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Disaster Risk Reduction and Climate Change Adaptation Integration into Peri-Urban Development Planning: A Case Study of Bandung Metropolitan Area, Indonesia

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Abstract. Rapid urbanization and frequent climate-related disasters are challenging issues in peri-urban areas. The integration process of disaster risk reduction (DRR) and climate change adaptation (CCA) into development planning is very essential in order to minimize the impacts and risks. This study attempts to assess to which extent the local government in peri-urban area has considered the significance of DRR and CCA integration into its development plan. This study focuses on flood disaster under climate change and peri-urban development. South Bandung Area, which is part of Bandung Metropolitan Area, is selected as a case study particularly the area along the river in the downstream of the Citarum River. Content analysis was conducted. The findings found that the integration process into development plan is not much strong. Although, the attention on the disaster has been mentioned. One of the challenges is the lack of policy direction of DRR and CCA into local development planning. Lack of understanding and law enforcement can be the drivers of this situation in peri-urban areas.

1. Introduction

Climate-related disasters, including flooding, storm, and landslide, are frequently happened disasters in a typical tropical country, like Indonesia. One of the significant areas that should be paid more attention is peri-urban areas. These areas are mainly to support the activities in urban center, however, in term of spatial aspect, it is a transition area between fully urbanized in cities and predominantly agricultural area. There is less attention to discuss the climate-related disasters in peri-urban areas in term of risk management. In order to achieve vulnerability and risk reduction, climate change adaptation (CCA) and disaster risk reduction (DRR) integration into development planning is required. Although, there is effort to deal with this situation in the early stage; there is limited research on the integration process at the local level. DRR and CCA measures have seen as two different things and fragmented matter. This study attempts to assess to which extent the local government has considered the significance of DRR and CCA into its development plan/program. South Bandung Area, which is part of Bandung Metropolitan Area in West Java Province, Indonesia, is selected as a case study. This study focuses on urban flooding under changing climate conditions and peri-urban development, especially in the southern part of BMA; there is always getting the frequent flood disaster every year due mainly to the geophysical condition in low-land area along the Citarum River. The massive development along the river also affect the disaster. The local government has attempted several strategies to reduce the impacts; however, the flood always occurs. Content analysis of local



development plan documents is conducted, including spatial plan (*Rencana Tata Ruang Wilayah/RTRW*) and local development plan (*Medium-Term Local Development Plan/RPJM*).

2. Contextual Consideration

Disaster risk reduction (DRR), climate change adaptation (CCA) as well as mitigation become current priorities of the national governments in order to minimize the impacts and risks. Nevertheless, the communities or local government units are the front position of preparation, mainstreaming and implementation of DRR and CCA in affected and vulnerable areas. From the global agreement of Sendai Framework for Disaster Risk Reduction (SFDRR), DRR policy needs to consider four priorities: understanding disaster risk, strengthening disaster risk governance, investing in DRR for resilience, and enhancing disaster preparedness and also to “Build Back Better”. Meanwhile, CCA requires understanding of hydrological, meteorological hazards, future climate and current extreme events [1]. Both DRR and CCA require appreciation of the interaction between current and future climate and weather-related hazards and their interaction to other forms of hazards [2]. One of significant processes in order to achieve vulnerability reduction or hazard mitigation as well as to achieve resilience, adjustment and transformation is the need of CCA and DRR integration into development planning. Vulnerability and disaster risk assessment become important in this process. However, Indonesia, which is considered as one of the most vulnerable areas to climate change impacts and natural hazards especially in low-lying areas including coastal and surrounding the river or delta areas, is still not yet much attention to the process of integrating CCA and DRR into its development planning. Although, there is effort to deal with this situation in the early stage, for instance, the establishment of guideline for mainstreaming, but the implementation is still not clear. Based on [3] and [4], the national adaptation planning of Indonesia (RAN-API) has focused on providing directions for mainstreaming CCA into national, local, and sectoral development planning. And it has a legal aspect based on the Ministerial Law No. P.33/2016 on the guideline to make CCA actions. However, there is limited research on the integration process of DRR and CCA into development plans at the local level. DRR and CCA measures have seen as two different things and fragmented matter.

2.1. Development planning hierarchy

Indonesia has three tiers of government, which are the state or national government, province, and local authorities (city and regency). These respective governments have the authority to develop their local developments plans according to the Law No. 25 of 2004 on The National Development Planning System, and spatial plans according to the Law No. 26 of 2007 on Spatial Planning. They include the 20-years-term of general spatial plan called *Rencana Tata Ruang Wilayah* (RTRW) and the long-term development plan called *Rencana Pembangunan Jangka Panjang* (RPJP) which also covers a 20-years period. These plans are translated to specific plans in the five-year period or mid-term development plan called *Rencana Pembangunan Jangka Menengah* (RPJM). Development of Indonesia depends on these planning policy documents.

[5] argues that development plans are considered as the appropriate means for transforming scientific information regarding climate impacts and natural hazards into long-term planning for building climate resilient cities. Development plans according to [6] range from the macro level (e.g., national physical/spatial plans or integrated/comprehensive plans) to the meso-level (e.g., structure plans or district plans) and the micro-level (e.g., special area plan, local action plans, and development program/projects). The hierarchical order of these plans should not be viewed as rigid and inflexible because higher-order plans provide guidance for lower-order plans to implements tasks and strategies at the appropriate level. In other words, each plan is interdependent while guidance trickles down the hierarchy and, at the same time, provide feedback on the achievements related to broader visions. At the meso- and micro-levels, a district plan or local action plan is a vital mechanism to control the uses of land in the relevant planning area in an orderly manner. The plans are usually accompanied by development and/or conservation strategies, zoning regulations and building codes. The preparation of

a local plan is generally the responsibility of a planning authority; however its implementation is usually entrusted to the relevant local authorities. The function of a local plan is to implement the development policies and strategies of higher-order plans in line with the socio-development, economic-development and environmental needs of the respective planning area. The hierarchy of spatial plan and local development plan in Indonesia can be seen in Figure 1. Indonesia's development plan and spatial plan are implemented in three level of governments, which are national, province and regency/city (*kabupaten/kota*).

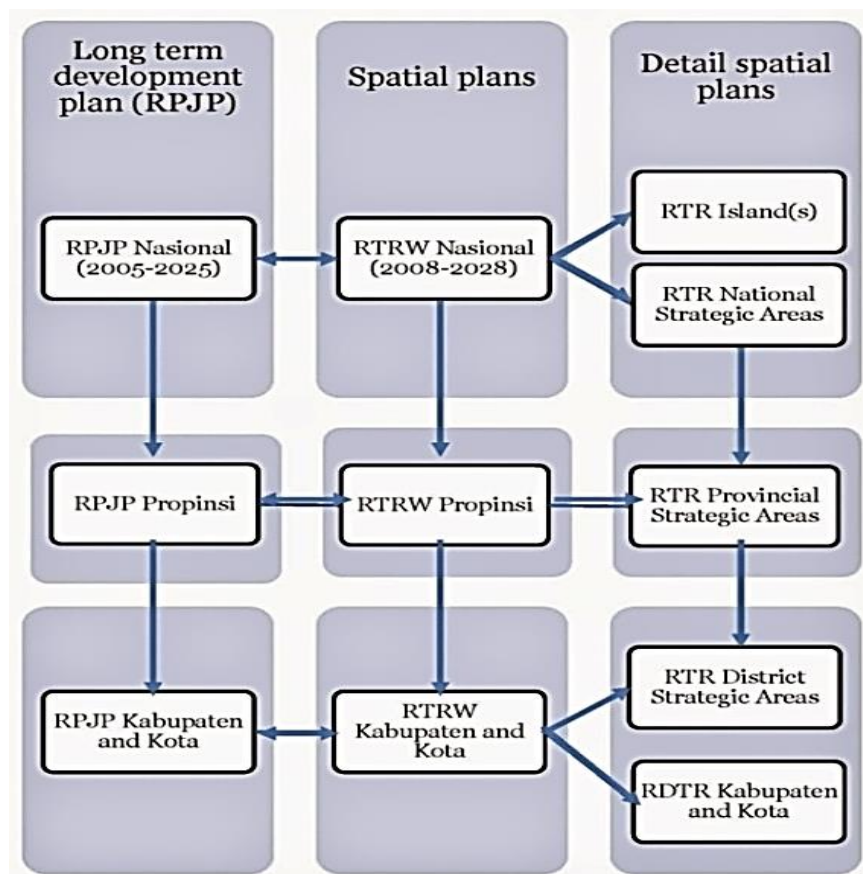


Figure 1. The hierarchy of Spatial Plan and Development Plan [7]

3. Methods

Content analysis is done to investigate the integration of climate adaptation measures in such documents of development planning. In this study, the documents include spatial planning and non-spatial planning. Spatial planning called Rencana Tata Ruang Wilayah (in Bahasa) is used to guide the development of areas in Indonesia. Non-spatial planning called Rencana Pembangunan Jangka Menengah (in Bahasa) or Development Plan is established to guide the local government by providing the strategies, program and plan in the current periods. The Spatial Plans and the Local Development Plans are used as the main document to guide physical, social, economic, and environmental development. RTRW represent spatial document plan, while RPJP represents non-spatial plan. Climate change mitigation and adaptation are claimed to be central to the new plan, because many evidence of the impacts influence sustainable urban development. The purpose is assessing to what extent the issue of CC, especially climate adaptation incorporates to the documents of urban development plan. The content analysis technique is used for this purpose. The use of content analysis technique was limited to analyzing the policies and strategies in the local development plans with respect to CCA measures.

4. Peri-urban Development in South Bandung Area

Bandung Regency has faced many challenges and issues such as transportation, solid waste management, and flood protection. Frequent floods become a big challenge in the peri-urban area, especially in the southern part of Bandung Metropolitan Area (see Fig. 2). This area is mostly in the low-lying area and along the rivers. Seasonal floods have proliferated in several areas of Bandung, especially in South Bandung. These events were much worse in the past few years due to the massive increase of built-up areas. Moreover, Bandung Regency faces the combination of strong intensity and volume of rain during the rainy season in particular between December and March. Due to the unbalanced topography, rain water usually flows from the northern to southern part of the city. Bandung Regency is selected as a case study area, which has a characteristic of rapid urbanization and many problems occurs due to urbanization. The city is prepared to have functional linkages with integrated infrastructure services and possible cooperation for city-to-city and city-to-regency level, related to industrial, economic, and service sectors. It is part of metropolitan area consists of Bandung City, Cimahi City, Bandung and West Bandung Regency with an area of 3,392 km² in 2005 and a total population of 8.2 million in 2014 (see Figure 1 and 2).



Figure 2. Orientation map of study area

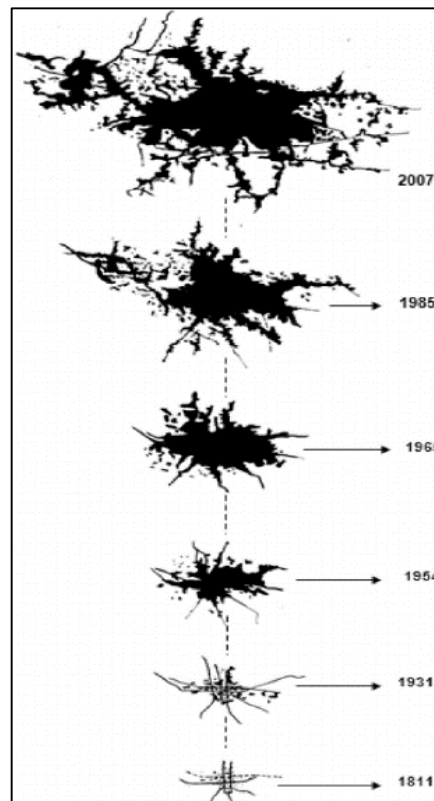


Figure 3. The urban development in BMA

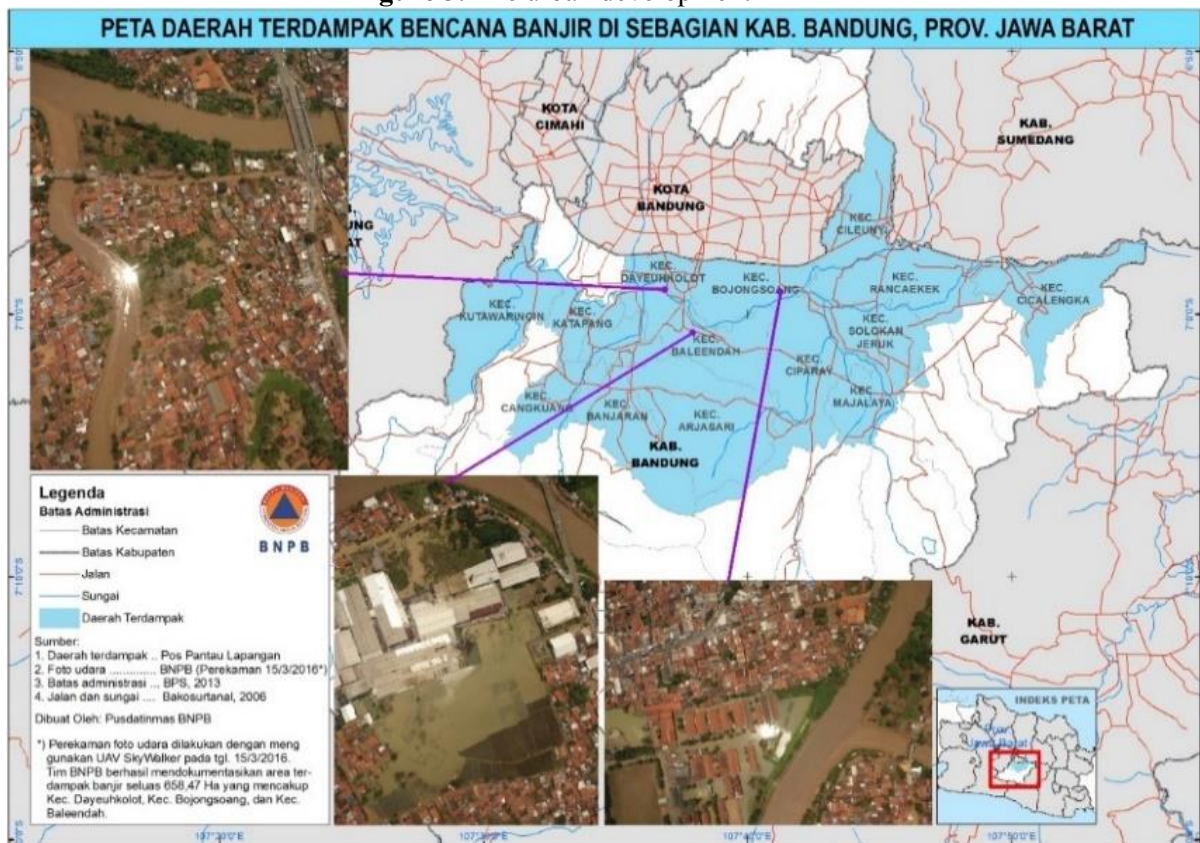


Figure 4. Affected areas to flood in the southern part of Bandung Metropolitan Area.

5. Results and Discussion

5.1. *Medium-Term Development Plan*

The Local Regulation of Regency Bandung No. 7 of 2016 is regulating the Medium-Term Local Development Plan of Bandung Regency 2016-2021 (hereinafter called RPJMD). RPJMD is based on the vision and mission of the elected Mayor for 5 years period. RPJMD has the function to give direction and the guideline for all stakeholders in order to achieve sustainable urban development goals.

Analysis of strategic issues in the Plan is an essential element in the process of making a local development plan. Strategic issue is a condition or something that have to be consider in development plan because of its significant impact to the entity (area or community) in the future. In the RPJMD of Regency Bandung, it is stated the issue of under control of massive development and inappropriate development with spatial plan. Meanwhile, the strategic issue related climate change and disaster has mentioned in one of development priority issues in Bandung Regency, which is preventing flood disaster and drought. Although, it does not explicitly state the notion of climate change and disaster, however, the impact of climate-related disaster is already considered.

The vision of Bandung Regency is to establish Bandung Regency being advanced, independence, and competitive through good governance, and rural development synergy based on religiosity, culture and environmentally sound. One of missions in regards to achieve the vision is to create environmentally sound.

In term of strategy and policy direction in the RPJMD, development strategies to make integrated basic infrastructure development with spatial plan and considering disaster aspect are directed by enhancing the availability of spatial plan documents, increasing the effectivity of spatial plan, intensification of coordination implementation, enhancing the rule and spatial plan documents regarding land use control, increasing the effort to prevent disasters and its impact, relocation from flood prone areas, construction of polder ad retention ponds, and management of drainage network system. This Plan also has considered the development of adaptation and mitigation measures imposed by climate change; although it is not explicitly mentioned.

5.2. *Spatial Plan of Bandung Regency 2016-2036*

Spatial Plan of Bandung Regency is regulated by the Local Regulation of Bandung Regency No. 27 of 2016. The objective of spatial plan is to make the integrity and independency of regional development of Bandung Regency as highly competitive areas based on natural and human resources through equitable distribution of environmentally sound development. The policy of spatial plan consists of development policy and strategy in spatial structure, spatial pattern and strategic areas. Although it is not mentioned obviously in the Plan about climate change-related disaster issue, however several strategies and policies consider the prevention measures to the impact of climate change, such as the statement of the vulnerable area to flooding. It is defined as the flat area in water basin, where is regularly or has potentially received a high surface water flow and it cannot be accommodated by drainage or river. For example, integrated water resource management through river water basin approach and public interests, irrigation and flood control. In particular, the development strategy to implement the policy for protecting the conservation area has stated the need to make detail planning of disaster prone area, and to remove build-up land use activities in highly disaster-prone areas.

Spatial structure plan comprises the development plans of activity center system, and main and other infrastructure systems. The development plan of activity center system consists of national and local activity centers. The spatial structure plan is not explicitly and directly explained the contribution of climate-related disasters to development, however, there are some measures plan to reduce the impacts and risks. For example, the development plan of disaster system and regional flood control system. It is also mentioned in the spatial plan that the need to manage river areas, including river conservation, river utilization, and river damaged control. Generally, the plan has already clearly stated to protect the area along the river from build-up area activities without regards to the provision

of spatial planning, however, the actual practice in the field is really difficult to control due to low of law enforcement and lack of understanding and awareness. In addition, the focus of plan is more on disaster rather than climate-related disasters. By understanding the linkage between climate change and disaster, the plan will be able to reduce the impact and risk by preparing some relevant measures. For example, based on the trend of historical climate, we can predict the anomaly and the extreme weather for the future.

Spatial pattern plan consists of protected area and developed area. In this plan, it presents a specific area that should be preserved, which is natural disaster-prone area, and local protected area. The areas that includes in this plan are the water catchment area in the upper land, the areas in along river, coast, pond, and reservoir, green road line. For disaster-prone area, it includes the areas that prone to flood, ground movement, earthquake, storm, and lava flow.

6. Conclusions

It can be found that the integration of CCA and DRR in local development plans of South Bandung Area is still not much strong. First, most of the issue is under the environmental aspect. However, the climate adaptation not considers only in the environmental dimension, but also to other dimensions, such as infrastructure, social (health) and economic aspects. Second, actually local development plan has adopted the measures to reduce the vulnerability in the prone areas, but it is less explanation on the cause of climate change phenomenon, such as the improvement of drainage system, the construction of water storage pond, the greening program, the education building capacity for community. Climate related disasters in peri-urban areas such as flood, drought, extreme weather event, and high precipitation can be predicted to be the input for the analysis. These results could be inputs and lesson learned for other cities in the context of policy consideration. Actually, it is not easy to integrate both of climate change and disaster issue on the local development plan.

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