

Integrating Spatial Planning and Disaster Risk Reduction at the Local Level in the Context of Spatially Enabled Government

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Abstract

Spatial planning is increasingly regarded as one of the important instrument in disaster risk reduction. It facilitates decision on the future use of space in any administrative unit, which in some cases may be confronted by natural hazards. This would be an important component of any society and government if they want to become spatially enabled. This paper discusses theoretical approach in integrating disaster risk reduction into spatial planning at the local government level. Attention is focused on the local government level because at this level mainly the operational aspect of spatial planning is executed. Prerequisites for proper integration are elaborated. A method for the integration based on integrated risk map and vulnerability map is proposed. It also shows example of how the local government in Indonesia tried to incorporate disaster risk reduction in the spatial planning. Four aspects of policy and regulation, organizational aspect, data consideration and platform for integration were assessed.

Keywords: spatial planning, disaster risk reduction, local government, spatially enabled government

1. INTRODUCTION

Recent figures from a number of international agencies indicate that there is escalation of casualties and economic losses from natural disasters. These conditions are closely related to the increase exposure of people and infrastructures to natural hazards, as a result from population growth, limited available space and global climate change (Sanderson, 2000; Resurreccion, et al, 2008). The high number of casualties and economic losses will weaken the ability of a community or country to achieve sustainable development objectives. A large amount of financial resources has to be allocated for emergency responses and reconstruction program afterward, and leaving another important sector receive less funding. Natural disaster will affect people, physical environment, and socio economic activities. Pre-disaster condition of these four aspects rarely can be brought back after the reconstruction phase ended. As disaster hit a particular geographical location, disaster risk reduction effort should also look at the utilization on the place in relation to natural hazards, at present time and foreseeable future.

Spatial planning is increasingly regarded as one important instrument for disaster risk reduction. Its attractiveness lies in its function for regulating long term use of space. Through appropriate land use allocation, exposures to natural hazards at the current and future situation can be minimized or even prevented. Multi hazards approach is required since a location may receive threat from numerous type of natural hazards. A coordinated policy, which contains laws and regulations, is needed to provide organizational and technical guidelines for the incorporation of disaster risk reduction strategy in spatial planning.

Within this context, this paper explores the conceptual method of integrating spatial planning and disaster risk reduction at the local government level. Attention is focused on the local government level since at this level the detail spatial plan is formulated and the responses to disaster risks is sought at first. Focus on the local government is also strongly endorsed by some international organizations and meeting, most recently by Incheon Declaration in 2009.

The structure of this paper is as follows. This paper begins with discussion on the relation between spatial planning and spatially enabled government, followed by description on the importance of disaster risk reduction in ensuring sustainable development. The next section describes the significant role of spatial planning in disaster risk reduction. It then addresses the method to integrate disaster risk reduction and analyses how the concept was being implemented in the Indonesian local government context. The final section provides summary and conclusions.

2. SPATIAL PLANNING AND SPATIALLY ENABLED GOVERNMENT

2.1. Elements of Spatial Planning

Spatial planning involves the process of allocation, forming, sizing, and harmonizing space (land) for multifunction uses (Albrechts, 2006). This task is conducted by city, district or municipal planning agency with close collaboration with other government agencies. The main objective of spatial planning is to decide the future use of space (Greiving et al., 2006b). Three challenges are now faced by planners: growing population, scarcity of suitable space and risks from natural disasters, as shown in Figure 1. With limited available space and population growth, there is an escalation of competition in the use of space. The problem in finding suitable location and appropriate allocation is coupled with the increasing number of disasters. The impact of natural disaster is predicted to becoming more severe, especially when coupled with global climate change (Resurreccion, et al, 2008).

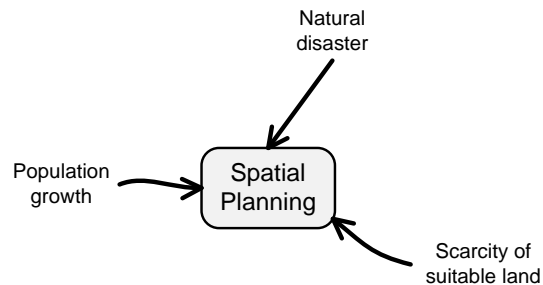


Figure 1. External pressures on spatial planning.

Spatial planning is usually classified into national, provincial (state), local (district or municipality), depending on the system of governance implemented in a particular country. National and provincial level spatial plans are concerned on strategic direction of the utilization of land at large coverage, harmonizing multi regions spatial plans and have little operational guidelines. Based on the spatial scales and information content, spatial plans can be classified into two categories: general and detail spatial plans.

- General spatial plans. It addresses the issues of pattern and structure spatial usage on residential, transportation and utility. The definition of developable and undevelopable zones is covered here. The general spatial plans are represented on maps on a scale from 1: 25 000 to 1: 100 000.
- Detail spatial plans. It contains information on zoning, density, ratios of building and open space and acceptable storey. It has a legally binding status on what type

of development that can or cannot be built in any particular location. It is usually represented on maps on a scale of 1:5 000 to 1: 10 000.

2.2. Spatial Planning in the Context of Spatially Enabled Government

Spatial planning extensively uses spatial information, together with non-spatial information. Spatial information is essential in different stages of spatial planning, from preparation, development to the presentation to the public. Spatial planning requires that any information therein should be made available and accessible to public. This fits with the main idea of Spatially Enabled Government (SEG) where government delivers spatial information in digital form on the web and makes it accessible to citizens and business (Wallace et al., 2006), to increase transparency and accountability of government activities and encourage further development of value added product. A spatially enabled government is applying spatially based information to facilitate productive and effective decision making and developing policy (Rajabifard, 2007).

Some countries have implemented SEG concept in spatial planning, such as the United Kingdom, the Netherlands, Australia and partly in Indonesia. UK has developed a web portal <<http://www.planningportal.gov.uk/>> which contain all information regarding planning matters in the UK. Every local government is required to develop its own portal to address local requirements. Information on these portals includes planning and building regulations, planning permit application, appeals on the decision and access to development information for a particular location (Planning Portal, 2010). The website of the Netherlands' Ministry of Housing, Spatial Planning and Environment <<http://www.ruimtelijkeplannen.nl/web-roo/>> aimed to transparently provide spatial plans to citizens, private institutions and government agencies. It has a collection of data from all level of government – state, province and municipality. The new law of spatial planning of the Netherlands requires that all municipalities make their spatial plans digitally available online by 1st January 2010 (Georgiadou and Stoter, 2010).

In Australia, every state has their unique approach in incorporating spatial planning in the SEG context. Some of the early implementation was developed before the terminology of SEG being coined. The implementing agency is usually the Department of Land in each state. In the State of Victoria, information on spatial plans is available at <<http://services.land.vic.gov.au/landchannel/jsp/map/PlanningMapsIntro.jsp>>. This portal provides information on planning scheme maps (including historical archives dating back to 1954), planning zones and overlays, and aerial imagery (Land Victoria, 2010).

In Indonesia, the website of the Directorate of Spatial Planning, Department of Public Work <<http://www.penataanruang.pu.go.id>> has wealth of information regarding spatial planning at the national, provincial and district level. It also contains information on laws and regulations. Its WebGIS has information at the national and provincial level as well as on the island and strategic area been developed. Small number of local governments have developed webGIS portal which include simple spatial planning map.

3. DISASTER RISK REDUCTION AND SUSTAINABLE DEVELOPMENT

Three aspects are closely related to natural disasters, namely hazard, risk and vulnerability. Natural hazard is a potentiality dangerous natural phenomenon which can cause injury or loss of life, property and infrastructure damage, and disruption of

social and economic activities (UNISDR, 2009). If added to the vulnerability, it becomes risk. Vulnerability is a condition related to exposure and susceptibility to losses. Disaster is the realization of risk. Natural disaster is a result natural hazard when it struck vulnerable people or property. It will remain a usual natural phenomenon if it hit remote area which is un-inhabited by people and no infrastructure lie in the area. The impact of disasters will depend on the type of natural disaster, geographic coverage, population density and condition of infrastructures.

In the last four decades, natural disasters have created a lot of suffering and great economic losses. The increase on disaster losses and reconstruction cost can hinder spending on other sectors such as education and health, thus reducing capacity of government in sustainable development. Reducing disaster risk, therefore, should be aimed at the development of resilience community to natural hazards and ensuring that development will not increase further vulnerability of community and infrastructures (UNISDR, 2001).

Disaster risk reduction is a systematic effort to reduce risks of disaster through the reduction of exposure of elements at risk to hazards, lessened vulnerability of people and property, better land management practices and improvement in preparedness (UNISDR, 2009). Mainstreaming disaster risk reduction and integrating it into development program and spatial planning at all levels of government is essential. At the national context, mainstreaming can be realized when all related government agencies at all levels become concerned and involved in the development of framework at the same time (Mitchell, 2003).

Disaster risk reduction focuses on three main component of disaster risk, hazards, vulnerability and exposure (DFID, 2006). Most of hazards are coming from the force of nature beyond human capability to reduce their destructive potentiality. However, some of them can be influenced or modified by human activities. Reducing vulnerability requires understanding of the underlying factors that create hazards and how they interact with elements at risk. Elements at risk are people, building, infrastructures, economic and social activities which are possibly in danger of hazards.

Impacts of disaster can last for several years or even tens of years which can hamper sustainable development. Brundland Commission (1987) defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Disasters can destroy development accomplishment, and reducing capacity to maintain and improving it in the long run. The long term impacts of disaster are on the people, infrastructures, environment and socio-economic activities. These elements at risk should be safeguarded against disaster risks to ensure sustainable development objective will not be compromised.

4. ROLE OF SPATIAL PLANNING RESPONSE IN DISASTER RISK REDUCTION

Spatial planning is responsible for the decision on long term utilization of land. Although not directly responsible for disaster risk reduction, spatial planning has fundamental role in disaster risk reduction. Four possible roles of spatial planning in disaster risk reduction, as identified by Fleischhauer et al (2005) are:

1. Prohibiting future development in certain areas. In highly prone area, especially with history of disaster occurrences, development should be prohibited. Areas required for emergency response and retention need to be keep free.

2. Classify different land use setting for disaster prone areas. Every disaster has their own acceptable risk on different land use classes. Steep slope which is highly susceptible to landslide should not be used for residential or commercial area, but may still be suitable for plantation.
3. Regulating land use or zoning plans with legally binding status. In an area vulnerable to earthquake, regulation on building density is essential to reduce impact of building collapse.
4. Hazard modification. Spatial planning can play role in promoting soft engineering method to reduce risk of flooding. Retarding basin required to contain flood water should be kept free of development to maintain its function.

Implementation of the functions of spatial planning in disaster risk reduction should be effectively conducted at the local government level. Incheon Declaration (2009) endorsed the importance of local government role in disaster risk reduction. The local government is the one who has to respond to the disaster at the very beginning of catastrophe. During the prevention stage, the local government is responsible to prepare a comprehensive policy on disaster mitigation. Figure 2 shows the relation between local disaster, planning and action. When a local disaster struck, the local government is the one who should first respond to the situation. Local planning in reducing disaster risk includes long term prevention strategy which can be manifested in spatial plan. Moreover, local planning will help in developing better local responses because of their knowledge on local condition.

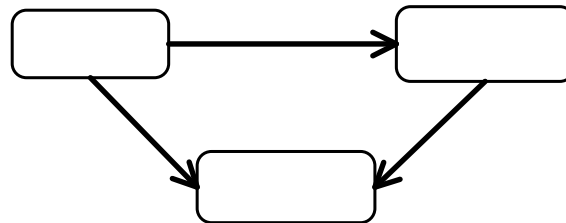


Figure 2. The importance of local planning in disaster risk reduction.

Disasters are mostly unpredictable and time-dependent. Current knowledge and technology cannot precisely predict where, what magnitude and extent a particular disaster will occur. The term time-dependent disaster means that the magnitude, extent and frequency of hazards may increase or decrease in the future. It is likely that disaster occurrence will increase along with the increase exposure of people and infrastructures to hazards.

Prediction on how disasters will occur in the future is a very important element in developing spatial plans. Prediction is more likely to succeed for long term hazards with slow progression, such as land subsidence and sea level rise. These two hazards produced noticeable signs of their progression in the long run, although in the short term may not be clearly visible. On other types of hazards, prediction could only rely on historical data of their occurrences, magnitude and frequency. In all cases of natural disasters, planners and scientists are confronted with uncertainty. However, any uncertainty should not hamper the incorporation of risk reduction strategy in spatial planning.

5. INTEGRATING DISASTER RISK REDUCTION IN SPATIAL PLANNING

5.1. Pre-requisites for integration

The integration of disaster risk reduction into spatial planning involves several aspects, i.e. policy, organizational, data and platform (Figure 3). Currently, organizations with

tasks on disaster risk reduction and spatial planning working separately. It appears that there was no direct relation between national or local disaster management agencies with their counterpart on spatial planning. Nonetheless, Observation on spatial plan maps in from various countries such as Australia, United States, Japan, Netherland and Indonesia reveals that into some extents spatial planning have considered disaster risks.

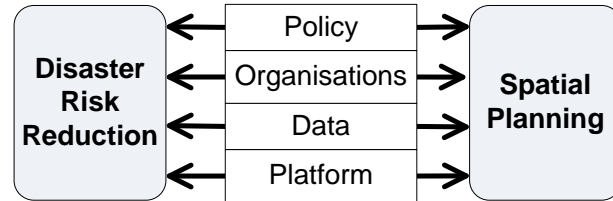


Figure 3. Elements in the integration of disaster risk reduction into spatial planning

Policy provides guidelines and directive on the implementation of integration of disaster risk reduction in spatial planning. It is formally materialized in laws and regulations. Laws and regulations will clearly defined responsibilities of all participating agencies, institutional arrangement and how the operational procedures be executed. The structure and hierarchy will depend on the system of government adopted by each country. Generally, a central (or federal) government laws and regulations are required to provide umbrella and directives for local government actions.

Data for disaster risk reduction are coming from different agencies in different format. Standardized data format is preferred to enable seamless data exchange and sharing, especially on spatial data. Spatial data come from different agency usually submitted in different format, projection system, visualization, semantic, and scale. One of the fundamental requirements is on the interoperability of spatial data, since inappropriate merging of data can result in misleading decisions. Similarity or interoperability on data format and projection system is another requirement. Different visualization coding may be used by different organization to depict similar features. Classification on categorical data, e.g. slope steepness, among participating organization should be made alike. There is also problem on the use of scale. Natural hazards, such as landslide and flooding, usually represented in small scale map. On the other hand, detail spatial planning requires large scale representation for zoning purpose.

Records on past event of disaster may well be maintained in develop countries, but are scarce in many developing countries. Availability and limitation of historical data can affect the prediction of the future probability events. In terms of thematic maps, the following are required for integration with spatial planning:

1. Past events of disaster
2. Hazard risks map
3. Element at risks map

Incorporation of disaster risk reduction strategy in spatial planning involves active participation from various government agencies as well as public engagement. A platform for facilitating this task is required, to enable seamless data sharing and exchange. Spatial Data Infrastructures (SDI) needs to be set up for this purpose.

5.2. Existing Risk Assessment Model

Some models for assessing disaster risks have been proposed by different organizations, for example by Munich Reinsurance Company (Munich Re), Hazards Research Lab, Department of Geography at the University of South Carolina, and the

Institute of Spatial Planning, University of Dortmund (IRPUD). Munich Re model (Munich Re, 2003) was aimed to find out overall risk index of 50 megacities all over the world. It consists of three major indices namely hazards exposure, vulnerability and exposed value. The hazards exposure component consists of two elements of 'average annual losses' (AAL) and 'probability of maximum losses (PML). On the vulnerability components, it consists of six elements: standard of preparedness, standard of safeguards, residential construction vulnerability, commercial/industrial vulnerability, building density and quality of construction. Exposed values components focuses on economic values of the area. The three main components receive same weight of 33.3%. The model seems to end with overall risk index of the existing environment but without prediction on the future situation. However, this can be understood since the model was developed from the viewpoint of an insurance company.

The second model called Total Place Vulnerability Index. The description of this model follows 'State of South Carolina Hazards Assessment 2005' (SCEMD, 2005) and Greiving et al (2006a). It is an index which ranks counties by level of their vulnerability to hazards. To come up with total place vulnerability, the model received inputs from total hazards probability of occurrences scores and total social vulnerability scores. These two inputs have same weight of 50%. The total hazards probability of occurrences scores were based on historical data of hazards affected all counties in the region, without consideration on their extent and magnitude. The total social vulnerability scores were obtained from variables of age, gender, population, race, income, and number of mobile homes per county. All sub-elements in the two inputs have similar weight regardless of their degree of importance. Although mathematically simple, some extreme values in one sub-element can distort the final place vulnerability index.

The third model, Integrated Risk Assessment of Multi Hazards, was developed by at the Institute of Spatial Planning, University of Dortmund (IRPUD) Greiving et al (2006a). The objective of the model was to develop an integrated risk map based on integrated hazards map and vulnerability map. Inputs for integrated hazards map were all relevant hazards in a particular geographical location. Weight for each hazard classes, e.g. typhoon, landslide, flood were derived using Delphi process, based on the opinion of scientist and stakeholders in the region. Therefore, there will be different weights on each hazards class. The vulnerability map consists of the following components, hazard exposure and coping capacity. Hazard exposure is the product of GDP per capita and human damage potential based on population density. GDP per capita is an aggregation of infrastructures, residential buildings, production capacity, etc. The coping capacity is actually representing financial capacity of the nation or region to cope with the disaster.

5.3. Model for Integrating Disaster Risk Reduction into Spatial Planning

The previously mentioned models provide a foundation on how to assess multi hazards risks in any urban or rural area. However, those models stop after risk indexes or maps have been produced. They did not move forward into the integration with spatial planning. In this section, a model which takes risk maps into spatial planning is presented (Figure 4). The integrated risk component of this model was adapted from IRPUD model (Greiving et al., 2006a), but was modified to suit the requirement in different geographical setting and was simplified in generating vulnerability map. The main component of this model is on the integration of integrated risk maps with spatial plan to produce disaster resilient spatial plan.

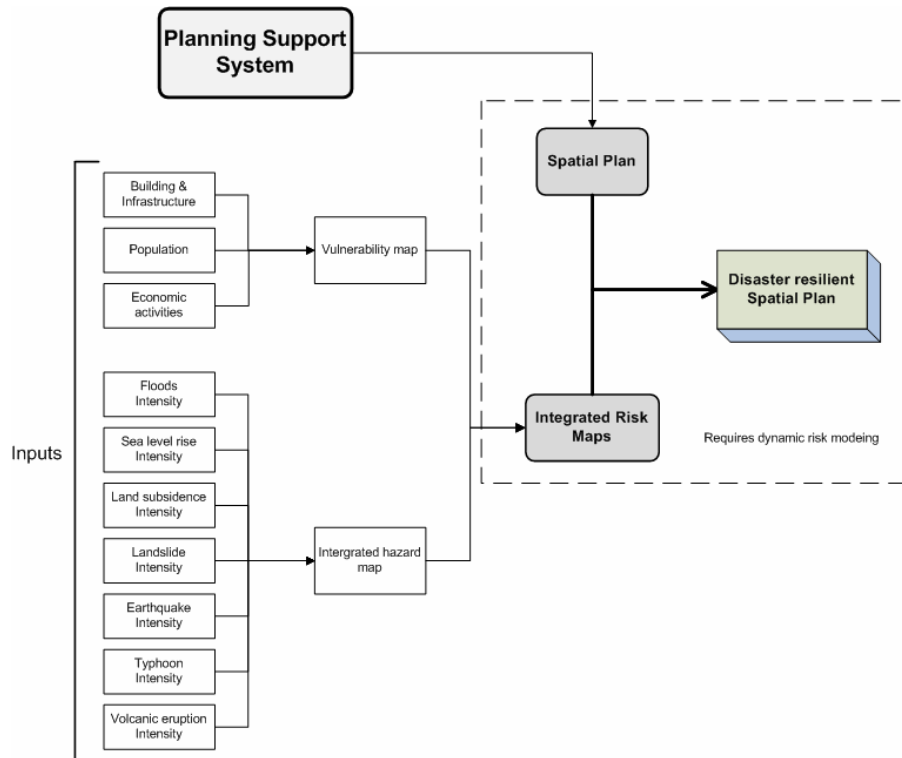


Figure 4. A model for integration of disaster risk reduction into spatial planning.

Integrated hazard map is the product of individual hazard, which is location-dependent. In this model, the natural hazards were typical of coastal urban cities located in deltaic area or alluvial plain. Individual hazard map is developed using historical data and prediction of probability of future events. The latter is essential in the context of dynamic disaster. The vulnerability map is created using three inputs, building and infrastructures, population and economic activities. Building is an aggregation of the residential, commercial, industrial and public buildings. Infrastructures consist of road and rail network, utility, energy and telecommunication facilities. To be able to map this entire element at risk, a large scale map with detail information is required. Integrated hazard map and vulnerability map are then combined to produce an integrated risk map.

The integrated risk map is to be used to assess the fitness of spatial plan with regard to disaster risk. Spatial plan is the product of planning support system, although not necessarily using it. Conventional method of developing spatial plan is still valid. Land use allocation need to be tested against the integrated risk maps to ascertain that they can accept disaster risks, if any. A measure on acceptable risk indicators should be developed to accommodate any land use assignment which can allow a certain degree of risk. For example, agriculture field can be located in floodplain since it does not possess any danger to human life. All accepted land use designation will result in disaster resilient spatial plan. Otherwise, the spatial planning should be repeated until it satisfies this requirement. The testing procedure is essential in relation to the possibility of future disaster, as shown in Figure 5.

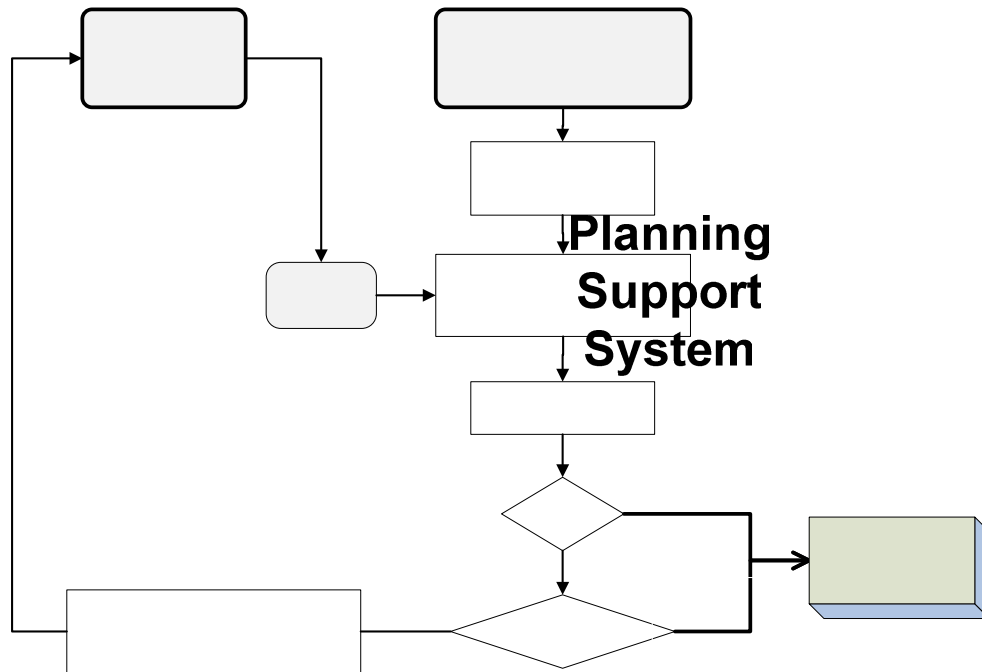


Figure 5. Dynamic risk modeling in spatial planning.

The process starts with dynamic risk modeling of some natural hazards, e.g. sea level rise, land subsidence, flooding, etc. The sea level rise, coupled with land subsidence in a coastal city, can increase the frequency, magnitude and extend of flooding. Location currently not subject to flooding may be inundated in 10 or 20 years from now. Therefore, anticipation strategy should be developed at earliest possible time because some development activities are irreversible. Relocating highly utilized industrial complex is costly and will create financial losses.

The spatial plan will then be evaluated, based on the predicted future risks. Element at risk will be developed, based on the overlay between spatial plan and integrated risks map. The next step is evaluating the degree of risk of the designated land use plan. If there is no risk found or the risk is acceptable, then it goes to final spatial plan. In case the risk is not acceptable, the second test whether a condition of exception is applicable will be conducted. An example whereby an exception is applicable is the location of seaport in flooding prone area. There is little possibility to move seaport to other location, but the flood hazard should be overcome by hard engineering measures. If disaster risk cannot be accepted and no exception applies, then the next step is to identify options for other uses or restriction on uses. It will go back to spatial plan formulation. Although planning support system will speed up the process with technically un-biased result, it may not be found everywhere.

6. Case Study from Indonesia

The economic losses of natural disasters in Indonesia since 1907 were paramount, exceeding US\$ 23.5 billion (EM-DAT, 2010). To gauge how the Local Planning Agencies respond to disaster risk reduction issues and link it to spatial planning, a survey was conducted in June and July 2009. The questionnaire was distributed to 70 Local Planning Agencies in Indonesia, with 34 responses were received from respondents from diverse geographic location of Sumatra Island, Java Island, Kalimantan Island, Sulawesi Island and Nusa Tenggara region. The respondents were Local Planning Agencies at the district or city level. The questionnaire covers aspect of

- * Identify options for other use
- * Restriction on use

No

organization, inter-agency cooperation, spatial data infrastructures and the incorporation of disaster risk reduction in spatial planning. The finding reveals that the local governments in Indonesia have started to integrate disaster risk reduction into spatial planning. Some impediments were found, but in general, the finding indicates that there are some considerable progresses in the move toward spatially enabled government in the disaster risk reduction and spatial planning sector.

6.1. Policy and Regulation

A number of policies have been issued by the central government to reduce disaster risks and casualties. The culmination of this effort was the enactment of the law regarding to disaster mitigation. Law number 24 on Disaster Mitigation which was enacted in April 2007 comprehensively regulates all aspects of disaster management. The idea of disaster preparedness and risk reduction is central in this law. Implementation and enforcement of spatial plans is essential in disaster risk reduction during pre-disaster event. Two other laws were enacted at the same year, Law 26 / 2007 on Spatial Planning and Law 27 / 2007 on Coastal Zone Management and Small Islands. The new Law on Spatial Planning has many improvements in the aspect of disaster risk reduction compare to the previous one which was enacted in 1992. It dictates that spatial plans should be based, among other things, on the consideration to includes disaster mitigation measures. Law on Coastal Zone Management and Small Islands has also a strong attachment to disaster mitigation. Disaster risk reduction strategy has to be included in the spatial plans of coastal zones and small islands. If there is a disaster as a result of negligence in developing disaster mitigation strategy, the responsible parties can be fined for up to US\$ 1.05 million or jailed for up to 10 years.

These three laws have been complemented with government regulations providing technical guidelines. In terms of policy dissemination, 72% respondents knew and understand the regulation. In some local governments, there were some local regulations on spatial planning and disaster mitigation already in place. What is still missing is a regulation on spatial data sharing and exchange between different government agencies. This situation leads to the reluctance of different government agencies to share their spatial data, especially because each agency has their own mandates and regulations which sometimes do not fit each other. Parcel level spatial planning information still difficult to achieve. Law on Geospatial Information, which is currently being discussed in the parliament, is thought will overcome the problem.

6.2. Organizational aspect

National organization for coordinating efforts in disaster mitigation and responses was set up in 1967 through a Presidential Decree. The agency was named the National Coordinating Board for Disaster Management and Internally Displaced People. This agency was transformed into the National Board for Disaster Mitigation (BNPB) in 2008. The Disaster Mitigation Boards were established at the National, Provincial and District/Local Level. The personnel usually come from the previous organization so that they already have the field experience in tackling disaster event.

The Disaster Mitigation Board has no role in spatial planning. Spatial plans formulation is the responsibility of Local Planning Agency, though usually contracted out to private consultant with close consultation with, and supervision from, a committee from Local Planning Agency. The committee consists of officials from various government agencies, such as the National Land Agency, Public Work, Forestry, Agriculture, and the Geological Agency. In this process data on natural hazards risk are shared between the parties. However, the utilization of this information depends on some factors, among them available expertise and infrastructure. Only 29% of the

respondents have staffs with education background in geosciences. Cooperation among local government agencies was mostly based on 'gentlemen's agreement', only a few have a formal agreement for cooperation.

6.3. Data consideration

Obviously all local planning agencies require data from other government agencies, public, private sector, university and Non Governmental Organizations. Main source for data on natural hazards was other government agencies. Agency who supplies most of the hazard maps is the Centre for Volcanology and Geologic Hazard Mitigation. Spatial data of hazards risk of, e.g. mass movement, usually available at small scale of 1:100,000 or 1:250,000. The small scale map was difficult to be overlaid on the detail spatial planning map of scale 1:5,000 or 1:10,000. Only recently there were initiatives from local government to execute hazards and element at risks mapping. These include flooding and landslide, and were executed by local government agencies. Local knowledge was considered in the process, as stated by 84% respondents.

The hazard maps were then being used in spatial planning. However, into what extent the information on hazards location affect the final product of spatial planning is unknown. Little has been done to predict future impact of disaster on the spatial plan. And if addressed in the planning document, the influence on the spatial planning is small. Planners faced a very complex situation with limited options and no adequate tools and accurate spatial data for simulation.

6.4. Platform for integration

Indonesia has almost 500 districts or cities spread well over 5,000 km east-west and 1600 km north-south direction in more than 13,000 islands. Their ICT capability is varied significantly, depending on the location, funding and local policy. The move toward fully digital spatial planning method is still on the way. Policy on spatial data infrastructures has been issued by the central government in 2007. It was aimed to develop spatial data clearinghouse in every department and local government. It is anticipated that the development of local SDI will facilitate better environment for collaboration in spatial planning and disaster risk reduction. As for the current practice, data sharing and exchange was conducted offline.

Information on disaster risk and spatial planning was mostly disseminated through printed documents on public meeting and newspaper. The use of internet for spatial data dissemination, which include spatial plan, was still limited. Information dissemination on the internet will facilitate greater participation on spatial planning, including disaster risk reduction effort. Some biggest challenges to provide interoperable across hundreds of local governments are preparing human resources and deploying equipment. Government initiatives on spatial data infrastructures and PALAPA Ring will accelerate the process toward spatially enabled government at the local level. SDI policy will create better environment and organizational arrangement. PALAPA Ring will connect all local government using fiber optic network, and add 320 Gbps internet connection (Iskandar, 2007) for the whole country.

7. CONCLUSION

In the past, disaster management was stressed at emergency response and reconstruction phase. However, it is currently endorsed a shifting paradigm toward prevention strategy before the disaster strike. Disaster risk reduction strategy can minimize economic losses, human casualties and ensuring sustainability of

development. It composed of developing vulnerability and integrated hazard maps. The combination of these two is integrated risk maps which is essential in the inclusion of disaster risk reduction strategy into spatial planning.

Integration of disaster risk reduction strategy into spatial planning means that there is a necessity to simulate future impacts of disaster. Spatial plans should be evaluated against integrated risk maps in order to have understanding the possible consequences of disaster on land use allocation. If the designated land use cannot withstand the risk, options on another land use should be sought. There are some degrees of acceptable risk or exception that may applicable, depending on the land use types. The focus of attention should be put on the local government level, as it will be the first to deal with disaster consequences and has the authority in spatial planning at their jurisdiction. Assessment on the Indonesian local government indicates that they are ready to incorporate disaster risk reduction strategy in their spatial planning. Policy, organizational aspect, spatial data, and enabling platform are currently being developed. Nevertheless, there are some differences among local government capacity in delivering this function.

Spatial planning is an important element in the spatial enablement of government. it should be publicly available at the most convenience way. Incorporation of disaster risk reduction strategy in spatial planning will enhance and enrich SEG functionalities. This process, however, should be designed carefully, because there are large disparities among countries and among local government in one country.

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Title:

Integrating Spatial Planning and Disaster Risk Reduction at the Local Level in the Context of Spatially Enabled Government

Date:

2010

Citation:

SUTANTA, H; Bishop, IDB; Rajabifard, AR, Integrating Spatial Planning and Disaster Risk Reduction at the Local Level in the Context of Spatially Enabled Government, Spatially Enabling Society Research, Emerging Trends and Critical Assessment, 2010, 1, pp. 55 - 68

Publication Status:

Published

Persistent Link:

<http://hdl.handle.net/11343/28949>

File Description:

Integrating spatial planning and disaster risk reduction at the local level in the context of spatially enabled government

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