IDR 90,000
	17. Land ability map (paper based)	sheet (per distric area)	IDR 120,000
	18. Analysis of land use map (paper based)	sheet (per distric area)	IDR 150,000
	19. Textual Information	sheet	IDR 25,000
IV	Education program of Diploma I in Surveying and Mapping Cadstral		
	A. Registration fee	per person	IDR 50,000
	B. Tuition fee:		
	1. Lecture		
	- teoritical	sks	IDR 20,000
	- practice	sks	IDR 30,000
	2. Education supporting fee	sks	IDR 50,000
	3. Examination fee	sks	IDR 8,500
	4. Graduation fee	per person	IDR 250,000
	5. Management fee	sks	IDR 12,500

Source : Attachment of Government Regulation number 46/2002 about Tariff for Type of Non Tax State Revenue (PNBP)

Annex 3 Tariff of Surveying and Mapping in Surabaya City Land Office – 2009

No.	Area Size Gradation (m2)			Tariff (in IDR)	
				Sporadic	Sistematic
1	1	-	250	198,000	148,000
2	251	-	500	308,000	231,000
3	501	-	750	403,000	302,000
4	751	-	1000	491,000	368,000
5	1001	-	1250	574,000	430,000
6	1251	-	1500	654,000	490,000
7	1501	-	1750	731,000	548,000
8	1751	-	2000	806,000	604,000
9	2001	-	2250	879,000	659,000
10	2251	-	2500	951,000	713,000
11	2501	-	2750	1,022,000	766,000
12	2751	-	3000	1,091,000	819,000
13	3001	-	3250	1,160,000	870,000
14	3251	-	3500	1,228,000	921,000
15	3501	-	3750	1,296,000	972,000
16	3751	-	4000	1,362,000	1,022,000
17	4001	-	4250	1,428,000	1,071,000
18	4251	-	4500	1,494,000	1,120,000
19	4501	-	4750	1,559,000	1,169,000
20	4751	-	5000	1,623,000	1,218,000
21	5001	-	5250	1,688,000	1,266,000
22	5251	-	5500	1,751,000	1,313,000
23	5501	-	5750	1,815,000	1,361,000
24	5751	-	6000	1,878,000	1,408,000
25	6001	-	6250	1,941,000	1,455,000
26	6251	-	6500	2,003,000	1,502,000
27	6501	-	6750	2,065,000	1,549,000
28	6751	-	7000	2,127,000	1,595,000
29	7001	-	7250	2,189,000	1,641,000
30	7251	-	7500	2,250,000	1,688,000
31	7501	-	7750	2,311,000	1,733,000
32	7751	-	8000	2,372,000	1,779,000
33	8001	-	8250	2,433,000	1,825,000
34	8251	-	8500	2,493,000	1,870,000
35	8501	-	8750	2,554,000	1,915,000
36	8751	-	9000	2,614,000	1,960,000
37	9001	-	9250	2,674,000	2,005,000
38	9251	-	9500	2,734,000	2,050,000
39	9501	-	9750	2,793,000	2,095,000
40	9751	-	10000	2,853,000	2,140,000

Source : Decision Letter of Head of Land Office of East Java
Province Number SK.499.35/2008 Date : 30 December 2008

Annex 4 List of LADM Definitions

Administrative source document	:	Document providing formal facts. As the evidence of a party's to a launit.
Face string	:	Boundary forming part of the outside of a spatial unit described in 2D as GM_MultiCurve.
Group party	:	Any number of parties, considers as an entity.
Land administration unit (launit)	:	Administrative entity consisting of zero or more spatial units against which (one or more) unique and homogeneous rights (e.g. ownership right or land use right), responsibilities and restrictions are associated to the whole entity, as included in a Land Administration system NOTE. By unique is meant that a right, or restriction, or responsibility is held by one, or several parties (e.g. owners or users) for the whole launit. By homogeneous is meant that a right, or restriction, or responsibility (e.g. ownership, use, social tenure, lease, or easement) affects the whole launit.
Level	:	Collection of spatial units with a geometric and/or thematic coherence NOTE. The notion of legal independence is the rationale for the level concept. The principle stipulates that spatial units, being subject to the same law and underlying a unique adjudication procedure, may be arranged in one individual level.
Mortgage	:	A conditional conveyance of (ownership) right as security for the repayment of a loan.
Party	:	Person or group of persons that compose an identifiable single (legal) entity. NOTE. A launit can play the role of party.
Party member	:	Member of a party.
Registration	:	Assignment of a permanent, unique and unambiguous identifier to an item (from ISO 19135).
Registry	:	Information system on which a register is maintained (from ISO 19135).
Responsibility	:	Formal or informal obligation to do something.
Restriction	:	Formal or informal entitlement to refrain from doing something.
Right	:	Formal or informal entitlement to own, or to do something.
Source document	:	Document providing facts.
Source point	:	Point of a spatial unit as observed in the field. NOTE. This can be observed by e.g. terrestrial surveying, photo interpretation, image interpretation, or identification on an existing map.
Spatial source document	:	Source document with the spatial description of a (part of) one or more spatial units.
Spatial unit	:	Single area (or multiple areas) of land (and/or water) or, more specifically, a single volume of space (or multiple volumes of space) under (one or more) unique and homogeneous rights, restrictions, or responsibilities.

Source : ISO/CD 19152, Date : 10 July 2009, Geographic Information – Land Administration Domain Model (LADM)

Annex 5 The Questionnaire for Land Officer

QUESTIONNAIRE A

Introduction:

Dear Land Officer,

I hope you would please to fill in this questionnaire. This instrument is aimed to collect data for my research as a part of my thesis writing in ITC, Enschede, The Netherlands. Data collected from this questionnaire will only be treated/used in academic purpose and the confidentiality will be guaranted. Your answers will be very useful and meaningful for the success of my research. Hopefully, findings from my research will contribute to the land administration science in general and the development of land administration in our country, Indonesia. Thank you very much.

Kind regards,

Kurnia Wulan Sari

(Researcher)

A. Personal Information
Please fill in the blanks below regarding to your personal information!

Office name	:
Office address	:
Province	:

B. Questions
Please write your answers for the following questions about land subdivision
based on your practical/factual knowledge/experiences, not based on your theoretical knowledge!

1.	Have the existing subdivision processes/procedures referred or been appropriate to/with the Standards of Operation Procedures?
	☐ Yes they all have, with no impediment ☐ Only some of them have
	☐ Yes they all have, with some impediments ☐ No, not at all

2.	Referring to the Standards of Operation Procedures, what is your opinion/assessment about the service for land subdivision at your office regarding to the procedures/steps?
	☐ The procedures/steps are appropriate
	☐ The procedures/steps could/should be simplified, *Please specify/explain*:

3.	Referring to the Standards of Operation Procedures, what is your opinion/assessment about the service for land subdivision at your office regarding to the time?
	☐ Time allocated is sufficient
	☐ Time allocated should be more. *Please specify/explain*:
	☐ Time allocated should be less. It should be shortened. *Please specify/explain*:

| 4. | Referring to the Standards of Operation Procedures, what is your opinion/assessment about the |

service for land subdivision at your office regarding to the cost?

☐ The cost is expensive and should be less/cheaper. *Please specify/explain*:

☐ The cost is appropriate
☐ Other(s), *Please specify/explain*:

5. According to your opinion/assessment, has the sofware application used for land administration service at your office accommodated all procedures described in the Standards of Operation Procedures?

☐ Yes, it has
☐ No, it has not. *Please specify/explain*:

6. According to your opinion/assessment, is the sofware application used for land administration services at your office easy to operate/to be operated or user friendly?

☐ Yes, it is
☐ No, it is not. *Please specify/explain*:

7. Regarding to the use of software application for land administration services at your office, how frequent do errors—both human errors and technical errors—happen?

☐ Always or frequent   ☐ Never
☐ Sometime

8. If errors happen in the use of the software—mentioned in previous question, who has the responsibility to fix/solve the errors/problems?

☐ Administrator (Admin)
☐ Other(s), *Please specify/explain* :

9. If errors happen in the use of the software—mentioned in previous questions, is there a special/certain department (*help desk)?* Is it available in 24 hours?

☐ Yes, there is. *Please specify/explain* :

☐ No, there is not
☐ Other(s), *Please specify/explain* :

10. According to your opinion/assessment, how often the database at your office get damage (which are caused by editing, inputting, updating, and deleting) therefore you should fix it with database tool editor?

☐ Never
☐ Sometime
☐ Always or frequent
Please explain:

11. According to your opinion/assessment, what is/are causing the condition of the database is not valid / corrupted / damaged? - The options can be more than one --

☐ There is error with the application/software.
☐ To frequent in editing database with database tool editor

☐ High in data transaction
☐ Error/crush/damage hardware.
☐ The electricity shut down suddenly
☐ No back up database
☐ Other(s), *Please specify/explain* :

12. As an Administrator (Admin), have you had/obtained all required educations and trainings which provide you appropriate and sufficient backgrounds for your responsibility in your job?

☐ Yes, I have had them all
☐ Yes, I have had most of them. *Please specify/explain the education(s) and training(s) you have not had*:

☐ Yes, I have had a few of them. *Please specify/explain the education(s) and training(s) you have not had*:

☐ No, I have not had.

13. According to your opinion/assessment, how is customer satisfaction on land subdivision service/procedures?

☐ Relatively high satisfaction
☐ Medium satisfaction. *Please specify/explain*:

☐ Low satisfaction. *Please specify/explain*:

14. At your office, are required supporting infrastructures for computerized services (e.g internet, LAN) sufficiently available?

☐ Yes, they are fully available
☐ Yes, they are mostly available
☐ No they are not.

15. At your office, are the availability and the capacity of the required/supporting hardwares (e.g PCs and server) sufficient?

☐ Yes, they are
☐ No, they are not yet. *Please specify/explain*:

16.. At your office, how are the availability and the adequacy of the storage devices (harddisks)?

☐ They are sufficiently available and adequate
☐ They are available but not adequate
☐ They are not available

17.. At your office, are data periodically and automatically backed up?

☐ Yes, they are. *Please explain* :

☐ Yes, they are periodically but not automatically backed up. *Please explain*:

☐

☐ No. They are sometime backed up and sometime not

18.	At your office, is there a good and standardized system for archieving documents (e.g. maps, letters, and land certicates)?

☐ Yes, there is. All documents are well archieved
☐ Yes, there is. Most documents are well archieved
☐ Yes, there is but anly a few documents are well archieved. *Please specify/explain* :

☐ No, there is not. *Please explain* :

19.	Please write down 5 impediments/hindrances/obstacles in land subdivision service/procedures!

1.

2.

3.

4.

5.

20.	Please write down 3 ways out to solve the problems in or to improve the land subdivision service/prosedures!

1.

2.

3.

Annex 6 The Questionnaire for Customer

QUESTIONNAIRE **B**

Introduction:

Dear Customers,

I hope you would please to fill in this questionnaire. This instrument is aimed to collect data for my research as a part of my thesis writing in ITC, Enschede, The Netherlands. Data collected from this questionnaire will only be treated/used in academic purpose and the confidentiality will be guaranted. Your answers will be very useful and meaningful for the success of my research. Hopefully, findings from my research will contribute to the land administration science in general and the development of land administration in our country, Indonesia. Thank you very much.

Kind regards,
Kurnia Wulan Sari
(Researcher)

A. Personal Information
Please fill in the blanks below regarding to your personal information!

Occupation :
Age :
Sex : ☐ Female ☐ Male
Address :

B. Questions
Please write your answers for the following questions about land subdivision
based on your practical/factual knowledge/experiences, not based on your theoretical knowledge!

1. How did you apply for land subdivision process?
   a. I did by my self without representative
   b. With Notary as my representative
   c. With Broker
   d. Other(s), Please specify/explain :

2. Did you know about the procedures/steps in land subdivision?
   a. Yes, all   c. Yes, a few
   b. Yes, most   d. No

3. From who did you get the information about land subdivision application and procedures?
   a. BPN staffs   d. Real estate company
   b. BPN website   e. Broker
   c. Notary   f. Other(s), Please specify/explain :

4. Did you exactly know/understand about the procedures/steps in land subdivision?
   a. Yes, I understand all   c. Yes, I understand few
   b. Yes, I understand most   d. No, I did not understand

5. According to your experience/knowledge, how many parts/departments did you have to meet in a land subdivision service/procedure?
   a. 2   c. 4
   b. 3   d. More than 4

6. According to your experience/knowledge, how many times did you have to come to BPN office in a land subdivision service/procedure?
   a. 2   c. 4
   b. 3   d. More than 4

7. According to your opinion/assessment, how are the procedures for land subdivision process?

	a.	Complicated, need to be accelerate		
	b.	More complicated, need to be more accelerate		
	c.	Clear and simple		
8.	According to your opinion/assessment, how is the (allocated) time in a land subdivision service/procedure?			
	a.	Too long	c.	Enough/precise
	b.	Quite long		
9.	According to your opinion/assessment, how is the cost for the land subdivision service/procedure referring to the defined rule?			
	a.	Too expensive	c.	Affordable/sufficient
	b.	Quite expensive		
10.	According to your opinion/assessment, how is the service of BPN staffs?			
	a.	Very good/satisfied	c.	Less good/satisfied
	b.	Quite good/satisfied	d.	Not good/satisfied
11.	How was your attendance in field survey/boundary investigation in the land subdivision procedure?			
	a.	I my self attended	c.	Not attended and no represented
	b.	Represented		
12.	Who became a whiteness in boundary agreement/delimitation in the field?			
	a.	Neighbors who stay for many years	d.	Head of district (camat
	b.	Head of district (Ketua RT)	e.	District government officer
	c.	Head of environment (Lurah)	f.	Other(s), Please specify/explain :
13.	According to your opinion/assessment, how is the field inspection/survey for boundary investigation/adjustment in the land subdivision procedure?			
	a.	Very accurate	c.	Inaccurate
	b.	Quite accurate		
14.	How long/how many hours did the boundary investigation/survey take time?			
	a.	1 - 4 hours	c.	8 - 12 hours
	b.	4 - 8 hours	d.	More than12 hours
15.	According to your opinion/assessment, how is the (allocated) time for a land-use change service/procedure?			
	a.	Too long	c.	Enough/presice
	b.	Quite long		
16.	According to your opinion/assessment, how are the procedures in the land-use change service?			
	a.	Complicated, need to be accelerate		
	b.	More complicated, need to be more accelerate		
	c.	Clear and simple		
17.	According to your opinion/assessment, how is the cost for the land-use change service/procedure referring to the defined rule?			
	a.	Too expensive	c.	Affordable/sufficient
	b.	Quite expensive		
18.	According to your opinion, how if the land application and transaction conducted on-line?			
	a.	Good, effective, efficient, save		
	b.	Good, effective, efficient, unsave		
	c.	Not good, efficient, effective, save		
	d.	Other(s), Please specify/explain :		
19.	What impediment(s)/hindrance(s)/obstacle(s) did you have/face in the land subdivision service/procedures?			
20.	According to your opinion or idea, what part/subject/thing should be improve for better services in land subdivision particularly and in other land administration generally?			