Urban Planning with the Combined Method of Perception-Driven Joint Learning Approach (PeDJoLA) and Geographic Information Systems (GIS) Model for Disaster Mitigation

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Abstract. This paper is aimed at disaster risk management in urban government. The combined method of Perception-Driven Joint Learning Approach (PeDJoLA) and Geographic Information Systems (GIS) model and were developed for disaster risk management in urban government purposes. The PeDJoLA model served as the basis for investigating disaster vulnerability of existing settlements and identifying areas for new settlements in cities. This method has six main elements of the development process of risk management capacity, dynamic process based on the cities perception, and leading to shape the understanding and assessment of geospatial information. The use of GIS model is only as an additional tool so that data and detailed. In fact, disaster risk management activities require a very high cost. The measurement of the level of expertise of municipal especially in relation to disaster risk management should be developed.

Keywords: Urban · PeDJoLA · Disaster management · Geospatial information · GIS

1 Introduction

Natural disasters can cause damage that is not controlled, especially in certain seasons. Damage such as damaged roads, residential areas, farmland and other sectors of life. This requires scientists and the government to find a solution in the form of modeling to cope with natural disasters with appropriate management to reduce fatalities [1]. The process of disaster management involves many interacting elements such as a person, a team of authorities, emergency, resources, procedures, random environmental situation and others which are complex. Benefits of a model of knowledge and communication are also functioning in the planning and management of different disaster region [2].

Limitations of remote sensing in the disaster management sector are still experiencing certain problems have run faster in agriculture, geology, cartography,

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meteorology, and natural resource management of the urban analysis and research. On the one hand, the use of ArcGIS software for the policies and management of natural disasters [3]. The process of drafting a classification scheme for Landsat imagery that can be applied to urban areas in generating quality index caused by natural disasters. Data measured as the number of population, urban growth charts, and land use. Urban environment, population abundance and distribution of vegetation play an important role in minimize impact of disasters [3]. The dynamics of complex urban environments can be observed several key variables that describe a city from the physical environment. Variables such as air temperature, surface temperature, wind speed and direction, rainfall, humidity and particle concentration. This situation has a direct impact on human health and the comfort level is still not well understood in some cities. Remote sensing is a way to make an indirect measurement as a proxy for much of this amount [3].

GIS models for the prediction of the degree of vulnerability before and after a natural disaster proposed using spatial data from geological and topographical factors in the linear combination of variables [4]. One empirical model that the authors examined in this article about remote sensing and geographic information systems (GIS) techniques have made significant contributions to the prediction of the damage caused by floods, forest fires, tsunamis, diseases, pandemics or earthquake [1].

2 Complexity of Disaster Management

Viewed from the side of the nature of the disaster, to collect relevant information, make the right decisions, and generate the appropriate action plan. Disaster management is a very complex and difficult influenced decision makers hardly feel the phenomenon of how the disaster spread within complex network systems. Water supply network, gas, electricity, roads and communication networks. Network disruption will have a direct impact on the community and the development of science and technology [5]. The advantage of remote sensing observations is able to design a very large area so as to provide spatial variations in the physical quantity. Some areas can be combined with measurements in providing spatial and temporal resolution that is better than the amount provided by the measurement of the internal aspects of the course. Remote sensing can be calibrated with measurements in the core area. Type of satellite-based remote sensing is capable of measuring a physical quantity in large areas with different temporal and spatial scales. The spatial resolution offered a variety of sensors useful for observations of the urban environment [3].

Spatial data derived from a remote sensing capacity of policy makers to provide spatial information that can be used to measure the condition of the urban environment at the time of the case, before and after a disaster occurs from time to time. Forces a site area of natural disasters in urban areas can be reviewed by using a spatial data from IKONOS, Quickbird, SeaWiFS, Landsat 7 and ASTER. The specification and information are available online in http://sedac.ciesin.columbia.edu/remote/. The combination of the sensor with high spatial resolution (1 m) and high temporal resolution (day) allows the different phenomena can be monitored at different levels in detail. Expected extreme events that have or spatial distribution of components, such as natural disasters (floods, storms, and hurricanes), extreme rainfall, changes in wetlands, population shifts are quick, and the extension informal settlement can be described with the prediction results of remote sensing [3].

Information, communication and technology (ICT) is a group of digital tools and resources used to communicate, generate, distribute, store and make information management. The role of information communication technology in disaster management activity has been demonstrated in the rescue, relief, and restoration of community. Technology has a risk that communities potentially affected by the implementation such as GPS (Global Positioning System), EWS (Early Warning System) and GIS (Geographical Information Systems). This technology also as a platform to launch rescue work in the event of a disaster and transmission precautions to society [6].

Factors of natural disasters that affect the lives of humans and other living creatures. Indonesia as a country that is in a positioning ring of fire is very vulnerable to natural disasters that can eliminate human life. Academia, government, private, and researchers in the field of meteorology, geology, environment, computer, and other disciplines have contributed and attempt to predict the time, location and severity of disasters area. Various predictions on aspects of weather forecasting models, data mining models have been used for the same purpose. New discoveries and concentrated research on disaster management and analysis of the needs of victims affected by natural disasters [7].

There are three categories in the classification of the purpose of the task in the response to natural disasters, namely:

- Prediction: This sets the task involves the prediction of natural disasters, disaster-prone areas and the different attributes of natural disasters that may occur. Basically, this task involving prediction or forecasting of time, place and magnitude of the disaster.
- Detection: This sets the task involves the detection of natural disasters soon after it has happened. Literature study shows that social censorship and other social media sites reported a lot faster to natural disasters from the observatory.
- Disaster management strategy: this method handles the identification of the different entities that take part in the fight against disaster so that communication improved, the right attention from people who are affected are identified and distribution of relief items is optimized [7].

Some progress in the transition system of emergency management and disaster risk reduction, emergency management agencies remain reluctant to adopt proactive management for natural disasters [8]. Material losses and economic impact or environmental exceed the ability of communities affected by the disaster. In the event of a natural disaster in an emergency is very important to minimize losses, damages, and build mental resilience population. The distribution of the resources immediately following the disaster, aid agencies need access to information about the size of the event, the location where the affected population, population dynamics, and distribution resources and infrastructure [9].

The latest European research project aims to support the development of products and tools repair of disaster response when crises occur, especially through the provision of mapping capacity, and for the delivery of services before and after the operation of the crisis [10]. Residents need to be equipped with knowledge and evacuation drills. Education and public awareness have influenced the development of emergency plans, evacuation routes and safe area in the event of a disaster [11]. Disaster mitigation is not only buildings to be reinforced or kept away from the danger zone at all, but the government must have a plan in place to deal with disaster by organizing and training the necessary personnel, making evacuation plan, have an emergency medical facility and make arrangements to provide food, clean water, clothing and other necessities required population [12].

GIS data used in detecting damage caused by a disaster. A remote sensor that varies in space contains a type of optical data, SAR, LIDAR, and vector map with the number of the resolution of 10 m to 0.3 m. Research shows data at a resolution of 10 m can only identify damage at the block level while the detection of damaged buildings individual requires a resolution of at least 1 m by 0.5 m to obtain detailed results [13]. Lack of emergency planning, limited resources (money, energy, medical care unit, etc.), the uncertainty and variability in demand, response time, a reliability of structures and delays in the arrival of aid [14].

The relevant government must have the authority and have a list of industrial energy, water, food, health, finance, transportation, chemical industry, telecommunications and other research facilities during natural disasters where it is required by the population [15]. Spry disaster areas tend to have good institutions, effective early warning, disaster preparedness, and response system. The resulting level of risk is most hazards are increasing over time. Disaster risk of harmful leads to economic losses much faster than the risk of death. In developing countries, the economic conditions and governance, in general, improve vulnerability decreases but not fast enough to offset the increase in foreign exchange. It is inversely proportional to the poorer countries which haveproportionately higher death and the risk of economic losses than developed and developing countries [16].

3 Capacity Development Model

The methodology used in this paper is a GIS software for mapping and the remaining information layers which are listed below were entered into the GIS [12]. The model reviews the model perception driven joint learning approach (PeDJoLA) is a model of the development of the capacity of disaster risk management simpler used in this paper has six main elements of the development process of risk management capacity and dynamic process based on the perception of the country (capacity deficit) on one side (top to bottom) and the people on the other side (bottom up). This perception explains that the state and society have a duty to take action (intervention project) in the capacity building process. Environmental factors play a key role in shaping the process of capacity building [17] (Fig. 1).

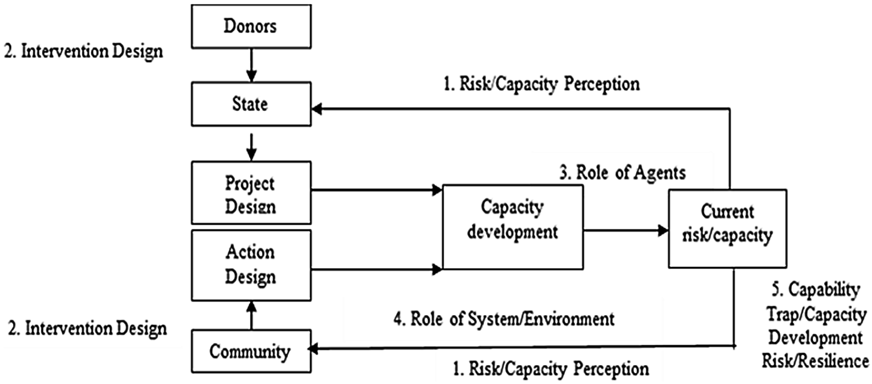

Fig. 1. PeDJoLa capacity development model (Tiwari [17])

4 Discussion

4.1 Perception of Risk and Capacity

Risk perception and capacity of disaster so far are still in good condition by the government and society, but most of the group assumes the risks and different capacities. Subjective disaster risk raises the probability that something bad will happen. Communications planning strategies appropriate to inform the public and understand the situation during emergencies and stress. Lack of understanding of risk perception translate into capacity building efforts such as the possibility that something bad will happen and that is where the subjective risk of bad assumption may not be the same as what other people think is bad. The perception that society, in general, can be used to plan capacity building efforts.

4.2 Intervention Design

Model risk and capacity deficits in perception with capacity building measures. Based on the assessment of disaster risks in the targeted sectors or areas, the existing capacity, and capacity Deficit (comparing what should be there for what is), the government and donors propose capacity building measures. At the same time, based on their own risk perception and capacity deficits to meet the level of acceptable risk in the community to take steps to build capacity.

4.3 Role of Agents

The role of an agent of an area affects change in the level of leadership as the national level of the government sector, non-profit leaders, and NGOs, representatives of donor organizations, community leaders, political leaders and government officials. Environmental work with tension, imperatives and incentives continuing into awards or hamper innovation. Here, the role agents can help reduce disaster risk management (Table 1).

Table 1. Components and sub-components of the PeDJoLA model

Capacity components	Sub components	Application in disaster risk management field
Government capacity		
Institutional	Enabling policies	DRM laws, DRM programs and projects at national, state and local levels
Organizational	Administrative structures	Clear roles and responsibilities in DRM emergency planning
		Risk mapping and mitigation planning, monitoring, DRM data collection
	Coordination	Before, during, and after disasters
		Coordination plans or protocols between departments and agencies, coordination plans
	Publicity	DRM plan publicly available, meetings, periodic DRM material made available
	Awareness	Public awareness plan
Implementation	Enforcement	Building codes, master plan, risk reduction, emergency plan implementation
Technical	Skills and resources	Trained staff, access and motivation for
	Experience	In handling emergency
Political	Leadership	Awareness and interest in DRM
	Publicity	Public campaigns on DRM
	Community participation	Community involvement in prevention and response planning
	Citizen committees	On DRM and response planning
Community capacity	Skills	On safer house, knowledge of disasters
	Coordination	With different community groups
	Cooperation	Trust and help during disasters
	Leadership	Many community leaders
	Inclusion	Minority, women, poor

4.4 Systems and Environment

Government and public sector there is a dynamic system. This measurement system can go through several stages such as transparency, information flow, and relationships between the parts and the whole. Consists of the environmental aspects of economic, political, administrative, social and cultural. Capacity development imposed on the enabling environment as a passive element which may affect the capacity of the development process, the system in disaster risk management efforts. Four factors are important for system management:

- Flexibility to adapt to changing circumstances: It is possible to generate innovatively.

- Flexibility in the relationship between parts and wholes: Risks should be shared the whole system to improve the safety of its members and the entire system. As part of the interconnected systems, weakness in one part of the system requires other parts to adjust and reduce the weaknesses throughout the greater system.
- Interactive exchange between the system and its environment: an ongoing process where the exchange generates a growing form so that it becomes a complex adaptive system.
- Exchange of information: the flow of information between the constituents and external the environment determines the capacity of the system to reduce the risk in the future and create an ongoing relationship with the elements in the environment.

4.5 Capacity Development Implementation

Community development and government in achieving preparedness and disaster resilience, in general, depend on the ministries that deal with the environment, agriculture, construction, planning, and municipal governments. The Ministry is responsible for emergency management, disaster risk management, and urban development.

5 Conclusion

This paper describes the disaster risk management planning at the municipal level. Perception Model-driven joint learning approach (PeDJoLA) used in this paper has six main elements of the building capacity process management and dynamic process based on the perception of a country. This model can be a guide to reducing the risk of natural disasters, leading to shape the understanding and assessment of geospatial information. Research shows PeDJoLA to integrate spatial thinking in local government, cannot approach that focuses only GIS-oriented applications. The use of GIS is only as an additional tool so that data and detailed and accurate geospatial information. Challenges of the city government to reduce the impact of disaster risk by preparing the evacuation area Kordan, physical facilities, counseling and training the public on preventive measures during natural disasters occur. In addition, the measurement of the level of expertise of municipal officials, especially in relation to disaster risk management should be developed. In fact, disaster risk management activities require a very high cost.

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