Strengthening Community Resilience from Spatial Plan Perspective

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Abstract

Under a research project entitled “Integrated Concept for Community Resilience”, community resilience is conceptually affected by internal socio-economic factors (vulnerability & capacity) and external factors (governance and spatial planning). As part of this research, this chapter scrutinizes the role of spatial plan in strengthening community resilience. Case study selected for this chapter is from two districts in Yogyakarta (Sleman and Bantul). These two districts experienced large scale volcanic eruption and earthquakes in 2010 and in 2006. This study proposes a framework that integrates spatial planning with community resilience and how spatial planning contributes to community resilience in the long run.

Keywords: spatial plan, resilience, community, external factor, Indonesia

Abstrak

Penelitian ini berada dalam sebuah proyek penelitian yang berjudul "Konsep Terintegrasi untuk Ketangguhan Masyarakat", ketangguhan masyarakat secara konseptual dipengaruhi oleh faktor internal sosial ekonomi (kerentanan dan kapasitas) dan faktor eksternal (pemerintahan dan perencanaan ruang). Sebagai bagian dari penelitian ini, chapter ini mendalami peran rencana tata ruang dalam memperkuat ketangguhan masyarakat. Studi kasus yang dipilih untuk chapter ini berasal dari dua kabupaten di Yogyakarta (Sleman dan Bantul). Kedua kabupaten ini mengalami letusan gunung berapi skala besar dan gempa bumi pada tahun 2010 dan 2006. Penelitian ini mengusulkan kerangka kerja yang mengintegrasikan perencanaan tata ruang dengan ketangguhan masyarakat serta bagaimana perencanaan tata ruang berkontribusi untuk ketangguhan masyarakat dalam jangka panjang.

Kata kunci: rencana tata ruang, ketangguhan, masyarakat, faktor eksternal, Indonesia

1. Introduction

There are many factors involved in determining how communities develop. In general, this can be grouped into internal and external factors. Internal factors include how community applies their internal characteristics as factors to develop the communities, such as capacities, weaknesses (vulnerability). Meanwhile, external factors include socio-economic politics that affect community settings, such as governance (law, norms) and physical planning settings, such as spatial plan.

Located at the pacific ring of fire, Indonesia has more than 100 active volcanoes (SI-USGS, 2009). Most of the volcanoes are inhabited since they offer many sources of economy to the inhabitants (fertile land, cold climate, tourism). Despite the benefits, a volcano also poses risks to the inhabitants living nearby. In the volcanic crisis situation, the residents have to evacuate and leave their place in time (Perry and Godchaux, 2005) in order to minimize the risks for lives while still suffer losses to their belongings (damages to houses, crops, cattle, etc). In some volcanic prone area, there have been hazard zones developed by National Geological Agency (NGA) of Indonesia. These zones are shown into maps that can be accessed freely from NGA websites. These maps have been recently used in the making or reviewing of spatial plans in hazard prone areas, such as Sleman and Bantul Districts in Yogyakarta.

Community exposures to disasters can be affected by many settings. Partly, this is due to the disasters occur in inhabited places whether in urban or in rural areas. Some of these problems can be attributed to the development of the built environment at hazard prone areas (e.g. floodplains, lowland at coastal areas, close to volcano, earthquake faults, etc). Spatial plans provide tools that can be effective in reducing disaster risks at wider scales (Brody, 2003a; Brody, 2003b; Burby, 1998; Burby and Dalton, 1994; Burby and French, 1981), such as floodplain zoning, hazardous area and built up areas. The questions are to what extent landuse plans can affect community resilience? How are spatial planning policies taking role into strengthening community resilience? Taking these questions as case studies, this paper examines the concept of community resilience in Sleman and Bantul from spatial plan perspectives.

2. Literature Review

In the context of community, Twigg (2009) defines community resilience as community that has capacities "(1). to absorb stress or destructive forces through resistance or adaptation, (2). to manage, or maintain certain basic functions and structures, during disastrous events and (3). to recover or 'bounce back' after an event". Twigg (2009) also notes out that spatial plan influence community resilience. Heijmans and Sagala (2013) echo this by proposing spatial plan should be seen as integral and wider components.

How community resilience is related to spatial plan is explained on the basic importance of spatial plan in disaster risk reduction. Urban and regional planners, such as Burby and French (1981) believe that by limiting the hazards through "the conventional ways of dealing with that problem" such as flood control programs, building codes, insurance and disaster relief would significantly reduce hazards and the risks. Furthermore, they suggest that the impact of "limiting development" in areas at risk would minimize the potential for losses of lives and property in large hazardous events and may provide protection for sensitive environmental features. For the study conducted seismic prone city, Cartago, Costarica, Montoya (2002) argues that hazard zoning is still an important approach to reduce the risks posed by natural disasters. Therefore, imposing land use plan will help for strengthening community resilience. Brody (2003b) argues that community resilience can be achieved by accommodating the issues of ecosystem management into spatial plan.

Despite many literatures propose the importance of land use plan, however, the implementation of the hazard-zone based land use plan to reduce the risk remains low. Lavigne and Gunnel (2006)

provided the examples from their observation to several volcanoes in Central Java, Indonesia. They further noted that the residents living at the slopes of the volcanoes cultivated tobaccos, potatoes and many agricultural plants despite the dangerous that might be posed by the volcanoes.

Nevertheless, there are some doubts on how land use plan can deal with the hazards that people are facing. Kelman and Mather (2008) noted, “avoiding the hazards”, such as through land use plan and hazard zoning implementation”, may not always work. In many cases, the impacts of the volcanic eruptions are not local and are sometimes global. Therefore, any place on the surrounding of the volcanoes can be affected and is not exclusive from the hazards that may occur. In the study at flood plain areas in the Philippines, Sagala et al (2007) also found that it is the residents themselves that ignore in implementing the land use plan. Despite flooded for two weeks in a year, the areas that they are living are close to the markets. Therefore they sacrifice the flood risks to other types of risks which are much higher for them (livelihood risks).

As argued above, land use plans offer several advantage to minimize the disaster risks that people are dealing with. However, when it comes to implementation, in hazard prone, it is challenged by many factors. Not only is it unable to fully provide an exclusive safe zone to the people, but also other types of risk also play role in the resident considerations. Thus, it is necessary to identify a land use plan that can be implementable to reduce disaster risks.

3. Location & Methods

This research was conducted in Sleman District and Bantul District, Yogyakarta The district has been spatially linked within the context Kartamantul Greater Areas (Yogyakarta, Sleman and Bantul). Kartamantul is a region with high interaction of economic activities, people and mobilization among the three districts in this region. In Kartamantul, Sleman serves as an upstream role the buffer of Yogyakarta and Bantul. Additionally, Sleman has been posed to the threats from the active Merapi Volcano. Meanwhile Bantul role as a downstream area is highly exposed to the threat of tsunami and coastal erotion along the coastal side. Since many rivers flow from Sleman to Bantul, passing Yogyakarta City, increasing rainfall intensity in Sleman will bring sediments and flood to Bantul area.

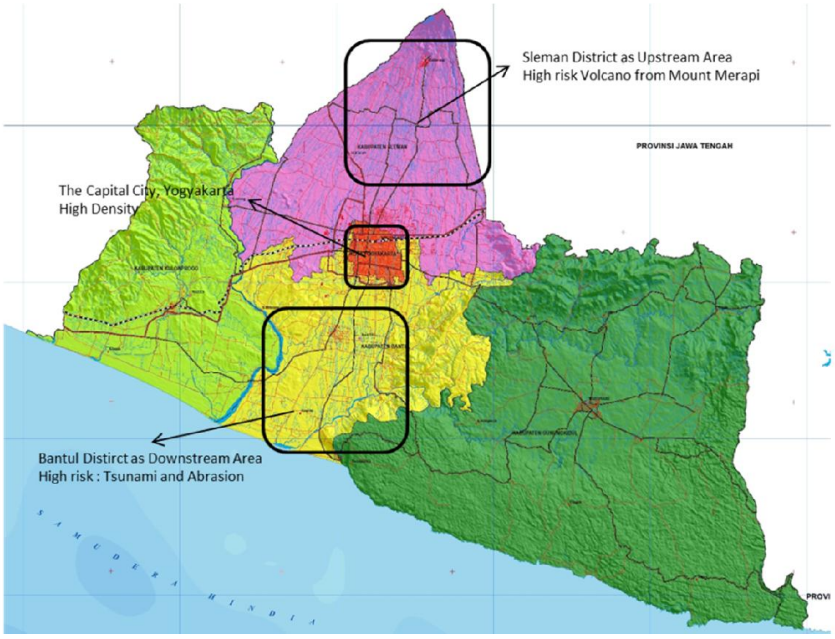

Figure 1 The Study Area in Bantul and Sleman Districts

According to BPBD of Yogyakarta Province (2014) Sleman has been 20 Destana (Desa tangguh bencana or Resilient Village) is divided into Tangguh Pratama (Early/Low Resilience), Madya Tangguh (Medium Resilience), Tangguh Utama (High Resilience). Meanwhile, in the district of Bantul has 70 Destana. The classification of these resilient villages are used for selecting the samples.

District	Village	Category	Number of Sample
Bantul District	Poncosari	Tangguh Utama (High Resilience)	30
	Mulyodadi	Tangguh Madya (Medium Resilience)	35
	Bangun Harjo	Tangguh Pratama (Early/Low Resilience)	35
Sleman District	Argomulyo	Tangguh Utama (High Resilience)	30
	Hargobinangun	Tangguh Madya (Medium Resilience)	35
	Glagaharjo	Tangguh Pratama (Early/Low Resilience)	35

Table 1 Samples based on Resilient Village Locations

From the spatial planning perspective, community resilience is measured by the following variables. Spatial planning variables include land use, infrastructure, contingency planning, risk maps, shelters for evacuation, zoning regulations, early warning systems, transportation, spatial planning policy, community awarness to spatial planning. To get an idea of the spatial resilience to disasters is used the approach of the research is mixed approach is quantitative and qualitative.

The Quantitative approach using by questionnaires given to people who are considered representative of the population. Questionnaires are scattered in villages study sites by the number of 200 families. This questionnaire using stratified random sampling approach to select three villages

in each district, where the strata are the criteria of a disaster resilient village consisting of Resilient Village Main, Associate, and Primary. Meanwhile for selecting households to be surveyed in each village with a systematic random sampling method, provided respondents the number of people aged ≥ 17 years for men and women.

The processing of data obtained from the survey results include scoring variables, using the SPSS statistical calculation process 20 and Microsoft Excel for processing the primary data that support this research. Data were obtained through a survey prepared by the method of data analysis and descriptive and correlation. Descriptive statistical analysis used to obtain variabel and indicator resillience of spatial planning. The Correlation analysis methods are used to find the relationship and prove the hypothesis of relationship between two variables when the second data in the form of interval or ratio variables, and data resources of the two variables are equal.

4. Results

To measure the 'resilience', we propose to sum up all the score from each variable that constitutes community resilience from spatial plan perspective. Therefore, community resilience from spatial plan (CSRP) is shown as below:

$$\text{CRSP} = \frac{\sum_{i=1}^{n} xi}{n}$$

Where:

CRSP : community resilience from spatial plan perspective which is measured as an average value.

x = resilience of indicator i for spatial resilience.

n = number of variables that constitute spatial resilience.

The total resilience that we obtained for In average, resilience score for Sleman is 2,8068 while in average, resilience score for Bantul is 2,6603. This means, in general the average resilience score in Sleman is higher than the average resilience score in Bantul. Therefore, this shows that from spatial plan perspective, Sleman has a higher (better) resilience from Spatial Plan perspective.

We also carry out correlation between the CRSP (for all data) with some variables that are related to physical conditions, such as (i) knowledge of spatial plan about disaster zone, (ii) availability of disaster risk reduction plan at village level, (iii) Understanding of contingency plan and (iv) Evacuation shelter for livestocks. The correlation results show that all of these variables are correlated with average resilience score.

		Average Resilience Score CRSP
Knowledge about spatial plan regulation on safe and dangerous zone?	Pearson Correlation	0.528**

	Sig. (2-tailed)	0
	N	200
Disaster Risk Reduction Plan at Village Level	Pearson Correlation	0.494**
	Sig. (2-tailed)	0
	N	200
Understanding about contingency plan	Pearson Correlation	0.440**
	Sig. (2-tailed)	0
	N	199
Evacuation shelters for movable goods and livestocks	Pearson Correlation	0.195**
	Sig. (2-tailed)	0.006
	N	198
****. Correlation is significant at the 0.01 level (2-tailed).**		

Table 2 Correlation between Average Resilience Score and other Variables

As shown in table 2, the more the respondents know about spatial plan regulation plan, the higher the average resilience score. This is shown by high correlation (0.528) between these variables. This implies that the existence of spatial regulation plan can make respondents aware of potential hazard zones. Furthermore, this means if a respondent is aware of spatial plan regulation, it also will highly correlated with the resilience of the respondent. Thus, provision of spatial plan regulation per se is not enough. It should be by making people aware of this regulation that guides about safe and dangerous zones.

Similarly, there is a high correlation (0.494) between disaster risk reduction plan with community resilience score. According to the respondents, the existence of disaster risk reduction plan at village level shows it's importance contribution to community resilience. Disaster risk reduction plan can guide community on future activities that can be carried out to reduce disaster risks, such as continuous assessment of the potential hazards, agreement about where and when to evacuate, maintenance of infrastrastructures that can support in case disaster happens, development of disaster management team that continuously increase community awareness, etc. The high correlation indicates that if one wants to increase resilience, development of disaster risk reduction plan at a village level is compulsory.

A high and significant correlation is also found between understanding contingency plan with community resilience score (0.440). This shows that respondents think in the case of disaster, contigency plan will guide them clearly on what to do, which includes standard operating procedures of who does what, where to get resources from, where to evacuate, etc. Thefore, this finding shows that this variable is an important component that contributes to community resilience.

Finally, a significant correlation is also found between evacuation shelters for movable goods and livestocks and resilience score (0.195). This implies that communities will consider their belongings and livelihood assets as important consideration before they evacuate. If the location of evacuation is too far from their assets, they are less likely to follow the evacuation. This can be approached by moving their goods and livelihoods to the place closer to the shelter to make sure the evacuees can still save and maintain their belongings. For some people, owning this asset is very important for sustainability of their lives (Kelman and Mather, 2008).

These various variables show that spatial plan at village level matters. This includes spatial plan regulation, DRR Plan, Contingency Plan and Shelter location. DRR Plan covers the identification of hazards, vulnerability, capacity (resources & infrastructures) and their whereabout. Contingency

plan explains the safe routes taken and also logistics needed in case a disaster happens. Finally, shelter location should consider about the community assets. These variables are considered as elements of spatial plans at village level and has to be integrated with the updated spatial plan outputs and processes.

However, it should be remembered that spatial plan is a document that cannot be separated with the larger contexts. In this sense, spatial plan at village level should be connected with the sub-district, district, provincial and even further until national spatial plan. It is because spatial plan is a consensus where public domain is the important factor in determining agreed products and processes. Therefore, all stakeholders coming in from village, sub-district, district, provincial and national should have mechanism to connect through the spatial plan mechanism. In this regard, this connection is conceptualized in Figure 2.

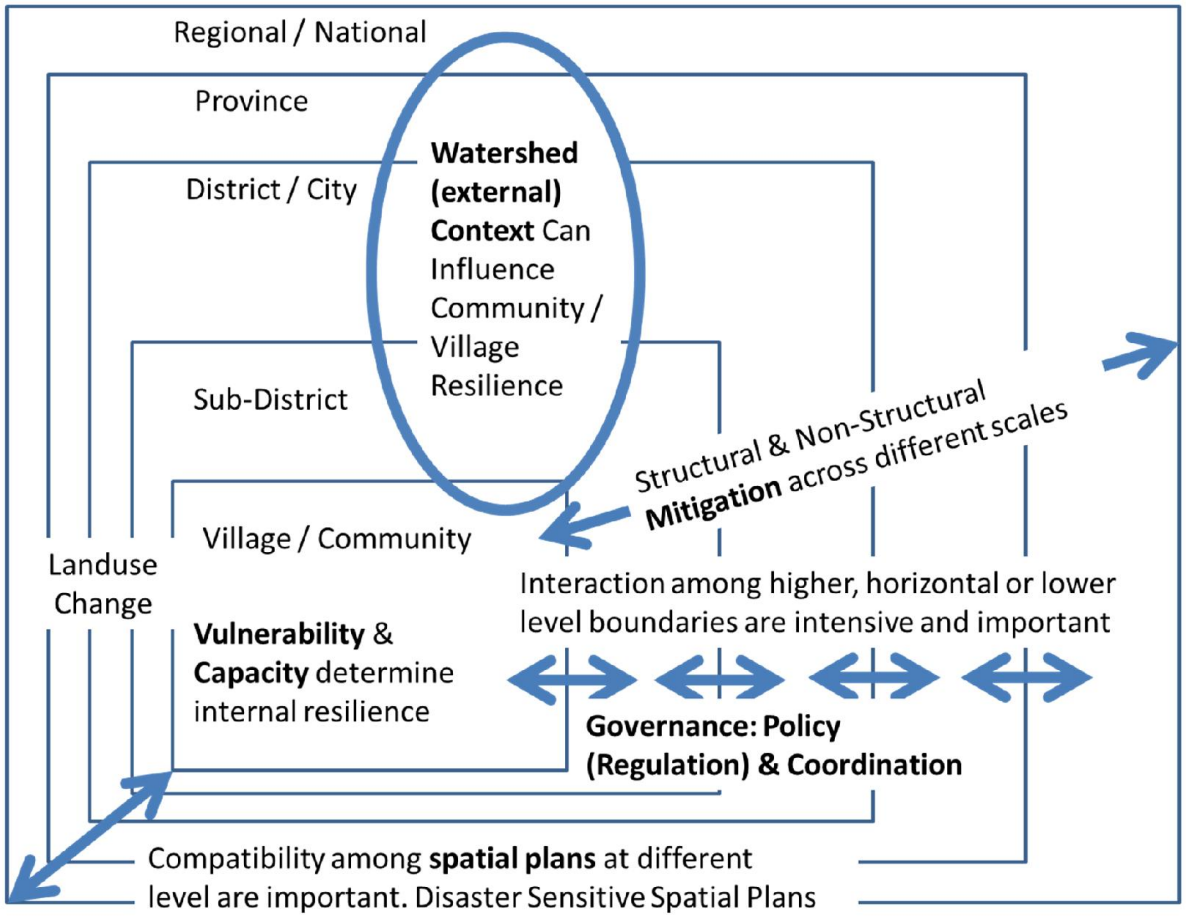

Figure 2 Conceptual Framework of Spatial Plan contribution to Community Resilience

Looking at wider perspective. Since a disaster can happen from outside of the administrative boundaries, it is important to have a wider perspective. This also implies that the solution may come from wider context. When talking about flooding, it is important to look at watershed context. Or, when there is a far field tsunami, a good early warning system should be in place.

Interaction among different scale and Stakeholder collaboration should be facilitated. This is actually the role of spatial plans. Spatial plan should be seen as a set of documents that deal with different scales based on it's scopes. As discussed, in Indonesia there are different level of spatial

plans. This includes National Spatial Plan (*Rencana Tata Ruang Wilayah Nasional*), Island Spatial Plan (Rencana Tata Ruang Wilayah Pulau), Provincial Spatial Plan (*Rencana Tata Ruang Wilayah Provinsi*), District/City Spatial Plan (*Rencana Tata Ruang Wilayah Kabupaten/Kota*). At a more detailed scale, there are also Sub-District Detailed Spatial Plan (*Rencana Detail Tata Ruang Kecamatan*) and Building and Environment Plan (*Rencana Tata Bangunan dan Lingkungan*).

As spatial plan entails different levels of activities, collaboration and coordination among stakeholders are needed. In an upstream and downstream context, collaboration is facilitized by districts. For example, Code River that flows from North Yogyakarta in Sleman to South Yogyakarta in Bantul needs a collaboration among different stakeholders in this region to inform the condition of river and potential of floods. Figure 2 illustrates that coordination across boundaries are important. These boundaries include at higher, horizontal as well as lower level. At higher level can include national and regional settings, while at lower level include sub-district and village level. It is important also to acknowledge horizontal boundaries, where coordination across the borders are important. Often the case, flooding is caused by deforestration or landuse change at adjacent districts or cities. Therefore, stakeholder collaboration will play important role to achieve agreed policy measures.

5. Conclusion

This paper discusses the role of spatial planning in increasing community resilience. The analytical results from two districts (Sleman and Bantul) show that there are elements related to the community resilience which have spatial components at internal village level. This includes spatial plan regulation, DRR Plan, Contingency Plan and Shelter location. Nonetheless, this paper argues that a further relation with external factor is a must. This is shown through a Conceptual Framework of Spatial Plan contribution to Community Resilience. This frameworks suggests that community resilience should consider spatial plan as not only external factors, but also condition that increase and maintain community resilience.

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