LAND ADMINISTRATION AND DISASTER RISK MANAGEMENT: CASE OF EARTHQUAKE IN INDONESIA

HANHAN LUKMAN SYAHID
FEBRUARY, 2011

SUPERVISORS:
Prof. Dr. J.A. Zevenbergen
Drs. J.C. de Meijere

LAND ADMINISTRATION AND DISASTER RISK MANAGEMENT: CASE OF EARTHQUAKE IN INDONESIA

Hanhan Lukman Syahid
Enschede, The Netherlands, February, 2011

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
Specialization: Land Administration

SUPERVISORS:
Prof. Dr. J.A. Zevenbergen
Drs. J.C. de Meijere

THESIS ASSESSMENT BOARD:
Prof. Ir. Paul van der Molen(Chair)
Dr. Norman Kerle (External Examiner, University of Twente)
Ir. W.T. de Vries (Member)

ABSTRACT

Natural disasters have been occurring and are expected to occur more frequently in the future. Integration between good land administration and disaster risk management can reduce the adverse impact of disasters. Good land administration plays a significant role in disaster risk management activities before, during and after the occurrence of a disaster. This thesis tries to enhance the understanding of the relationship between land administrations and disaster risk management with a focus on the pre disaster period. Interaction and integration between disaster risk management (risk assessment and prevention and mitigation) and land administration (land use planning and cadastre) and impact of their integration including impact of natural disaster on changes in land use, land tenure and land value were investigated in theory as well as in practice.

The methods used in this research are desk research and the use of case studies. Literature review was done to understand the relationship between land administration and disaster risk management in theory. While case studies were used to get a deeper understanding of the relationship between land administration and disaster risk management in practice. The study consists of two empirical cases: Padang and Banda Aceh, both in Indonesia. The assessment framework was developed by using desk research. Five elements of integration have been defined to assess the integration between disaster risk management, land use planning and cadastre in the study areas. The elements defined are: policy, organizations arrangement, data and sharing of data, involvement of external agents including their impact on land use, land value and land tenure. The evaluation of assessment in case study areas was done using "good practice" criteria.

Risk information (e.g. hazard zoning) coming from risk assessment affects the land use plan. In some cases, hazard zoning directly imposes the restrictions and responsibilities to landowners located in hazard prone areas. Similarly, the risk-based land use plan could also impose the restrictions and responsibilities to landowners, limit the uses of land and change land value. All these restrictions and responsibilities can be made parcel-based and publicly available by the cadastre. On the other hand, the land use plan only plays a minor role in the risk assessment process. However, it plays a major role in the prevention and mitigation phase through non-structural measures. The cadastre plays a role as sound base information in land use planning, risk assessment and prevention and mitigation processes by providing land-related data. Based on the elements in the framework used, the disaster risk management and land administration have not been fully integrated yet in the case study areas. Some major gaps both in Padang and Banda Aceh were identified related with the absence and inappropriate regulations, weak in sharing data and lack of involvement of external agents (e.g. community).

It was also found that in Padang and Banda Aceh, integration between land administration and disaster risk management has an indirect impact on land use, land tenure and land value. However, the impacts are not as significant as the impacts on land use, land tenure and land value due to natural disasters themselves. In Padang, some people leave their properties which are located in the high hazard zone. This becomes a driving factor (among others) in the increase of the price of land in the safe areas. In Banda Aceh, the risk based land use plan changed the areas along the coast to become open space and mangrove forest zone to reduce the adverse impact of a tsunami which might occur in the future. Consequently, landowners are not allowed to build their houses there and other physical development requires specific permits. Resettlement and relocation were carried out by local government for the vulnerable group who live in high hazard zone, but many people returned back to their hazardous place. The discussion has also identified the different phenomena between people in Padang and Banda Aceh concerning their response to the natural disaster that need to be addressed for future studies.

Keywords: *Risk Assessment, Land Use Plan, Cadastre, Land Tenure, Land Value, Earthquake.*

ACKNOWLEDGEMENTS

Firstly, I would like to thank to Neso-Indonesia and ITC which have provided the opportunity for me to study abroad.

Secondly, I would like to express my sincere gratitude to Prof. Dr. Jaap Zevenbergen and Drs. Johan de Meijere for their never-ending supports in giving me the feedbacks and constructive ideas until I could finish my thesis. It will be difficult for me to finish this research without their patient encouragement. My appreciation is directed to Prof. Paul van der Molen for constructive comments during the proposal and mid-term defence. My thankful is also directed to all LA lecturers. All of you have been opening my mind to think out of the shell.

I also would like to thank to Mr. Kees Bronsveld, Mrs. Jaccqualine Mol, and other ITC staff for their support during I was studying here.

I would like to thank you to Chinny and my "Niger brother" Mahaman for the nice discussion and exchange our LA and DRM knowledge. I also convey my gratitude to all LA 2008 classmates. Thank you for our friendship and our sharing knowledge together. I would also to convey my gratitude to Dr. Alice Laborthe for the positive discussion and constructive inputs concerning my research.

I am thankful to my colleges from Land Taxes Department, National Land Agency in Jakarta and Local Land Officer in Padang (pak Suhaimi, mas Hanif, mba Uge) and in Banda Aceh (mas Mulyadi, Irfan, etc.) who were helped me a lot during data collection period. My thankful is also directed to Awang from BAPPEDA Padang and Sari Fitri, Parmakope form BAPPEDA Banda Aceh and Didik Sugianto from Unsyiah. My thankful is also directed to Tintus and Tantan. Special thanks to my best friend Sudarman Harjasaputra who support me in providing the data and F.N. Nugroho Adi for the discussion.

To all my Indonesian family (Subur, Sandra, Turi, Dyah, Hendro, Andri, Uda Tedy, Uda Frinaldi and others), all of you guys made me feel home here. Thank you for sharing the happiness and our friendship.

I dedicate my special gratitude to my beloved family who are always patience and pray for me every day. All of you raise me up to more than I can be.

Hanhan Lukman Syahid
February 14, 2010
Enschede, the Netherlands.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AWI	:	The Alfred Wegener Institute for Polar and Marine Research (German)
BAPPENAS	:	*Badan Perencanaan dan Pembangunan Nasional* (National Planning and Development Agency)
BAPPEDA	:	*Badan Perencanaan dan Pembangunan Daerah* (Regional Planning and Development Agency)
BAPPEDA *Kab./Kota*	:	*Badan Perencanaan dan Pembangunan Daerah Kabupaten/Kota* (District/City Planning Agency)
BAKORNAS PB	:	*Badan Koordinasi Nasional Penanggulangan Bencana* (National Coordinating Board of Disaster Management)
BAKOSURTANAL	:	*Badan Koordinasi Survei dan Pemetaan Nasional* (National Coordinating Board of Survei and Mapping)
BMKG	:	*Badan Meteorologi, Klimatologi, dan Geofisika* (Meteorology, Climatology, and Geophysics Agency)
BNPB	:	*Badan Nasional Penanggulangan Bencana* (National Agency for Disaster Management)
BNPBD	:	*Badan Nasional Penanggulangan Bencana Daerah* (Regional/Local Agency for Disaster Management)
BPN	:	*Badan Pertanahan Nasional* (National Land Agency)
BPS	:	*Biro Pusat Statistik* (Statistics Census Bureau)
BKPRD	:	*Badan Koordinasi Penataan Ruang Daerah* (Regional/LocalCoordinating Board of Spatial Planning)
DLR	:	*Deutsches Zentrum für Luft- und Raumfahrt* (German Aerospace Centre)
DRM	:	Disaster Risk Management
DTRB	:	*Dinas Tata Ruang dan Bangunan* (Local Spatial Planning and Building Agency)
GoI	:	Government of Indonesia
GTZ	:	German Technical Assistance Agency
Ha or ha	:	Hectare
IDR	:	Indonesian Rupiahs (1 US$ ≈ 9.000 IDR)
IMB	:	*Izin Mendirikan Bangunan* (Building Permits)
ISDR	:	International Strategy for Disaster Reduction
ICT	:	Information and Communication Technology
Keppres	:	*Keputusan Presiden* (Presidential Decree)
LA	:	Land Administration
LUP	:	Land Use Planning
NGO	:	Non-Government Organization
PP	:	*Peraturan Pemerintah* (Government Regulation)
PPAT	:	*Pejabat Pembuat Akta Tanah* (Notary)
PU	:	*Pekerjaan Umum* (Public Works Agency)
RRRs	:	Right, Restrictions and Responsibilities
TNI	:	*Tentara Nasional Indonesia* (Indonesian Military)
UU	:	*Undang-Undang* (Law)
UNISDR	:	United Nations International Strategy for Disaster Reduction
UNECE	:	United Nations Economic Commission for Europe

1. INTRODUCTION

Nowadays, natural disasters like hurricanes, tsunamis and earthquakes damage and wipe out resources vital to peoples' livelihoods. They adversely affect land administration by destroying land records and erasing boundaries. These disaster events not only destroy lives and properties but also reduce liquidity of the economy and hinder social development (GTZ, 2002). Lessons from the responses to the Asian tsunami in 2004 show that land tenure will remain secure after the occurrence of a natural disaster only when there are adequate land administration data or land records have received little damage, or landholders have documentary evidence of legal rights to their land (Mitchell, 2009).

Sustainable land administration systems provide clear identification of individual land parcels and land rights attached to these parcels (Enemark, 2009). Access to reliable, accurate, and timely information at all levels of society is crucial immediately before, during, and after a disaster. Information about land tenure, land use, land value as well as improvement of land development needs to be readily collected, processed, analysed, and shared in order for stakeholders to effectively respond.

In the Indonesian land administration system, cadastral data shows the essential information of relationships of people to their land. The data contains information about the owner, types of rights, area, boundaries of parcels and unique identification number which can connect it with other information attached to the land. A land use plan contains information about the suitability of uses of land for particular purposes. This determines the building units, economic activities that are carried out, density of population in different periods of the day, etc. All these information are important in risk and vulnerability assessment which is important in planning for preventing and mitigating the adverse impact of future disaster. One of the results of risk and vulnerability assessment is a risk map. The information about land use and land rights are important for calculating the elements-at-risk (Westen, 2009). In addition, the information resulting from risk assessment is useful to enable risk-based spatial planning and improvement of land administration for the future.

This thesis was carried out to enhance the understanding of the relationship between LA and DRM in theory as well as in practice. Banda Aceh city and Padang in Indonesia, areas which have been hit by earthquakes, were selected as case study areas. In this research, the relationship between LA and DRM will be analysed by focusing on risk assessment, prevention and mitigation (from DRM side), land use planning and cadastre (from LA side). Understanding this in practice includes investigating impacts of their integration including natural disaster on changes in land use, land value and land rights.

1.1. Conceptual Background

1.1.1. Risk assessment and prevention and mitigation in disaster risk management

In the context of risk assessment, risk is defined in short as "the probability of losses" (UN-ISDR, 2010). Risk assessment should be done based on certain basic spatial units (Westen, 2009). Risk can be presented conceptually with the basic equation as follow (figure 1.1).

Risk = Hazard * Vulnerability * Amount of elements-at-risk

Figure 1.1: Definition of risk

The elements-at-risk could consist of population, properties, assets and economic activities, including services or any other defined values exposed to hazards in a given area. The number (e.g., buildings, people), monetary value (e.g., replacement cost, market cost) and area may be used to quantify the elements-at-risk (UN /ISDR, 2004).

Meanwhile, prevention and mitigation aims to avoid and to minimize the adverse impact of disasters. Disaster prevention depends on social and technical feasibility and cost/benefit considerations, investing in preventive measures which is justified in areas that are frequently affected by disasters (UN/ISDR, 2004).

1.1.2. Land use planning and cadastre in land administration

Land use planning is one of the mechanisms used by the government to promote and contribute to socially desirable land allocation and utilization (World Bank, 2003). The government manages certain uses of land by proposing some functions and imposing some restrictions to the use of land. As a result, the government may impose restrictions on private rights (Molen, 2001). This condition results in changes in rights and interests in land. The changes could take place voluntarily (by owners or users), or may be enforced by government.

As representation of land administration, cadastral data contain information about parcel boundaries a unique identification number as a key connector with all related land information. The relationship between the people and their land can be shown diagrammatically as in figure 1.2.

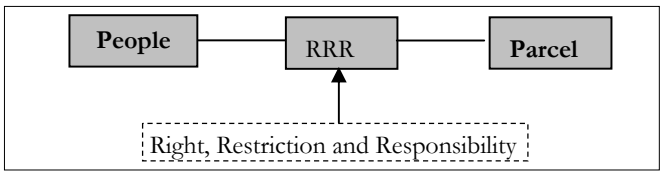


Figure 1.2: The relationship between people and land
(Source: (Lemmen, van Oosterom, & Uitermark, 2008))

1.1.3. The relationship between risk assessment, prevention and mitigation, land use planning and cadastre

In the risk and vulnerability assessment process, information about land use, land rights and land value are important inputs for calculating the elements-at-risk. Land use is one of the most important spatial attributes of the mapping units for elements-at-risk inventory (Westen, 2009). The patterns of land use in subsequent steps of the risk assessment are useful to determine whether this activity is exposed to a hazard or not. By intersecting land use data with administrative data, spatially analysing

statistical data such as demographic or economic key data could be done (GTZ, 2009). Other essential data in risk assessment are cadastral records which contain both spatial and non-spatial information. In cadastral records, information about types of rights - private, public and state land- are part of the vulnerability factor (World Bank, 2001). Parcel size and its location are needed in defining physical and environmental elements of vulnerability. The other function of up-to-date cadastral records is a source of information for the recovery and reconstruction phase such as guaranteeing tenure security, finding out shelter location, resettlement areas, reducing land disputes, etc. The value of land is also necessary information for calculating the possible economic losses. In addition, risk information is an essential information source in making and deciding new land uses. Areas with considerable level of hazards and vulnerability in a risk map could affect land use planning (Westen, 2009).

Re-arranging and re-allocating high-risk areas may be needed to protect the people and their capital from severe impact of future disasters (UN /ISDR, 2004). In this regards, land use plan plays a role for re-zoning the high-risk areas as prevention and mitigation to reduce adverse impact of disaster. Afterwards, the new risk-based land use planning might result in a change in the status of land units in cadastral records by adding new restrictions. The land use planning can change the land rights and may enforce restrictions on land rights which have already been registered in the cadastre organization. At the time when the revised land use planning is published, it would be better if the changes in status of land rights are reflected in the registration process by updating the cadastral records to improve land administration in the future. Timely information pertaining to cadastral records is essential data required to solve land issues in pre and post disaster (FIG, 2006).

1.2. Research Problem and Justification

1.2.1. Research problem

The current land administration system is not always adequate to respond to consequences of natural disasters which frequently occur in the country like in Indonesia. To support reduction of vulnerability and strengthening the resilience of vulnerable groups, the land administration system should be better linked with disaster risk management. In reality, however, it appears that the relation is weak or non-existent. Therefore, this thesis focuses on enhancing the understanding of the relationships between LA and DRM in theory as well as in practice with focus on the pre disaster period. The relationship between DRM (risk assessment and prevention/mitigation) and LA (land use planning and cadastre) in practice was carried out by assessing the case of Padang and Banda Aceh, Indonesia.

1.2.2. Justification

Enemark (2009) stated that "By combining disaster risk information with the relevant information on land tenure, land value, and land use, the necessary risk prevention and mitigation measures can be identified and assessed in relation to legal, economic, physical, and social consequences. Ideally, disaster risk reduction should be an integrated part of land use planning and land management". The information on land tenure and land use can be retrieved from cadastral and land use planning maps. These pieces of information could be used in assessing risk for a comprehensive analysis to prevent and mitigate future disasters. Another argument comes from Mitchell (2009) who mentioned that "land administration and management can reduce the vulnerability of people to natural disasters through improved capacity to make decisions on land, the development of land policies that includes

the lessons learned from previous disasters, the development of land valuation records in at-risk areas, and the development of sound land use master plans that consider risk areas and resettlement options in consultation with the community" .

Cadastral records play an important role in spatial land use planning. In Denmark, cadastral records are used as basic information in the planning process. The cadastral records also play an important role as a basic element in spatial planning and utilities management in Australia as well as in Germany (Cadastral Template, 2003).

In Indonesia, like in most countries, the relationship between risk information, land use planning and cadastre depends on the regulations imposed by and responsibilities of the organizations which are in charge and the condition of the data itself. Some questions about the risk-based land use planning may or may not legally change the types of rights and add new restrictions and/or responsibilities to the land. The new restrictions and/or responsibilities of the land registered in the cadastre organization and the question regarding regulations on registration of land parcels without any restrictions may need to be verified and investigated to enhance the understanding of the relationships between LA and DRM in practice.

In this thesis, Padang and Banda Aceh were selected as study areas. Both locations have been hit by high intensity earthquakes. In 2004, Banda Aceh was hit by earthquakes followed by tsunami. In 2005, the government of Indonesia published the Master Plan for Banda Aceh City which includes disaster-related regional characteristics. The master plan proposes a coastal zone, fishing/fishpond zone, settlement, restricted settlement zone, new settlement zone for residents wishing to relocate, etc. (Goverment of Indonesia, 2005).

In 2007, Padang experienced an earthquake of intensity 6.9 on the Richter scale. An earthquake could be potentially followed by a tsunami similar to what hit Banda Aceh in 2004. This condition makes the people in Padang at risk each day and fear for their lives. The latest 7,2 Richter scale earthquake followed by a tsunami that hit Mentawai island in 2010 (around 150 km from Padang City) has also affected Padang and made people in Padang more afraid for a tsunami.

Regarding the conditions above, government has to take actions to mitigate the impact of disasters such as preparing temporary shelter. In anticipation of the adverse impact of future disasters, the government also needs to implement the mitigation and preparedness activities. Beside by physical measures (e.g. escape building), government agencies together with NGOs also need to prepare the evacuation route and implement other non-physical measures such as keeping the earthquake and tsunami prone areas free from developments and reducing the density of population in these areas. To implement appropriate and effective prevention and mitigation, the decision-maker needs appropriate, accurate, and timely updated information. In this regard, the required hazard-related information including the vulnerability level needs to be obtained. To implement the entire DRM program, the agencies also require good coordination. Integration among them can contribute to effective achievement of goals of DRM.

Based on the reasons above, it is necessary to enhance the understanding of the relationship between LA and DRM in practice as well as investigating the impact of their relationship and natural disaster itself to the changes of land use, land value and land right in the hazard prone areas in Indonesia.

1.3. Research Objectives

1.3.1. Main objective

This study aims to enhance the understanding of the relationships between LA and DRM with a focus on the pre disaster period in theory as well as in practice.

1.3.2. Sub-objectives

To achieve the main objective, the following are the specific sub-objectives:

1. To enhance the understanding of the relationship between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) theoretically.
2. To assess the integration between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in practice and the impacts of integration among them including the impact of natural disaster on land use, land tenure and land value.

1.4. Research Questions

Sub-objective 1:

Q1: What data in LA (land use planning and cadastre) could support DRM (disaster risk assessment and prevention and mitigation) and vice versa?

Q2: What is the relationship between DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre)?

Q3: What is the framework needed to assess the integration between DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in practice including impact of their integration and natural disaster on land use, land tenure and land value?

Sub-objective 2:

Q4: Have DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) already been integrated in practice?

Q5: What are the impacts of integration of LA and DRM and natural disaster on land use, land tenure and land value in practice?

Q6: What are the gaps (if any) in integrating DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in practice?

1.5. Research Design

1.5.1. Conceptual framework and scope of research

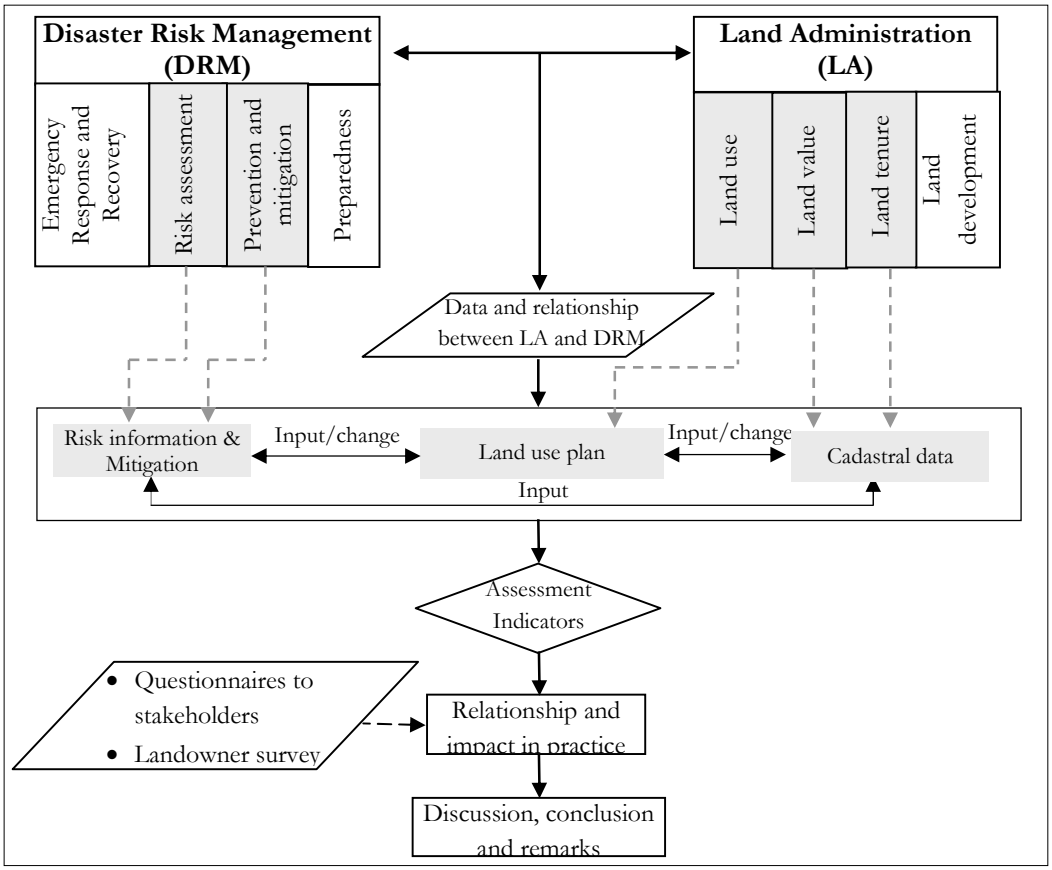


Figure 1.3: Conceptual framework

Due to time limitation, the scope of this study is more focused on the relationship between DRM and LA on pre disaster period. Specifically, risk assessment and prevention and mitigation were chosen from DRM side while land use planning and cadastre were chosen from LA side. The investigation of the impact of their integration on land in practice focuses on the impact of risk-based land use plan on changes in land use, land tenure as well as in land value in study areas rather than the impact of risk assessment, prevention and mitigation and cadastre itself. Meanwhile, the impact of natural disaster is also investigated to get deeper understanding of changes in land use, land tenure and land value in study areas.

1.5.2. Methodology

The methodology of this research was carried out by using two approaches. The first relies on literature review and desk research to have a deeper understanding of concepts and theories. The second approach relies on empirical evidence based on a case study.

a) Literature review

Literature review on the concept of LA and DRM were carried out. Understanding the process and data used in risk assessment, prevention and mitigation, land use planning, cadastre and their

interrelationship were elaborated in detail. This method is used to answer questions 1 and 2. Papers, journals, reports including rules and laws related with the topic were used as sources in this method.

b) Desk research

The main purpose of using this method is to develop the framework that is required for this research to answer question 3. Desk research is also used to understand the relationship between risk assessment, prevention and mitigation, land use planning and cadastre to answer question 2.

c) Case studies

A case study is used to fully understand the relationship between DRM (risk assessment, prevention and mitigation) and LA (land use planning and cadastre) in practice. According to (Yin, 1994), case study uses interviews, observations, questionnaires, and documents and text analysis as data collection techniques to get an in-depth understanding about the temporary phenomenon in real-life context. In this research, the observations technique is not used due to researcher could not go to the field.

To investigate the relationship between DRM (risk assessment, prevention and mitigation) and LA (land use planning and cadastre), primary and secondary data were used from two locations in Indonesia: Banda Aceh and Padang. Data, institutions which are in charge and the legal status were analyzed and compared. The case study is done to answer questions 5 and 6.

Stages of the methodology in detail are diagrammatically shown in Figure 1.4 .

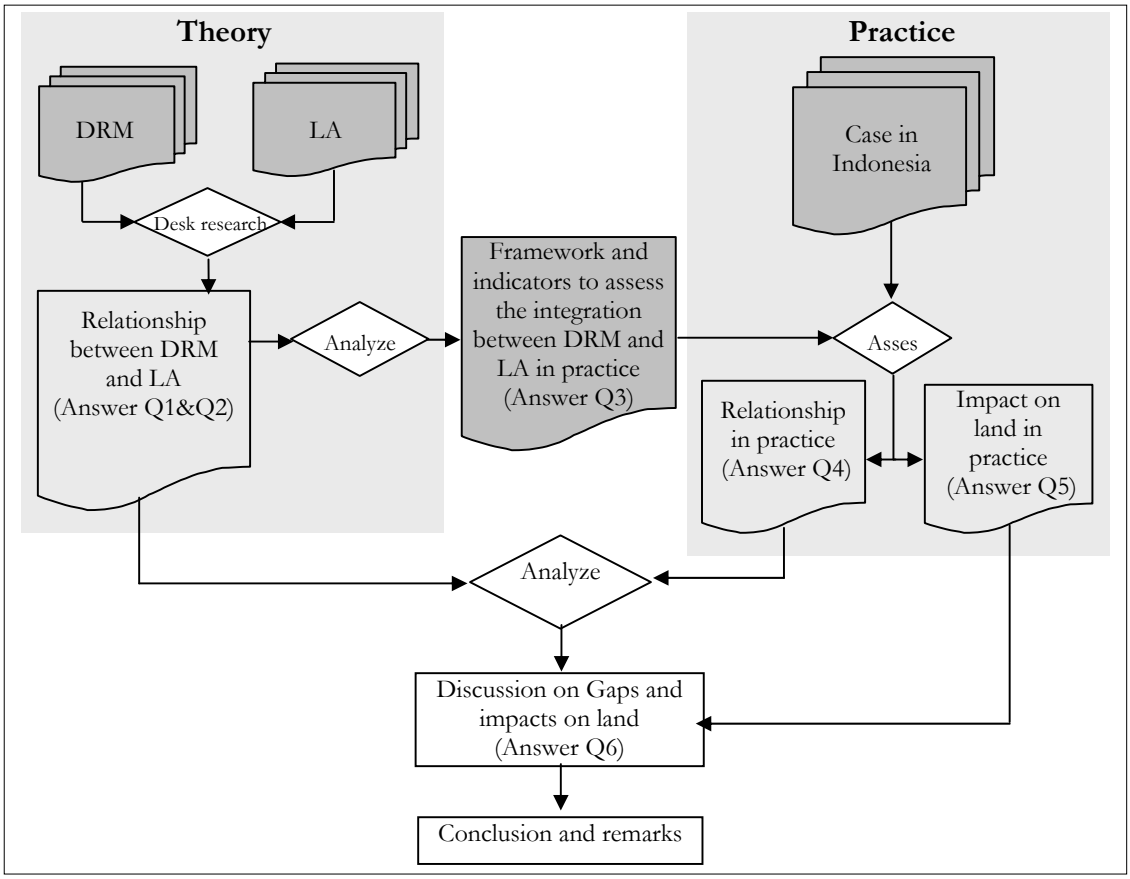


Figure 1.4: Methodology

1.6. Thesis Structure

Chapter 1 – Introduction
This chapter provides an overview of this research including the general background, research problem, justification, research objective, research questions, and research design.

Chapter 2 – Literature review on disaster risk management and land administration
This chapter reviews the concept of LA and DRM. The LA and DRM data which can support each other and relationship between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) are described based on the theory to answer Questions 1 and 2.

Chapter 3 – Assessment framework of disaster risk management and land administration
This chapter presents the conceptual framework and indicators to evaluate the relationships between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in practice to answer question 3. Understanding the relationship in practice were carried out by assessing the integration between main organizations which are in charge in DRM and LA including the impact of their integrations and natural disaster itself to the changes on land use, land tenure and land value.

Chapter 4 – Data collection methodology
This chapter starts with an explanation about the methodology used in data collection. This chapter also presents the description of study areas and the way of data are collected, analysed and presented.

Chapter 5 – Disaster risk management and land administration in the study areas
This chapter starts with the explanation about LA and DRM in Indonesia. This is followed by the discussion about disaster management, land use planning and cadastre in the study areas to answer question 4. The impact of risk-based land use plan and natural disasters to land use, land tenure and land value are assessed to answer question 5.

Chapter 6 – Discussion,
This chapter deals with the discussion of the gaps for integrating DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) and impact on land use, land tenure and land value in practice based on the result from the assessment to answer question 6.

Chapter 7– Conclusion and recommendations
This chapter consist of two sections: the first is conclusion presented for each questions based on the sub objectives of the research and the second is recommendations.

2. LITERATURE REVIEW ON DISASTER RISK MANAGEMENT AND LAND ADMINISTRATION

This chapter aims to review some literature related to disaster risk management and land administration to develop a conceptual base for this research. Section 2.1 gives an overview of disaster risk management which focuses on risk assessment, prevention and mitigation. A general introduction about land administration which focuses on land use planning and cadastre is described in section 2.2. Meanwhile, explanation concerning the relationship between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) is described in section 2.3. Finally, concluding remarks are given in section 2.4.

2.1. Disaster Risk Management

Disaster risk management (DRM) is "the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters" (UN/ISDR, 2004). All forms of activities, including structural and non-structural measures to prevent and to limit the undesirable impacts of hazards are included in disaster risk management.

Disaster risk management includes measures before (risk assessment, prevention and mitigation, preparedness), during (emergency response) and after disaster (recovery) (Figure 2.1). In disaster risk management, the original causes and fundamental factors which lead to disasters are needed to be understood well to arrive at solutions that are practical, appropriate and sustainable for the community (UN/ISDR, 2005).

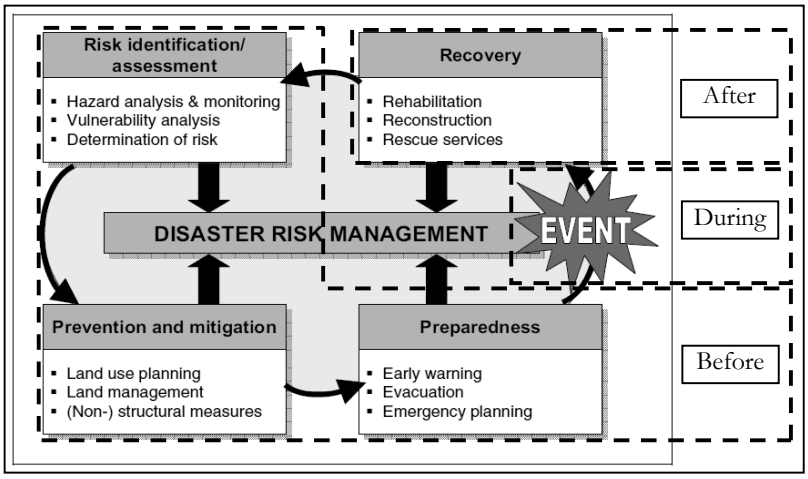


Figure 2.1: Key elements of disaster risk management
(Adapted from: (UN/ISDR, 2004)

2.1.1. Risk assessment

UN/ISDR (2004) defines risk assessment as "a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose

a potential threat or harm to people, property, livelihoods and the environment on which they depend". Risk assessment process uses systematically the available information to find out the probability of certain events which could be happening and the magnitude of their possible consequences. The stages of risk assessment consist of (UN/ISDR, 2004):

1) Identification of the nature, location, intensity and probability of a threat;
2) Finding out the reality and level of vulnerabilities and exposure to those threats;
3) Identification of the capacities and resources which are available to handle the threats;
4) Determining the tolerance levels of risk.

Risk Assessment incorporates risk analysis and risk evaluation. The risk analysis phase uses available information to estimate the risk caused by hazards to individuals or populations, property or the environment. Afterwards, risk evaluation is done by making decisions including the consideration of the importance of the estimated risks and the associated social, environmental, and economic consequences, to identify a range of alternatives for managing the risks (Van Westen, 2009). Accordingly, identification of hazards is a starting point in the risk assessment process.

a) Hazard

There are two types of hazards: natural and man-made hazards. Natural hazards are natural processes or phenomena within the earth system (lithosphere, hydrosphere, biosphere, or atmosphere) that may form a damaging event. Examples include earthquakes, floods, landslides, etc. On the other hand, man-made hazards include dangers which come from technological or industrial accidents, infrastructure failures or certain societal activities such as conflicts that may cause the loss of life or injury, property damage, social and economic disruptions or environmental degradation. Examples include industrial pollution, toxic wastes, industrial or technological accidents (explosions, fires, spills) (ADPC, 2010a).

Natural hazards become a disaster when it has a negative impact on vulnerable properties or people including their activities. The impact of natural hazard depends on the type of natural disaster, intensity, geographic coverage, population density and condition of physical infrastructures.

The hazard levels together with the probable associated intensity or magnitude of each hazard zone is usually presented in hazard zoning map. The map consists of a series of magnitude or risk level defined into zones. The map may also provide other relevant characteristics such as the extent of damage where the hazard occurs, hazard duration, etc. As a result, each hazard map may have different scales, spatial unit used, characteristics and information. It depends on purpose, capability of map maker and information obtained and availability of data resources.

Many literature related with hazard mapping have argued that the period of validity of a hazard map relies on the type of the hazard. A flood hazard map may be valid for a year or two years whereas an earthquake hazard map may be valid for ten or even hundreds of years. This would also depend on the probability of occurrence of each type of hazard.

b) Vulnerability

The term vulnerability varies and depends on different views. According to (UN/ISDR, 2005), vulnerability is "the condition determined by physical, social, economic, and environmental factors which increase the susceptibility of a community to the impact of hazard". According to this definition, the vulnerability factors are divided into four: physical, social, economic and environmental factors.

Data of vulnerability factor has different kinds of characteristics and value. Some researchers classify and present the data in vulnerability map into three levels (GTZ, 2009): low, medium and high. Others like Myeong & Jung Hong (2009) classify vulnerability into 5 levels: very low, low, medium, high, and very high.

Basically, the scale, spatial unit and period of data of vulnerability are widely varying. It depends on the purpose of the vulnerability map. The way the data of each factor is combined with the data of element at-risk determines how vulnerability is mapped and spatially presented.

c) Element-at-risk

Element-at-risk is defined as all objects, persons, animals, activities and processes that may be adversely affected by hazardous phenomena in a particular area, either directly or indirectly. This includes buildings, facilities, people, livestock, economic activities, public services, and environment (Van Westen, Kingma, & Montoya, 2009).

Element at-risk can be classified into different ways depending on the country, the setting (urban, rural), the objectives of the risk assessment, the scale, available resources, etc. As example Asian Disaster Preparedness Center (ADPC) classifies the elements at risk into physical, economic, societal and environmental elements which can be linked later immediately to physical, economic, social and environmental vulnerability. Elements at risk also can be classified as tangible or intangible, depending on whether they can be quantified. Tangible elements are physical elements such as people, buildings, equipment and infrastructure, as well as economic elements such as income and savings. Intangible elements are social elements such as social ties, cultural heritage and psychological well-being (ADPC, 2010b). Most of the physical elements which could be counted, localized, mapped and quantified are categorized as tangible elements at-risk while intangible elements at-risk are those things that are hard to identify and map, because they do not have a particular spatial dimension, such as cultural values, psychological condition, and sociological behavior (Van Westen, et al., 2009).

Spatial and non-spatial characteristics of element-at-risk could be carried out at various scale levels and various spatial units which are depend on the requirements of the risk study. The scales and spatial unit for determining the element-at-risk is ranging from small scale (1:10.000.000) to detailed scale (>1:10.000) (Van Westen, et al., 2009).

2.1.2. Prevention and mitigation

Prevention activities in disaster risk management aim "to provide comprehensive avoidance of the unfavourable impact of hazards and means to minimize related environmental, technological and biological disasters".

Prevention and mitigation could apply to structural and non-structural measures which are undertaken to limit the adverse impacts of natural hazards, environmental degradation and technological hazards (UN/ISDR, 2004). As prevention and mitigation activities, structural measures refer to any physical construction to decrease or keep away from all possible impacts of hazards. This includes the manufacturing measures and physical construction of hazard-resistant and protective structures and infrastructure such as construction of dams and reservoirs, artificial levees, etc. On the other hand, non-structural measures refer to the policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory instruments and the dissemination of information, which can reduce the risk and related bad impacts of disasters. The strategy of structural measures aims to modify or reduce the hazard, whereas the goals of non-

structural measures is to modify the susceptibility of hazard damage and disruption and/or the impact of hazards on individuals and the community such as policy, planning, regulatory framework, education and training, early warning, etc. (UNHABITAT, 2003).

To implement the prevention and mitigation of disaster in practice, it requires public commitment and institutional frameworks, including organisational, policy, legislation and community action (World Bank, 1998). The role of many government organizations, NGOs and communities and cooperation among these parties are needed to be carried out systematically to ensure the effectiveness of prevention and mitigation activities.

2.1.3. Preparedness

Preparedness is the activities and measures taken in advance to make sure the effective response to the impact of hazards, including the issuance of timely, effective and efficient early warnings and the temporary evacuation of people and property from threatened locations (UN/ISDR, 2004).

2.1.4. Recovery process

According to UN/ISDR (2004), recovery process refers to " decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk". Recovery (rehabilitation and reconstruction) offers an opportunity to build up and implement disaster risk reduction measures as well as to strengthen local organizational capacity to facilitate economic, social and physical development long after the disaster (UNECE, 2005).

2.2. Land Administration

There are many definitions of land administration. According to UNECE (UNECE, 1996, 2005) land administration is defined as "the process of determining, recording and disseminating information about the tenure, value, and use of land when implementing land management policies. It is considered to include land registration, cadastral surveying and mapping, fiscal, legal and multi-purpose cadastres and land information systems". Based on this definition, there are three elements of land administration (UNECE, 1996, 2005): land tenure, land value and land use. Land tenure refers to the possession of rights for a particular piece of land. This right determines what could legally be done with the land. Land value, on the other hand, refers to the actual price of land based on the capital market value, rental value, or construction costs in case of rebuilding costs after a disaster. Land use relates with rights to use the land and obtain some private and social benefits from that land.

Land administration is a government tool to support the implementation of land policy which involves many different sectors of society (UNECE, 1996, 2005). It implements land policies that affect land rights, delivers the titles and deeds, and manages land information systems. The government through legislation, rules and regulations is managing the operation of institutions which are established for achieving the purposes of land administration, the management of land rights, and land use planning.

2.2.1. Land use planning

According to (FAO, 1983), land-use planning is the "systematic assessment of land and water potential, alternatives for land use and economic and social conditions to select and adopt the best land-use options". The goals of land use planning are to select and put into practice those land uses

that will best meet the needs of the people while safeguarding resources for the future. Meanwhile, the aim of land use planning is to make the best use of limited resources.

Land use arrangements and allocation that carefully considers community activities (e.g. intensity and productivity growth) and the characteristics of land (e.g. physical characteristics, location and also area) are necessary to make the community's activities work efficiently. To achieve the efficient allocation of land use to meet the current and future needs of all sectors of society is imperative (Jordi & Biel/Bienne, 2006).

a) Different levels of land use planning

Land-use planning can be applied at three broad levels: national, district and local. This task is conducted by planning agency in collaboration with other government agencies. The decision, the methods of planning and kinds of plans developed at each level are different. However, at each level there is the need for a land-use strategy that defines priorities, projects that deal with these priorities and operational planning to get the work completed. The greater the interaction between the three levels of planning including the collaboration with other agencies, the better the result of the planning (FAO, 1983).

b) Natural disaster as external pressure of land use planning

In land use planning, the problem to find the suitable and appropriate location is coupled with the increasing number of disasters. An earthquake, as an example, makes the impact of natural disasters more severe. In countries vulnerable to the natural disaster, there are three challenges faced by planners now: growing population, scarcity of suitable space (land) and risk from natural disaster Figure 2.2.

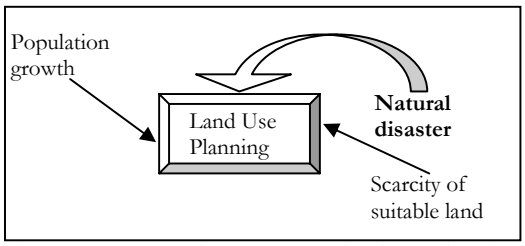


Figure 2.2: External pressures on land use planning
Adapted from Sutanta et.al (2009)

Regarding data of land use plan, in practice, the LUP is spatially presented in the land use plan map. The scales, spatial unit and the validity period of LUP map are varying depending on the purpose of LUP itself. The scale is commonly range from 1:5000 for LUP in urban areas up to 1: 50.000 for rural areas. The spatial unit of land use plan could be parcel, ward, block, village, sub-district or even district depends on the objectives of LUP. Meanwhile the validity period of land use plan is depending on the goal of the LUP itself which is influenced by political and institution arrangements in a country.

2.2.2. Cadastre as planning tools

Mclaughlin/Nichols (1989) defined cadastre as "an official record of information about land parcels, including details of their bounds, tenure, use and value". Meanwhile, if we are referring to FIG (2005), cadastre is defined as "a parcel-based and up-to-date land information system containing a record of interests in 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 interest, the ownership or control of those interests, and often the value of the parcel and its improvement. It may be established for fiscal purposes (e.g., valuation and equitable taxation), legal purposes (conveyancing), to assist in the management of land and land use (e.g for planning and other administrative purposes), and enables sustainable development and environmental protection".

From both definitions above, it can be concluded that the function of cadastre has been evolved from traditional to multipurpose cadastre. This affinity occurs not only because the traditional

cadastre system were slowly responding to the needs of society (Dale & McLaughlin, 1988), but also because the relationship between people and land has become more dynamic.

The changes of cadastre functions from traditional to multipurpose-cadastre has caused the data and information that are recorded in cadastral databases to grow more and become different from country to country. This depends on the requirements (e.g. for land market and land registration, land taxation and valuation, urban or rural land management or utilities management) of the users (Williamson & Enemark, 1996). In Netherlands, the cadastre provides information including the mortgage information of landowners (www.kadaster.nl,2010). However, cadastral data could traditionally be categorized based on the relationship between people and land which comprises landowner data, parcel data and the data of relationship between landowner and their parcel as modelled in Figure 2.3.

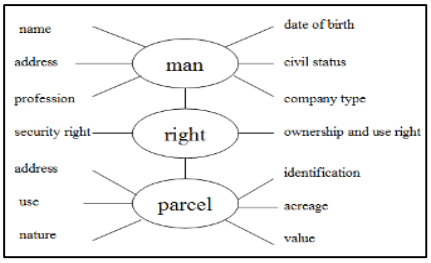


Figure 2.3: Data model in cadastre record (Source: (Henssen, 1995)

All spatial cadastre data are presented in various scales which ranges from scale map 1:500 (usually used for mapping urban area) to scale map 1: 20.000 (usually for rural area). However, it generally has the same spatial unit which is a parcel. The validity of cadastral data depends on the type of data itself. Example, the data on parcel boundaries is valid until there are changes due to legal actions by subdivision process. Similarly, the data about the landowner includes the relationship information to the land will be valid until there are changes due to transfer of ownership.

Community activities requiring land are increasing rapidly in line with population growth and economic growth. The basic demand for food, water, fuel, clothing and shelter are also increasing. All these basic needs must be met from the land, which is in limited supply. So, land becomes an increasingly scarce resource. As a result, there is increased competition for limited land, especially in areas that have already been developed.

Because the land become as scarce resource, the cadastre plays role as planning tool (Ting & Williamson, 1999). Cadastre became a useful tool (when teamed with large-scale maps) for city planning and the delivery of vital public services like electricity, water, sewerage, etc. Thus a focus on planning was added to the pre-existing applications of cadastre as a fiscal and land transfer tool (Ting & Williamson, 1999).

2.2.3. Rights, restriction and responsibilities (RRRs) on land

As described in section 2.2.2, the relationship between people and land is dynamic. Economic growth, population growth and the scarcity of land resources have forced the government to regulate the way people relate to their land. The government has increasingly turned to using legal rules known as property rights, restrictions and responsibilities (RRRs) (Bennett, Wallace, & Williamson, 2006). The absolute control of individual or legal entities of land is increasingly being restricted by public interest. To provide the security on land tenure, all the rights, restriction and responsibility related with land should be made obvious by the cadastral system in the future as stated by (Kaufmann & Steudler, 1998) in Cadastre 2014 "Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions".

A traditional cadastral system provides land tenure security by registering the private rights and sometimes includes other interests related to the land which are only published in private law. Meanwhile the RRRs which are published in public laws, such as by land use planning, environment

protection, noise protection and construction laws are commonly not officially registered yet. In the future, RRRs which are published under different types of legal (traditional, private and public law) and institutional regimes could be analysed and managed in such a way that people would know what RRRs they have and how they influence their land (Bennett, et al., 2006). All those RRRs need to be registered in cadastre and to be publicly available to enable people get reliable information about the legal situation of a piece of land (Kaufmann & Steudler, 1998).

2.3. Relationship between Disaster Risk Management and Land Administration

This section describes the relationship between DRM (Risk Assessment and Prevention and Mitigation) and LA (Land Use Planning and Cadastre).

2.3.1. Risk assessment, prevention and mitigation and land use planning

Risk assessment activities in DRM and land use planning and cadastre in LA activities have a reciprocal relationship. On one hand, hazard and other risk information might change the zoning in LUP. Moreover, the risk-based zoning in LUP imposes some restriction on a particular piece of land which changes the land use, land value or even the ownership of a land parcel. On the other hand, the data in a cadastre could be used as an input in LUP and risk assessment processes. The detailed explanation of each role and relationship are described below:

a) Risk information as input to the land use planning processes

The occurrence of disasters might not be precisely determined and time-dependent. Where, what magnitude, how large the extent and the frequency of occurrence of a hazard are predicted with some degree of certainty. Predictions about disasters that will take place in the future is a very important element in the spatial planning process (Sutanta, Rajabifard, & Bishop, 2009). Therefore, land use planning, as one of the form of spatial planning, then, could be used as a tool for mitigating and reducing the unexpected impact of disasters. By integrating related hazard information into land use planning, the planners could allocate and re-zone a particular area to ensure that most if not all activities would contribute to a safer future. Hyogo Framework for Action also highlights that the risk assessment must be incorporated into land use planning of city and management in disaster prone human settlements to reduce the adverse impact of disaster.

To ensure that land use planning can play an essential role in risk management, certain information related with hazard need to be addressed. Even though the local government level plays much more role in disaster risk reduction, the implementation of land use planning is also conducted with planning agency from national and regional planning. Therefore, requirements of data, such as scale and completeness, also depend on the level of land use planning. In the case of earthquake, the extent of earthquake area, intensity, type and the effects (ground motion, liquefiable soils) are required for detailed land use planning (Fleischhauer, Greiving, & Wanczura, 2005)).

b) Land use planning as non-structural measures in prevention and mitigation of disaster

As explained in section 2.2.5, land use planning aims to find the best uses of land which meet present and future requirements. In land use planning, long-term clear decisions about utilization of land at a particular area are defined. For every decision made, risk is unavoidable. Planning, therefore, should also predict the consequences of risk from planned actions. This is especially so when it is related with classifying the uses in the hazard prone areas (Fleischhauer, et al., 2005).

In disaster risk management, effective land management and land use planning can mitigate disasters and reduce risks by avoiding or limiting human settlements in hazard prone areas, controlling population density and expansion and arranging of infrastructures facilities for transport, power, water, sewage and other critical facilities (Kötter, et.al., (2006) UN/ISDR, (2004)).

Natural disasters as external pressures in land use planning are necessary considerations among other aspects in deciding the sustainable uses of land. Land use plan has an essential role, even though it is not directly reducing the adverse impact of disaster. Spatial planning (including land use plan) has four possible roles in disaster risk reduction (Fleischhauer, et al., 2005):

1) Restricting certain areas from new constructions. In highly hazard prone areas, development should be prohibited. Retention areas need to be limited and areas for emergency response need to be free of development;
2) Distinguish possible land uses for hazard prone areas. Each disaster has different tolerable risk on different land use classes. Flood prone areas might be allowed for agricultural use but forbidden for settlements;
3) Arranging and legalizing the land use or zoning plans with legally obligatory status. Regulations about physically building structures and building density are essential in decreasing the impact of building collapse in earthquake prone areas;
4) Modification of impact of hazard. Spatial planning can reduce the effect of hazard by modifying the engineered structures. An example is keeping the river flood retention areas unoccupied.

Modifying the hazard by having protective measures and improving the sites, reducing the structural vulnerability by strengthening the buildings and infrastructures, changing the functional characteristics of settlements by regulation of land use and expansion of infrastructures are options for disaster risk reduction (UNDRO, 1991). In the case of earthquakes, land use regulations coupled with vulnerability reduction is essential and an effective option for earthquake mitigation.

The role of land use plan in prevention and mitigation could be implemented at different levels of planning from national, regional to local planning agencies. However, local planning agencies can play a role in disaster risk management effectively. At the very beginning of a catastrophe, local governments have the capability to respond quickly to the disaster. During the prevention phase, local governments are responsible to implement a comprehensive policy for disaster mitigation.

2.3.2. Land use planning and cadastre

Influences of zoning regulation by LUP on land parcel where the information of changes on land (e.g. changes on restriction and responsibility) need to be up dated in cadastre information. Some restriction and responsibility comes from zoning in risk-based LUP might change the situation on land parcel in reality. Zoning regulations published by the government (e.g. municipality) directly affecting the use of land. Meanwhile, the limitation on the use of land directly or indirectly changes the value of the property on related land. All these relationships are described as follows:

a) Zoning plans imposing restrictions and responsibilities on land

As mentioned in section 2.4, increasing population, demography changes, and other changes in the community are raising the demands for property ownership and property uses. These changes are needed to keep up with the balance with the availability of land as a scarce source. Therefore, applying restrictions on property in development processes need to be adapted based on these changing demands.

Regarding to the conditions above, local governments (e.g. municipality) are using the zoning as the most important method to regulate the uses of land which geographically divides their jurisdiction into "zones". The municipality uses the zoning to control over the land and use it as collective property rights to maximize the benefits of land (e.g. through taxes) from those which are located in their jurisdiction (Fischel, 1985) and (Fischel, 2008). This is also used to standardize development to ensure that land is used for the common good of the community. The zoning in LUP determines what can be done and what cannot be done by landowners either on their land or their environment privately or publicly.

In some cases, the local government enforces restrictions to landowners with expropriation processes based on their zoning plans in LUP. By doing so, the local government is limiting or even taking private interests. In extreme cases, the local government uses their power and position to do so by giving compensation which is based on their standard (usually below market value) or even without any agreement with landowners at all. Another example of the restriction and the responsibility imposed through LUP is re-zoning one of an area through a land consolidation program. The government applies this program to ensure the usability of land much more effectively and efficiently. In a broader sense, it also improves the socio-economic conditions (FAO, 2003). This activity could be done after a consensus is achieved between the government and the involved landowners. When the zoning plan has adversely affected the property by causing a reduction of its market value, according to Jaeger (2006), the land owners need to be compensated with a payment equal in value to the reduction based on the nominal fair market value.

In hazard prone areas, the local government tries to protect the people from losing their property caused by adverse impact of disasters by imposing restriction and responsibility on land. The landowner could not get the optimum benefits from using their land due to risk-based zoning regulation from government which defines the locations as protected areas.

b) Zoning plans change the use of land

The zoning plan determines the kinds of use which are allowed or not allowed in a specified land. It divides the jurisdiction areas into several classes (for example, residential, agricultural, commercial or industrial). It also regulates the maximum height of buildings, minimum distance of buildings from the roads, total number of building units which can be constructed at a specified area, etc.

In providing public facilities such as roads, parks, and airports, the municipality requires a suitable area as defined in the zoning plans. For example, in the case of constructing an airport, tall buildings are not allowed around the airport (for some distance) for flight safety. These regulations limit the landowners who have land in the area to use the land as they want. In a similar way, the zoning plan which determines the area as buffer zones for natural hazards (e.g. tsunami) limits the landowners to build the houses or to use their land as they need. In short, zoning plans change the use of land based on the desires of stakeholders including political parties and the suitability of the land to achieve societal goals.

c) Zoning plans affecting property value

Besides the use of land, zoning regulations impose restrictions and responsibility to landowners which may also affect the property value. The zoning plans redistribute the control of using land which may involve many owners in a collective role. This distribution may increase land values and the next impact could (arguably) increase the welfare of the society. But, it is also possible to have negative impact in the community. At the same time, unregulated areas which are located near regulated land may increase due to easy access to land as compared with regulated land.

In hazard prone areas, the appropriate zoning plans including restrictions which protect the community from the adverse impact of disasters may also decline the property value. However, stakeholders might take the risk and the bad impact of disaster as the most important consideration in determining the zoning plans in their LUP rather than the negative effect of property value itself. Establishing risk-based zoning plans could increase the fear of people in investing their capital in hazard zone areas.

Because the boundary of the hazard's affected area is obviously defined, it could exacerbate the decrease of the property values for all properties within these areas. Due to factors such as local population growth and the tendency of people to live in safe areas, the demand for property increase. These unbalance supply and demands might also increase the property value of those area located outside hazard prone areas as illustrated in Figure 2.4.

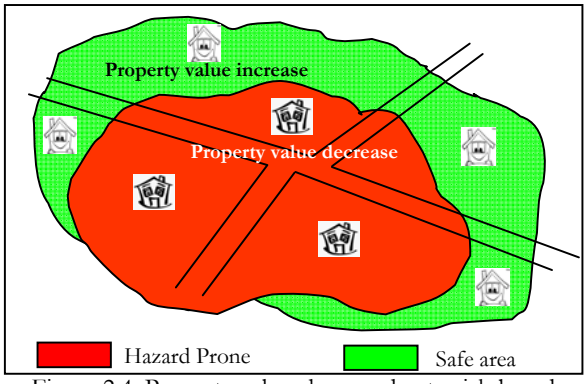


Figure 2.4: Property value changes due to risk-based zoning in LUP

In conclusion, in making the zoning plan, a stakeholder needs to consider both negative and positive effects to property values. Cadastre plays role as basis for compensation as well as for supporting land rights transaction.

d) Role of cadastre in land use planning

In land use planning, legal procedures need to be applied for compulsory acquisition and re-allocation of land rights in such a way that people feel secure with their ownership. In constructing public facilities, for example, the municipality needs to expropriate private land. In this regard, there should be compensation granted to the landowners whose rights are negatively affected. Regarding this, compensation payment to the right holders needs to be precise. Up to date information about the landowners should be recorded in the cadastre to ensure that the claim is paid to the right person. This must be consistent with the way that land is valued within the land administration system.

In some countries, some rights related with land are allocated in the spatial planning process. Building permits are recorded in the land registers and cadastre. According to the result of survey in CADASTRE 2014 by (Kaufmann & Steudler, 1998), there are 25 out of 31 that responded countries wherein the cadastre is used in LUP processes. Out of these, 14 countries have a legal basis to support the implementation of cadastre in LUP. This means that, the cadastre plays an essential role in LUP processes by providing necessary data. However, in some cases LUP planning also could be done without any information from cadastre.

Concerning this, there is a need to implement the zoning regulation in an effective way. The cadastre also could be used as a tool to implement these regulations, as explained in chapter 2.5. Moreover, the restriction and responsibility comes from the zoning regulation which also needs to be publicly available. The cadastre can play a role in making these restriction and responsibility publicly available for each parcel. By doing so, people can rationally calculate when taking actions related with the property and property restrictions and make decisions in such a way that they do not misspend scarce resources.

2.3.3. Risk assessment, prevention and mitigation and cadastre

a) Hazard zoning imposing right, restriction on land and responsibility of land owner

Risk assessment provides the zoning in hazard prone areas into several classes based on the level of risk. The hazard zoning published by the government affects the parcels which are located in the hazard prone area. The landowner may have much more restriction and responsibility. In the country (e.g. Switzerland), restriction and responsibility in hazard zoning map could directly affect the landowners. But, it may also affect the landowners indirectly through LUP. In this regard, cadastre can provide hazard information for every affected parcel to be shared

b) Cadastre data as input data in risk assessment processes

Spatial and non-spatial data recorded in cadastre databases could be used as input data in risk assessment processes. A cadastral data can be used as a baseline data for defining hazard affected areas in detailed scale. The use and value of the parcel could be used as input data in calculating element at-risk for defining the level of vulnerability. Moreover, the information about landowners (if it is combined with census data) can be used as input data for defining the vulnerability.

c) Cadastre in prevention and mitigation activities

Regarding to the function of cadastre in mitigation, it is clear that cadastre cannot induce mitigation by themselves (Pantellic & Srdanovic, 1992). However, the function of cadastre which registers land tenure in hazard prone areas influences in implementation of DRM. The land information concerning the legal status, area, location and other information related-land is required by the government or NGO in applying either structural measures (e.g. build the dike, dam, canals, escape building, etc.) or non-structural measures (e.g. zoning regulations) as prevention and mitigation of future disasters.

2.3.4. Toward a conceptual model of the relationship between land administration and disaster risk management

The concept of land administration as a tool for implementing land policy has evolved from traditional purposes (e.g., taxes and market) to a multipurpose cadastre which also provides the information base for supporting spatial planning. Because of changing relationships between people and land especially in disaster prone areas, there is a need to manage the rights, restrictions and responsibilities affecting the land to ensure the security of activities related to the land and to share those RRRs to be publicly available. In this regards, the cadastre plays role as planning tool.

The relationship between risk assessment, prevention and mitigation, land use planning and cadastre could be summarized as follows:

- The hazard zoning and or risk information coming from risk assessment processes could be used as input in determining the zoning in a risk-based LUP process. The risk-based zoning plans impose the restriction and responsibility on land which also could change the use and value of land as that was described in subsection 2.3.2. In some cases, hazard zoning could also directly impose the restriction and responsibility to the landowners, changing the property value and limiting the uses of a specified land which are located in the hazard zone areas.
- LUP plays a minor role in risk assessment. However, it plays a major role in the prevention and the mitigation process by providing a non-structural measures through zoning and infrastructure regulations.
- It is obvious that there is a need of support data in LUP processes. To support accurate and reliable decisions, LUP process needs accurate, timely and up dated information from several sources. In this regard, the cadastre, as one of the information sources, can play the role as sound

base information for LUP process. However, in some countries, LUP can also be made without using the data provided by cadastre office. On the other hand, cadastre also can make the restrictions and responsibilities from the zoning plan are publicly available.

- For cadastre data, the parcel map can be used as a baseline unit. The information about the use and value of the parcel could be used as input data in calculating element at-risk. Moreover, the information of landowners (if it is combined with census data) also can be used as an input data for defining the vulnerability.
- Cadastre plays indirectly roles in prevention and mitigation activities. However, it can be as an information source of land management (e.g. through LUP) which can mitigate the adverse impact of disaster through non-structural measures.

Diagrammatically, those relationships between risk assessment, land use planning and cadastre can be depicted in Figure 2.5 The relationship between DRM (risk assessment, prevention and mitigation) and LA (LUP and cadastre) as explained above is used to assess the gaps of the integration between DRM and LA in practice (in study areas) which are described in chapter 6.

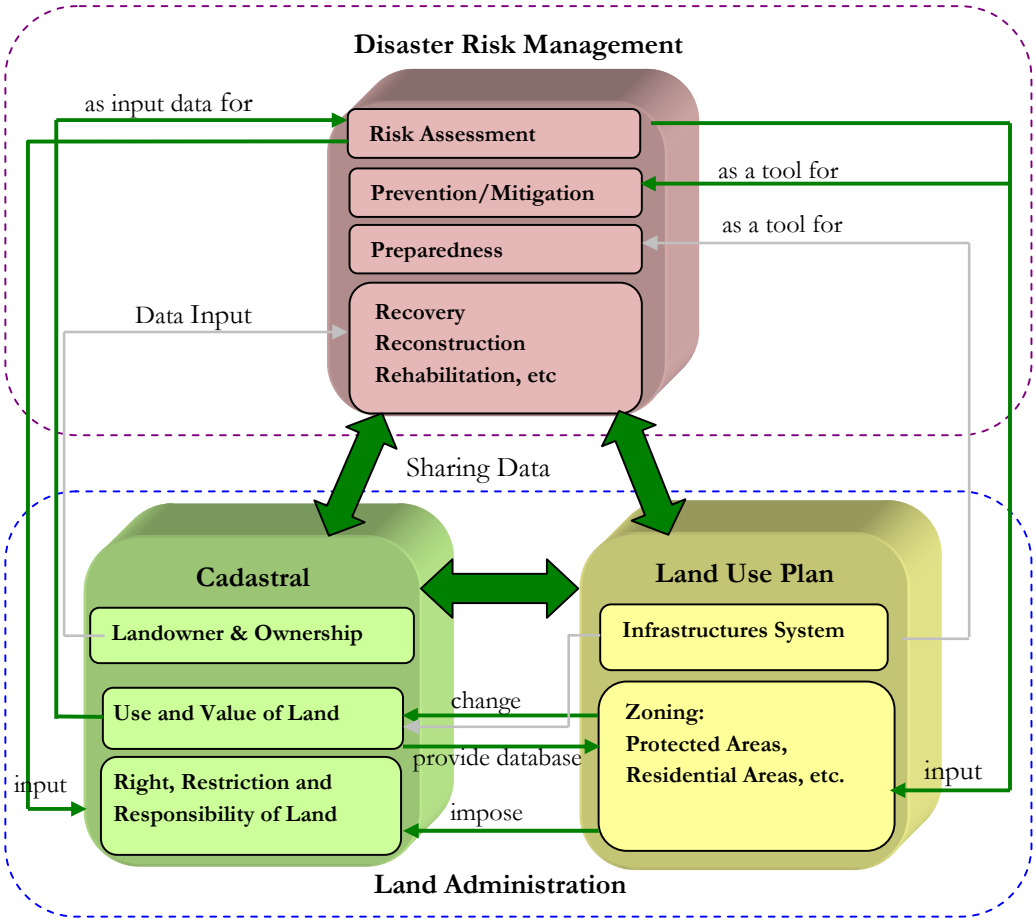


Figure 2.5: Schematic relationships between disaster risk management and land administration

2.4. Concluding Remarks

Disaster risk management consists of four activities: risk assessment, prevention and mitigation, preparedness and recovery which should be applied before and after a disaster. Prevention and mitigation could be implemented by among others risk assessment. Analysis and assessment of the hazard and vulnerability are part of the risk assessment activities which result in hazard zoning and vulnerability information at a particular area in a particular time. Risk assessment produces risk information which is presented through risk map.

Land use planning is a process to find the best use of land based on its suitability and the desire of stakeholders to maximize the benefits from using the land. Land use planning is the iterative and continuous process which takes place at different levels (national, regional and local level) and involves many agencies. The collaboration among the agencies and integration of comprehensive information are required to arrive at the best plan. Besides population growth and scarcity of land, the problem in finding the suitable and appropriate location is also coupled with the increasing frequency of disasters. Natural disasters become one of the external pressures in spatial planning. Therefore, the integration of natural hazard-related information into land use planning is important.

The concept of land administration as a tool for implementing land policy has evolved more. Three elements of land administration (land right (ownership), land use and land value) are basic components of land administration. Land registration and cadastral records which register the relationship between people and land are also evolving from traditional purposes (e.g., taxes and market) to a multipurpose cadastre which provides the information base for supporting spatial planning. Because of changing relationships between people and land especially in disaster prone areas, there is a need to manage the rights, restrictions and responsibilities affecting the land in such a way all these information could be made publicly available.

From the explanation in section 2.3 above, it could be concluded that the relationship between DRM (risk assessment, prevention and mitigation) and LA (land use planning and cadastre) are reciprocal. The risk and hazard information resulted from risk assessment is as an input in risk-based LUP processes. Meanwhile, the land use plan plays a major role in prevention and mitigation through non structural-measures. The risk-based land use plan may impose restriction and responsibilities to land owners through zoning regulations. The restriction and responsibilities on land could be made obvious publicly through cadastre. The cadastre also plays a role as sound base information for LUP process as well as indirectly for prevention and mitigation activities. The size and the location of parcel and the related information of land owner also could be used as input for calculating element-at-risk in risk assessment process.

3. ASSESSMENT FRAMEWORK OF DISASTER RISK MANAGEMENT AND LAND ADMINISTRATION

The relationship between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) theoretically has been presented in the previous chapter 2. Understanding these relationships in practice (in study areas) was done by assessing the integration between DRM and LA activities. Therefore, a framework is required. Assessing the integrations in practice is done using the framework adapted from several existing related frameworks which were adjusted according to the purpose of this research. Accordingly, in this chapter, the framework for assessing the integration between DRM and LA in study areas is further discussed (section 3.1). Then, some elements and indicators for this evaluation were identified based on reviewed frameworks theory (section 3.2). Finally, this chapter is ended by concluding remarks (section 3.3).

3.1. Evaluation and Assessment Framework: a review

Evaluation of the performance of the process or system is required because of the fundamental requirement to improve the productivity, efficiency and also the performance of organizations (Kaplan & Norton, 1996). Regarding to the land administration system (LAS) field, there are no fixed methodologies which could be applied universally to evaluate and compare the LAS across different countries (Steudler, Rajabifard, & Williamson, 2004).

According to Baird (1998), there are four key elements for evaluating the performance of an organization or system: well-defined objectives; clear strategy; outcomes and indicators that can be monitored and the evaluation of results. The objectives define the target that will be achieved; the strategy defines the way to achieve the objectives, whereas the outcomes are the results of the activities to get the objectives using the strategy applied. The indicators are tools to measure the impact of performance inputs in the evaluation. Evaluation is the process of reviewing the objectives and strategies by considering the outcomes based on the indicators. All four evaluation elements are processes which permit an assessment and a review process of the performance of the organizations regularly (Steudler, et al., 2004).

Furthermore, (Steudler, et al., 2004) developed the evaluation framework for land administration systems based on management model using 'good practice' criteria as indicators to evaluate the land administration or system in practice. They proposed five elements as basis for evaluating administration system: *policy, management level, operational level, external factors* and *review process. Policy* relates to the objectives of the organizations, the management level could relate to the strategy and the **organization arrangement**. *Operational level* relates to the outcomes as **impact** which results from the responsible operational unit. The *external factors* which could relate with **external agents** have an impact at three organizational levels. The *review process* ensures the performance of the whole system satisfies the objectives and strategy of the organizations.

Regarding to the purpose of this research, the policy level, management level, operational level and external factors are adopted to be used as framework's elements to assess the integration between DRM and LA in practice (Figure 3.1).

Another evaluation framework is the "Cross-Organizational Business Processes Framework (CBPs)" (Chimhamhiwa, Molen, Mutanga, & Rugege, 2009). In this framework, cost, time, quality, technological innovation (ICT), customer satisfaction and society are six elements which are designed into a performance measurement system for cross-organizational LA processes. This framework was developed to evaluate the quality management in Land Administration CBPs chain. The indicators of the ICT element are: data capture, data processing and management and data access and dissemination.

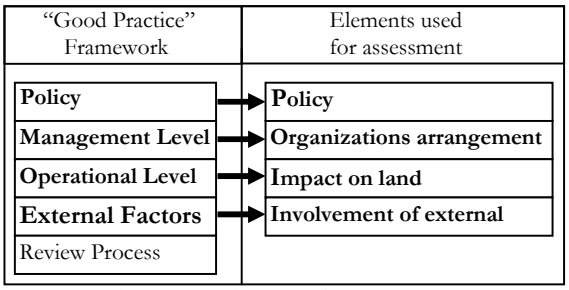


Figure 3.1: Elements for assessment
Adapted from ((Steudler, Rajabifard, & Williamson, 2004))

Regarding the purpose of this research, from the management perspective model, the framework made by (Chimhamhiwa, et al., 2009) lack of policy and management aspects. Performance dimension on this framework is much more focused on the results of the activities at the operational level. However, the innovation technology (ICT) element ensures that data sharing among the involved organizations could be effectively and efficiently done. The platform used for sharing data and the standardization of data are required to ensures the integration among the organizations in charge in DRM and LA. Therefore, in this thesis, **data and sharing data** which could be related with innovation technology (ICT) is used as the fifth element for evaluation and assessment framework to achieve the objective of this research (Figure 3.2).

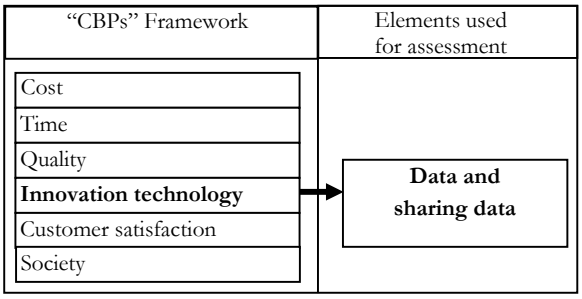


Figure 3.2: Elements chosen for assessment
Adapted from(Chimhamhiwa, Molen, Mutanga, & Rugege, 2009)

3.2. Selecting the Assessment Elements and Determining the Indicators

There are no international fixed frameworks for evaluating and assessing the performance of either internally or cross-organizations. However, the aims of evaluation should define what and how to measure in evaluation processes (Chimhamhiwa, et al., 2009). Therefore, to achieve the objective as mentioned in chapter 1, this research will evaluate the integration between risk information as result of risk assessment (from DRM side), LUP and cadastre (from LA side) in practice from the management model perspective which is based on the elements of integration required among the organizations involved. The elements used in this framework are adapted from the frameworks developed by (Steudler, et al., 2004) and by (Chimhamhiwa, et al., 2009) as described in previous section 3.1 above. All these elements as follows:

a) Policy

The activities of the organizations are done based on existing policies. The existence of policies which are interrelated and which support each other, are essential in serving as a guideline for involved organizations in DRM and LA. Usually, laws and regulations are formed which determine the responsibilities and organizational arrangements including the operational procedures and, sometimes, hierarchy of the agencies. Besides this, the way that the policies are made also influences the effectiveness of implementation of policies. Top-down, bottom-up or combination are

approaches in formulating policies. A bottom-up approach can give more advantages to formulate the policies because it can accommodate the aspirations and expectations of the community.

b) Organizations arrangement

The management level areas, as explained by (Steudler, et al., 2004), could relate with the organizational arrangements. Based on this element, the assessment might include links among involved organizations in DRM and LA. The clarity of job and responsibility and the integration between involved organizations can contribute to the organizations' effectiveness by ensuring that there will be no overlap in roles which could result in uncertainties in implementing their activities.

c) Data and sharing data

Commonly, data in risk assessment, LUP and (sometime) cadastre coming from different agencies and are in different formats. Data (especially spatial data) from several organizations usually have different formats, spatial units, scales, projection systems and visualizations. Standardization of data enables data sharing among different agencies. Furthermore, a platform is also required to efficiently facilitate data exchange among involved organizations in DRM and LA.

Nowadays, technological development plays an essential role in making organizations provide better service to the citizens. Infrastructure technologies, such as internet network provide an effective and efficient means that facilitates cooperation, coordination and communication within and among involved organizations. In this regards, the internet network can make the sharing data more effective and efficient in terms of time and cost. Therefore, in this assessment, the standardized data, the existence of data sharing and platform are used as indicators to evaluate the integration of DRM, LUP and cadastre in practice.

c) Involvement of external agents

The involvement of external agents can influence policy, organizations arrangement, and data sharing including the platform used also including the impacts of their interactions. NGOs, professional associations (e.g. private companies), academicians (university) and the affected community are part of the external agents that influence the success of the program.

The people needs often can not to be met if people are not involved in decision-making process. The methods for solving their problems are not socially or culturally acceptable which can cause disinterest and lack of enthusiasm of the people. The result is failed projects (Rolly, 2001). The community need have an access to information concerning the policies of development proposal and plans as well as access to the stakeholders who make the decisions. This will increase legitimacy of policies made and ensuring the people and landowners rights as a consideration in decision-making process by the stakeholders. Assuring them that they can actively play roles in the risk assessment, prevention and mitigation, LUP and cadastre activities might give the positive impact on the whole process including impact on land as well as the awareness of the community. Therefore, these involved external factors need to be addressed to evaluate the interaction among DRM and LA in practice.

d) Impacts on land

The impacts resulting from the interactions of the relationship of DRM, LUP and cadastre in practice, especially on land, need to be addressed to know the effectiveness and efficiency of reaching the objectives and goals during implementation of organizations involved in DRM and LA. In this research, the following impacts on land assessed are: changes on land use, land tenure (ownership), and land value. Risk zoning could influence the ownership rights to land by limiting

the right to use and causing the land is difficult to be sold. The restriction and responsibility made by zoning gives a positive impact if it is increasing the land tenure security. The awareness of the community about the potential hazards can increase the resilience of the community by making their property to be registered to the responsible agency (e.g. cadastre). Registering parcels in hazard prone areas to the cadastre can also improve the security of land tenure. This is especially important when the government does the recovery, reconstruction and rehabilitation or give compensation to landowners when the parcel boundary are destroyed or even when part or the whole parcel are lost after a disaster. In similar way, applying the risk-based land use plan in hazard prone areas can reduce adverse impact of hazard including prevent or at least reduce the decrease of land value as well.

Aside from the interaction between DRM and LA agencies, the natural disaster also may have an impact on changes in land use, land tenure and land value itself. Therefore, the impact of natural disaster need to be addressed in practice to get deeper understanding of the changes in land use, land tenure and land value.

Diagrammatically, the relation among all those five elements is shown in the Figure 3.3.

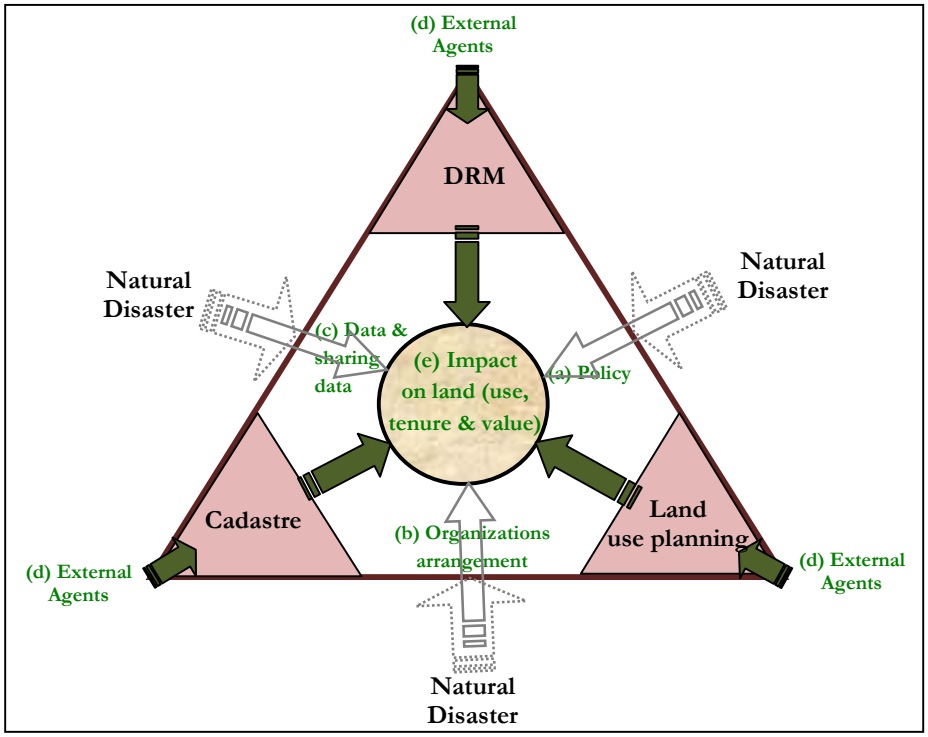


Figure 3.3: Assessment framework used for evaluating the relationship between information, land use planning and cadastre in practice

The summary of each indicator used in each elements are shown in the Table 3.1

Table 3.1 : Elements of evaluations and indicators for assessing the integration between DRM and LA in practice

Elements	Indicators	Good Practices
Policy	• Existence of policy on DRM and LA • Method in formulating the policy (top-down, bottom-up or combination) • Existing regulations are support each other	• Policies and adequate technical regulation exists • The bottom-up method allows the community to be participating in the policy formulation. • Existing policies and regulations support each other and provide clear guidelines to integrate hazard/risk information into land use plan; to use cadastre as implementation tools of risk-based land use plan and allow cadastral data to be shared and used in DRM activities.
Organizational arrangements	• Integration between involved organizations • Job and responsibility	• Cooperation and communication exists among involved organizations and they work well together • Involved organizations have clearly defined job and responsibilities.
Data and sharing data	• Standardization of data (spatial unit, scale, projection system, and visualization) • Data sharing among the involved agencies • Platform used	• Standardized data • Necessary and required data are shared among the involved organizations • Internet Network is used by involved organizations for sharing data.
External factors	• Involvement of academicians, NGOs, professional association and community in DRM and LA activities	• Academicians (e.g. universities) are involved in DRM and LA activities • NGOs, professional associations and the community play an active role in DRM and LA activities
Impacts on land:	• Changes on property tenure (ownership) • Changes on property use • Changes on property value	• Increased tenure security of land. • Compensation exists for vulnerable people in hazard prone areas. • Land use is accordance with risk-based LUP. • The increase of land value in safe areas more than in hazard area.

3.3. Concluding Remarks

There are no international fixed frameworks for evaluating and assessing the performance of DRM and LA either internally or cross-organizations. However, regarding the purpose of this research, five elements of evaluations are adapted from existing developed frameworks. The elements were defined for the assessments are: policy, organizations arrangement, data and sharing of data, involvement of external agents and impact on land. The impact on land is focused on impact on land use, land tenure and land value. The performance of integration between DRM, LUP and cadastre in study areas is compared with each "good practice" indicator of each element.

4. DATA COLLECTION METHODOLOGY

This chapter describe the explanation on data collection methodology (sections 4.1). Primary and secondary data collections were also discussed (subsections 4.2.1 and 4.2.3) including the method for presenting data (subsection 4.2.4). At the end of this chapter are some conclusion and remarks.

To understand the relationship between DRM and LA including the impacts on land in practice, this research uses case studies as empirical evidence using primary and secondary data sources. Primary data were collected through survey by using questionnaires and interviews with stakeholders involved in the DRM and LA activities. Secondary data was obtained through documents and reports from governmental organizations at national, regional and district level. The secondary data are including spatial data and non-spatial data.

4.1. Description of Case Study Areas

The case study comprises two sites: Banda Aceh City and Padang City. The location of the study areas is shown in the Figure 4.1.

Figure 4.1: Locations of study areas

4.1.1. Case study area I: Padang

Padang City, the capital of West Sumatra Province, is located on the west coast of Sumatra Island. According to BPS data (2006), its total area is 694,96 km2 and the total population is 819.740. Administratively, Padang city consists of 11 sub-districts and 104 villages.

Located along the West Sumatra subduction fault, Padang has been hit by the earthquake several times due to the unstable tectonic collision between Indo-Australian and the Eurasian plates. The urban areas are located in relatively flat and low topography. Settlements have high population density, and infrastructures and community service facilities are concentrated in this region. Padang City is mostly located along the coast. This condition makes the city vulnerability to tsunami caused by earthquakes. Historically, the West Sumatra Earthquake in 1797 was hit with magnitude 8.9 on the Richter scale and the tsunami that followed had a wave height of 9 meters (http://tsun.sscc.ru/htdbpac/, accessed: 17 November 2010).

Since 2004, Padang was hit by earthquake for several times (BNPB, 2010) : in 2004, caused 100 houses medium damaged; in year 2007 (6-3-2007 and 12-9-2007), caused 4 death toll, 19 people injured, 1.921 houses totally damaged, 4.625 houses medium damaged and 38 schools destroyed; in

year 2009, caused 383 death toll, 1.216 people injured, 37.587 houses totally damaged, 78.891 houses medium damaged, and it was destroyed 3.547 schools, 21 hospitals including 30 roads. Moreover, the latest earthquake hit Mentawai, the islands located in south-west of Padang, in October 25, 2010 has been increasing the fear of Padang people that a tsunami might occurs in the future. However, Padang has so far been spared of the damaging effects of a tsunami.

As such, the land issues are not as severe as in Banda Aceh (especially after it was hit by tsunami in 2004). Still, the high probability of occurrence of tsunami has made the people of Padang live with fear, especially in high risk areas. This condition leads to changes in land use and property values in Padang.

4.1.2. Case study area II: Banda Aceh

Banda Aceh is the provincial capital and the largest city in Nanggroe Aceh Darussalam (NAD) province, Indonesia. It is also located on the island of Sumatra. On December 26, 2004, the Indian Ocean earthquake struck off the western coast of Sumatra. Banda Aceh was the closest major city to the earthquake's epicentre, and suffered heavy damage when a tsunami struck shortly afterwards. It was the worst hit area out of all the affected locations. The tsunamis which resulted from an earthquake of magnitude 9.3 struck at about 6:58am (USGS, 2006). The impacts of this disaster in Banda Aceh were caused 128.728 death toll, 2.830 people injured, 37063 people lost, 179.312 houses totally damaged, 50.970 people were evacuated and was destroyed 58.087 ha of land and 34.884 roads (BNPB, 2010).

The preliminary loss and damage assessment in Aceh after the earthquake and tsunami prepared by the Consultative Group for Indonesia stated that "…to the degree that land ownership issues are not satisfactorily resolved, this could create delays and higher cost in the reconstruction effort". This means that land issues had been assessed as an important issue to be addressed for recovery in Aceh after the earthquake and tsunami hit the area. The recovery and reconstruction process were immediately required to reduce the impact on vulnerable groups. During the implementation of recovery and reconstruction by the government, some delay happened due to some obstacles related with land issues (World Bank, 2005). Loss of cadastral maps, damaged land books and loss of personal identity records were some land issues which served as barriers to the mitigation, recovery and reconstruction in Aceh.

4.2. Data Collection

4.2.1. Primary data

Primary data were collected through sending questionnaires to stakeholders involved in DRM and LA, notaries and landowners. Different stakeholders were chosen as respondents to obtain the information concerning the rules, regulation and their roles in DRM and LA.

a) Questionnaires

This research uses questionnaires as one of the tools to collect required data and information. The indicators determined on the framework as defined in previous chapter 3.2, were used as guidelines to determine the question according to the purpose of the respondents. The next step was to define the group of respondents. The group of respondents also were determined based on the data and information required. Accordingly, land owners, notary, government official, NGOs and academicians were chosen as respondents. The information from landowners is needed to obtain information concerning the changes in their land due to hazard and risk-based LUP. Aside from land

owners, the notary was also chosen as source to obtain information concerning changes in property values within their jurisdictions due to hazard and LUP. Moreover, the information concerning the interaction and integration among the involved stakeholders were obtained from government officers in each related agencies. The existence and activities of the NGOs have an influence to the government agencies. Therefore the NGOs were defined as respondents. Moreover, the opinions of experts and academia were required to be able to evaluate their interaction objectively.

Due to regulation imposed by my fellowship provider, I could not go to the field to collect data on site. Therefore, questionnaires were distributed to respondents supported by the land local officers in the two study areas. For each city, two staffs of land local offices (from local land office of Padang and local land office of Banda Aceh) were appointed as surveyors. Boundary survey measurements, valuations and land use survey activities are daily tasks of these surveyors. Before the questionnaires were distributed, I gave explanations in detail concerning the questions and information that are required for the purposes of this research including the procedures for filling out the questionnaires through distance communication (e-mail and mobile phone).

- **Landowners Survey**

Information related with the impact of the implementation of hazard information and zoning by LUP on land parcels in hazard prone areas were obtained from landowners.

The questions for the landowners were determined in such a way that it covers three main topics: changes in land right, restriction, and responsibility (RRRs), land value and changes on land use due to hazard and implementation of LUP and cadastre. Landowner survey questionnaires (Appendix A) were used to get the information about the impacts of hazard, hazard information and zoning on land parcels at each location. The number of respondents was defined by using Slovin's formula based on the total number of household in each study area as follows:

$n = N/(1+NE^2)$, where: n = sample size, N= population size, E = margin of error (10%).

- Households in Padang are 210.840 (BPS, 2008) => Sample = $210.840/(1+210.840\ (10\%)^2)$ $=99.95 \cong 100$ household.
- Households in Banda Aceh are 61,007 (BPS, 2010) => Sample = $61{,}007/(1+61{,}007(10\%)^2)$ $= 99.93 \cong 100$ household.

Accordingly, 100 landowners were sent the questionnaire in each study area (Padang and Banda Aceh). The landowners were selected randomly in such a way it that the researcher can get an overview of the landowners in the case study areas. The preliminary identification of distribution of respondents was defined visually by using satellite imagery (Figure 4.2 and Figure 4.3).

In Padang

The respondents were randomly selected from three villages representing different levels of earthquake and tsunami hazard (see chapter 5.2.1 (c) and Figure 5.2). All the three villages selected are (Figure 4.2):

1) Air Tawar Barat village. Located in very high zone in coastal area, this village has total population 17,625 people (BPS, 2008).
2) Andalas village. Located in high zone nearby city centre, this village has total population 10,425 people (BPS, 2008).
3) Cengkeh village. Located in low zone in eastern part of the city, this village has total population 4,157 people (BPS, 2008).

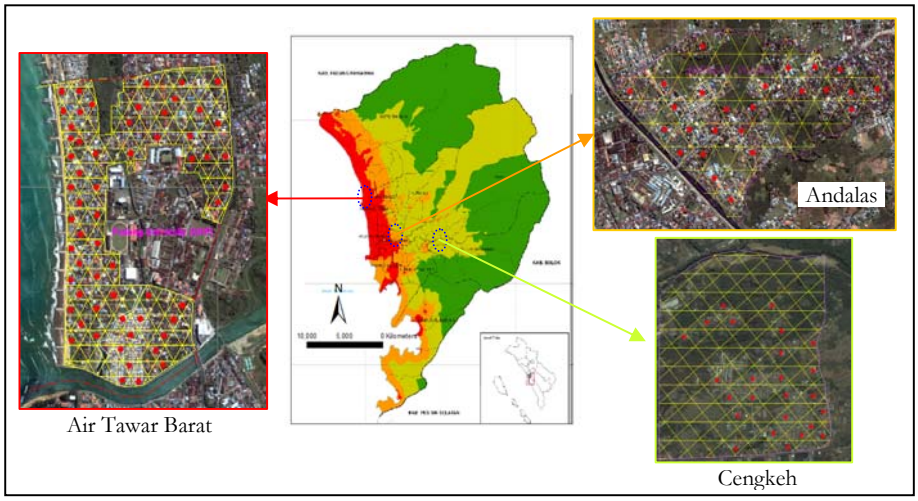


Figure 4.2: Distribution of respondent in Padang

The distribution of respondents in each village is shown in Table 4.1.

Table 4.1: Number of respondents sent the questionnaires and responses achieved based on levels of hazard

Number of landowners		Village	Sub-district	Location based on Risk Map
RT	RA			
50	50	Air Tawar Barat	Padang Utara	Very high level (Red Zones)
25	21	Andalas	Padang Timur	High level (Orange Zones)
25	25	Cengkeh	Lubuk Begalung	Low (Green Zones)

RT = Respondents targeted; RA = Responses achieved.

In Banda Aceh

The respondents were also randomly selected from three villages representing different levels of earthquake and tsunami hazard (see chapter 5.3.1 (c) and Figure 5.13), those are (Figure 4.3):

1) Gampong Pie village. Located in medium level zone, in coastal area, This village has total inhabitants 422 people (BPS, 2010).
2) Punge Jurong village. Located in low level zone, nearby the city centre, this village has total inhabitants 3.279 people (BPS, 2010).
3) Ilie village. Located in safe zone, this village has total inhabitants 3.279 people (BPS, 2010).

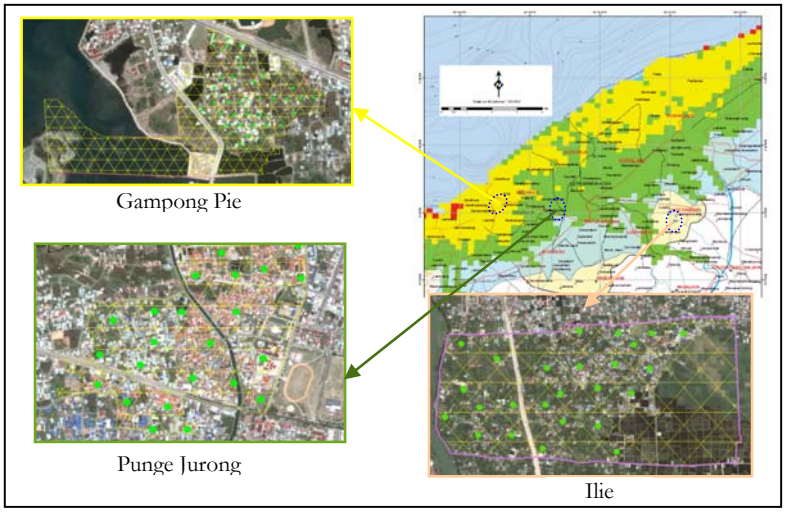


Figure 4.3: Distribution of respondent in Banda Aceh

The distribution of respondents in each village is shown in Table 4.2.

Table 4.2: Number of respondents sent the questionnaires and responses achieved based on levels of hazard

Number of landowners		Village	Sub-district	Location based on Risk Map
RT	RA			
50	40	Gampong Pie	Meuraxa	Medium (Yellow Zone)
25	25	Punge Jurong	Meuraxa	Low (Green Zone)
25	25	Illie	Ulee Kareng	Safe (Cyan Zone)

RT = Respondents targeted; RA = Responses achieved.

Details questionnaire is given in Appendix A.

- **Notary Survey**

The notary is a source of information on changes in land value. The questionnaires were sent to the notaries to get the data related with the impact of hazard/hazard information and zoning by LUP on land value, especially market value. This information is required to be analysed by comparing the land market value and land tax value in hazard prone areas. In both study areas, 3 notaries were sent and responded to the questionnaires. The set of questionnaires is given in Appendix B.

- **Other Stakeholders Survey**

The questionnaire also was sent to the government officer involved in DRM and LA. This technique is done to get more information which is not available form secondary data such as papers, report and journal from reliable sources. The questions for the targeted agencies were grouped into four: policies and policies formulated; organization arrangement; data and platform used for sharing data; the involvement of external agents. The respondent selected and responded to the questionnaires are:

- In Padang: 1) government agencies: BNPBD of Padang City, BAPPEDA of Padang City, Local Land Office; 2) NGO: KOGAMI.
- In Banda Aceh: 1) government agencies: BNPBD of Banda Aceh, BAPPEDA of Banda Aceh, Local Land Office; 2) NGO: TDMRC and 3) academia: from University of Syiah Kuala.

Details questionnaire is given in Appendix C.

b) Interviews

Interviews were done to get additional information which is not available or unclear. Government officers, NGOs and academicians in Banda Aceh and Padang (as mentioned above) were the targeted group for this method. The interviews were done by phone to cross check unclear data and/or information and to comprehensively validate the data obtained from questionnaires and secondary data. The interviews also focused on the topic related with the element of evaluation as described in previous chapter 3.2. This method is also required to get needed supporting data. The interviews were also done through distance communication (e-mail and mobile phone).

4.2.2. Secondary Data

Secondary data were collected by searching reports and others documents related to this subject. These were carried out through internet and email to contact persons in Banda Aceh and Padang, Indonesia. Some important secondary data, such as risks map, land use and land use planning map and cadastral map were collected from both locations. The secondary data are divided into two categories: spatial and non-spatial data. Detail list of spatial and non-spatial collected is shown in Appendix D.

4.3. Data Analysis and Presentation Method

The method for data analysis and presentation uses qualitative and quantitative techniques.

4.3.1. Data analysis

a) Spatial analysis

The Spatial data collected has different formats and projections in the coordinate system. All maps coming from BAPPEDA Padang and Banda Aceh were geo-referenced (Universal Transverse Mercator /UTM Zone 47, Datum WGS 1984). The format of the maps is in PDF format. The re geo-referencing process of all these maps was done by using ArcGIs software. The re geo-referencing processing technique was also applied for the risk maps in Banda Aceh and Padang. Meanwhile, the cadastral map collected from the local land office of Padang city was in Autodesk Map digital vector format (dwg) and the projection coordinate system used is Transverse Mercator 3° (TM3°) which is different with the projection coordinate system of land use plan and risk map. Therefore, it is required to transform the projection coordinate system from TM3° to UTM zone 47 to be superimposed with risk map and to changes maps into the same format (shp). The changes of format and transforming of projection coordinate system were also done by using ArcGIS software. The number of parcels located in each level of earthquake and tsunami areas in Padang was calculated by superimposing the cadastral map and risk map. While in Banda Aceh, the number of parcels in each zone of risk map could not be calculated since the cadastral map could not be collected.

b) Non-spatial data analysis

Qualitative method was used to analyse the documents and information from literature reviews, secondary data and questionnaires. Meanwhile, the primary data collected from landowners and notaries were analysed in percentages form categorized based on the answered questions statistically and graphically using Microsoft Excel. The results from landowner and notary questionnaires were presented in percentages (%). Meanwhile, the data concerning land tax and land market value were analysed to calculate the average of land price in sample villages. The changes in land value were also presented in percentages (%). The result is used to discuss the impact of hazard/risk information, LUP and cadastre on land use, land value including rights, restriction and responsibility on land.

4.3.2. Data presentation method

The results of data collection, especially from primary data collection were summarized in tabular format to enable the reader to understand the results (mostly in %) more easily. Graphs were also used to make the discussion and conclusion easily depicted.

4.4. Concluding Remarks

Primary and secondary sources were used to obtain the data required in this research. The questionnaires were developed based on assessment framework's indicators. The respondents were selected and distributed in three villages located in different levels of hazard zone as sample locations. Some official documents were also collected to complete the required data. Then, the data obtained were qualitatively and quantitatively processed and presented to achieve the objective of this research.

5. DISASTER RISK MANAGEMENT AND LAND ADMISNISTRATION IN STUDY AREAS

The previous chapter 4 described the data collection methodology used and the data collected. This chapter analyses and uses the data collected for assessing and understanding the interaction between DRM and LA including the impact their integration and natural disasters of changes on land in the study areas.

Section 5.1 describes DRM and LA in Indonesia in general. The legal framework and organizations arrangement of DRM as well as of LA in Indonesia are described in the subsection. Section 5.2 describes DRM, land use planning and cadastre for Padang while DRM, land use planning and cadastre for Banda Aceh is described in section 5.3. Both cases were assessed based on primary and secondary data collected. The purpose of the assessment is to understand the interaction between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) and to elaborate the impact of their integration (focused on risk-based land use plan) includes natural disaster (earthquake and or tsunami) on land use, land tenure and land value in the study areas. The assessment of these interactions and the impact on land were done by comparing each indicator, as defined in chapter 3.2, both in Padang and Banda Aceh with "good practice" criteria (section 5.4). Finally, this section is ended by concluding remarks.

5.1. Disaster Risk Management and Land Administration in Indonesia

5.1.1. Disaster risk management in Indonesia

a) Legal framework

Since 2007, the GoI has enacted regulations to respond to disasters in Indonesia: Disaster Management Law No. 24 Year 2007 refers to disaster management at the national level, Government Regulation No. 21 Year 2008 refers to the implementation of disaster management, Government Regulation No. 22 Year 2008 on financing disaster management, number 23 year 2008 concerning participation of international organizations and NGOs, and Presidential Regulation No. 8 Year 2008 concerning the national agency for disaster management. Moreover, to support all these regulations, the Ministry of Home Affairs also has enacted the regulations No. 46 Year 2008 on organization and administration of local agencies for disaster management.

All these regulations give the new dimension of task for all actors in disaster risk management in Indonesia. First, comprehensive and proactive effort including disaster risk reduction, emergency response, and rehabilitation and reconstruction; second, involving all the stakeholders based on their roles and functions and third, the effort to develop and to improve the resilience in times of disaster. By those regulations, it is expected that the implementation of disaster risk management in Indonesia will be more reliable and the involved agencies can effectively handle disaster-related activities.

Based on these regulations, it is also highlighted that part of disaster risk management activities are land use planning and environmental management. In practice, land use planning must also concern the safety standards and the need for monitoring and evaluating process gradually. Other aspects which were also highlighted are risk and vulnerability assessment which are parts of disaster risk reduction measures.

b) Organizations arrangement

Regarding all these laws and regulations on disaster management, the GoI has formed the organizations and administration on disaster risk management agency (BNPB) at national, provincial (BPBD *Propinsi)* and at the municipality/district level (BNPBD). Aside from the formal institutions, there are non-formal institution formed by local people and NGOs (local, national or international NGOs). As mandated by Law No.24/2007, implementation of disaster management should be done holistically and by involving all actors. Disaster management, therefore, need to be coordinated and well planned by involving the government, civil society including the private sector. In this regard, BNPB plays a key role at the national level as policy maker and serves to encourage and facilitate the local, provincial, and national level institutions including universities, non-formal institutions, and international organizations into one integrated and holistic disaster management program. For international aid derived from the military, Indonesian Military (TNI) serves as coordinator while BNPB provides guidance concerning the location where assistance should be deployed.

Information and communication are the factors that influence the success of emergency management. These factors are very important to support the commands which are mandated to BNPB and/or BNPBD. BNPB provides accessible and up-to-date information concerning data on disasters through internet (http://www.bnpb.go.id). The data/information is shared with the involved organizations through internet network.

5.1.2. Land administration in Indonesia

5.1.2.1 Land tenure system in Indonesia

Two legal frameworks on land tenure exist in Indonesia: statutory law and *Adat* law. Statutory law regulates the formal land tenure system throughout the country whereas *Adat* law is a regulation belonging to the ethnics which are different from one tribe to another.

a) Statutory tenure

The statutory tenure comprises three laws:

1) Basic Agrarian Law (BAL) No. 5 Year 1960. This law is a basic land policy which regulates the agrarian principles in Indonesia. According to the BAL, the basic land policy are: the unity concept defines land, water, space and all natural resources as national properties; all the Indonesian citizens have equal opportunities to have land rights and get benefits from the land (equality concept); communal rights is acknowledged as long as it is not contrary with the national interest; the social functions are embedded in every land right; the land right holders (person, institutions) have to utilize their lands based on existing regulations; land use planning supports the need of land by society and state by arranging the use of land including maintaining natural resources.

   Presently, only five of the primary tenure types are commonly implemented, those are (Heryani & Grant, 2004): *Hak Milik* (HM) – ownership (freehold); *Hak Guna Usaha* (HGU) – cultivation only; *Hak Guna Bangunan* (HGB) – building only; *Hak Pakai* (HP) – use only; *Hak Pengengelolaan* (HPL) – land management only.
2) Basic Forestry Law No. 5/1967 then amended to Law No 41/1999. This law mentioned that all the non-owned forests belong to the state. By this law, the existence of customary rights is threatened.
3) Mining Law No. 11/1967 gives authority to the state to control and manage all resources within the Indonesian territory.

b) Customary tenure (Adat Law)

Customary tenure is applied based on *Adat* law. This tenure is explicitly acknowledged in BAL (article 5). It regulates many aspects of human life that exists in *suku* (tribes) including the regulation between *adat* community and their land. Commonly, *adat* law is used and managed by *adat* community members hereditary and controlled by the leader of the *suku*. The *adat* community has communal land so-called *Hak Ulayat* (Ulayat land). Within the communal land, individual rights are still reserved, such as right for occupation, harvest, and transfer among their *suku* members.

Although the BAL has already acknowledged customary tenure, unfortunately, there is no regulation to integrate the customary tenure into formal registration yet.

5.1.2.2 Land registration in Indonesia

a) Legal framework

To guarantee the security of land tenure and protect the landholders from recognized tenures on BAL, the GoI enacted Government Regulation No. 24 year 1997 (PP No.24/1997) concerning Land Registration which is then described in more detail through Regulation of Ministry of Agrarian Affairs/Head of National Land Agency No. 3 year 1997. According to this land registration regulation, the simplicity, security, affordability, up-to-datedness, and openness are features of land registration in Indonesia.

In fact, the rights on land are recorded by private conveyancing and registration of deeds. Even though private conveyancing is not regulated, it is accepted by court as informal but not legal transfer. The document of this transfer is done privately usually witnessed by two persons. Meanwhile, the registration of deeds is a formal registration where all copies of the documents of transfer of ownership should be recorded at the land registration office when the land holder wants to register it (Heryani & Grant, 2004). According to the land registration regulations, in case of registering the parcel, the deed which is done by the land deed registry official (Pejabat Pembuat Akta Tanah /PPAT) should be reported within seven days after the signing of the deeds.

b) Organizations arrangement

According to article 19 of BAL, the government is responsible for registering all non-forest land to guarantee the tenure security of land ownership. This statement is then translated and detailed in Presidential Decree No. 103 year 2001(Keppres No. 103/2003) concerning Status, Tasks, Functions, Authorities, Organizational Structures and Order of Operation of Non-departmental Government Institution which gives tasks to the National Land Agency (BPN) to register land.

To perform the mandated tasks, BPN has offices at the national, regional and district/municipality levels. Every office level has different jobs and responsibilities. All registration process of the parcel is held by local land offices in the district/municipality except for certain types of rights (e.g. HGU or HPL or HP) and involves the regional and central offices based on the size or area of the parcel. The regional land offices in every province help the local offices and perform the tasks mandated by the central offices. The main job and responsibility of the central office is to provide the guidelines and policy in land registration process for all regional and local land offices.

Beside the national land agency, land taxes agency (under the ministry of finance) has responsibility in performing cadastre for taxes purposes. According to the law No. 28 year 2009, since 1 January 2010, the authority for land taxes registration has been giving to the local government. But in fact, it could not be implemented yet due to lack of technical regulation in each local government.

5.1.2.3 Land use planning in Indonesia

a) Legal framework

As stated in the Law No. 24 of year 1992 (UU No. 24/1992) then revised by Law No. 26 year 2007 (UU No. 26/2007) concerning Spatial Planning, land use planning as sub system of spatial planning comprises some principles as follows:

- Sustainability. Land should be utilized for improving the prosperity of the people at the present and in the future;
- Effective and efficient in using the land;
- Equality and harmony. Various developments on the right location should be accommodated in spatial planning based on the proper and suitability of the locations.

All those three principles are interconnected. Land ownership and social function of any uses of land should be considered without have any different service and approach for privileged people.

Spatial planning is used to manage and control the development. The other regulation is building regulation which is used in provincial and district/municipal level. It is compulsory for people who have already owned the lands to adjust with spatial planning before they use their land. The land owner is required to get permits from the government agencies in charge for the purpose of the activities on their land, such as for housing (by having building permit), industry or agricultural purposes (farm or plantation).

Spatial planning is valid for 20 years period and can be evaluated in every five years. In the region or district/municipality which is categorized as hazard prone area, spatial planning could be evaluated more than one time within 5 years (UU No. 26/2007).

b) Organizations arrangement

According to the Presidential Decree No. 103 year 2001, National Planning Agency (BAPENNAS) and Ministry of Public Works (PU) are two agencies which are responsible in spatial planning. BAPPENAS is responsible on the formulation national development planning policy and to facilitate the coordination among the involved organization in spatial planning processes. In regional level, the tasks of BAPPENAS are carried out by BAPPEDA (Regional Developtment Planning Agency) while in the district/municipal level, the tasks is performed by BAPPEDA *Kab./Kota* (District/Municipal Development Planning Agency).

Meanwhile, the Ministry of Public Works is responsible in spatial planning for operational aspect in every administrative level. In regional and district/city level, the tasks of the ministry of public works are performed by regional and district/city development planning agency. In fact, the public work agency also involves in formulating spatial planning.

5.2. Disaster Risk Management and Land Administration in Padang

5.2.1. Disaster risk management in Padang

a) Policy

In terms of disaster risk management, the BNPBD agency of Padang city follows the same legal framework with other districts as regulated by Disaster Management Law No. 24 year 2007 as explained in section in 5.1.1. The formulation of policies follows the mixed (top-down and bottom up) approach.

b) Organizations arrangement

According to the Disaster Management Law No. 24 year 2007, in district level identified as hazard prone areas are required to establish local disaster management agency (BNPBD). Therefore, in 30 September 2009, BNPBD of Padang city was established.

Based on article 19 Disaster Management Law, BNPBD is led by local high government officer (one level under the mayor) who is responsible directly to the local mayor and BNPB. Some of the main tasks of BNPBD are (GoI, 2007):

- Providing the guidance and direction in accordance with local government policy and the national disaster management policy towards relief efforts of disaster management which includes disaster prevention, emergency action, rehabilitation, and reconstruction;
- Standardizing the requirement for implementing disaster management in municipal level in accordance with disaster management law;
- Providing, enacting and informing risk map to the people;
- Preparing and enacting the fixed procedure for handling the disasters;
- Reporting disaster relief efforts for every month to the mayor in normal period and every time during emergency period, etc.

BNPBD of Padang city consists of steering committee and operational division of disaster management. The tasks of steering committee are providing the local policy of disaster management, monitoring and evaluating the implementation of disaster management. This committee has the members coming from high government officer that are involved either directly or indirectly with implementation of disaster management and representative of the communities (e.g. community elders) and the expert people (e.g. academician from university). Meanwhile, the tasks of operational committee are doing the coordination, command and as an implementation party of local disaster management. The members of this committee are coming from professional and expert people.

During the implementation of disaster risk management programs, other organizations such as Public Works (PU), BPN, Marine and Fisheries Agency, Agency of Health, are also involved. BNPBD served as the coordinating agency. The involvement of these organizations are: PU is involved in constructing structural measures such as roads which can serve as escape route and shelter building; BPN is involved in land acquisition for evacuation routes; Marine and Fisheries Agency is involved in conducting training related with the actions during emergency time whereas the Agency of Health is involved in providing the hospitals.

c) Data and sharing data

To implement the tasks, BNPBD of Padang city collects data and information from reliable sources. For example, data on socio-economic and demographic data that are used for identifying the social vulnerability of Padang people are obtained from BPS. Most of the spatial data comes from National Agency of Meteorology, Climatology, and Geophysics (BMKG). Data sharing with all organizations involved are done by bureaucratic procedure, personal contact while internet is used limitedly (usually used for communication among government officer only/email).

As explained above, one of the tasks of BNPBD is to provide the risk/hazard map to the public. BNPBD has not been delivering this information yet. BNPBD of Padang city, however, has been publishing the evacuation map to prepare the community for future disasters. This map is made supported by local, national and international NGOs (Mercy Corp of United Kingdom). The scale of this map is 1:50.000 and has been disseminated to the public through pamphlets, brochures and billboards (Figure 5.1) and through the Internet (www.padang.go.id).

(c)

According to these maps, local people can use seven evacuation routes in case of a tsunami. These routes spread in Alai By Pass road, Kurao Pagang, Andalas, Dr Sutomo, and Lubuk Buayo. The essential information related with temporary shelter, hospitals, police station and other public building, including the route and direction for local people to follow in case of an earthquake/tsunami are also available.

Figure 5.1: Billboard of evacuation map published by BNPBD of Padang City

The earthquake and tsunami risk maps have been made by several parties such as by the Ministry of Marine (Figure 5.2). The risk map that is using a tsunami inundation simulation model caused by earthquake with the strongest intensity (magnitude 9,3 Richter scale) that hit Padang city as explained in chapter 4 (section 4.2.1.1). According to this risk map, Padang city was divided into four zones (Departemen Kelautan dan Perikanan, 2008):

- Red zone as **very high** risk areas which covers 7,5 % of the city (52,3 Sq km2) ; In case tsunami occur, it will inundated with water depths >3 metre);
- Orange zone as **high** risk areas which covers 11,9 % of the city (82,5 Sq km2). In case tsunami occur, it will inundated with water depths >3 metre);
- Green zone as **medium** risk areas which covers 33,2 % of the city (230,6 Sq km2). In case tsunami occur, it will inundated with water depths < 1 m);
- Dark green zone as safe/conservation and protected areas which covers 47, 4 % of the city (329, 1 sq km2). In this zone, there are no the residential available and all development activities are forbidden.

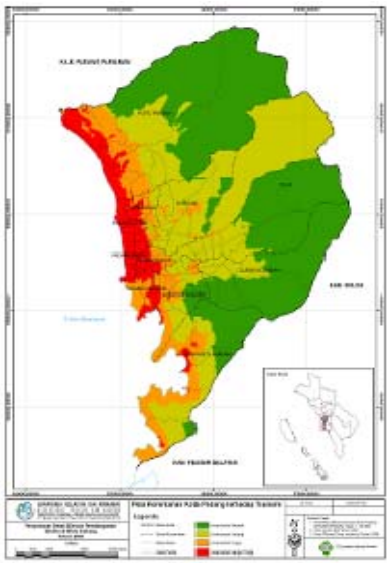


Figure 5.2: Risk map of Padang city (Source: (Departemen Kelautan dan Perikanan, 2008)

From this map, we can see that most of the areas along the coast of Padang are categorized as very high risk areas. Regarding the land issues in these zones, interesting questions are: how has land value changed in these zones? What are the specific restrictions and responsibility applied by the local government through LUP and cadastre on land in that area? How land use has changed in that zone? All these questions were reviewed and described in the next subsection 5.2.4.

d) Involvement of external agents

As mentioned above, the members of BNPBD of Padang city in charge of disaster management consist of professional and expert staff. The experts usually come from universities whereas the professional staff comes from private companies and NGOs. NGOs play an essential role in disaster management in Padang City. *Komunitas Siaga Tsunami* (KOGAMI) is the local NGO which has a program focused on preparedness and mitigation including training and education programs, and drills. Together with Journalists Network of Disaster Preparedness (JJSB) of West Sumatra, KOGAMI is using radio to disseminate information concerning earthquakes and tsunamis to local people. Moreover, KOGAMI also supports implementation and socializing of BNPBD programs through educational curriculum in schools. Detailed information related with KOGAMI activities is available through website (www.kogami.or.id). In addition to local NGOs, national NGOs such as Mercy corps and international NGOs such as CIT (USA), GTZ, AWI-DLR (German), ISDR, and UKaid (United Kingdom) also support disaster management in Padang city. CIT and AWI-DLR in cooperation with United Nation of University (UNU) provide hazard assessment data.

5.2.2. Land use planning in Padang

a) Policy

As explained in section 5.2.1.7, the local government refers to the Spatial Planning Law No. 26 year 2008 as guidelines in formulating a spatial plan for the district/municipal level. Beside this, the local government should also refer to the directives of the national and provincial spatial plans.

In 2004, the local government of Padang City has enacted the spatial planning which contains the policy, regulations and zoning for the entire Padang city's territory for period 2004-2013. According to this spatial planning, Padang city was divided into 22 zones, those are (Bappeda & PU, 2004): residential area, trading and services area, offices area, industrial area, water conservation area, sport area, warehouse area, station and sub-station area, tourism and recreation area, agricultural and rice field area, funeral and cemetery area, education area, harbor area, market area, coastal and river buffer zone, conservation area, cultural heritage area, lay stall area, military, plantation area, city forests area, and protected forests area. According to this LUP, most of the city centre such as, local government offices, residential area, trading and public services were directed along the coastal area.

Furthermore, in 2005, local government was issuing the regulation No. 1 year 2005 concerning Retributions of Building Permit. The aim of this regulation is to control the environment development in accordance with the city planning. Therefore, for all those who want to build or to reconstruct their property for all purposes are compulsory to have the building permit from municipality. Furthermore, these regulation states that for every issued permit there is amount of money will be charged to the applicant based on the location (zone) of the property, the size of area, materials used, the number of floor and the purposes of the building.

In 2010, due to earthquake and tsunami hazard and to implement the Law No. 24 year 2007 concerning Disaster Management, local government has finished re-evaluated and changed their LUP. The main change on new LUP of Padang city planning is integrating the issues of earthquake and tsunami hazard into LUP. As explained in previous chapter 4.2.1.1, Padang is vulnerable city from earthquake and tsunami disasters. Due to this fact, in 2008, local government with the assistance from provincial and national governments was re-evaluated and revised their LUP concerning earthquake disaster that was hit since 2006 and potentially-tsunami in the future. The new enacted LUP is valid from 2008 up to 2028 (see Appendix E). Some basic concept in zoning and spatial pattern has taken into consideration in the new hazard-based LUP is based on four criteria of hazard: tsunami, earthquake, landslide and flooding.

Regarding to the tsunami hazard, according to the new hazard-based LUP, Padang city was divided into five zones, those are:

1) The areas which have tsunami water depths > 3 meter and the water flow velocity> 2 meter/second as **very high** risk zones;
2) The areas which have tsunami water depths 1,5 - 3 meter and the water flow velocity 1,5 - 2 meter/second as **high level 1** risk zones;
3) The areas which have tsunami water depths 1 – 1,5 meter and the water flow velocity 1 – 1,5 meter/second as **high level 2** risk zones;
4) The areas which have tsunami water depths 0,75 - 1 meter and the water flow velocity 0,75 - 1 meter/second as **medium** risk zones;
5) The areas which have tsunami water depths < 0, 75 meter and the water flow velocity < 0, 75 meter/second as **low** risk zones.

According to these zones, further LUP 2008-2028 was described that generally, the areas categorized into high level2 up to very high areas are recommended to be used as protected area or non-

residential areas (e.g. plantation or agricultural area). Some mitigation actions were planned for those areas are: developing green space area for the areas categorized as high risk tsunami area by plants which can be used as withstands from the tsunami waves; identification tsunami prone area based on the probability of the damage level; identification high public buildings (e.g. government offices building, supermarkets, banks, etc) and using these building as escape building; and identification and preparation for escape route to the safety places.

Further the LUP 2008-2028 also describes more details regulation to mitigate the impact of tsunami with controlling, monitoring and limiting the development along the coastal area by (Bappeda & PU *Kota* Padang, 2010): the new building along the coast should parallel with the waves flow; developing green space area along the coastal as water front area; the minimum allowed distance for new building from the shore is 100-500 metre; the structure of new building along the coast is stage house and for permanent (brick) building should has resistance of the earthquake.

But in fact, the condition in these three zones have mostly developed as residential and city centre. Moreover, in their LUP documents, all these tsunami zones were not shown spatially. This fact could bring the difficulties in implementing the LUP in operational level.

Regarding to the earthquake hazard, most of the area located in eastern of Padang city are vulnerable due to adverse impact of earthquake. LUP 2008-2028 regulates that for the areas which have been developed are compulsory to have earthquake-resistant buildings, arranging the buildings in such a way that the evacuation routes are appropriate, providing the green area as safety places, and for the area located in the fault zones are recommended for open space and agricultural areas.

Due to earthquake and tsunami hazards, the mitigation plan strategy is by distributing the city centre and reducing the intensity of the people activities. The existing city centre and government offices in Padang Barat sub-district will be disseminated into several sub city centre (Figure 5.3), those are (Bappeda & PU *Kota* Padang, 2010):

- The first ten years, the city centre will be distributed within Padang Barat, Padang Timur and Padang Utara sub-district and the government offices will be moved into Air Pacah;
- The second ten years, the city centre will be focused in eastern, northern and southern part of the Padang city.

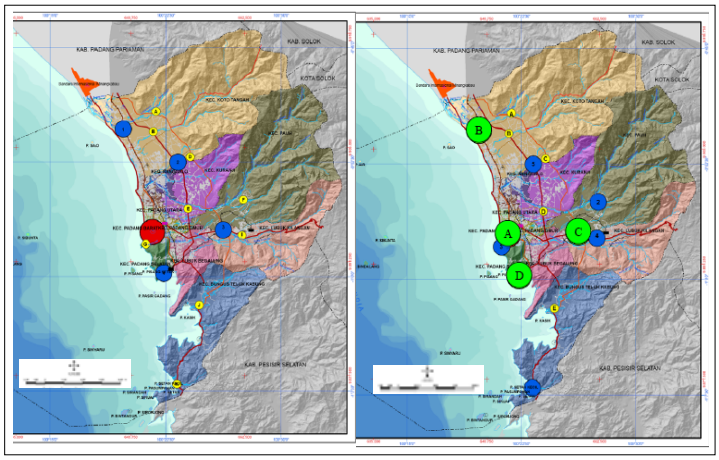


Figure 5.3: The distribution of city centre for Padang based on LUP 2008-2028
(Source:(Bappeda & PU Kota Padang, 2010)

As an example, in implementing new LUP and as mitigation of disaster, BAPPEDA together with PU and BNPBD has been re-constructing Market Building of Padang (Pasar Raya Padang/Pasar Inpres 1, 2, 3 & 4). This market got heavy damaged by earthquake in 2009. The building will have a function to be used as market and as shelter during emergency time (Figure 5.4).

According to all those regulations on LUP, the author argues that the new LUP 2008-2028 of Padang city has been incorporated mitigation plan. This integration may bring the disaster risk management activities in Padang can be fully implemented as mandated by Disaster Management and Spatial Planning Laws. Among other structural measures, the vertical escape building to mitigate the adverse impact of tsunami seems more effective to be implemented along the coastal zone since this area has been developed with high density population. Meanwhile, providing the open space or green area along the coastal is as buffer zone to reduce the adverse impact of earthquake and tsunami, but it seems hardly to be implemented.

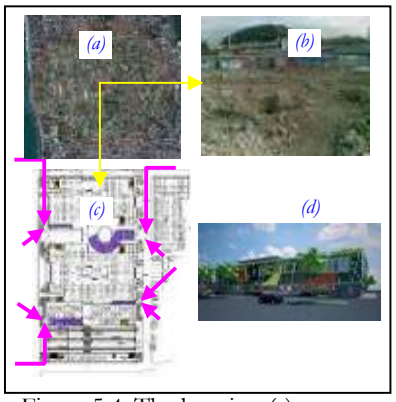


Figure 5.4: The location (a), current status of construction (b), evacuation route (c) and future physical view (e) of Pasar Raya Padang
(Source: BAPPEDA, 2010)

b) Organizations arrangement

As in other districts throughout Indonesia, in formulating LUP processes, the coordination among the organizations involved is undertaken by the Spatial Planning Coordinating Board Agency (BKPRD) which is under the main agency for spatial planning (BAPPEDA).

Based on the Spatial Planning Law No. 26 year 2008, BAPPEDA of Padang city has the main responsibility of preparing and implementing the LUP of Padang city; monitoring and evaluating the implementation of LUP; making an inventory and analyzing the problems, and providing the information concerning LUP, etc. Meanwhile, the Spatial Planning and Building Agency (DTRB) is mainly responsible for issuing location and building permits for those who will use their land for certain purposes. Soon after the LUP is legally published, some permits such as IMB (building permits), location permits and other related permits should be in accordance with LUP. Another agency responsible in LUP is public works (PU), as explained in section 5.2.1.7. This agency is responsible in the operation mainly regarding utilities network development such as transportation network, and cities infrastructures (e.g. drainage system development and flood control of the city, utilization of the network infrastructure for pedestrian, etc.).

Even though BAPPEDA is responsible for developing the LUP, in principle, formulating the LUP in Padang involves many local agencies. The decision regarding zonings and other regulations are made based on the consensus among other organizations involved. As an example, because Padang city is located in a coastal area, BAPPEDA always involves the local agency on marine and fisheries in formulating the spatial plan for the coastal area. Other local agencies involved are: Public Works (PU) involves in providing data and conduct hearings-discussions related with the utilities network and physical infrastructures such as transportation, drainage system, etc); Land local offices which involves in providing land record data and conducting in the discussions related with land issues (e.g. land acquisition, resettlement, etc); DTRB which involves in formulating, implementing and monitoring regulations related with zoning and building codes; Universities which involves in giving their expert opinion used by the local house of representative members in approving the land use plan; NGO is involved in monitoring the implementation of land use plan; and private sector is also involved in developing land use plan. In this process, the information is gathered from those involved agencies.

Regarding to the formulation of land use plan, the local government follows top-down approach where the communities has limited access to the LUP process.

c) Data and sharing data

The spatial data used in the LUP map is in accordance with the National Standard Data Infrastructure (NSDI). This regulation is concerning the requirements of spatial data that should be followed by government institutions in processing and providing spatial data either for their internal use or for the public. The organization in charge is National Coordinating Board of Survey and Mapping Agency (BAKOSURTANAL). The specification of and characteristics of data is available through the Internet (www.bakosurtanal.go.id).

According to the Spatial Planning Law No. 26/2007 the land use plan in Padang is valid for 20 years. But, in fact, due to the hazard and disaster management, the local government has changed land use plan twice since 2004 (2008 and 2010). Some changes regarding the hazard and mitigation plans have been included. All these changes are either digitally or manually documented in the land use plan regulation book. The scale map used is 1:25.000 for LUP at the municipality level and 1:5.000 for detailed LUP at the sub-district level. The projection system used is Universal Transverse Mercator (UTM) with World Geodetic System 1984 (1984) datum.

It is obvious that BAPPEDA requires data from other government agencies, private sectors, university and NGO in making and formulating the land use plan. Utilization of all the required data and information for LUP process depends on some factors: human resources and infrastructures among others. Results from questionnaire show that the coordination between BAPPEDA and other involved local government organizations is done based on bureaucratic procedure and personal contact. For example, in sharing data with the Statistical Census Bureau (BPS), although both organizations (BAPPEDA and BPS) have been using appropriate internet connections in their daily work, it still limited to only sending e-mail and passively providing information related with their organizations (e.g. website of their organizations). By this procedure, the sharing of data usually takes one up to seven days.

d) Involvement of external agents

As mentioned in subsection 5.2.1.7, according to Spatial Planning Law No. 26 year 2008, external parties should be involved either directly or indirectly. LUP is technically developed by a private consulting company based on the terms of reference specified by BAPPEDA and with supervision from a committee. Committee members consist of the person in charge from involved local organizations such as from National Land Agency (BPN), public works, agricultural, marine and fisheries and BAPPEDA itself.

In Padang, formulation of LUP involves the academicians as experts from universities. The academicians from universities are involved as source of expert opinion for local house representative members regarding the contents and issues within LUP before they endorse to the proposed LUP. Another external party involved is NGOs. They play the role of publication and monitoring of implementation of the LUP. The community itself is only involved in its implementation and monitoring. Generally, the community only plays a role in implementation and monitoring of LUP such as providing information on violations to the LUP. In the case of the aggrieved community; they have rights to claim by sending the objection to the authorized agency regarding regulations of enacted LUP.

Based on the way the LUP was formulated and the involvement of the community in LUP processes as explained above, the local government of Padang city uses top-down approach where the communities as the most affected party by the LUP only plays a minor role in the LUP formulation process.

5.2.3. Cadastre in Padang

a) Policy

The policy and legal framework of land registration in Indonesia were explained in section 5.2.2.2. Since Law No. 22 year 1999 concerning regional autonomy (*Otonomi Daerah*) was published, the district and province play essential roles to govern their respective jurisdictions. This law was revised and replaced by Law No. 32 year 2004 concerning *Otonomi Daerah*. Since that time, most of the agencies were decentralized in terms of tasks and authority. The local agencies no longer have direct relationships with the central agency. However, the general guidelines and directives are still in accordance with national rules and regulations. But, BPN as non-department organization is an exception. The registration system is centralized. Therefore, the rules and regulations are the same for every local land office throughout Indonesia including in Padang city. Top- down approach is used in formulating the land policy and legal framework in Padang.

b) Organizations arrangement

As mentioned in section 5.2.2.2, the local land office is responsible for applying land registration in Padang city. In implementing the tasks, the local land office is supported by either permanent or temporary PPAT and Adjudication Team. Both PPAT are assigned by the Ministry of Agrarian Affairs/Head of National Land Agency (BPN). The adjudication team is responsible in administering systematic land registration (PP No. 24/1997, 1997).

The head of the local land office is assigned by the head of BPN. However in performing the tasks, the local land office of Padang city coordinates with other local agencies such as with PU, DTRBD and BNPBD.

c) Data and sharing data

Data regarding land rights are provided in digital and hardcopy. Registered parcels are commonly documented and mapped in large scale 1:1000. The projection system used to map the parcel is Transverse Mercator 3° (TM3°). Basically, this projection system is Transverse Mercator system which is divided into two zones. The differences are the scale factor (0.9999) and the false coordinate origin used is (500.000 of North Axis (y) and 1.500.000 of East Axis (x)).

Cadastral data have been digitally managed and computerized. The central office can check and download data from the local land office through the Internet. However, according to the Land Registration Act, cadastre data are state documents and confidential data. Accordingly, public parties are not able to access cadastral data directly. But, land owners and other agencies can get information regarding the registered parcel from local offices following bureaucratic procedures.

Besides registering parcel, the local land offices have also been providing land use data. This map is developed by using a base map coming from BAKOSURTANAL agency (e.g. topographic map). Private parties and the other local agencies use the land use data for their specific purposes.

d) Involvement of external agents

The external agents involved are usually private consultant company which support land local offices in digitalizing and mapping. The community plays an important role in the registration process. The land owners complete the related land document and identify boundaries of land parcels when the survey and mapping of the parcels are done by the local land surveyor.

5.2.4. Impact of earthquake and risk-based land use plan on land in Padang

a) Impact on land use

According to the data obtained from BAPPEDA Padang, the changes in land use identified in year 2008 show that the land use is dominated by forest with an area of 35.448 hectares (51, 01%), followed by agricultural areas (farming and husbandry excluding rice field) with 18.300 hectares (26, 3%), and residential area with 6.625,24 hectares (9, 5%) and rice fields (irrigated and non-irrigated) with 5.134 hectares (7, 4%). From 2007 to 2008, unused land area decreased to 129,33 hectares from 158 hectares, non-irrigated rice areas decreased by 28,2% (78,47 hectares) from 278,5 hectares, mixed farms decreased by 0,6% from 13.920,32 hectares to 13829,92 hectares, whereas bush land decreased by 1,2 % from 1565,75 hectares to 1546,48 hectares while the others land uses remained the same (see Error! Reference source not found.). All these changes in land use were replaced with residential areas which has increased significantly around 309, 71 hectares (4, 9%) from 6315, 53 hectares in 2007 to 6.625,24 hectares in 2008 (Pemerintah Kota Padang, 2010).

Regarding the hazard zone, the areas highly vulnerable to earthquakes and tsunamis are dominated by residential and service (private and public services) areas with high population density (Figure 5.5).

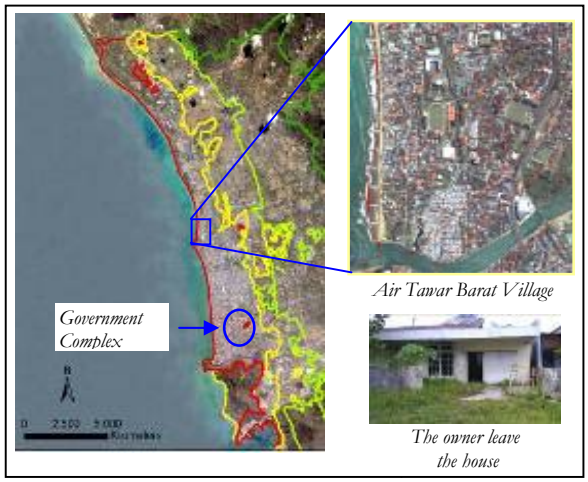


Figure 5.5: Highly hazard areas are dominated by residential

It is common that people try to live in the city centre. Since 2006, new residential areas have been developed in eastern part of the city. According to the heads of villages and land use planning officers who were interviewed, this tendency has happened due to earthquake and tsunami hazard. More people are moving to the high elevation areas and avoid the coastal areas which are prone to tsunamis. As a result, many new residential complexes which located in the eastern part of Padang city and developed by private companies are easy to sell whereas almost all properties located along the coastal areas such as in Air Tawar Barat villages, Ulak Karang and Ujung Gurun villages are hard to sell due to unwillingness of the buyers to purchase these properties.

As another example of impact of earthquake and potential of tsunami, the local government offices located in Padang Barat sub-district are planned to be moved to Air Pacah village, Koto Tangah. The background of this plan is to build a new city centre and to reduce the adverse impact of tsunami and earthquake since the recent local government offices are located nearby coastal area.

The evidence obtained from head of village survey of Air Tawar Barat, 15 % of inhabitants in this village moved to other places, mostly to high lands and the eastern part of Padang city, due to the impact of earthquake and to avoid the tsunami since this village located in highly earthquake and tsunami prone area (red zone). While 3% of new inhabitants that came to this village continue their study in Padang University which is located in this village. In the contrary, after several eartquakes hit between 2006 and 2010, there were 5% who migrated to Andalas village and 4,6% to Cengkeh village due to avoid earthquakes and tsunamis (Figure 5.6). Both two villages are located in safe areas from tsunami.

Imbalance between the number of people who come and leave the village affects the number of housing. For example, in Air Tawar Barat, many houses are empty while in Cengkeh and Andalas villages the residential areas has been expanding because many people come from high hazard prone areas such as Air Tawar barat village. There are no detailed data collected concerning the large changes in settlements in these villages.

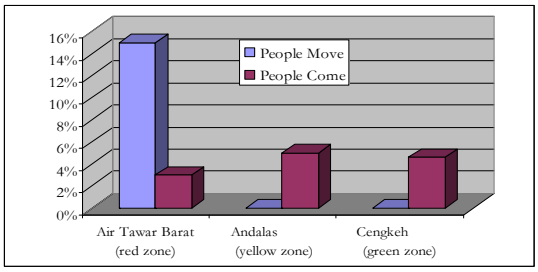


Figure 5.6: Percentages of inhabitants who move and came due to earthquake and tsunami

According to the household survey in Air Tawar Barat village, 24 % of 50 repondents desires to move from their houses due to impact of earthquake and to avoid tsunami while 56 % of the respondents who do not want to move argues that they do not have enough money to buy a new house and 20% of respondents believe that they do not have sufficient reason to move from their houses due to their belief that earthquake and tsunami disaster come from God

Regarding to the impact of LUP and cadastre on land use, all the head of village surveyed argues that the established land use planning and cadastral are not give the impact of changes on their land use. Eventhough 96 % of total respondents have registered their parcel to the land offices, but 46% of them, even, did not know the existence of LUP planning itself.

b) Impact on land tenure

Based on the cadastral map, most of the registered parcels were located in the residential areas and along the coastal area. In contrast, most of the parcels located in eastern part of the Padang city (in the areas safe from tsunami) are not registered yet (Figure 5.7).

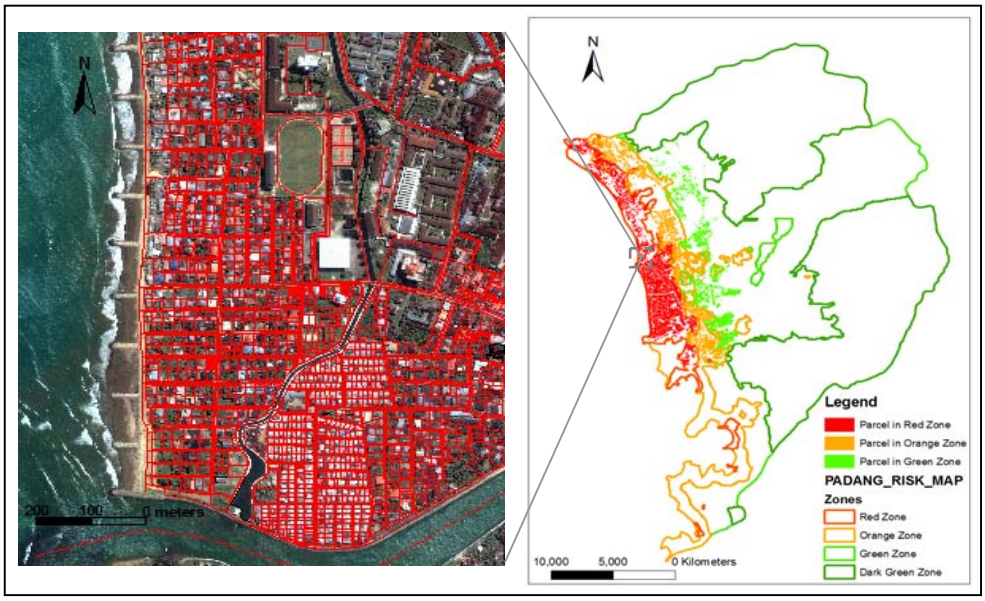


Figure 5.7: Registered parcels mostly located along the coastal zone (Source: BPN and Ministry of Marine and Fisheries, 2010).

Until 2010, there are around 102.344 registered parcels in Padang (Kantah Kota Padang, 2010). Around 53 % of these parcels are located in the red zone, 32% located in the yellow zone and around 15% of registered parcels located in green zone areas (Figure 5.8).

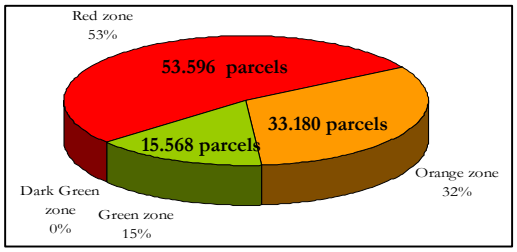


Figure 5.8: Number of registered parcels in each zone in Padang

In three selected villages for landowners' questionnaires, the registered parcels are dominated by ownership (HM) followed by the rights to use and construct (HGB) and use right (HP). The composition of each type of land rights is shown in the (Figure 5.9)

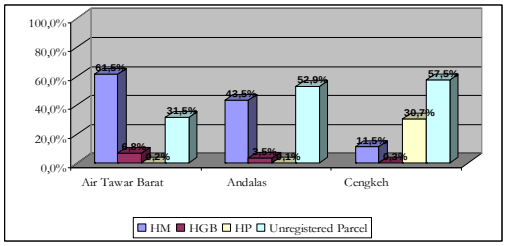


Figure 5.9: Type of land rights in each village (Source: BPN and PBB, 2010)

As responds to the latest earthquake hit Padang city on 30 September 2009, the central and local governments through BNPB and BNPBD provided reconstruction and rehabilitation assistance funding. The victims were able to get money to reconstruct and repair their houses based on the level of the damages. There is no available information related with the amount of money received by the households. Other compensation from local governments to the people is through the building permit regulation. The mayor of Padang city promulgated and issued the regulation No. 25 B year 2005 concerning free retribution cost of IMB for re-constructing houses affected by the earthquake. According to this regulation, those who want to get IMB for reconstructing their house are not charged until 2010. It has also highlighted that for the private buildings such as malls and supermarkets which could be used as temporary shelter, in case of disaster, will get the compensation by free of retribution cost. Usually, this fee has to be paid by the owner of the buildings as retribution taxes to the local government.

Regarding the impact of LUP to the land tenure, the zoning in LUP of Padang city 2004-2024 and newer version LUP 2008-2028 have established some of the forest areas as buffer zones (see Figure 5.10). As a consequence, the cadastre office could not register their land and the local government (through DTRB agency) also could not issue a building permit even though they have been living there for a long time before the zoning regulation was published. This results insecurity of land tenure for the owner and creates the informality areas.

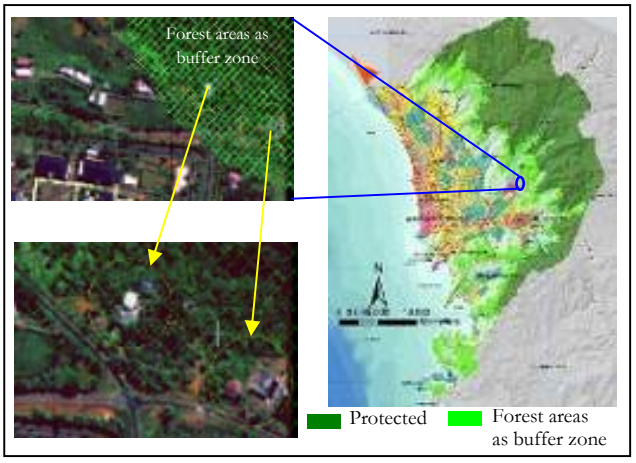


Figure 5.10: Parcel in forest buffer zone areas

As mentioned above, in Padang there exists the customary tenure. Even though the BAL has recognized the existence of this type of tenure and the local government has already published the regulation concerning this, in practice there is no registered customary land yet. The author argues that this condition may bring uncertainty in land tenure for all the customary land in Padang.

c) Impact on land value

- **Land value based on land tax data**

The land taxes data comprises land value and building value. In land valuation process, "Market Data Approach" is as the appraisal method used by land taxes office. By this method, the value of land is calculated by comparing it with other similar land for which the market value of that land has already known. In this method, the location (strategic or not) and access to other public facilities are considered as factor influencing the price of land. Meanwhile, in building valuation process, land taxes office use "Cost Aproach" method. The building value is defined by calculating all costs to construct that building minus depreciation of that building within some period (1-3 years). In this research, land and building value in each village were defined by calculating the total price of the land, then, divided by the total area of the land in square metre in each year from 2005 to 2008.

Based on the land taxes data from 2005 to 2008, land price in Padang has been increasing. In 2005, the average land price in Air Tawar Barat is around IDR. 179.592 Per square meter. In 2008, the average price increased 42 % into IDR. 264.657. In Andalas village, the average land price increased significantly up to 74 % since 2005. Similarly, in the same period, the average land price in Cengkeh village also increased around 57%. Contrary with land taxes value, the recorded taxes data shows that from 2005 to 2008 the averages of building values in Air Tawar Barat and Andalas villages declined around 48% and 26% since 2005 to 2008. Whereas in Cengkeh village the building value was declined only 2% for the same period. Detailed changes of average land and building values in each village are shown in the Table 5.1.

Table 5.1: The average of land and building tax value in study areas

Name of Village	Average Land Tax Value (per m2) (IDR)				Average Building Tax Value (per m2) (IDR)			
	Year 2005	Year 2006	Year 2007	Year 2008	Year 2005	Year 2006	Year 2007	Year 2008
Air Tawar Barat	179.592	206.951	251.545	264.657	419.396	220.076	429.882	535.771
Andalas	70.985	83.631	93.536	134.990	383.310	283.260	400.961	498.425
Cengkeh	90.741	85.836	139.792	151.291	393.340	385.836	381.225	476.124

(Source: Land Taxes Office, 2010)

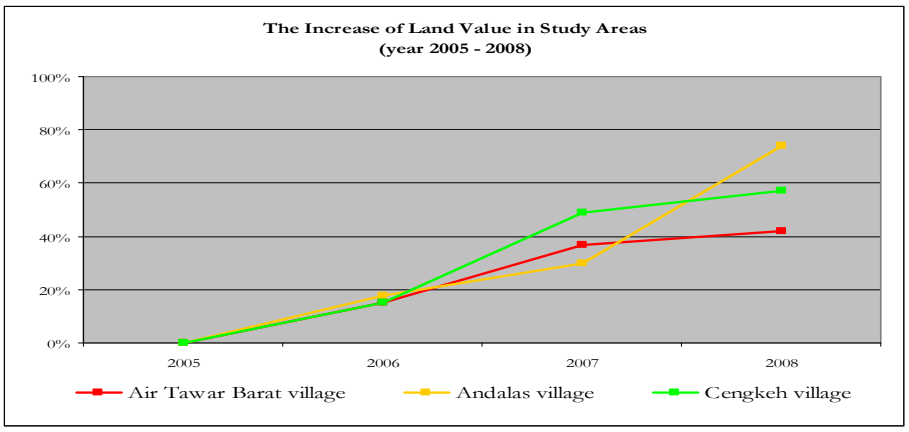


Figure 5.11: The increase of land tax value in study areas

- **Land market value**

As explained before, people who live along the coast feel scared and unsafe due to earthquake as well as potential tsunami which may occur in the future. This condition has brought the decline in land market value. As an example, according to the data obtained from notaries in Padang, the market value in Air Tawar Barat decreased around 27 % from IDR. 400.000 In year 2005 to IDR. 300.000 per m2 in year 2008. In contrast, the average land market price in Andalas and Cengkeh villages increased by 31 % and 27 %, respectively. These contrasting conditions happened because people move to live in the safe areas. Details changes of each average of land market price are shown in the Table 5.2.

Table 5.2: The average of land market value in study areas

Name of Village	Average Land Market Value (per m2) (IDR)			
	Year 2005	Year 2006	Year 2007	Year 2008
Air Tawar Barat	400.000	350.000	330.000	300.000
Andalas	650.000	750.000	800.000	875.000
Cengkeh	500.000	550.000	600.000	650.000

(Source: Notaries in Padang, 2010)

The comparison between taxes and market land values show that there is a substantial increase in land value. In Air Tawar Barat village, example, the market value declined by 27 %, but the land taxes value increased to 42 % (Figure 5.12).

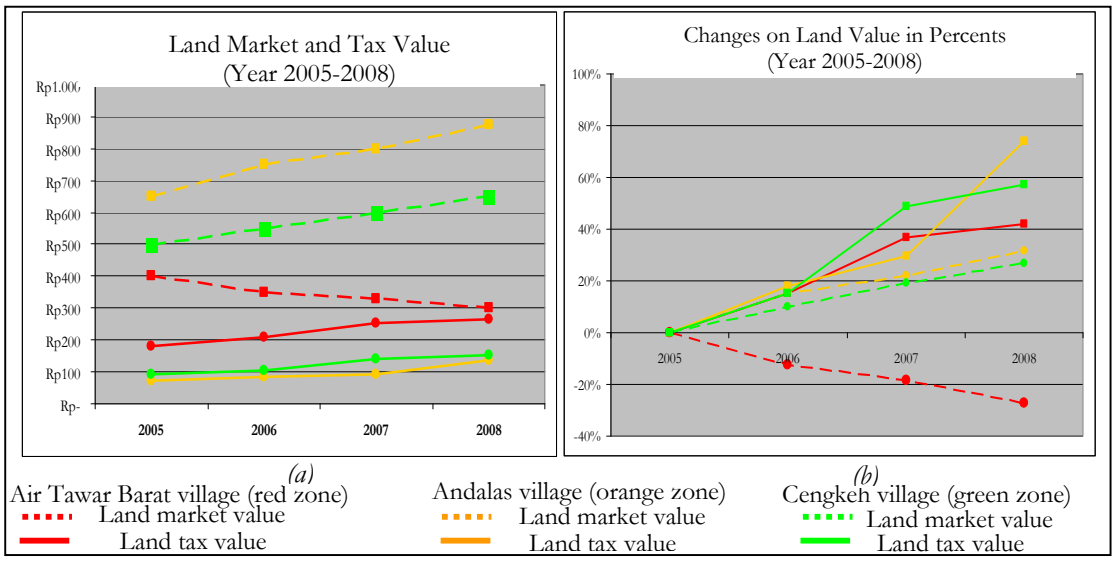


Figure 5.12: Land value (a) and the changes of land value in percent (b) in study areas.

(Sources: Land Taxes Office and Notaries in Padang, 2010)

According to data above, land taxes agency has only considered earthquake damages to decrease building values, while the impact on parcel is not considered yet. Therefore, the author argues that the land taxes agency has not integrated the disaster risk reduction policy into their implementation yet. Disaster risk reduction could be applied by giving the reduction of the land tax value for the affected areas.

5.3. Disaster Risk Management and Land Administration in Banda Aceh

5.3.1. Disaster risk management in Banda Aceh

a) Policy

Since the decentralization law was published in 1999, each district throughout Indonesia has the authority to govern and manage their administration and resources. Therefore, in terms of disaster management, the BNPBD agency of Banda Aceh city follows the same regulations as with the BNPBD agency of Padang city as explained in section in 5.2.1.1. The formulation of policies follows the mixed (top-down and bottom-up) approach.

b) Organizations arrangement

In general, the organizations involved in disaster management and their interactions are also the same as in Padang City. BNPBD agency of Banda Aceh is the main agency that coordinates the entire program related with disaster management in Banda Aceh. However, from 2005 to 2009, the disaster management activities were carried out by BRR (Rehabilitation and Reconstruction Agency for Aceh Province and Nias Island in North Sumatra Province). Four months after the 2004 tsunami, the GoI formed the BRR agency responsible for implementing reconstruction and rehabilitation for 4 years until 2009. This is based on the regulation in lieu of Law No. 2 year 2005 concerning Rehabilitation and Reconstruction for NAD and Nias. Moreover, this regulation also mentioned the structural organization which is detailed in Presidential Decree No. 34 year 2005. Accordingly, the BRR comprises three divisions: Steering Committee, Supervision Committee and Implementation Division. BRR has the authority to:

- Manage the implementation of reconstruction and rehabilitation activities,
- Manage all available resources: human, natural, funding including technological resources to implement the reconstruction and rehabilitation process,
- Coordinate, collaborate and monitor all reconstruction and rehabilitation activities, including the program directly funded by foreign donors.

Furthermore, this regulation also emphasizes that BRR could request information and technical support from central, provincial and local government in order to perform their duties.

c) Data and sharing data

In performing their tasks, it is obvious that BNPBD of Banda Aceh require the data from various sources. The data coming from other government agencies are commonly obtained through bureaucratic procedure, personal contact and through the internet. However, since 2005 most of the disaster-related data have been publicly available through internet. The user could download the data for free.

Regarding the hazard map, BNPBD has not produced this map. Since 2010, the hazard map has been made and published by the Tsunami and Disaster Mitigation Research Centre (TDMRC) in coordination with the local government and international agencies (UNDP and Multi Donor Fund). The map was produced at scale 1:50.000 and which divides Banda Aceh city into five zones:

The levels of earthquake and tsunami hazard are defined based on the Earthquake and Tsunami Risk Map of Banda Aceh which divides the city into five levels represented by different colours that are (Figure 5.13):

- High level (red) zone. In case tsunami happens, it will inundate with water depths 7-23 metres. In this zone, there are no residential available and all development activities are forbidden;
- Medium level (yellow) zone which will inundated with water depths 3-7 metres if tsunami ccours;

- Low level (green) zone. In case tsunami occurs, it will inundate with water depths 1-3 metres;
- Very low (cyan) zone. In case tsunami happen, it will inundate with water depths < 1 metre; and Safe zone.

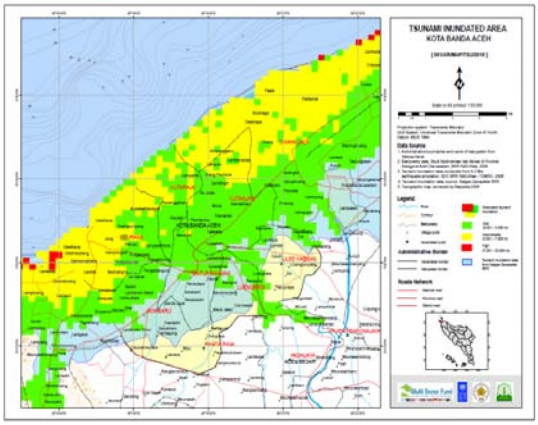


Figure 5.13: Hazard map of Banda Aceh
(Source: TDMRC, 2010)

d) Involvement of external agents

The University of Syiah Kuala (UNSYIAH) plays an essential role in disaster management in Banda Aceh. Almost a year after earthquake and tsunami in Aceh, UNSYIAH established the Unsyiah for Aceh Reconstruction (UAR) centre. UAR acts as liaison organization and coordinates with the government and the community in designing the plan for reconstruction and rehabilitation in Aceh. UAR then was later changed to Tsunami and Disaster Mitigation Research Centre (TDMRC) that focuses on reducing impact of tsunami and disaster risk. The mission of this organization is to disseminate the research outcome to the community in Aceh especially, and in Indonesia and internationally in general.

5.3.2. Land use planning in Banda Aceh

a) Policy

Principally, the legal framework used in LUP in Banda Aceh is based on the Spatial Planning Law No. 24 of year 1992 (UU No. 24/1992) which then revised by Law No. 26 year 2008 (UU No. 26/2007) as explained in section 5.2.2.3. However, the local and central government have revised the spatial plan three times since the earthquake followed by the devastating tsunami in 2004.

Two years before the earthquake and tsunami, the local government published the spatial plan for the period 2002 to 2010. This spatial plan has the characteristics such as:

- Banda Aceh was divided into four development area: City centre area, Western, Eastern and Southern part of the city.
- Urban development was spread,
- The distribution of population was spread with the city centre having the highest density.

In 2005, to respond to the adverse impact of the earthquake and tsunami, the GoI published the Master Plan for the Rehabilitation and Reconstruction of the Regions and Communities of the Province of Nanggroe Aceh Darussalam (NAD) and the Islands of Nias, Province of North Sumatera. The Master Plan was prepared and made by the National Development Planning Agency/BAPPENAS incorporating input from stakeholders from the central, provincial and local levels, university, local, national and international NGOs, including international donor communities.

The Master Plan was developed to spatially re-structure Aceh in order to reconstruct the areas, the cities and the regions including the settlements devastated by the earthquake and tsunami, enabling the communities to carry out their activities under enhanced conditions, and making them safe from future disasters by spatial policies through zoning regulations. It promulgated the directives of spatial use pattern of Banda Aceh city adjusted to disaster prone areas: coastal zone, fishing/fishpond zone, city park zone, settlement zone, restricted settlement and urban settlement zone, landmark and administrative centre of Banda Aceh, city-scale and regional-scale facilities, higher education zone and

agricultural zone (see Appendix F). The purpose of these spatial use patterns is to offer the local government the reference in preparing or revising their detailed spatial structure such as detailed structure plans for building and the environment.

The newest spatial plan of Banda Aceh was published in 2009 by the local government of Banda Aceh for the period 2009-2029. According to this spatial plan, the zoning plan of land use was categorized into two: protected areas and cultivation areas. Around 1.258 ha (20, 52%) of Kota Banda Aceh was classified as protected areas. This area consists of local reservation areas (e.g. coastal and river buffer zone), natural reservation areas (e.g. mangrove forest), cultural heritage areas, disaster prone areas (coastal area which is tsunami prone), green/open space area. The planned cultivation areas is around 4.877 ha (79, 48%) which consists of residential, trading and services, offices, tourism, fishery, public services, and harbour area including the unused land and water bodies (Appendix G).

Regarding disaster risk management, the newest spatial plan has already incorporated a mitigation plan such as defining the areas along the coast as buffer zone. The areas between 50-100 metre distances from the highest tide point to landward are defined as protected areas. Another zoning regulation is to provide emergency route and to develop public emergency facilities such as escape buildings and open spaces. At least 5 rescue buildings were built distribute in Lambung, Alue Dayah Tengoh and Deah Geulumpang villages.

Local government of Banda Aceh has involved the communities and uses a combination of top-down and bottom-up approach in formulating the spatial plan. By top-down approach, the local government ensures that directives and conceptual structures of the spatial planning could be achieved based on their goal. Whereas the settlement scale, village and sub-district scale development are to be designed and employed in collaboration with concerned communities. The community in each village, helped by the NGOs developed their land use plan in accordance with spatial planning directives of Kota Banda Aceh.

Village-based planning

The GoI, through the BRR Agency provides the guidelines for village-based planning. It has highlighted that each village planning should include the plan on land use, basic infrastructures and utilities (e.g. road, drainage, sanitary system, landfills area, etc.), establishment housing and public and social facilities, establishment of rescue facilities (e.g. escape hill), environmental rehabilitation (e.g. rice field, fishponds and farm) (BRR, 2005). Some alternative solutions proposed by BRR for village planning are: reconstructing the village same as the previous condition before the disaster without any changes; reconstructing the village same as the previous condition before the disaster with some changes such as developing rescue facilities (e.g. widening road, drainage); re-arranging the village either partly or wholly. This case is what happened in Kota Banda Aceh; resettlement, if: the people do not want to return back to their village or their property is gone.

b) Organizations arrangement

Same with the agency responsible for LUP in Padang city, BAPPEDA of Banda Aceh is the local agency responsible for LUP. However, from 2005 up to 2009, the task of preparing LUP was performed by BRR. In the case of spatial planning 2009-2029, BRR in cooperation with GTZ has prepared the draft of LUP. The local government, then, published the new spatial plan through local regulation.

The other local agencies involved in preparing and making a spatial plan for Banda Aceh are PU, BPN, Marine and Fisheries Agency, and national agency (BAPPENAS).

c) Data and sharing data

The land use plan of Kota Banda Aceh is documented and published as a book with maps documents. The scale of the spatial planning map of Banda Aceh is presented at 1:15.000 scale whereas the village planning map is made at 1:5.000 scale. The projection system used is Universal Transverse Mercator (UTM) with World Geodetic System 1984 (1984) datum. The spatial planning map is made in accordance with the government regulation No. 10 year 2000 concerning Accuracy Level of the Spatial Planning Map and Presidential Decree No. 85 year 2007 concerning National Spatial Data Network.

Completeness spatial and non-spatial data in Banda Aceh was influenced by the existence of BRR agency. During reconstruction and rehabilitation period, BRR and NGOs purchased and provided enormous spatial and non-spatial data. Aerial photography, satellite imageries including other vector data related with land use plan, roads networks and others spatial data were produced in large scale and could be access through internet by free. Later, all those data were given to the local government agencies.

According to BAPPEDA *Kota* Banda Aceh, the sharing of data with other government and non-government agencies is done through bureaucratic procedure, personal contact, internet and GIS forum. BAPPEDA of Banda Aceh agency has GIS Centre division. This division is responsible for collecting, maintaining and exchanging spatial data with other organizations. This division is also responsible for monitoring the implementation of the spatial plan of Banda Aceh. Sharing of data also is supported by Administration and Development Bureau agency of NAD province which provides all available spatial data such spatial planning for all districts within Aceh province territory, village planning, aerial and satellite imagery, etc. The data may be downloaded freely through the website (http://biropembangunan. acehprov.go.id/).

d) Involvement of external agents

In Banda Aceh, the communities are involved in preparing and formulating the spatial planning since the local government with BRR are used top-down and bottom-up approach. An example, in village-based planning, the communities provide the following data (BRR, 2005): 1) Land, the owner information and residents of the village before and after the earthquake and tsunami, including: the land owners who are going to and not going to settle back in the village; the land owners who have passed away with no heirs; unidentified land owners; submerged land; residents who rent the house, and residents who moved to other villages; 2) Border of flooded and inundated area; 3) Property tax; 4) Village map In case the map is not available yet, the communities could perform participatory mapping and community driven adjudication program; 5) Identifying and adjusting with other related villages planning and district planning such as in drainage system plan, road, school, wipe water and other public infrastructures; 6) Identifying of land use, housing arrangement, building outlines and green belts/open space places.

In preparing and making the village plan, the communities were also supported by NGOs and the private sector (e.g. private consultant company) for technical assistance.

5.3.3. Cadastre in Banda Aceh

a) Policy

Basically, the regulation and legal framework applied in performing land registration in Banda Aceh is the same as in Padang (section 5.2.2.2). However, since the earthquake and tsunami in 2004, the policy and regulation regarding land registration has been changed.

To respond the adverse impact of tsunami to land administration and land tenure, GoI has stipulated Law No.48/2007 to replace the Government Regulation No. /2007 concerning Handling of Legal Issues in Implementation of Rehabilitation and Reconstruction for the Community in NAD and Nias Island - North Sumatra Province. According to this law, the policy of land tenure and land administration includes: reconstruction of land rights; prohibition of land ownership transfer; reproduction of land documents and land records; recovery of abolished land; management of land right for the "Owner Unknown". In the case where the land owner or the heirs, were missing, the land right including occupation of the land will be given to *Baitul Mal* for Moslems or to Property and Heritage Agency (BHP) for non Moslems; and property tax exemption. The land owner of the disaster-affected land are free from paying the 5% of the assessed value when the land registration initially done.

Formulation of the policy is conducted by GoI using top-down approach. However, the GoI also considers the local government participation including NGOs involved in reconstruction and rehabilitation of Aceh province and Nias-North Sumatera province.

b) Organizations arrangement

Regional Land Office and Land Local Office are the main organizations that perform land registration in Banda Aceh, as explained in section 5.2.2.2. However, during reconstruction and rehabilitation of land administration system after the 2004 disaster took place and until 2008, the land administration activities was performed by BPN (central-province and land local office) as a main agency in coordination with BRR, local government, NGOs including the community itself. BPN has the main tasks of surveying, mapping, issuing certificates and distributing them to land owners. BRR and local government are involved such as in relocation and re-settlement while NGOs and the community are involved in CDA.

c) Data and sharing data

Principally, the data collected, processed and stored in the local land office in Banda Aceh is same in Padang. The data is collected, processed and stored based on the technical standard regulation applied throughout Indonesia. In Banda Aceh, cadastral data have been digitally managed and computerized. Currently, the central office can check and download the data in the local land office through internet connection. High resolution satellite imageries (e.g. QuickBird and Ikonos) and aerial photo have been used as base map for surveying parcels.

During the reconstruction and rehabilitation phase, in 2005, BPN purchased the pre-disaster satellite imagery and produced maps at 1: 3.500 scale. The European Union provided the fund and technical assistance for 2 weeks. Later, the aerial photo was also used to support BPN's mapping, surveying and adjudication for reconstructing the land administration system and also to prepare maps to be provided for CDA. Almost all the parcels in Banda Aceh were mapped and registered as result of RALAS program.

Regarding to data sharing, the situation is the same as in Padang. Data could not be shared publicly due to confidentiality as regulated in Land Registration Act. However, the owners and other parties interested could apply to get the data formally from local land office through bureaucratic procedure.

d) Involvement of external agents

The private company is usually involved in providing required spatial data and the community is involved in the registration process. During reconstruction and rehabilitation of land administration phase (2005-2008) some NGOs were involved. BPN also received feedback from the community and

NGOs (e.g. from Urban Poor Consortium (UPC), INFID and Land Forum). In 2005 and 2006, UPC provided input related with Community Land Mapping (CLM). This program had accelerated the reconstruction of land ownership. INFID had carried out assessment in 2007 and issued the recommendation for the improvement of RALAS implementation. Land Forum provided input in selecting adjudication location. During the implementation of RALAS, BPN and NGOs have regular meetings in the joint forum so-called Land Forum to discuss and monitor the community-based agreements in CDA and the process of adjudicating of land rights. The Steering Committee (SC) of Land Forum has also been developed by involving BPN, NGOs, Press, and Academic Representatives. Now, the local NGOs still involved in finishing remained related-land issues after the reconstruction and rehabilitation phase was ended in 2009.

Community feedback was also obtained during identification of land boundary, adjudication committee meeting and announcement of land registration. Feedback related to the quality of land titling reconstruction was also acquired from the community.

5.3.4. Impact of earthquake and tsunami and risk-based land use plan land in Banda Aceh

a) Impact on land use

Devastating earthquake and tsunami in 2004 caused 3 out of 9 sub-districts to be totally damaged, these are Meuraxa, Jaya Baru and Kuta Raja sub-districts. The disaster also caused 3 sub-districts, Baiturrahman, Kecamatan Syiah Kuala, and Kuta Alam to be moderately damaged. Meanwhile the rest, Ulee Kareng, Lueng Bata, and Banda Raya , were safe from tsunami (Pemerintah Kota Banda Aceh, 2005).

Aside from the death toll, the earthquake and tsunami also changed the land use in Banda Aceh, especially along the coastal region. The coastline has been lost and mangrove forests and settlements along the coast were destroyed. The earthquake and tsunami of 2004 also caused changes in the city space structures. The pattern of city space structures has been changed as follows:

Before the tsunami, an urban space structure in Banda Aceh has a symmetrical radial pattern where the activities of inhabitants were concentrated in the downtown. The shops, service centres and other city's activities have linearly followed the main road network pattern and relatively radial from Baiturrahman Grand Mosque (as city centre) (Figure 5.14). The existence of Peunayong and Aceh markets has also supported the activities of people in the city centre. The main centre was supported by several sub-city centres such as: Ulee Kareeng, Lampulo, Beurawe, Lueng Bata, Peuniti, Neusu, Seutui, and Keutapang, and by Ulee Lheu with port and tourism activities (BAPPEDA Kota Banda Aceh, 2010).

After the tsunami, urban space structures in Banda Aceh evolved into a combination of "multi-center" and "linear-growth" which divides the city into four city centers', those are (BAPPEDA Kota Banda Aceh, 2010): Main city center located administratively in Baiturrahman and Kuta Alam sub-district; Western city located in Ulee Lheue , Eastern with Ulee Kareng as centre, and Southern city centre with Mibo as the city centre.

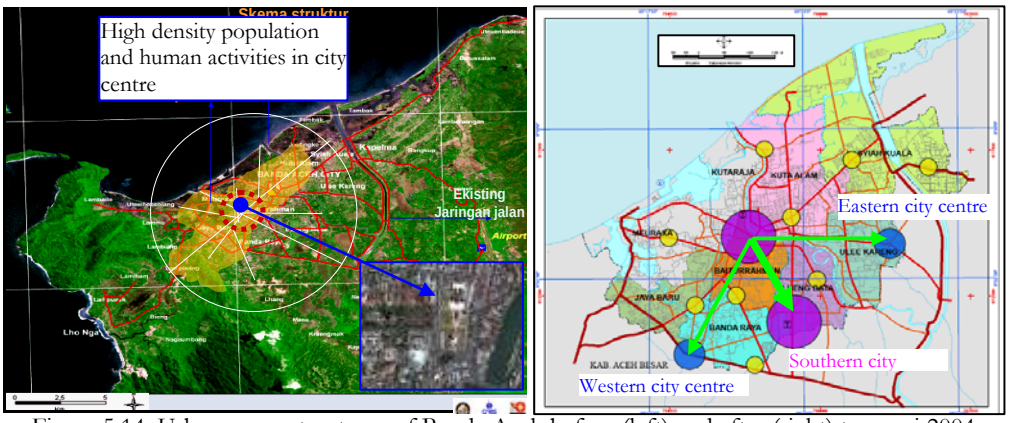


Figure 5.14: Urban space structures of Banda Aceh before (left) and after (right) tsunami 2004 (Source: (BAPPEDA Kota Banda Aceh, 2010)

After the 2004 earthquake and tsunami, the residential areas along the coast were zoned as mangrove forest and open space area. In contrast, according to the LUP 2002-2010, most of the areas in Ulee Kareng sub district was planned as protected forest areas and green areas. But since 2009, most of the areas in Ulee Kareng have been reclassified as residential areas (Figure 5.15).

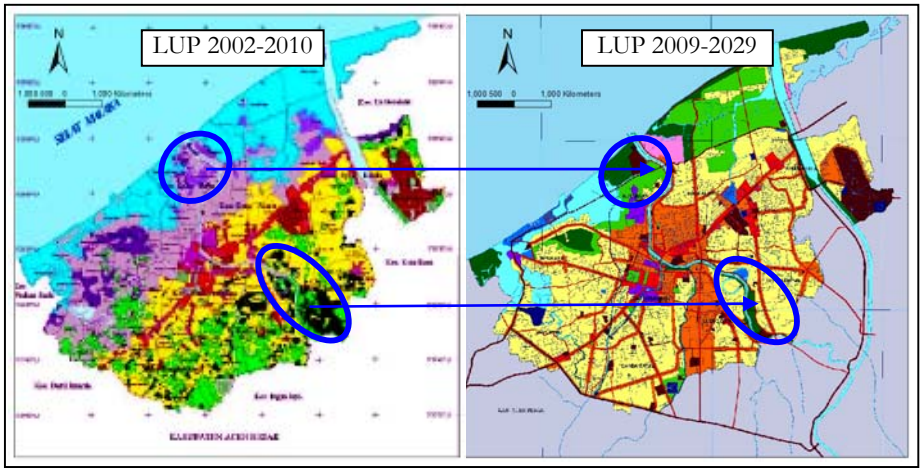


Figure 5.15: Changes in land use from protected areas to residential areas in Ulee Kareng sub-district (Source: BAPPEDA Kota Banda Aceh, 2010)

Among three districts that were relatively not affected by the tsunami, Ulee Kareng is the most prominent destination for people to migrate. This sub-district located around 3.5 kilometers from the city centre has become a favorite destination for migrant people.

As it is located in an area safe from tsunami, the demand for housing in Ulee Kareng was high within three years. The number of housing has significantly increased by 64. 45% from 2.540 houses in 2004 to 4.177 houses in 2007 (Driska, 2007). The local government has provided housing for government employees. The private developer has also developed housing complexes in this sub-district, while the NGOs have facilitated and supported people to get houses in Ulee Kareng. As a consequence, many areas were reclassified as residential. The high demand for housing also increased due to the establishment of this sub district as new residential development areas by the LUP of Banda Aceh 2009-2029.

b) Impact on land tenure

As mentioned previously, the disaster has resulted in changes in the land use in Banda Aceh. The changes in LUP resulted from the implementation of Law No. 26 Tahun 2007 concerning Spatial Planning and Law No. 2/2007 concerning Disaster Management in Indonesia. Some changes in the newest LUP 2009-2029 of Banda Aceh have included the publishing of restrictions and responsibilities applied to the related "zones". Example, to build the house on the parcels which are located in open space along the coast are restricted except with the permission from government.

Based on the landowners surveyed, 50% of respondents in Gampong Pie village said that they are restricted to construct a house on their land. Of the respondents in Ilie village, 52% said that they should not build their house to close to the road, while in Punge Jurong village all respondents argues that they do not have any restrictions on using their land due to published LUP of Banda Aceh since 2005.

During the recovery phase, the GoI provides the relocation and re-settlement as a form of compensation for those who lost their land and do not want to return back to the original place or for those whose land were affected by infrastructure construction (e.g. road, bridges, harbour, etc) based on spatial planning. In 2007, the BRR built roads and 2 bridges in Ulee Lhuee village so-called Ulee Lhuee Road (ULR) project. BRR (supported by Up Link NGO) paid a total of IDR 3.825.897.000 for:

- acquisition of 3,944 m² of residential lots from 13 land owners, and 2,913.5 m² of damaged fishponds from 6 owners;
- relocation and transfer of 3 small shops including compensation for livelihood losses of the owners of these shops.

These compensations are in accordance with Law No. 48/2007 which states that for those whose land was lost and destroyed by the tsunami, either registered or not registered, will get compensation or resettlement from local governments or BRR.

c) Impact of land value

- **Land value based on land taxes data.**

In the study areas, the value of land tax has been increasing. In Gampong Pie village, the land value increased by 316% from IDR 30.316 in 2004 into IDR 149.934 per square meter. In the same period, in Punge Jurong village, the land value also increased by 174% from IDR.48.000 to IDR. 162.025, while in Ilie village the increase of land value was up to 201%.

Aside from the appraisal of the land value, the land taxes office of Banda Aceh also appraised building value. The data shows that the average building value also increased by 51% from IDR 241.813 m² in 2004 to IDR 365.000 in 2007. Meanwhile, in Ilie village the building value increased by 26% from IDR 227.898 to IDR 372.645 (Table 5.3 and Figure 5.16).

Table 5.3: The average of land and building tax value in the study areas

Name of Village	Average Land Tax Value (per m2) (IDR)					Average Building Tax Value (per m2)				
	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008
Gampong Pie	30.316	44.871	69.268	243.577	149.934	241,813	272,542	248,485	365,000	no data
Punge Ujong	60.66	67.97	111.05	170.21	105.78	295,142	319,576	380,008	426,173	387,518
Ilie	21.44	21.44	38.50	85.25	85.25	227,898	225,018	258,926	291,453	289,475

(Source: Land Taxes Office, 2010)

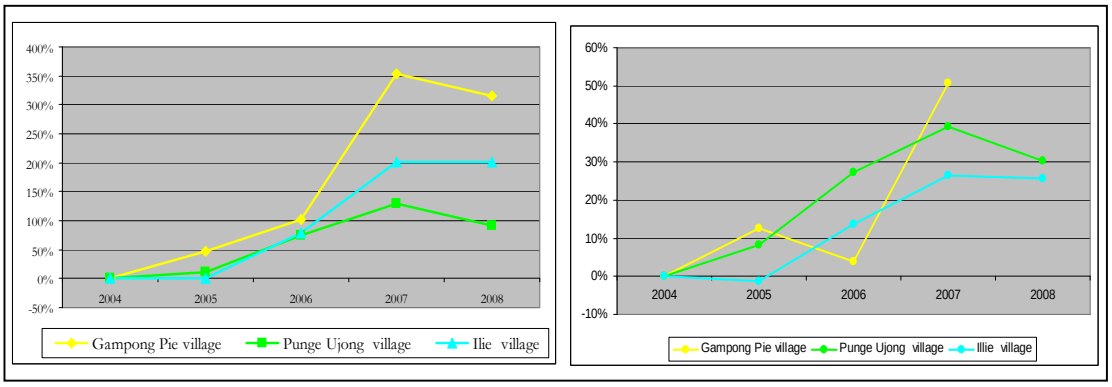


Figure 5.16: The increase in land and building tax value in the study areas (% changes over 2004 levels) (Source: Land Taxes Office, 2010)

Based on Figure 5.16, the increase in building value in Punge Jurong is higher than that of the other two villages. This suggests that many people have improved their buildings either in terms of either quality or size of their building.

- **Land market value**

After the earthquake followed by tsunami in 2004, the GoI was prohibited land transactions. However, land transaction persisted such as in Ilie village. The land market value was increased significantly since 2004. In four years it increased by 250 % (Figure 5.17). According to the notary, this was caused by the Ilie's location which is safe from tsunami. Another influence is coming from road built that pass by the village.

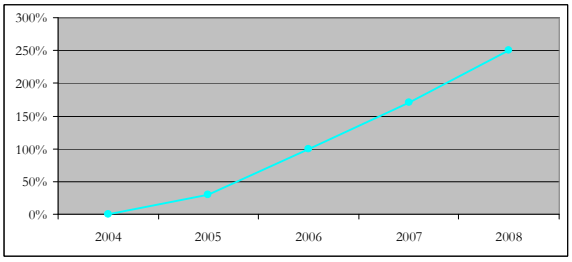


Figure 5.17: Changes of land market value in percent in Ilie village (Source: Notary, 2010)

Detailed data concerning the impact of the disaster to land market value in Gampong Pie and Punge Jurong could not be collected from the notaries interviewed due to confidentiality. However, both notaries surveyed reported that from 2005 to 2009, the land prices in both villages decreased. In contrats, since 2010, the land prices in these villages have been increasing. However, according to the head of the village, in Gampong Pie (located in yellow zone), the land price has been increasing around 50% from 2005 to 2010. In the same period, the land price in Ilie village (Ulee kareng sub-district) has been increasing up to 100%.

According to landowners, 50 % out of 40 respondents said that land price in Gampong Pie village has been increasing around 30% on average from 2005 to 2010. In the same period, 60% out of 25 respondents in Punge Jurong village said that land price has been increasing by 54% on average. Meanwhile in Ilie village, 84% of respondents said that land price has been increasing 60% for the same period (Figure 5.18).

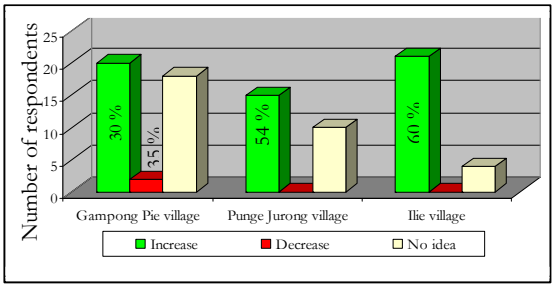


Figure 5.18: The changes of land price in percent after disaster based on of landowners' opinion.

Regarding the impact of LUP of Banda Aceh to the land market value, one notary surveyed said that the increase in land price in Ilie village has also been influenced by the newly built roads that pass by that village. According to the head of the village, the land price in Ilie village has been increasing up to 100% from 2006 to 2010. In Punge Jurong the land price has been increasing up to 110 % due to the establishment of LUP of Banda Aceh. While in Gampong Pie village, there is no impact on this.

According to land owners surveyed, 80% out of 25 respondents in Ilie village said that the revised LUP from 2006 to 2009 has caused the increase in land price by up to 40%. In contrast, only 16% out of 25 respondents in Punge Jurong village said that land price has increased by around 50% due to establishment of LUP while in Gampong Pie village; all respondents said that they have no idea on the impact of established LUP to the land price (Figure 5.19).

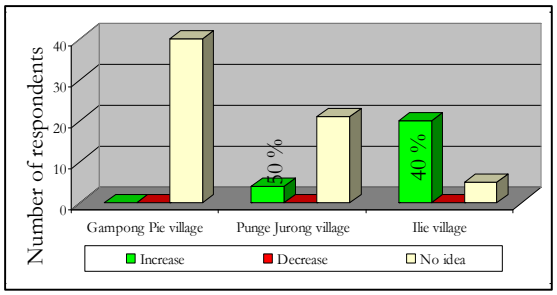


Figure 5.19: The changes in land price due to the establishment of LUP based on landowners' opinion.

5.4. Integration between Disaster Risk Management and Land Administration and Impact on Land in Padang and Banda Aceh

This section provides a comparison between Padang and Banda Aceh cases resulting from the assessment of the integration between DRM (risk information and prevention and mitigation) and LA (land use planning and cadastre) (subsection 5.4.1) and the impact of natural disaster (earthquake and or tsunami) on land (subsection 5.4.2).

5.4.1. Integration between disaster risk management and land administration in Padang and Banda Aceh: a comparison

The comparison of integration between DRM, LUP and cadastre in both study areas is shown in Table 5.4.

Table 5.4: Comparison of integration between DRM, LUP and cadastre in study areas

Indicators	Good Practices	Padang	Banda Aceh
Policy			
Existence of policy on DRM and LA	Policies and adequate technical regulation exists	Yes	Yes
Method in formulating the policy in local level	The policy formulation uses bottom-up method which allows the community to be actively participate.	DRM: Yes **(**mixed method) LUP: **No** Cadastre: No	DRM: Yes (mixed method) LUP: **Yes** (mixed method) Cadastre: No
Existing regulations are support each other	Provides clear guidelines: ▪ To integrate hazard/risk information to LUP, ▪ To use cadastre as implementation tool of risk based-land use plan, ▪ Allow cadastral data to be used in DRM activities.	▪ Yes ▪ Cadastre only plays a minor role. ▪ No	▪ Yes ▪ Cadastre only plays a minor role. ▪ No

Organizations arrangements			
Integration between involved organizations	Cooperation and communication exists among involved organizations and work well together.	Yes	Yes
Job and responsibility	Involved organizations have clearly job and responsibilities.	Yes	Yes
Data and platform used for sharing data			
Standardization of data	Data is Standardized (in term of scale, projection system, and visualization)	DRM: No LUP: Yes Cadastre: Yes	DRM: No LUP: Yes Cadastre: Yes
Data sharing among involved agencies	Necessary and required data are shared among the involved organizations	Yes	Yes
Platform used	Internet is used by involved organizations for sharing data.	DRM and LUP: **No,** by bureaucratic procedure and personal contact Cadastre: No	DRM and LUP: **Yes** (through GIS forum) Cadastre: No
Involvement of external agents			
Involvement of academicians	Academicians (e.g. universities) are involved in DRM and LA activities	DRM: Yes LUP: **Limited** Cadastre: **No**	DRM: Yes LUP: **Yes** Cadastre: **Limited** (through land forum)
Involvement of NGOs, professional associations and the community	NGOs, professional associations and the community play an active role in DRM and LA activities	DRM : Yes LUP : **Limited** Cadastre : **Limited** (only private company)	DRM : Yes LUP : **Yes** Cadastre : **Yes** (through land forum)

In Banda Aceh the risk map, LUP and other related DRM and LUP data from local agencies in Banda Aceh have been made publicly available. The user can download the required data through the Internet for free. Moreover, the bureaucratic procedure applied in each agency also have made data available either paper based or through the website. These conditions bring the transparency and accountability and could serve better information to the people. The external agents (academician, NGOs and community) play significant roles in formulating the policies of DRM, LUP and the community get involved in cadastral activity. In Padang, on the other hand, all such data are not made publicly available yet. The risk map is not published and the LUP is still published in paper and bureaucratic procedure is needed to get such kind of information.

Accordingly, DRM, land use planning and cadastre in Banda Aceh are more integrated than in Padang. The existence of BRR, as the organization in charge during reconstruction and rehabilitation after the 2004 tsunami has become one of the driving factors for better integration among local government agencies in carrying out their tasks and in serving the people in Banda Aceh.

5.4.2. Impact of natural hazard and risk-based land use plan on land in Padang and Banda Aceh: a comparison

- **Changes on land use:**

In both cases, the most obvious changes in response to the disaster is change in city centre. The local government of Padang city has transformed the city centre into six locations through their spatial plan (see Figure 5.3). The purposes are to reduce the density of population and to stimulate the development in new-planned locations. As mitigation action, the government has been modifying some building which may be used as temporary shelter in the event of another tsunami (see Figure

5.4). Similarly, the local government of Banda Aceh has transformed their city centre into four locations (see Figure 5.14). As a mitigation plan, some areas along the coast are prohibited for development activities and enacted as a mangrove forest and open space areas through zoning regulations (see appendix G).

- **Changes on land tenure:**

In Padang, the adverse impact of earthquake in land tenure could be related with the inheritance issues. In case land is not registered yet and the land owner passed away due to an earthquake, the heirs become more vulnerable to loss of their land. The earthquake also could destroy the parcel boundaries, especially in the dense settlements such as along the coast in Padang. The edges of the building often serve as parcel boundaries. In cases when buildings are totally damaged, parcel boundary disputes may occur. There are around 53.596 parcels located in high risk areas (see section 5.3.3 (b)) but so far, there are no related-report/documents publicly available related with land disputes or inheritance issues resulting from an earthquake. The impact of risk information could also not be determined because the risk map is not publicly available.

Regarding the impact of LUP to land tenure, forest areas (buffer zone) were enacted as protected areas. Consequently, all the parcels located within those areas could not be registered because the certificate of land title can only be issued if the land use of those parcels is in accordance with the existing LUP.

In Banda Aceh, the 2004 tsunami has caused the disappearance of landowners and land parcels, destruction and loss of land parcel boundaries, loss and severe damage of land documents, loss of documentary evidence of mortgage and damage of cadastre infrastructures (e.g. land local offices) including death of some BPN staff. All those adverse impact to land tenure also generated other land- related issues such as finding the new locations for temporary shelters and relocation/resettlement program, land grabbing, inheritance, etc. To responds to the disaster might occur in the future, the local government established new risk-based LUP. The new risk –based LUP zoned the areas (especially located along the coast) as open space and mangrove forest. As a consequence, the landowners of the parcels located within these areas got new restrictions and responsibilities such as limitation to build their house or other development activities without permission from the local government. In Gampong village, 50% of respondents said that they could not build their houses because restrictions imposed by the new risk-based LUP published by the local government.

- **Changes on land value:**

In Padang, the occurrence of earthquake since 2004 and the fear of tsunami which may occur in the future have caused the decrease in land value in high risk areas (red zone). According to the head of Air Tawar Barat village, which is located in the coast and classified as high risk areas for tsunami, property price reduced by up to 27% from 2005 to 2008 and until 2010 by around 50 %. Also, many owners could not sell their property because there are no buyers. At the same time, the value of land located outside the hazard areas, such as in Cengkeh village, increased by around 27% from 2005 to 2008 and until 2010 by around 60%. These were caused by high demand for new properties and land due to (among others) many people migrating from high risk to the areas safe from tsunami (subsection 5.3.4 (c)). The established LUP distributes the city centre of Padang into several locations. The government office complex is planned to be moved from its existing location to Air Pacah (located to the east part from the existing location). This zoning plan has been increasing the land price located in the new government complex.

In contrast with the condition in Padang, In Banda Aceh, land prices in Gampong Pie village which is located in high risk areas for tsunami has been increasing. According to the head of the village, the land price in Gampong Pie increased 50% from 2005 to 2010. On the other hand, the land price in Ilie village, located in areas safe from tsunami, increased by up to 100% due to high demand for housing including other supported activities such as trading and any residential-related business activities. This condition is supported by the establishment of LUP which enacted this village as one of the new residential classes.

In summary, the impact on land in the study areas is shown in the Table 5.5.

Table 5.5: The impact on land in both two study areas

Indicators	Good Practices	Padang	Banda Aceh
Changes on land use	Land use is in accordance with risk based LUP	Distribution of city centre, modifying the function of public buildings.	Distribution of city centre, limitation of developments in high hazard prone area.
Changes on land tenure (ownership).	Increased land tenure security	Parcel located in forest area (buffer zone) could not be registered by the cadastral office.	Parcels in open space and city forest area were registered (by RALAS).
Changes on land value	▪ The increase in land value in safer areas is higher than in hazard prone areas. ▪ Compensation exists for vulnerable people in hazard prone areas.	▪ Land price in high hazard areas has been decreasing ▪ Compensation exists for victims.	▪ Land price in high hazard areas has been increasing ▪ Compensation exists for victims.

5.5. Concluding Remarks

In Padang and Banda Aceh, the existing policies regarding DRM (risk assessment and prevention and mitigation) and LUP have already been integrated. Unfortunately, the regulation of cadastre does not fully support LUP and risk assessment yet. The cadastre data which could be shared is limited only to some particular issues in LUP such as in resettlement/relocation by bureaucratic procedures due to confidentiality of the data as regulated by the Land Registration Act.

In Padang, top-down approach is the method used in the policy formulation. The organizations involved in DRM and LA have been cooperating with each other. Each agency has a clear job and set of responsibilities. The data are already standardized and geo-referenced. Bureaucratic procedure and personal contact are methods used for sharing data among organizations involved. The risk maps and hazard zoning are not officially published. However, the local government has disseminated the evacuation map through the Internet, billboards and in meeting forum. The community, NGOs and academicians only play minor roles in the implementation of risk assessment, LUP and cadastre.

In Padang, the earthquake and fear of people due to tsunami might occurs in the future has indirectly changed the land use classes in Padang. Some of the owners left their houses in high tsunami-risk zones to go to safe areas (eastern part of the city). As a consequence, some land use classes (unused land, non-irrigated rice field, bush and farming uses) in these areas have changed to residential due to high demand for housing. The impact of LUP to land tenure is related with the parcels which are located in the buffer zone. These parcels could not be registered by cadastre. This condition may result in informality settlement and reducing land tenure security of owners. Meanwhile, there is a

reduction in the price of land located in high hazard zone in the coast. In contrast, the land price in the safe areas increased.

Meanwhile, in Banda Aceh, the policy formulation follows top-down method, except in formulation of LUP follows mixed (top-down and bottom-up) method. The organizations involved in DRM, LUP and cadastre have also been cooperating. Each agency has clear job and responsibilities. The data are already standardized and geo-referenced. Bureaucratic procedure and personal contact including internet network (website) are methods used for sharing data among the organizations involved. The community, NGOs and academician play major roles in formulation and implementation of risk assessment (DRM), LUP and cadastre.

In Banda Aceh, the 2004 earthquake and tsunami have changed some land use classes in tsunami-affected areas such as transformation some areas to mangrove forest areas. Some development activities are limited and some are restricted through zoning regulations from LUP by requiring permits. Owners are limited to build their houses on their land. On the other hand, the established LUP has also reclassified some forest protected areas located in safe areas for residential purposes. Owners are allowed to build the houses in these areas. The hazard and LUP also changed the value of the land. In contrast with the Padang case, land prices in high hazard areas (e.g. Gampong Pie village) have been increasing after the tsunami although the increase was not as high as the increase in safe areas (e.g. Ilie village).

The gaps between theory and practice concerning the relationship between risk assessment, LUP and cadastre and the discussion concerning their impact on land will be described in next the chapter.

6. DISCUSSION

In this chapter, the gaps in integrating DRM and LA in the study areas are discussed (section 6.1) based on the assessment in chapter 5. The gaps in the relations between DRM (risk assessment, prevention and mitigation) and LA(LUP and cadastre) were identified and presented by comparing the real conditions in the two study areas with their roles theoretically as described in chapter 2.3 which is diagrammatically shown in Figure 2.5. This chapter ends with a discussion concerning the findings of impact of risk-based land and natural disaster use plan on land in the two case study areas (section 6.2).

6.1. Gaps in Integrating Disaster Management and Land Administration in Padang and Banda Aceh.

6.1.1. Risk assessment, prevention and mitigation and land use planning

a) Risk information as input to the land use planning processes

In Padang:

The major gaps in this issue are organizations arrangement and data and sharing of data.

The gap in organizations arrangement concerns the lack of cooperation between local agencies with (some) other agencies. As an example, the risk map made by the Ministry of Marine and Fisheries Department, as used in this research, is only used for their own purpose (i.e., in identifying shelters to be used during emergencies). Because this is not made available to other agencies, duplication of work is possible. In case the LUP agency (or other agencies) makes another (similar) risk map, the result might be different. This condition can cause uncertainties because the maps produced may be conflicting and this can cause confusion as to which source is more reliable and should be used.

Meanwhile, the sharing of data could also be considered as another gap. The local government did not officially publish the risk map. According to the information from a BAPPEDA officer, one of the reasons is to avoid panic which might happen if this information is officially published. The author argues that hazard-related information needs to be made publicly available. The hazard level zones are important information so that the residents are better prepared in case another earthquake occurs in the future.

The importance of making the hazard/risk map publicly available was also addressed by NGOs. JJSB *(Jaringan Jurnalis Siaga Bencana Indonesia*/Indonesian Disaster Preparedness Journalist Network), one of the national NGOs has asked the government to publish the risk map for all disaster prone cities throughout Indonesia. According to the data from KOGAMI as cited in (SIGAP, 2010), 534.878 people live in high risk areas for tsunami within North Sumatera province. Among them 380.402 people live in high risk areas for tsunami in Padang city while the rest are spread in the district of Pesisir Selatan (36.980), Pasaman Barat (29.649), Pariaman (25.029), Padang Pariaman (24.861), Agam (20.644), and in Mentawai Island (17.313). Accordingly, the risk/hazard maps need to be published to be used by NGOs as a guide in delivering aid to vulnerable groups. This is also to increase the awareness of people who live in high hazard areas. The importance of sharing data to

reduce the disaster risk is also highlighted in Hyogo Framework for Action. Local authorities and communities need to be empowered to have adequate access to necessary information.

In addition, people also know whether they live in high risk areas. Based on the land owner's survey, 98% of all respondents already know the escape routes in case of a disaster. This information was obtained from pamphlet/brochure distributed by local government authorities and NGOs.

In Banda Aceh:
The data (scale of the risk map) could be considered as a gap. The risk map was made at a scale of 1:50.000, while LUP was produced at a scale of 1:15.000 and 1:5.000. As a consequence, the planner could not use it directly to be superimposing it into the in LUP processes. Only general overview of the risk areas could be identified which might not be accurate enough to define the risk zones areas in the LUP processes. Even though the risk map is officially published and the people could access freely, users could not precisely identify high hazard areas because the scale of the risk maps is not detailed enough.

Aside from the spatial unit and scale of the risk map, there are different classifications of the scale level of water depths of inundated areas shown in the risk maps of Padang and Banda Aceh. In this regard, it would be better if the classification regarding the level of the risk is standardized nationally in order to avoid misinterpretations by users.

b) Land use planning in disaster risk management activities
As described in previous chapter 2.5, Fleischhauer, *et al.* (Fleischhauer, et al., 2005) mentioned that spatial planning has four possible roles in disaster risk reduction: 1) restricting certain areas from new constructions; 2) distinguishing possible land uses for hazard prone areas; 3) arranging and legalizing the land use or zoning plans with legally obligatory status; and 4) modifying the impact of hazard.

In the case of Padang, only the third and fourth options could be implemented effectively. The first and the second options are nearly impossible to be implemented because the hazard prone areas are already built up areas. LUP of Padang has been applying structural measures by providing the escape route and modifying the functions of high buildings in case of a tsunami.

In Banda Aceh, on the other hand, all four options can possibly be implemented. After the tsunami, the areas along the coast became empty land and the government had a chance to implement all those options. GoI planned through the Master Plan of Reconstruction and Rehabilitation of Aceh and Nias Island- North Sumatera Province that the area along the coast is classified as green area. Unfortunately, this plan could not be implemented due to lack of coordination among the organizations involved during implementation of reconstruction and rehabilitation in Banda Aceh as indicated in the Master Plan.

6.1.2. Land use planning and cadastre

a) Zoning plans impose RRRs and change the use and value of land
In this role, the policy formulation, sharing of data and the involvement of external agents (community) could be considered as gaps in Padang.

According to the good practices criteria, the bottom-up method is supposed to be used in formulating the LUP. The method allows the community to participate in policy formulation. As mandated in the Spatial Planning Law as described in chapter 5.2.2.3, it is clear that in LUP processes, the community should be involved (Article 65, 2 (a)). With this, the community can ensure their participation in formulating, implementing and monitoring of LUP processes.

In Padang, zoning regulation is applied through permits issued by local government agencies. However, all respondents in Padang said that they do not have any restrictions on their land. The existing LUP also does not indicate the impact of changes on land use and land value. According to the head of the three villages interviewed, this condition happens because the existing LUP is not published to the community.

In Padang, the community only plays a role in implementation and in monitoring processes of the published LUP. Therefore, in Padang, the community is not fully involved in policy making regarding LUP yet. Participation of the community helps the planners to understand the local condition and the needs of the community. By allowing the community to play an active role in policy formulation, the awareness of community will increase and result in successful implementation.

In Banda Aceh:

The combination (top-down and bottom-up) method used was considered as a breakthrough in LUP system in Banda Aceh. However, the zoning regulation in the LUP 2009-2029 could not be fully implemented yet. Some areas were classified as open space areas (green area). Residences are not allowed in these areas. However in practice, houses exist in some of these areas (see Figure 6.1).

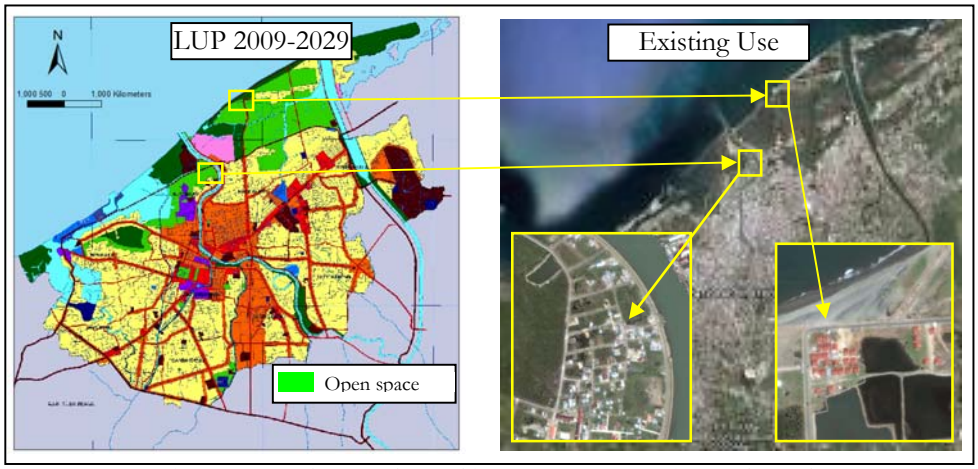


Figure 6.1: Settlements located in open space areas in Banda Aceh
(Source: BAPPEDA Kota Banda Aceh, 2010 and Google Earth, 2010)

During implementation, the zoning regulation by LUP could not impose the restriction and responsibilities over the land effectively yet. The lack of binding power and participation of the community during implementation and lack of human resources are the reasons why the LUP system in Banda Aceh could not support the objective of Indonesian land policy yet (Abdulharis, 2006).

b) Cadastre as planning tools of LUP

Considering to the BAL and Basic Forestry Law as described in section 5.2.2, land located in forest areas could not be certified. However, in case the land use of a parcel located in such areas is not in accordance with the existing LUP, the regulation that prohibits the land to be registered is still weak at the implementation level. Take for example registered parcels in mangrove and open space areas in Banda Aceh. As a consequence, (Kaufmann & Steudler, 1998) states that "Cadastre 2014 will show the complete legal situation of land, including public rights and restrictions" could also not be achieved and implemented yet because all restrictions and responsibilities over the land coming from LUP are not registered yet. Therefore, the cadastre as planning tool as mentioned by (Ting & Williamson, 1999) (see section 2.5), could not be fully implemented yet both in Padang and Banda Aceh in particular and in Indonesia in general.

c) Cadastre is sound base information for LUP processes

In this role, the data and sharing of data could be considered as a gap in both study areas. The cadastral map in Indonesia (including Padang and Banda Aceh) uses the Transverse Mercator 3° (TM3°) projection system. On the other hand, the LUP use Universal Transverse Mercator 6°. Therefore, the zones in LUP could not be directly overlayed to cadastral map. Similarly, the cadastral map also could not be used directly (in case it will be used in LUP processes). This condition could also be considered as ineffectiveness for Indonesian coordinate and projection system in general.

In addition, according to the Land Registration Act, the cadastre data could only be shared with the permission from the Ministry of Agrarian Affairs or Head of the National Land Agency or from their designated officers. The complex bureaucratic procedures could cause inefficiencies in the sharing of data among the organizations involved.

Based on these reasons, it can be concluded that the role of cadastre as sound base information in LUP processes as described previously in section 3.2.2 (d), could not be fully implemented yet both in Banda Aceh and in Padang due to inappropriate regulations. Therefore, it is recommended that regulations should be made which would allow the necessarily cadastre data (e.g. parcel size, parcel location, land value, land use) to be shared and made publicly available while the information concerning land owners is not necessarily to be published due to privacy reason.

6.1.3. Risk assessment, prevention and mitigation and cadastre

a) Hazard zoning imposing right, restriction on land and responsibility of land owner

As described in subsection 3.2.2, restriction and responsibility in hazard zoning map could affect the landowners in some countries (e.g. Switzerland).

In Banda Aceh the risk maps are used only as a source of hazard-related information which can be made publicly available. Meanwhile, in Padang, the risk map is not even published officially. This may bring uncertainties and lack of information due to hazard zoning for users who need the hazard information as their consideration in taking some rational action related to their investments. It was also listed in Hyogo Framework for Action that developing, updating periodically and disseminating the risk maps and other related information to decision-makers including to the communities are key activities to reduce disaster risk and increase their resilience.

The restriction and responsibilities for land owners in both Banda Aceh and Padang applied indirectly through risk-based LUP. The main gap is the absence of the policy/regulation which enables the hazard zoning to be applied at the operational level.

b) Cadastre data as input data in risk assessment processes

In this role, the policy, organizations arrangement, data and sharing of data could be considered as gaps both in Padang and in Banda Aceh.

As described in section 5.2.2 (b), there are two organizations involved in land registration in Indonesia: national land agency (BPN) and land tax department. The data recorded in national land agency is the cadastre data for legal purposes (e.g. name of the owner, type of ownership, address and geographic location of the parcel including size of the parcel) while the data recorded in land taxes department are the data for taxes purposes (e.g. name of the owner and user, address and geographic location of the parcel including size of the parcel, land and building value). In fact, both agencies map land parcels for their own purposes. As a consequence, often the resulting information (parcel boundaries and sizes) are different. The absence of data sharing between BPN and land tax

departments also could become as an obstacle for implementing the cadastre as sound base information.

Theoretically, the cadastre data (e.g. parcel map, land value and building value) could be used as element-at-risk data for detailed risk assessment processes (see section 3.1.1 (c)). In practice, however, this function is not being implemented yet in both Padang and Banda Aceh. There are two reasons for this. First, risk assessment in Padang and Banda Aceh was done at a small scale, so the cadastral data are not used at this level. Second, regulations to get the data from BPN and land taxes department need complex bureaucratic procedure. These conditions result in difficulties in using cadastre data as input data for risk assessment.

The absence of regulations for sharing of data which can be implemented effectively at the operational level would cause difficulties in integration among them. Integration of several land registration agencies into a "one-stop shop" allows customers efficient access to information (FAO, 2007). A single responsible agency can reduce overlapping legal activities and save on operational expenses. However, the integration of organizations involved could still be achieved without creating a "one-stop shop" by implementing and linking their respective information systems.

a) Cadastre in prevention and mitigation activities

In Padang, the gap is inappropriate land policies in practice.

In both cases, the function of cadastre is to register the land tenure. In Banda Aceh, the cadastre office registered the parcels even though it's located in restricted areas (through LARAS program). But in Padang the cadastre cannot register parcels located in forest areas (mostly customary land) which defined as buffer zones by land use plan even though the owners have already been living there before the land use plan established. Unregistered parcels, especially for those are located in buffer zone areas in Padang make the cadastre cannot perform their function as sound base information of planning in disaster risk reduction completely since the cadastre cannot reflecting the reality tenure on these areas.

Moreover, the local government also cannot issue the building permits in these parcels. This could create the informality settlements and decrease land tenure security which make the landowner become as vulnerable group in case the earthquake occur in the future due to unregistered their land rights in a formal land registration system.

There exists a local government regulation concerning the recognition of customary land (*Ulayat* land) made by West Sumatera provincial government in Padang. However, it could not be implemented yet. Accordingly, the author argues that there is a need of appropriate regulations which enable the parcels located in forest areas (including customary land) to be registered formally to be made available in Indonesia.

6.2. Impact on Land in Padang and Banda Aceh.

As result of the assessment, there are two different phenomena that could be observed from both study cases.

- **In Padang**

Since 2006, Padang has been hit by several earthquakes and residents living along the coast (Air Tawar Barat village) are afraid that a tsunami may occur in the future. As a result, many houses along the coast were abandoned. Meanwhile in Andalas (located in medium (orange) hazard zone) and

Cengkeh (located in low (green) hazard zone) villages, the result of the surveys shows that in these villages, none of the inhabitants want to move from their houses. Regarding to the land tenure security, all the respondents in Andalas and Cengkeh villages feel secure with their rights on land.

As mentioned in section 5.2.4, most of the high hazard areas are dominated by residential areas (see Figure 5.6). The tendency of people to move to safe areas caused the change in land use and land value in Padang. This is a driving force that motivates people to migrate from high to lower hazard areas. As a consequence, the land use, especially in both areas (high hazard prone area and safe areas) has changed. In safe areas, the residential area has been expanding. The demand for housing is high in safe areas while the available land is declining. This has resulted in increasing land value in safe areas. This condition was supported by the local government through the new LUP aimed at distributing the city centre and providing adequate public infrastructures such as roads, markets, etc. Therefore, the new LUP becomes another driving factor which supports the people to migrate voluntarily, even though the resettlement and relocation program does not exist in Padang.

- **In Banda Aceh**

Soon after the 2004 tsunami was over, the GoI together with NGOs provided the relocation and resettlement for those who lost their land due to adverse impact of tsunami or due to the impact of reconstruction and rehabilitation activities including for those who do not want to return to their original residences. As a consequence, changes in land uses classes could not be avoided. The government has distributed the city centre and provided adequate public infrastructures. The city forests in the southern part of city were protected areas before the tsunami and became planned for residential areas. In contrast, some development activities were prohibited through zoning regulation in areas previously classified as residential areas. High demand for housing in safe areas has been increasing the land value. Surprisingly, the land price in high hazard areas has also been increasing. The return of some people to their hazardous place may be a driving factor in the increase in the land value in Banda Aceh.

The 2004 earthquake and tsunami resulted in complex physical, economical and socio-cultural problems. The trauma, unsafe from tsunami and the willingness to return to their normal lives have forced some of the affected people to migrate elsewhere to find alternative places which have better public and social facilities. The migration of residents was also followed by economic actors such as traders and service providers who also brought their businesses in areas safe from tsunamis. However, in Banda Aceh, many people returned to their original residences even though they realized that they live in areas with high hazard areas for tsunami. Of the respondents in Gampong Pie, 60% said they do not want to move from their land even though all of them already know that their lives are at risk.

According to the two different situations concerning the land value in high hazard tsunami areas and differences in response in terms of choosing to leave or to stay leads to the question: what factors may influence the differences in the two case studies? Why did some people in Banda Aceh (even though they have experienced the adverse impact of tsunami) decide to return back to their homes which are considered high hazard for tsunamis instead of moving to safer areas either voluntarily or by resettlement? Why many people in Padang leave and want to move from their houses even though the local government did not provide the resettlement/relocation program directly as in Banda Aceh?

According to these questions above, some reasons that could be highlighted are related with: 1) the support of financial aid; 2) resettlement/relocation program, 3) risk-based land use plan; 4)

coordination among organizations; 4) livelihood advantages and 5) the trauma of people due to disaster itself.

1) The support of financial aid

Regarding the increase in land value in Banda Aceh, the huge financial assistance funding coming from national and international level for the reconstruction and rehabilitation program influenced the land price in Banda Aceh. The increase in demand on land for relief housing, new roads, harbour and other public infrastructures while at the same time, supply of the land has reduced caused the increase in land value in Banda Aceh.

2) Resettlement/relocation program

The author argues that resettlement and relocation program is one of the solutions to reduce the vulnerable group of disaster-affected people. In fact, such programs were implemented in Banda Aceh by the government (through the BRR) in cooperation with international and national NGOs. However, those programs also need to be supported by socio-economic development programs such as by providing programs for developing appropriate skills of members of the community. This is often overlooked by the stakeholders involved. The government and NGOs involved with their knowledge and technology are often applying a standard programme and leave the community to survive when the program terminates. As a result, disaster-affected people often return back to the prohibited areas (Pantellic & Srdanovic, 1992). Lack of basic infrastructure services for their livelihood such as water, drainage system, roads and lack of community involvement are factors which can influence the success of resettlement and relocation programmes. The choice of safe relocation sites for vulnerable groups needs to be connected with infrastructure networks.

Moreover, this provides opportunity for the community to participate actively in the resettlement and relocation program. The community (both displaced community and host community) needs to become active participants to help them for their future livelihood. This is also to reduce the potential conflict might occur concerning the livelihood and to ensure that the displaced community get an equal access to the markets and services (Mitchell, 2010)

3) Land use plan

It is clear that enacting hazard prone areas as open space area and to be keep free from development through risk-based land use plan was also intended to protect the people from future hazards. Unfortunately, the Master Plan for Banda Aceh was published one year later. It was out-dated already and too late to be implemented. One year after the disaster, the recovery process has already built enormous physical infrastructures in affected areas including along the coast in Banda Aceh. This was supported by hundreds of NGOs involved which came with their international and national financial capability. Soon after the disaster, the affected people helped by the NGOs started to build their houses in their original land including some escape buildings and hill for the community as their structural mitigation. At the same time, the government and NGOs also trained the people how to escape from the tsunami in the future. With these, the people feel confident to take the risk of future tsunamis. Accordingly, the Master Plan no longer reflected the reality on the ground.

Out-dated information and discrepancies with actual conditions resulted in failed implementation of the risk-based land use plan. In Padang, even though the local government has been building an escape building which is not finished until now (as explained in section 5.2.2 (a)), some people have already decided to move voluntarily to safe areas. They cannot wait further and decided to move to avoid the adverse impact of disaster which might occur anytime.

4) Coordination among involved agencies

In the case of Banda Aceh, the government has the opportunity to re-arrange the zones following the risk-based land use plan. Residential along the coast could be avoided by imposing the restrictions through zoning regulations. Unfortunately this opportunity cannot fully be achieved. Soon after the emergency response is over, the next step is the recovery process. The reconstruction and rehabilitation was the main focus of the GoI. They focused on returning the condition to normal as quickly as possible. Because of this, the government often overlooked their long term goals (as enacted in their risk-based land use plan) and would realize it when the recovery process was almost done. This condition was exacerbated by the lack of coordination among government agencies and hundreds of NGOs involved in the reconstruction and rehabilitation process. After GoI established the BRR, the implementation of reconstruction and recovery process was more coordinated and integrated.

5) Livelihood advantages

Moreover, many who returned to their land located along the coast find it more advantageous to live there, even if the place is hazard-prone rather than go to the resettlements. An example is for fishermen to want to continue to live along the coast rather than relocate far away from the sea, which is their main source of livelihood. It would be costly and time consuming for them to go to the harbour. On the other hand, for the people who are not fishermen the resettlement is a choice to avoid the adverse impact of future disasters (this may be the reason why in Padang more people moved voluntarily to the safe areas).

6) The trauma of earthquake and tsunami

In Padang many people move due to avoid and feel fear of tsunami. Meanwhile, many people in Banda Aceh have put behind them the bad experience from the tsunami and have accepted the risk to be granted. This argument was supported by the opinion of Bukhari, the expert in property and land investment in Banda Aceh as cited in www.siwah.com. He mentioned that "two years ago, the number of people moved to the area along the coast has been increasing. Now, around 75% of the tsunami relief houses were occupied. This is the evidence of trauma of community has reduced" (Abdurrani, 2009).

There are other possible reasons behind the differences in the two study areas that need to be addressed for a deeper understanding of the impact of disasters to related land issues. This is included in the recommendation for future research

6.3. Concluding Remarks

Based on the elements of evaluation, the assessment has found out the gaps in the integration of DRM and LA in the study areas. The major issues are having gaps such as: absence of appropriate regulations which allows the cadastral data to be shared with other agencies or officially published; weak of data sharing among the organizations involved which are still using bureaucratic and personal contact approach (in Padang) and lack of involvement of the community in formulating and implementing the land use plan.

From the discussion regarding impact on land, there are two different phenomena could be observed both in Padang and in Banda Aceh. Some people in Padang moved to the area safe from tsunami in Banda Aceh move to the hazardous place. Some reasons that could be highlighted are related with: financial aid, resettlement/relocation program; land use plan; coordination with other agencies involved, livelihood advantages and the trauma of people due to tsunami.

7. CONCLUSION AND RECOMMENDATIONS

This chapter summarizes the conclusions of this thesis based on the objectives and research questions. The aim of this thesis is to enhance the understanding of the relationship between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) theoretically as well as in practice. The desk research and study case analysis in Padang and Banda Aceh were carried out in order to achieve the objective of this research. The result of this research is drawn based on each objective and research question (section 7.1). Finally, some recommendations are given in section 7.2.

7.1. Conclusion

The conclusions are discussed sequentially based on sub-objectives and research questions as follows:

Sub-objective 1: To enhance the understanding of the relationship between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) theoretically.

Q1: What data in LA (land use planning and cadastre) could support DRM (disaster risk assessment and prevention and mitigation) and vice versa?

The cadastre data (e.g. parcel map) can be used as a baseline for risk assessment processes. The information about land use, land value and the information of landowners (if it is combined with census data) could be used as input data in calculating elements-at-risk for defining the level of vulnerability and as input in planning the prevention and mitigation activities to reduce the adverse impact of disaster. On the other hand, the risk information can be used as an input in land use planning processes and may impose the new restrictions and responsibilities over the land. These new restrictions and responsibilities could be made parcel-based and publicly available by cadastre.

Q2: What is the relationship between DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre)?

The relationship between DRM (disaster risk assessment, prevention and mitigation) and LA (land use planning and cadastre) can be seen from the roles among them. Hazard/risk information coming from risk assessment processes could be used as input in determining the zoning in a risk-based LUP process. The risk-based zoning plans impose the restrictions and responsibilities on land which also could change the use and value of land as described in subsection 3.2.2. In some cases, hazard zoning could also directly impose the restrictions and responsibilities to the landowners, changing the property value and limiting the uses of a specified land which are located in the hazard zone areas. On the other hand, LUP plays a minor role in risk assessment. LUP plays a major role in the prevention and the mitigation process such as by providing non-structural measures through zoning and infrastructure regulations.

Basically, LUP processes are still possible without using cadastre data. However, the planner needs updated, accurate and reliable information concerning the real situation of the land to get better plan. In this regards, the cadastre plays as one of the sound base information sources which provide reliable and accurate data for LUP process. On the other hand, cadastre also can make the restrictions and responsibilities regulated by the zoning plan parcel-based and publicly available.

Regarding the role of cadastre and risk assessment, the cadastre can provide information relating to ownership, land use and land value which can be used as input for calculating the elements at risk. Cadastre data that can be used is described in *Q1*. On the other hand, the risk assessment results in hazard zoning which (in some cases) can influence the parcel through restrictions and responsibilities on land. In this regard, cadastre can ensure that these restrictions and responsibilities can be made parcel-based and publicly available. Meanwhile, regarding the role of cadastre in mitigation is that cadastre play indirectly role through land management as an information base.

Q3: What is the framework needed to assess the integration between DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) including impact of their integration and natural disaster on land use, land tenure and land value in practice?

Understanding the relationship between DRM and LA in practice was carried out by assessing the integration between DRM and LA from management perspective model using defined elements and indicators of assessment which were applied through case study.

As described in section 3.3.2, there are no international standard framework for evaluating and assessing the performance of either internal or cross-organization performance in practice. In this research, the policy, organization arrangements, data and sharing of data and the involvement of external agents including impact of their integration on land are the elements used in assessing the relationship between DRM and LA in practice. All these elements were adapted from "good practice" framework developed by (Steudler, et al., 2004) and "CBPs framework" developed by (Chimhamhiwa, et al., 2009). The method used for the evaluation process uses the indicators adapted from the "good practice" method.

Based on the elements and indicators defined in the framework used, it could be found that between DRM and LA in Banda Aceh more integrated rather than in Padang even though both study cases have the same national policy of DRM and LA. In the other words, this framework is applicable for investigating the relationship between DRM and LA in practice. However, other possible elements and indicators may also leads to the different result.

Sub-objective 2: To assess the integration between DRM (risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in practice and the impacts of their integration and natural disaster on land use, land tenure and land value.

Q4: Have DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) already been integrated in practice?

In the study areas, risk assessment, prevention and mitigation and land use planning has been integrated. The existing land use plan has been incorporated hazard information. In Banda Aceh, most of the areas along the coast has planned as open space and mangrove forest areas, while in Padang the local government tries to reduce the density of people along the coast. Some structural measures (e.g. move the city centre, modify the function of public building as temporary shelter, etc.) have also been applied in Padang. Meanwhile, land use planning and cadastre are not fully integrated yet. The cadastre still plays a minor role in LUP processes. The function of cadastre as planning tools and as sound base information could not fully be performed yet as well as the function of cadastre to support risk assessment and prevention and mitigation activities. This is because the absence of regulations which allow necessarily cadastre data (e.g. parcel map, land use and land value) to be publicly available.

Q5: What are the impacts of integration of LA and DRM and natural disaster on land use, land tenure and land value in practice?

Based on the findings of this research, risk-based land use plan has not directly impacted the changes in land use, land tenure and land value in both study areas. A risk-based LUP results from integrating risk information into the LUP planning. However, the risk zones were not spatially shown in risk-based land use plan both in Padang and Banda Aceh. Moreover, it was found also that the natural disaster itself has already been impacting the land use, land tenure and land value significantly more than the risk-based land use plan. The changes in land in both study areas are as follows:

In Padang, the hazard has changed the land use classes. Some of the owners left their houses in high tsunami-risk zone to move to safe areas (mostly eastern part of the city). As a consequence, some land uses classes (unused land, non-irrigated rice field, bush and farming uses) in these areas have become residential due to high demand for housing. The impact of LUP on land tenure is related with the parcels which are located in the forest buffer zone. These parcels could not be registered by cadastre. This condition may bring informal settlement and reduce land tenure security of the owner. Meanwhile, the impact on land value was reduction in the price of the land located in highly hazard zone in the coast. At the same time, the land price in the safe areas increased.

In Banda Aceh, the hazard has changed some land use classes in high tsunami-affected areas such as mangrove forest areas. Some development activities are limited and some are restricted through zoning regulations from LUP through permits. The owners are limited to build their houses for on their land. On the other hand, the established LUP has also changed the forest protected areas located in safe areas to residential which allow the land owners to build the houses. The hazard and LUP also changed the value of the land. In contrast with the Padang case, the land prices in high hazard areas in Banda Aceh have been increasing after the 2004 earthquake and tsunami although the increase was not as high as the increase in safe areas.

Q6: What are the gaps (if any) in integrating DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in practice?

Some gaps exist in integrating DRM (disaster risk assessment and prevention and mitigation) and LA (land use planning and cadastre) in the study areas. The gaps vary depending on the interaction among risk assessment, prevention and mitigation, LUP and cadastre. The assessment has found some major issues concerning the gaps:

- in DRM (disaster risk assessment and prevention and mitigation), the gaps is lack of sharing of data with other among organizations involved such as happen in Padang case where the risk map is not officially published and publicly available.
- in LUP process are: lack of the implementation of risk-based land use plan in operational level; and lack of involvement of external agents (e.g. community) such as in Padang case.
- in cadastre is absence of policy which allows that necessarily cadastral data (e.g. parcel map, land value, land use) could simply be shared with other agencies and publicly available.

7.2. Recomendations

This study aims to enhance the understanding of the relationships between land administration and disaster risk management theoretically as well as in practice. The relationships between them are seen from the interaction between risk assessment and prevention and mitigation (from DRM side) and land use planning and cadastre (from LA side). According to the results of this research, some recommendations are proposed:

- **General recommendations:**

1) It is recommended to have the regulation which allows the necessarily cadastral data (e.g. parcel map, land use, land value) to be made publicly available in the study areas in particular and in Indonesia in general. By this, the other parties/people can get and use reliable and updated information about the legal situation of the parcel. The people also can indirectly contribute to improving the quality and validity of the data by reporting the errors of data shown.
2) The community needs to be made an active participant in DRM and LA activities from the formulation of policy until monitoring and review of the implementation activities in Indonesia. The involvement of the community can increase the legitimacy of decision-making made by stakeholders and can indirectly increase the resilience of those who live in hazard prone areas.

- **For further research:**

1) In this research, understanding the relationship between DRM and LA in practice was seen based on policy, organizations arrangement, data and sharing data, the involvement of external factors and the impact of their interaction on land. In practice, the interaction among them can also be seen from another aspect such as from good governance perspective which includes their impact on land (land use, land tenure and land value) and to the communities. Aside from that, all other possible elements and indicators to assess the relationship between DRM and LA in practice also need to be incorporated for further research.
2) This research does not cover the investigation concerning the reasons behind the factors that influence some people in Banda Aceh to decide to return to their original places even though they realize that they live in high hazard areas from tsunamis. Therefore, there is a need to investigate those factors in both locations which are different in terms of their response to live in disaster areas to get a deeper understanding of the impact of hazard, risk-based land use plan and cadastre in practice.

LIST OF REFERENCES

Abdulharis, R. (2006). *Land Administration in Post Disaster Areas: Study Case of Banda Aceh, Indonesia.* Delft University of Technology, Delf.

Abdurrani, M. N. (2009). *Pengamat : Investasi Tanah Pinggir Banda Aceh Menguntungkan* (Observer: Land Investation in Fringe Areas of Banda Aceh is Provitable) *The Globe Journal.*

ADPC. (2010a). *Urban Governance and Community Resilience Guides : Our Hazardous Environment* (Vol. 1). Bangkok: Asian Disaster Preparedness Center (ADPC).

ADPC. (2010b). *Urban Governance and Community Resilience Guides :Risk Assessment in Cities* (Vol. 2). Bangkok: Asian Disaster Preparedness Center (ADPC).

Baird, M. (1998). *The Role of Evaluation*. In K. Mackay (Ed.), *Public Sector Performance - The Critical Role of Evaluation*. Washington DC,: World bank Operations Evaluation Department.

Bappeda, & PU. (2004). *Materi Teknis Rencana Tata Ruang Wilayah (RTRW) Kota Padang Tahun 2004-2013*. Kota Padang: Kementrian Pekerjaan Umum Direktorat Jenderal Penataan Ruang

Badan Perencanaan Pembangunan Daerah.

Bappeda, & PU *Kota* Padang. (2010). *Materi Teknis Rencana Tata Ruang Wilayah (RTRW) Kota Padang Tahun 2008-2028*. Kota Padang: Kementrian Pekerjaan Umum Direktorat Jenderal Penataan Ruang

Badan Perencanaan Pembangunan Daerah.

BAPPEDA Kota Banda Aceh. (2010). *RTRW Kota Banda Aceh 2009-2029 (Land Use Planning of Banda Aceh 2009-2029)*. Banda Aceh: BAPPEDA Kota Banda Aceh.

BAPPENAS. (2005). *MASTER PLAN FOR THE REHABILITATION AND RECONSTRUCTION OF THE REGIONS AND COMMUNITIES OF THE PROVINCE OF NANGGROE ACEH DARUSSALAM AND THE ISLANDS OF NIAS, PROVINCE OF NORTH SUMATERA*. Jakarta: Badan Perencanaan Pembangunan Nasional.

Bennett, R. M., Wallace, J., & Williamson, I. P. (2006). *MANAGING RIGHTS, RESTRICTIONS AND RESPONSIBILITIES AFFECTING LAND*. Paper presented at the Combined 5th Trans Tasman Survey Conference & 2nd Queensland Spatial Industry Conference 2006 ***Land and Sea Spatially Connected – In A Tropical Hub***.

BNPB. (2010). Data Bencana Indonesia (Indonesian Disaster Database). Retrieved 1 December, 2010, from http://dibi.bnpb.go.id

BPS. (2006). Padang Dalam Angka. Badan Pusat Statistik (National Berau Cencus)

BPS. (2008). Padang Dalam Angka. Badan Pusat Statistik (National Berau Cencus)

BPS. (2010). *Banda Aceh Dalam Angka* (Banda Aceh in Number). Badan Pusat Statistik (National Berau Cencus)

BRR. (2005). *Pedoman Menata dan Membangun Gampong/Desa*. Banda Aceh: Rehabilitation and Reconstruction Agency for NAD and Nias.

Cadastral Template. (2003). Country Report 2003 Available from http://www.cadastraltemplate.org/

Chimhamhiwa, D., Molen, P. v. d., Mutanga, O., & Rugege, D. (2009). Towards a framework for measuring end to end performance of land administration business processes - A case study. *Computers, Environment and Urban Systems, 33*(4), 293-301.

Dale, P. F., & McLaughlin, J. D. (1988). *Land information management : an introduction with special reference to cadastral problems in Third World countries / Peter F. Dale and John D. McLaughlin*. Oxford [England] : Oxford ; New York :: Clarendon Press ; Oxford University Press.

Departemen Kelautan dan Perikanan. (2008). *Penyusunan Detail Desain Pembangunan Shelter di Kota Padang*. Jakarta.

Driska, C. (2007). *Wilayah Kecamatan Ulee Kareng Dampak dari Bencana Gempa dan Tsunami Tahun 2004* (The impact of 2004 Earthquake and Tsunami in Ulee Kareng Sub District) *Wahana Hijau Jurnal Perencanaan & Pengembangan Wilayah, Vol.3, No.1,* (Agustus 2007).

Enemark, S. (2009). *Sustainable Land Administration Infrastructures to support Natural Disaster Prevention and Management*. Paper presented at the Ninth United Nations Regional Cartographic Conference for the Americas.

FAO. (1983). Guidelines for Land-Use Planning.
FAO. (2003). *The design of land consolidation pilot projects in Central and Eastern Europe*. Rome: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS.
FAO. (2007). *Good Governance in Land Tenure and Land Administration*. Rome: Food and Agriculture Organization of the United Nations.
FIG. (2006). *The Contribution of the Surveying Profession to Disaster Risk Management*. Copenhagen, Denmark: International Federation of Surveyors (FIG)
Fischel, W. A. (1985). *The Economics of Zoning Laws: A Property Rights Approach to American Land Use Controls*. Baltimore: John Hopkins University Press.
Fischel, W. A. (2008). Zoning and Land Use Regulation *2200*.
Fleischhauer, M., Greiving, S., & Wanczura, S. (2005). *SPATIAL PLANNING IN THE FOCUS OF HAZARD AND RISK ASSESSMENT/MANAGEMENT IN EUROPE*. Paper presented at the EURO-RIOB Conference Wroclaw 19 – 21 X 2005 "Exchange of experiences connected with flood prevention".
UNDANG-UNDANG REPUBLIK INDONESIA TENTANG PENANGGULANGAN BENCANA, NUMBER 66(2007).
Goverment of Indonesia. (2005). *Master Plan for The Rehabilitation and Reconstruction of the Regions and Communities of The Province of Nanggroe Aceh darussalam and The Islands of Nias, Province of North Sumatera*. Jakarta: Goverment of Indonesia.
GTZ. (2002). *Disaster Risk Management:Working Concept* Eschborn: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
GTZ. (2009). Guide Book for Assessing the Risk To Natural Hazards Case Study: Province of Central Java,
Henssen, J. (1995). *Basic Principles of the Main Cadastral System in the World*. Paper presented at the FIG Commission 7 Working Group "Cadastre 2014".
Heryani, E., & Grant, C. (2004). *Land Administration in Indonesia*. Paper presented at the 3rd FIG Regional Conference.
Jaeger, W. K. (2006). The Effects of Land Use Regulation on Property Value. *Vol. 36(105)*.
Jordi, B., & Biel/Bienne. (2006). *Recommendation Spatial Planning and Natural Hazards*. Retrieved from http://www.bafu.admin.ch/publikationen/publikation/00806/index.html?lang=en.
Kaplan, R. S., & Norton, D. P. (1996). *Balanced Scorecard: Translating Strategy Into Action*. Boston, USA: Harvard Business School Press.
Kaufmann, J., & Steudler, D. (1998). *CADASTRAL 2014 - A VISION FOR A FUTURE CADASTRAL SYSTEM*. Paper presented at the FIG XXI International Congress:.
Kötter, T., Schwieger, V., Altan, O., Müller, H., & Friesecke, F. (2006). *The Contribution of the Surveying Profession to Disaster Risk Management*. Paper presented at the International FIG Congress XXIII Munich, Germany.
Lemmen, C., van Oosterom, P., & Uitermark, H. (2008). Geographic information — Land Administration Domain Model.
Mitchell, D. (2009). *Reducing Vulnerability to Natural Disasters in the Asia Pacific through Improved Land Administration and Management*. Paper presented at the FIG Working Week 2009 Surveyors Key Role in Accelerated Development.
Mitchell, D. (2010). Land Tenure in Disaster Risk Management. *Land Tenure Journal*.
Molen, P. v. d. (2001). *The Importance of The Institutional Context for Sounds Cadstral Information Management for Sustainable Land Policy*. Paper presented at the International Confrence on Spatial Information for Sustainable Developtment.
Myeong, S., & Jung Hong, H. (2009). *DEVELOPING FLOOD VULNERABILITY MAP FOR NORTH KOREA*. Paper presented at the ASPRS 2009 Annual Conference.
Pantellic, J., & Srdanovic, B. (1992). Housing reconstruction and earthquake vulnerability: Some examples from the developing world. Retrieved from http://desastres.usac.edu.gt/documentos/pdf/eng/doc3300/doc3300-contenido.pdf)
Pemerintah Kota Banda Aceh. (2005). *Rancangan Strategis Kota Banda Aceh 2005-2009 (Startegic Planning for Banda Aceh 2005-2009)*. Banda Aceh: Pemerintah Kota Banda Aceh.
Rolly, H. F. (2001). Participatory Planning of Sustainable Development Projects.

SIGAP. (2010). *Padang: Jurnalis Desak Buat Peta Bencana* (Padang: Journalist Push to Publish the Hazard Map) from http://sigapbencana-bansos.info/berita/2478-padang-jurnalis-desak-buat-peta-bencana.html

Steudler, D., Rajabifard, A., & Williamson, I. P. (2004). Evaluation of Land Administration Systems. *Land Use Policy*.

Sutanta, H., Rajabifard, A., & Bishop, I., D. (2009). Integrating Spatial Planning and Disaster Risk Reduction at the Local Level in the Context of Spatially Enabled Government.

Ting, L., & Williamson, I. P. (1999). Cadastral Trends: A Synthesis. *No. 4*. Retrieved from http://www.geom.unimelb.edu.au/research/publications/IPW/CadastralTrendsSynthesis.html

UN-ISDR. (Ed.) (2010). United Nation - International Strategy for Disaster Reduction.

UN /ISDR. (2004). *Living with Risk*. New York, USA: United Nations.

UN/ISDR. (2004). Living with Risk : A global review of disaster reduction initiatives

UN/ISDR. (2005). *REDUCING DISASTER RISK A CHALLENGE FOR DEVELOPMENT*. New York: United Nations Development Programme Bureau for Crisis Prevention and Recovery.

UNDRO. (1991). *Mitigating Natural Disasters: Phenomena, Effects and Options. A Manual for Policy Makers and Planners*. Geneva: United Nations Department Relief Co-ordinator (UNDRO).

UNECE. (1996, 2005). *LAND ADMINISTRATION IN THE UNECE REGION Development trends and main principles*. New York and Geneva: United Nations.

UNECE. (2005). *Social and Economic Benefits of Good Land Administration (Second Edition)* (Vol. Second Edition). London: HM Land Registry.

UNHABITAT. (2003). *HANDBOOK ON BEST PRACTICES, SECURITY OF TENURE AND ACCESS TO LAND Implementation of the Habitat Agenda*. Nairoby: Land and Tenure Section, Shelter Branch Shelter and Sustainable Human Settlement Development Division UN-HABITAT.

USGS. (2006). Magnitude 6.3 - JAVA, INDONESIA. Retrieved 28 July, 2010, from http://earthquake.usgs.gov/earthquakes/eqinthenews/2006/usneb6

Van Westen, C. (2009). Risk Analysis. In C. Van Westen (Ed.), ***Multi-Hazard Risk Assesment*** *Distance Education Course Guide Book*. Enschede: United Nation University - ITC School on Disaster Geo-information Management (UNU-ITC DGIM).

Van Westen, C., Kingma, N., & Montoya, L. (2009). Elements at Risk. In C. Van Westen (Ed.), ***Multi-Hazard Risk Assesment*** *Distance Education Course Guide Book*. Enschede: United Nation University - ITC School on Disaster Geo-information Management (UNU-ITC DGIM).

Westen, C. V. (2009). Introduction to Disaster Risk Assesment. In C. Van Westen (Ed.), ***Multi-Hazard Risk Assesment*** *Distance Education Course Guide Book*. Enschede, The Netherlands: United Nation University - ITC School on Disaster Geo-information Management (UNU-ITC DGIM).

Williamson, I. P., & Enemark, S. (1996). *Understanding Cadastral Maps The Australian Surveyor, Vol. 41, No. 1, 38-52, .*

World Bank. (1998). *Public Sector Performance - The Critical Role of Evaluation*. Washington DC,: World bank Operations Evaluation Department.

World Bank. (2001). *Assesment of High-Risk Disaster Hotspots Brainstorming Meeting Synthesis and Recomendations*. Palisade, NewYork, USA: World Bank and Centre for Hazard and Risk research at Columbia University

World Bank. (2003). *LAND POLICIES for GROWTH and POVERTY REDUCTION*. Washington, USA: World Bank.

World Bank. (2005). *Indonesia: Preliminary Damage and Loss Assesment*. Jakarta: The Consultative Group on Indonesia.

Yin, R. K. (1994). *Case Study Research: Design and Methods*.

APPENDICES

APPENDIX A

Questionnaire No…….

Landowner Survey Questionnaire

ITC Faculty of Geo-Information Science and Earth Observation — UNIVERSITY OF TWENTE.

Dear Respondents,

I would like to ask your favour to fill this questionnaire. This is to collect the information for my research in ITC-University of Twente, The Netherlands. The information collected will be used for educational purposes only and the information will be keep confidentially. Your answer will be useful for the successfulness of my research. I wish my research will have a contribution for the land administration knowledge generally and for supporting disaster risk management.

Thank you very much.

Best Regards,
Hanhan Lukman Syahid
Student of Land Administration Programme
ITC Faculty-University of Twente
E-mail: syahid24251@itc.nl

Adress of landowners: ……Village…….……Sub-district…….

Type of land rights: …… land use zone (based on land use plan 2009-2029): Mangrove forest/Housing

1. What is your land/property use? ☐ Housing ☐ Shops ☐ Office ☐ Husbandry ☐ Agriculture/Farming ☐ Others, please specify:……
2. Do you know that the land use is in accordance with land use plan established by Bappeda?
   ☐ **Yes** ☐ **No**
   If yes, from where do you know it? ☐ Internet ☐ TV
   ☐ Pamphlets/government's brochure ☐ Check to Bappeda ☐ Others, please specify:……
3. When you build/reconstruct your house, have you been applied the earthquake-resistant house based on the building permits from the local government (Spatial Planning Agency)? ☐ **Yes** ☐ **No**
   If no, why? ……
4. Since the 2004 tsunami, has the tsunami changed land price of your property/land or the land/property around you? ☐ **Yes** ☐ **No**
   If yes, was it **DECREASED** (….%) or **INCREASED** (……%) ? (changes of land price in one year)
5. Has the land use plan of *Kota Banda Aceh* 2009-2029 been changed your land/property or land/property around you significantly? ☐ **Yes** ☐ **No**
   If yes, was it **DECREASED**? (…….. %) or **INCREASED**?(……%)
6. Do you have any restrictions or responsibilities in using your land based on the building permit or other regulation applied from Bappeda/other agencies in using your land?
   ☐ **Yes** ☐ **No**

If yes, from which agency?: .....
What are the restrictions? :……
What are the responsibilities? : ……

7. Have you got the compensation from the government when your land/property has the restriction based on the land use plan? ☐ **Yes** ☐ **No.**

   If yes, in which form the compensation is? ☐ Fresh money ☐ others, specif…..

8. Do you know, where should you go if you want get the building permits? ☐ **Yes** ☐ No
   If yes, how many days do you spent time for getting the building permits? How about the process to get the building permits from the government? ☐ Difficult ☐ Easy and ☐ time consuming ☐ less time needed.
9. According to the land use plan (RTRW) year 2009-2029, do you know in which zone the location of your land/property (city forest/housing/industrial areas)?
   ☐ **Yes** ☐ **No**
   If yes, from where do you know it? :.....
10. Has your land/property registered (certificate from BPN)? ☐ **Yes** ☐ **No**
11. Do you feel safe from?
    a) Land tenure security by having the landownership certificate? ☐ **Yes** ☐ **No**
    b) The damage of your land/property due to earthquake/tsunami mighty occurs in the future? ☐ **Yes** ☐ **No**
12. Do you have a plan to move to other places due to potential adverse effects of earthquake/tsunami?☐ **Yes** ☐ **No**
    If yes, where will you go? Village: ……Sub-district/district:……
13. Do you know the escape route/temporary shelter in case the earthquake/tsunami occurs in the future? ☐ **Yes** ☐ **No**
    If yes, from where did you get the information?
    ☐ Internet ☐ TV ☐ Pamphlets/government's brochure ☐ NGOs ☐ Others:……

Signature of interviewer……Date……

APPENDIX B

Questionnaire No…….
Date:……..

Notary Survey Questionnaire

UNIVERSITY OF TWENTE.

Faculty of Geo-Information Science and Earth Observation

Dear Respondents,

I would like to ask your favour to fill this questionnaire. This is to collect the information for my research in ITC-University of Twente, The Netherlands. The information collected will be used for educational purposes only and the information will be keep confidentially. Your answer will be useful for the successfulness of my research. I wish my research will have a contribution for the land administration knowledge generally and for supporting disaster risk management.

Thank you very much.
Best Regards,
Hanhan Lukman Syahid
Student of Land Administration Programme
ITC Faculty-University of Twente
E-mail: syahid24251@itc.nl

Notary's name: ……..

Address: ……

1. a) If refers to the IMB (building permits) regulatiosn and land use plan of Banda Aceh city 2008-2028, do you know the restrictiosns and responsibilities for the landowners located along the coast in Banda Aceh? ☐ Yes ☐ No

   b) If yes, did you provide these information to your client/community before they did transfer ownership/property? ☐ Yes ☐ No

   c) After you provide that information, how was the responses from the client/community?
   ☐ Continuing transfer ownership of their land/property;
   ☐ Cancelling transfer ownership of their land/property

2. After the 2004 tsunami, based on your data, has the land market value been drastically changed in the areas along the coast which enacted as open space and Mangrove forest by land use plan and the in the areas far away from the coast (e.g. Ulee Kareng sub district)? ☐ **Yes** ☐ **No**
   If yes, has the land/property value been **DECREASED** or **INCREASED** and how many % the changes? (please fill in the table 1 below).

Table 1. The Changes of Land/Property Value due to the 2004 Earthquake and Tsunami

Name of Village Desa/ subdistrict	Changes of the Land/Property Value*) in %						Notes
	2005	2006	2007	2008	2009	2010	
Gampong Pie, Meuraxa sub district							
Punge Jurong, Meuraxa sub district							
Illie, Ulee Kareeng sub district							

3. Has the established land use plan of Banda Aceh year 2006-20026 and the newest year 2009-2029 been influenced to the land/property value in the areas along the coast which were planned as mangrove forest and open space areas and in the areas far away from the coast (Ulee Kareng sub district)?

Table 2. The Changes of Land/Property Value due to establishment of land use plan

Name of Village Desa/ subdistrict	Changes of the Land/Property Value*) in %						Notes
	2005	2006	2007	2008	2009	2010	
Gampong Pie, Meuraxa sub district							
Punge Jurong, Meuraxa sub district							
Illie, Ulee Kareeng sub district							

Note: *) = give (-) for decrease or (+) for increase

Date:……

Respondent,

(……Signature ……)

APPENDIX C

Questionnaire No…….
Date:……..

Stakeholders Survey Questionnaire

Faculty of Geo-Information Science and Earth Observation

UNIVERSITY OF TWENTE.

Dear Respondents,

I would like to ask your favour to fill this questionnaire. This is to collect the information for my research in ITC-University of Twente, The Netherlands. The information collected will be used for educational purposes only and the information will be keep confidentially. Your answer will be useful for the successfulness of my research. I wish my research will have a contribution for the land administration knowledge generally and for supporting disaster risk management.

Thank you very much.
Best Regards,
Hanhan Lukman Syahid
Student of Land Administration Programme
ITC Faculty-University of Twente
E-mail: syahid24251@itc.nl

Organization's name: **BAPPEDA** ….

Administrative level: ☐ National ☐ Province ☐ District

1. RESPONDENT INFORMATION
   1.1 Name of respondent: ……..
   Position: ……..

   1.2 What is/are your job/s and responsibility/es in your organizations?
   ☐ Technical decision-maker ☐ Policy-maker ☐ Head of unit/division
   ☐ Staff ☐ Others please specify: ……..

   1.3 How long have you been working? ……..month/years

2. ORGANIZATION TASKS AND REPONSIBILTIES
   2.1 What is/are main tasks of your organizations? Please explain…

   2.2 What is/are tasks of your organizations concerning disaster risk management in Indonesia? Please explain. ……..
   ☐ Prevention/Mitigation ☐ Preparedness ☐ Risk assessment
   ☐ Recovery ☐ Response ☐ Others……..

   2.3 Are the tasks of your organizations overlap with the other agencies?☐ Yes ☐ No
   If yes, with which agencies the overlap is? ……..

3. POLICY
   3.1 Does your organization have the policy and technical regulations concerning/suporting disaster risk management? ☐ Yes ☐ No

If yes, please explains……..

3.2 Does your organizations in formulation of policy and other technical regulations already concerning disaster risk management? ☐ Yes ☐ No
If yes, what are your involvements? Please explain ……..

3.3 In land use planning process, has your organization been considering and integrating risk/hazard information in defining zones in your district? ☐ Yes ☐ No

4. ORGANIZATIONS ARRANGEMENT

4.1 In making land use plan, which agencies/NGOs are involved and what their roles are? Please fill in the table and explain……..

Agencies	Yes	No	The roles
Government agencies (Public Works, BPN,…			
Local/national/international NGOs			
Others…			

5. OPERATIONAL LEVEL (DATA)

5.1 In which scale the maps that is made/used in your organizations? Please explain ……..

5.2 Do you have regular schedule for changing the land use plan?☐ Yes ☐ No

5.3 What are the main reasons to change the land use plan? Please explain……..

5.4 Do you have standardization regulation concerning spatial and non-spatial data used?
☐ Yes ☐ No, please explains……..

5.5 From where did you get the base maps that are needed for making land use plan? ……..

6. PLATFORM USED FOR SHARING DATA

6.1 Does your organization already have the regulation for sharing data with other agencies? ☐ Yes ☐ No,

If yes, how your organizations share the data? Please explain
☐ Bureaucratic procedures ☐ personal contact ☐ Internet ☐ Others ……..

6.2 With which organization your organization often share the data?.please explain……..

6.3 Do the citizens can access the data from your organizations? ☐ Yes ☐ No
If yes, how? please explain…..
☐ Bureaucratic procedures ☐ personal contact ☐ Internet ☐ Others ……..

6.4 What the problems which are often occurs in sharing the data with other agencies
☐ No agreement ☐ late in delivering the data ☐ data is not complete ☐ Others ……..

6.5 How many days is needed to get the data from other agencies?. Please explain ……..
☐ 1-7 days ☐ 1-2 weeks ☐ more than 2 weeks ☐ more than 1 month

6.6 In your opinion, are the procedures to get the data from these agencies easy?
☐ Yes ☐ No

6.7 Has your organization been using Internet for sharing the data with other agencies and citizens? ☐ Yes ☐ No

If yes, is the speed for access data is enough for sharing data? ☐ Yes ☐ No

7. IMPLEMENTATION OF LAND USE PLAN

7.1 Do you have publication program to the citizens? ☐ Yes ☐ No, please explain….
Program: ☐ Formal meeting ☐ Pamphlets/billboard ☐ TV/Radio ☐ Others ……..

7.2 When the land use in reality is not in accordance with the established land use plan, what is/are the actions usually taken by your organization? Please explain ……..

I hereby certify that to the best of my knowledge and belief the facts that I have stated are true.

Signature ……Date:……..

APPENDIX D

a) Spatial data collected

Table E-1: Spatial data collected

Study area	Spatial data collected	Year	Data Source
Banda Aceh	Earthquake and Tsunami Risk Map	2008	TDMRC
	LUP Map before and after Tsunami 2004	LUP year 2002, 2005, 2007 and 2009.	BAPPEDA NAD province
	Cadastral Map	2010	Land local offices,
	Satellites imagery and Aerial Images before and after Tsunami	Ikonos 2004, Aerial photo 2005 and Quickbird 2009	BAPPEDA Banda Aceh
	Boundary village	-	BPN and BPS
Padang	Earthquake and Tsunami Risk Map	2008	Ministry of Fisheries
	Land Use Map before and after Earthquake 2007	Ikonos 2006, and Quickbird 2009.	BAPPEDA Kota Padang
	Cadastral Map	2010	Land local offices
	Satellite Images before and after Tsunami.	2004 and 2008	BAPPEDA Padang
	Boundary village	-	BPN and BPS

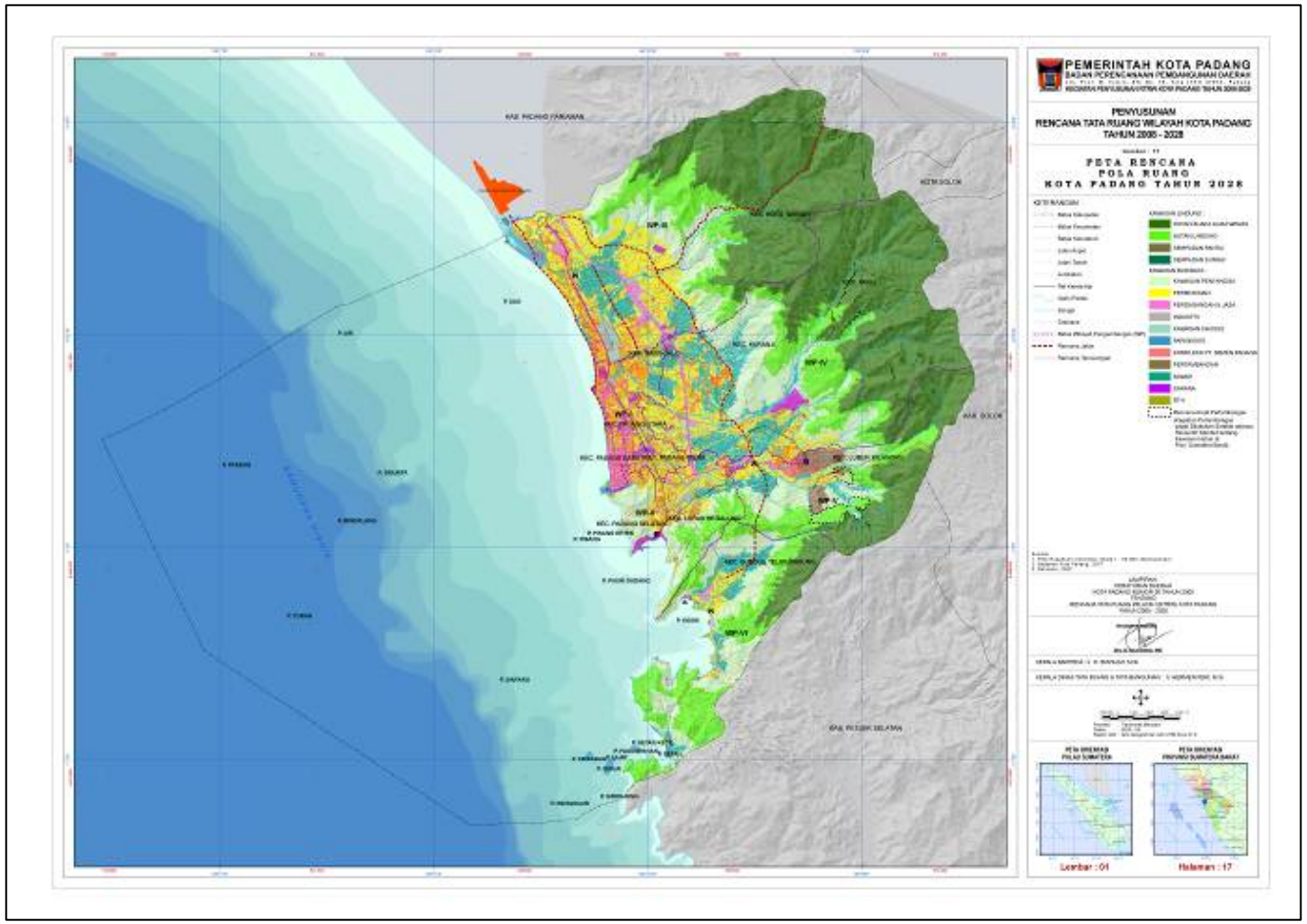
b) Non-spatial data collected

Table E-2: Related documents collected

Study area	Documents collected	Year	Data Source
Banda Aceh	Laws on LUP	2010	BAPPEDA Banda Aceh
	Report of LUP Before and after earthquake in 2007	2005 and 2009	BAPPEDA Banda Aceh
	Land value (taxes value) of three villages	2005 - 2008	Land Taxes Department
Padang	Laws on LUP	2010	BAPPEDA Padang
	Report of LUP before and after earthquake in 2007	2004 and 2008	BAPPEDA Padang
	Land value (taxes value) of three villages	2005 - 2008	Land Taxes Department

APPENDIX E

LAND USE PLAN OF PADANG 2008-2028



Source: BAPPEDA Padang city, 2010

APPENDIX F

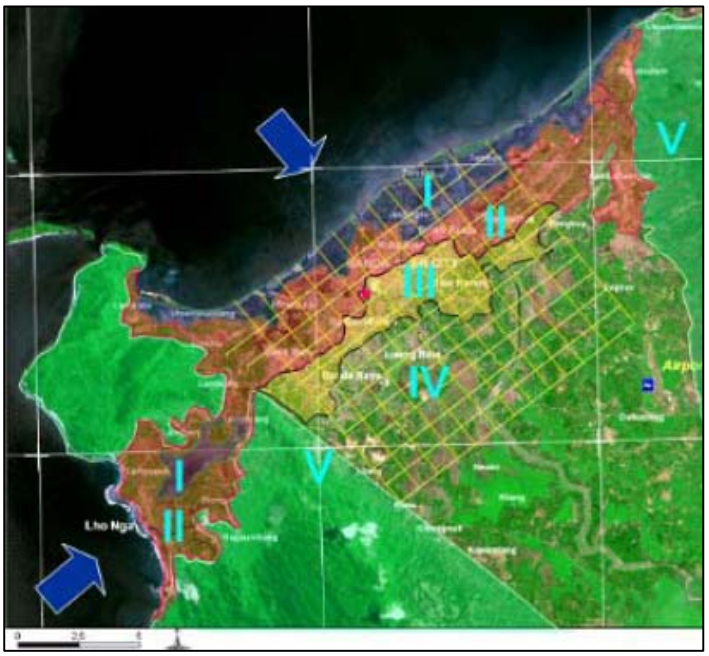


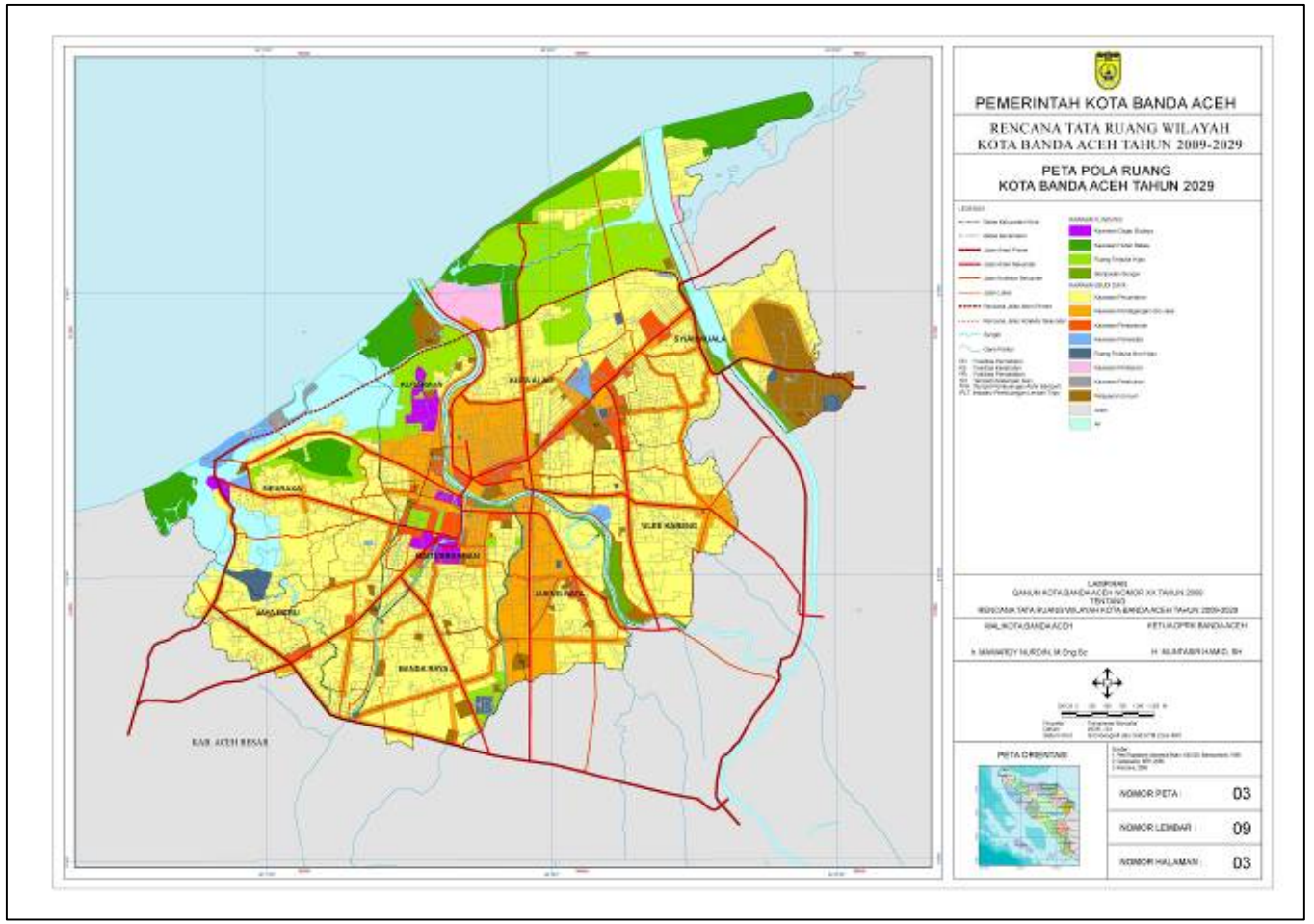
Figure 5.x Physical zoning of *Kota* Banda Aceh (source: (BAPPENAS, 2005)

According to this Master Plan, Banda Aceh city was divided into five zones categorized into three areas:

1) Restricted development area, which is comprised by:
   - Zone I was planned for coastal fishponds, mangroves forest, recreational beach area and limited only for earthquake and tsunami–resistant building with very low density settlements.
   - Zone II was planned for low density development area. Commercial and social activities were not advisable and housing must be built based on stringent building and environment codes.
   - Zone III was planned for medium density development. Housing should be supported by earthquake and tsunami –resistant buildings and directed to preserve the heritage area.
2) Promoted development area (Zone IV): Housing must be built in accordance with the earthquake and tsunami building code. The development was proposed for the same function as before the disaster by giving tax incentives, controlling land prices and completing infrastructure,
3) Conservation area (Zone V). This area was planned as evacuation place when tsunami hit in the future.

APPENDIX G

LAND USE PLAN OF BANDA ACEH 2009-2029



Source: BAPPEDA Banda Aceh city, 2010