Study on integrating disaster risk reduction in Indonesian municipal spatial planning

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Abstract. Indonesia has experienced many major natural disasters. As result, the Spatial Planning Law number 26/2007 and the Disaster Management Law number 24/2007 were enacted. Spatial Planning Law number 26/2007 requires local governments to revise their municipal spatial plans. This paper aims to investigate the obstacles to revising the municipal spatial plans in response to disaster risk reduction and analyze the application of disaster risk reduction by municipalities in relation to the municipal spatial plan. For these purposes, questionnaires were distributed to 106 municipalities (52 responses were obtained) and document analysis was conducted on eight revised municipal spatial plans. The questionnaires, interviews, and document analysis revealed two obstacles to revising the municipal spatial plan (stakeholders with differing interests and a lack of spatial data) and that the eight plans had varying levels of application in disaster risk reduction as a result of the differences in support from government and non-government agencies.

1. Introduction
Indonesia is a nation that has experienced many major disasters, including earthquakes, tsunamis, volcanic eruptions, and mudflows. For this reason, disaster mitigation-based spatial planning is required. The central government amended Spatial Planning Law number 24/1992 (SP 24/2007), to Spatial Planning Law number 26/2007 (SP 26/2007) and enacted Disaster Management Law 24/2007 (DM 24/2007). Both laws require local governments to actively implement disaster risk reduction (DRR) in their spatial planning. After the enactment of those laws, many training sessions and workshops have been conducted by the Public Works Ministry, the National Development Planning Agency, the Indonesian Association of Planners, and other concerned organizations, all to enhance the understanding and knowledge of local government staff and planners regarding spatial planning and the law.

The Indonesian planning system is similar to those of other countries. It has a hierarchical planning structure in which local governments make key decisions within a national policy framework. With the enactment of Laws 32 and 33/2004 on regional administration and regional fiscal balancing (DSZN 32&33/2004), Indonesia is currently experimenting with an ambitious decentralization policy [1]. In line with DSZN 32&33/2004, SP 26/2007 and DM 24/2007 explicitly stipulate the authority and responsibility of local governments in regard to their spatial planning and DRR [2], [3], [4].

This paper aims to investigate the obstacles encountered by the local governments (e.g., regencies and municipalities) in revising the spatial plan, and to analyze the application of DRR with regard to the spatial structure plan, the spatial pattern plan, and the control of spatial utilization. Here, regency and
municipal governments have the same level of autonomy, but generally regencies are concerned with rural areas and municipalities with developed areas. Hereafter in this paper, regency and municipality will be termed “municipality” and their spatial plan known as the “municipal spatial plan.”

Questionnaires regarding related obstacles were distributed to the 106 municipality staff who worked on the revision of the municipal spatial plan in Java Island, Kalimantan Island, Sumatera Island, Bali Island, and Lombok Island. Consequently, 52 municipal respondents participated. Additionally, interviews were conducted with nine municipal staff and seven consultants to confirm the questionnaire answers. Furthermore, eight revised municipality spatial plans were selected as samples from the following areas: Sidoarjo Regency, Padang Municipality, and Yogyakarta Municipality (all have experienced a major disaster); and Pasuruan Regency, Malang Regency, Lumajang Regency, Probolinggo Regency, and Sukamara Regency (these areas have not experienced major disaster). The application of DRR in the municipal spatial plans, in terms of its presence in the spatial structure plan, spatial pattern plan, and the control of spatial utilization, was analyzed.

2. Role of DRR in Spatial Planning in Indonesia

2.1. Indonesia Spatial Planning

The Indonesian spatial planning system is complex. It not only contains aspects of spatial development, but also economic, social, political, and environmental development aspects. The Indonesian spatial planning system is similar to land use management, because spatial development there is controlled by rigid zoning regulation (ZR) and codes [5]. Indonesian municipal spatial plan can be formulated either by a self-reliant municipality or by a private consultant under the close supervision of a governmental advisory team (officials from various local agencies, e.g., a development planning agency, public works agency, land administration agency, mining agency, local investment coordinating agency, or forestry agency). Under Ministerial Home Affairs Regulation number 1/2008, municipal spatial planning encompasses a comprehensive plan [6]. A comprehensive plan is advantageous in DRR because it provides powerful tools for a municipality to facilitate and coordinate service delivery (e.g., the central placement of a fire station, hospital units within a residential area, and open space/public space services) and development (spatial development and expanding facilities and infrastructure). Table 1 shows the general content of Indonesian spatial planning: 1) the goal, policy, and strategy of the spatial plan, 2) the spatial structure plan, 3) the spatial pattern plan, and 4) the control of spatial utilization based on Article 19-32 of the Spatial Planning Law (hereafter SP Article 19-32) [4].

Residential centers and infrastructure networks systems, such as roads, railways, and water supplies, are determined in the spatial structure plan. Conservation and cultivation areas are spatially allocated in the spatial pattern. Conservation areas are classified into land use categories, such as disaster prone areas, natural reserves (wildlife sanctuaries and cultural heritage sites), and locally protected areas (mangroves, rivers, river banks, open spaces, and the seashore). Cultivation areas are classified into the following areas: residential, agriculture, mining, industrial, tourism, and trading and service areas. The determination of the spatial structure and the spatial pattern is a non-structural mitigation countermeasure of DRR, because settlement restrictions, evacuation routes, and evacuation points are outlined in these plans. As previously mentioned, the spatial structure plan and the spatial pattern plan can permit the inclusion of DRR. Building permission has the primary task of structural mitigation within the municipal spatial plan [7]. The control of spatial utilization in the municipal spatial plan can be used as a guideline with regard to building permission regulations. Thus, the building permission itself is to be stipulated in the district spatial plan by the relevant zoning regulation (ZR).

Table 1 shows the hierarchy of the Indonesian spatial plan. As shown in the upper columns of the table, the spatial plan has to follow a nationally set policy framework and that of a higher-level government. SP 26/2007 specifies that the municipal spatial plan must refer to the national plan and the provincial spatial plan with regard to spatial development. In Table 1, symbols +, ++ and ○ symbolize the degree of contribution by the various substances to the spatial plans.
DM 24/2007 has resulted in a change in disaster management in Indonesia. It articulates the implementation and enforcement of DRR in the spatial plan and comprises precise enactments for spatial plan regulations, safety standards, and sanctions against violators. Municipalities are required by Article 42.a-b of the Disaster Management Law (hereafter, DM Article 42.a-b) to periodically monitor and evaluate the implementation of the spatial plan [3].

This paper focuses on the municipal spatial plan that is dot-lined in Table 1, because the municipal spatial plan has been shown to be the most effective method to achieve the long-term reduction of community vulnerability to multiple hazards [8]. As described above, the municipal spatial plan has a spatial dimension and is the legal basis for the authorization of development location and land administration, and the implementation of physical development. SP 26/2007 stipulates the minimum standards of services for municipal spatial planning (SP Article 58). To preserve the environment, at least 30% of a watershed area must include a designated forest area (SP Article 17), and at least 30% of all urban areas must be open space areas (SP Article 28-30) [4]. SP 26/2007 also provides for new methods of enhancing development control such as zoning, planning permits, the implementation of incentives and disincentives (SP Article 35-40), and imposing sanctions, such as administration and criminal sanctions (SP Article 69-75) [4].

Table 1. Hierarchy and general content of Indonesian spatial law (SP article 19-32) [5]

2.2. Revision of Municipal Spatial Plan under SP 26/2007

This part discusses the obstacles to the revision of the municipal spatial plan in response to DRR under SP 26/2007. The municipality itself begins the revision process of the municipal spatial plan. A draft municipal spatial plan is drawn up and the municipality then has to discuss, consult, and coordinate at a provincial level to ensure accordance with the provincial spatial plan. If the draft is in accord with the provincial plan then the provincial authority gives its approval. After this agreement process, the municipal spatial plan is reviewed by the Kementerian Tata Ruang dan Agraria to ensure integration with the national spatial plan and the various ministerial sectoral plans. This process of discussion, consultation, and coordination requires a long timeframe and sizable budget.

As described above, questionnaires were distributed to 106 municipalities and 52 respondents participated. Table 2 shows the attributes of the 52 respondents. It can be seen that the respondents can all be considered to have an appropriate level of expertise in spatial planning.

The questionnaire content contained questions regarding: 1) respondent attributes; 2) revision progress of the municipal spatial plan; 3) knowledge regarding SP 26/2007, DM 24/2007, and DSZN 32&33/2004; 4) obstacles to the revision of the municipal spatial plan regarding DRR; 5) the application of DRR in the content of municipal spatial plan; and 6) type of cooperation among municipalities regarding DRR. The questionnaires contained open answered questions except with regard to questions
number 3) and 5), where multiple-choice answers were provided. The focus of this paper is on the answers to question 4); the results were classified into seven categories. Figure 1 shows the results for question 4): the obstacles to the revision of the spatial structure plan, the spatial pattern plan, and the control of spatial utilization in the municipal spatial plan with regard to DRR, as answered by the 52 respondents (18 municipalities and 34 regencies). Eleven of the thirty-four regencies answered that the differing interests among the stakeholders were the biggest obstacle. The open answers and the information obtained from the interviews identified the stakeholders as municipal officials, non-government organizations, the private sector, and the community. Within the 18 municipalities, the competing interests among stakeholders were identified as the second obstacle to the revision of municipal spatial plans. With regard to the results in Figure 1, interviews were conducted with the nine municipality staff and seven consultants, as shown in Table 2. Interview questions covered: a) the different interests among stakeholders; b) the content of the required spatial data; c) how to obtain spatial data; d) ZR arrangements; e) the existence of hazards maps and their content; and f) evacuation routes and meeting points. The examples given for different interests among stakeholders within the municipalities regarding DRR were: 1) classification of land as either cultivation or conservation areas, and 2) the expansion of residential, industrial, and agriculture areas, and infrastructure in hazard prone areas versus DRR. Respondents also answered that the different interests arose from issues over revenue gathering in the municipality. That is, the taxes paid by companies and individuals (for example, for land acquisition and fix assets) are the main sources of municipal income, and as such competing interests can arise.

Table 2. Attributes of the 52 municipal staff and consultants

| Agency                          | Work experience | Educational background | Additional knowledge |
|---------------------------------|-----------------|------------------------|---------------------|
|                                 | <3  | 3-6 | 6< | URP | CE | Arch | Other | Yes | No   |
| Local Planning Board Agency     | 37  | 16  | 9  | 22  | 2  | 3    | 10    | 20  | 17       |
| Local Public Works Agency       | 10  | 6   | 2  | 6   | 2  | 1    | 1     | 4   | 6        |
| Other                           | 5   | 2   | 3  | -   | -  | 1    | 1     | 1   | 4        |
| Interview Local Planning Board Agency | 9   | 3   | 4  | 7   | -  | 2    | -     | 7   | 2        |
| Consultant                      | 7   | 1   | 4  | 7   | -  | -    | -     | 6   | 1        |

URP = Urban and Regional Planning, CE = Civil Engineering, Arch = Architecture.

Further obstacles identified in the 34 regencies were: 1) lack of spatial data; 2) ZR arrangements; 3) compliance with regard to 30% of watershed areas to be forested areas; 4) land use planning at border areas between other municipalities; and 5) compliance with regard to 30% of urban areas to be comprised of open spaces. For the 18 municipalities, the main obstacles were identified as being: 1) compliance with regard to 30% of urban areas to be comprised of open spaces; 2) different interests among stakeholders; lack of spatial data; 3) ZR arrangements; compliance with regard to 30% of watershed areas to be forested areas; and land use planning at border areas. Spatial data are used as a common reference set by various local planning authorities for hazard modification. However, 11 respondents answered that a lack of spatial data was an obstacle to revision. Municipal staff and consultants stated that the absence of up-to-date, accurate, relevant, and reliable
land-use and other thematic maps hindered the process. These answers suggest that an appropriate governmental authority should be responsible for standardizing the scale of spatial data, classification schemes, and survey methods.

ZR are legal tools for guiding land utilization with consideration to ecological constraints and socioeconomic objectives, and are used to match the operational aspects of spatial pattern plans with municipal spatial plans. As Indonesia is now highly decentralized, the enforcement of zoning, standards, and codes lies in the hands of local governments. The Ministry of Public Works published the latest technical ZR guide in 2010, however the guide did not reflect DRR, and as a result six regencies and two municipalities stated that they have experienced difficulties with regard to ZR arrangements (Figure 1).

As described above, the requirements for watershed areas to be comprised of 30% forested areas and urban areas to include 30% open spaces are new articles in SP 26/2007. The requirement for 30% forested areas will also indirectly prevent flooding and landslides, and the requisite 30% open space area provides an evacuation point and evacuation route plan (SP Article 30) [2]. These requirements are more often seen as obstacles for municipalities than regencies, because a municipality’s main activities involve urban residences, government services, social services and economic activities that involve high competition for land utilization. Thus, it is problematic to retain 30% of urban areas as open space. Usually one watershed encompasses a number of municipalities, and to comply with the order that 30% of the watershed be a forested area is a critical issue for three of the respondent regencies and two of the municipalities. A key challenge in implementing forestry decentralization in Indonesia is the increase in requests from municipalities to convert forestland [9]. Negotiations are occurring between the national government and municipalities regarding such conversions. The decision on whether proposals are accepted or rejected is a lengthy process, taking months and often years to complete.

Land use planning at border areas of municipalities is also a crucial issue. Land use planning at administrative boundaries is important because major disasters impact beyond these bounds. Good cooperation among municipalities regarding DRR was demonstrated between Yogyakarta Municipality and Central Java Province at a local DRR forum, which established the Merapi Forum in 2006. The Merapi Forum was a multi-stakeholder forum that addressed a single hazard in a particular area in that instance, volcanic eruption. Merapi Forum members were from the surrounding regencies affected by the Merapi eruption. The forum has fostered mutual understanding among the different stakeholders, and established cross-border and cross-sector collaboration in DRR. This has been maintained through regular communication, information sharing, and knowledge sharing [10].
number 50/2007 regarding co-operation among municipalities articulates that the municipalities in the process of decentralization can still build a suitable governmental institution to optimize the potential of their region, while having regard for DRR.

3. Integrating of DRR in Municipal Spatial Plan

3.1. Application

This chapter analyzes the application of DRR in the eight municipal spatial plans. The eight municipal spatial plans were chosen using the following criteria: 1) the municipal spatial plan was already published as a municipal ordinance, or 2) the revision of the municipal spatial plan was complete and awaiting being made a municipal ordinance. Consequently, three regencies in areas that had experienced a natural disaster and five municipalities without such events were chosen as shown on the left side of Table 3. The left of the table shows the characteristics of the regencies and municipalities, and any major disasters.

In the context of DRR, spatial planning and land management must support the following essential functions [10]: 1) early warning systems; 2) risk assessments and mapping; 3) prevention and reduction of disasters; 4) risk management; and 5) reconstruction after disasters. Another expert also indicated that spatial planning has four possible roles in DRR: 1) making differentiated decisions on land use; 2) keeping areas free from development; 3) following recommendations for legally binding land use or zoning plans; and 4) hazard modification [12].

Table 3 shows the application of DRR in the municipal spatial plan based on document analysis. As shown in the upper column, the application of DRR was observed in the following indicators: hazard identification, control of spatial utilization, existence of a hazard map, and existence of evacuation routes. Hazard identification estimates and evaluates the extent, intensity, and magnitude of potentially harmful events caused by certain hazards. The hazard map has to be included in the municipal spatial plan to raise public awareness. It will influence the behaviors of builders, developers, public agencies, and individuals in the location of critical activities and assets. The control of the spatial utilization municipal spatial plan is performed by stipulating the guidelines of ZR, permit incentives, permit disincentives, and sanction imposition. It is a valuable assurance of actual DRR implementation. Evacuation routes and meeting point plans are important issues for the improvement of spatial structures and spatial patterns in the municipal spatial plan, in response to DRR under SP 26/2007.

Table 3 shows the various types of disasters, such as earthquakes, tsunamis, tidal waves, volcanic eruptions, floods, landslides, fires, forest fires, drought, and abrasion. It can be seen from the third column that all the municipalities have already completed their hazard identification of the various disasters, which are considered in response to the various geographical conditions of the municipalities. As shown in the second column, hazard identification was classified into three categories: “AD: Available in detail”, “A: Available”, and “ND: Not in Detail”. For example, there are many “ND” classifications in Sidoarjo Regency, Malang Regency, and Sukamara Regency, representing an insufficient application of DRR in those regencies.

The third column of hazard map in spatial structure plan and spatial pattern plan shows Yogyakarta and Padang Municipalities both having experienced major disasters. All applications of DRR are “AD”. In addition, many of the municipalities that have never experienced a major disaster are classified as “ND” with regard to their hazard identifications. This classification indicates a range in levels of DRR among the municipalities. According to the interviewee answers, these situations have arisen because of the different interests among stakeholders, a lack of spatial data, as shown in Fig. 1, a lack of understanding regarding the nature of disasters, and little disaster information (as explained below). Tidal waves, droughts, abrasions, and forest fires are disasters for which municipalities cannot provide detailed hazard identification and maps. While Padang Municipality has an “AD” map of an abrasion hazard, Probolinggo Regency’s hazard identification of abrasion was “ND”, because it is only areas prone to abrasion that are included in a hazard map with other hazards. There are “NDs” with regard to tidal waves in Sidoarjo Regency, drought in Malang Municipality, and forest fire in Sukamara Regency. It is
difficult for these municipalities to both identify these types of hazards and to make detailed hazard maps because of a lack of information about these risks.

SP 26/2007 requires an evacuation point and an evacuation route plan. As shown in the third column of Table 3, Sidoarjo Regency, Yogyakarta Municipality, and Padang Municipality have hazard maps with an “AD” classification. Yogyakarta Municipality, Padang Municipality, and Pasuruan Municipality have an evacuation point and evacuation route plan, classified as “E: Exist” in the fourth column. Fig. 2 is an example of the evacuation point and evacuation route plan included in the Yogyakarta Municipal Spatial Plan. The map shows the direction and destination point of any evacuation. Government Regulation number 8/2013 regarding the accuracy of maps for spatial planning has stipulated that the minimum map scale for regency spatial plans is 1:50,000 and the scale for municipality spatial plans is 1:25,000 [13]. A 1:50,000-scale map in a regency spatial plan cannot be said to represent an evacuation point and evacuation route plan for DRR. Therefore, regencies require action plans for evacuation points and evacuation route plans, and this should be stipulated in an article of a municipal ordinance to ensure its implementation.

Table 3 Application of DRR in municipal spatial plans under SP 26/2007 [15], [16], [17], [18], [19], [20], [21], [22].

| Municipality                  | Indicators                  | Spatial pattern          | Control of spatial utilization |
|------------------------------|-----------------------------|--------------------------|-------------------------------|
|                              | General description         | Type of disaster         | Hazard identification | Hazard map | Evacuation point and evacuation route plan |
|                              |                             |                          |                              |             |                                             |
|                              |                             | Flood                    | ND                           | ND          |                                             |
|                              |                             | Mudflow*                 | AD                           | ND          |                                             |
|                              |                             | Tidal wave               | ND                           | ND          |                                             |
| Sidoarjo Regency             |                             | Earthquake               | AD                           | AD          | E                                          |
| East Java Province (coastal) |                             | Volcanic eruption        | AD                           | AD          | Scale of map 1:25,000                        |
| Area: 634,34 km²             |                             | Landslide                | AD                           | AD          |                                             |
| Density: 2,441 persons/km²   |                             |                          |                              |             |                                             |
|                              |                             | Tsunami*                 | AD                           | AD          | E                                          |
| Yogyakarta Municipality      |                             | Earthquake               | AD                           | AD          | Scale of map 1:25,000                        |
| Yogyakarta Province (inland) |                             | Volcanic eruption        | AD                           | AD          |                                             |
| Area: 32,5 km²               |                             | Landslide                | AD                           | AD          |                                             |
| Density: 15,197 persons/km²  |                             |                          |                              |             |                                             |
|                              |                             | Tsunami*                 | AD                           | AD          | E                                          |
| Padang Municipality          |                             | Earthquake               | AD                           | AD          | Scale of map 1:25,000                        |
| West Sumatera Province       |                             | Volcanic eruption        | AD                           | AD          |                                             |
| (coastal)                    |                             | Landslide                | AD                           | AD          |                                             |
| Area: 69,5 km²               |                             | Flood                    | AD                           | AD          |                                             |
| Density: 1,101 persons/km²   |                             | Abrasion                 | AD                           | AD          |                                             |
|                              |                             | Tsunami*                 | AD                           | AD          | E                                          |
| Pasuruan Municipality        |                             | Earthquake               | AD                           | AD          | Scale of map 1:25,000                        |
| East Java Province (Coastal)  |                             | Volcanic eruption        | AD                           | AD          |                                             |
| Area: 35,29 km²              |                             | Landslide                | AD                           | AD          |                                             |
| Density: 4,502 persons/km²   |                             | Flood                    | AD                           | A           | E                                          |
|                              |                             | Tidal wave               | AD                           | A           | Scale of map 1:25,000                        |
| Malang Regency               |                             | Earthquake               | ND                           | ND          | NE                                          |
| East Java Province (coastal) |                             | Volcanic eruption        | ND                           | ND          | Scale of map 1:50,000                        |
| Area: 110,06 km²             |                             | Landslide                | AD                           | A           |                                             |

Fig. 2 is an example of the evacuation point and evacuation route plan included in the Yogyakarta Municipal Spatial Plan. The map shows the direction and destination point of any evacuation. Government Regulation number 8/2013 regarding the accuracy of maps for spatial planning has stipulated that the minimum map scale for regency spatial plans is 1:50,000 and the scale for municipality spatial plans is 1:25,000 [13]. A 1:50,000-scale map in a regency spatial plan cannot be said to represent an evacuation point and evacuation route plan for DRR. Therefore, regencies require action plans for evacuation points and evacuation route plans, and this should be stipulated in an article of a municipal ordinance to ensure its implementation.
| Density: 3,459 persons/km² | Volcanic Eruption | ND | ND |
|---------------------------|-------------------|----|----|
| Landslide *               | AD                | AD |
| Flood                     | AD                | AD |
| Drought                   | ND                | ND |
| **Lumajang Regency**      |                   |    |    |
| East Java Province (coastal) | Area: 1,790.90 km² |    |    |
| Density: 779.82 persons/km² |                   |    |    |
| Tsunami*                  | A                 | A  |
| Earthquake                | A                 | A  |
| Volcanic eruption*        | A                 | A  |
| Landslide                 | A                 | A  |
| Flood                     | A                 | A  |
| **Probolinggo Regency**   |                   |    |    |
| East Java Province (coastal) | Area: 1,696.17 km² |    |    |
| Density: 644 persons/km²  |                   |    |    |
| Earthquake                | A                 | A  |
| Volcanic eruption*        | A                 | A  |
| Landslide                 | A                 | A  |
| Flood                     | A                 | A  |
| Abrasion                  | ND                | A  |
| **Sukamara Regency**      |                   |    |    |
| Central Kalimantan (coastal) | Area: 3,827 km² |    |    |
| Density: 11 persons/km²   |                   |    |    |
| Flood                     | ND                | ND |
| Forest fire*              | ND                | ND |

*Major disaster

**Hazard identification**

**AD**: Available in detail. Municipal spatial plan states location, estimated impact, and scale of hazards.

**A**: Available. Municipal spatial plan states only location and scale of hazard.

**ND**: Not in detail. Municipal spatial plan states only type of disaster.

**Hazard map**

**AD**: Available in detail. Hazards map for each hazard are drawn in municipal spatial plan.

**A**: Available. All hazards are drawn in one map.

**ND**: Not in detail. Only a conservation map is drawn.

**Evacuation point & evacuation route plan**

**AD**: Available in detail. Control of spatial utilization is distinguished by cultivation area and conservation area. Conservation areas are divided into many criteria, such as disaster prone areas, protected areas, etc.

**A**: Available. Control of spatial utilization is separately applied to conservation area and cultivation area.

**ND**: Not in detail. Control of spatial utilization in a general sense.

In the process of decentralization, the municipality has the authority to develop an appropriate mechanism to act as a spatial utilization permit, taking into account both local conditions and the established national framework [14]. The spatial utilization controls found in a municipal spatial plan consist of four mechanisms: 1) direction of ZR; 2) spatial utilization permit; 3) incentive and
disincentive mechanism and; 4) administration and criminal sanctions. The “Controls of spatial utilization” in the fifth column of Table 3 shows that both the Yogyakarta Municipality Spatial Plan and the Padang Municipality Spatial Plan include detailed information regarding the control of spatial utilization for conservation areas, and are classified as “AD”.

In the case of Padang Municipality, the utilization of conservation areas is divided into two categories: protected areas and disaster prone areas. The directions of the ZRs are divided into three categories: “Directed”, “Controlled”, and “Restricted”. Padang Municipality employs a spatial utilization permit to ensure the implementation of the municipal spatial plan. This mechanism is expected to assist in the identification, prediction, and evaluation of the foreseeable environmental consequences of land utilization.

![Figure 2. Evacuation point and evacuation route plan for DRR (Yogyakarta Municipality Spatial Plan 2009-2029) [15].](image)

In Pasuruan Municipality, Malang Regency, Lumajang Regency, and Sukamara Regency, local NGOs, the private sector, and the community were involved in, for example, 1) municipal developments such as the development of infrastructure and facilities (roads, office blocks, hospitals, etc.); 2) land use development; 3) economic development; and 4) disparity development. However, DRR is not the responsibility or concern of these institutions because they do not have the relevant experience with major disasters, although SP 26/2007 does state that DRR is an issue to be addressed in municipal spatial plans.

There were a number of institutions in Sidoarjo Regency, Yogyakarta Municipality, and Padang Municipality available to supply spatial data relevant to DRR (and therefore mitigate the lack of data). For example, Deutche Gesselschaft fur Technische (GTZ), a German NGO, developed a guideline on how to integrate DRR criteria into spatial planning. This was then applied to the Yogyakarta Municipality Spatial Plan. Padang Municipality is the area most frequently stricken by earthquakes, and as such it is used as a benchmark for disaster mitigation in Indonesia. Therefore, many DRR plans and
programs have been issued by both national and local governments in this area, such as an evacuation point and evacuation route plan by the Ministry of Marine Affairs and Fisheries. The Sidoarjo DRR forum, the Yogyakarta DRR forum, and the Padang DRR forum are organizations that exist in three regencies and municipalities. The forums are focused on DRR efforts. The members of the DRR forums include government staff, academics, NGOs, the Indonesian Red Cross, media, and community organizations. The Sidoarjo DDR and Yogyakarta DDR forums have supplied spatial data and risk reduction programs to SPP and CSU to support DRR management. The Padang DDR Forum has supplied data on communities in disaster prone areas and supported evacuation route plans for earthquakes and tsunamis. It is in this manner that the forums play important roles in municipal spatial planning for DRR.

**Table 4** Support of government and non-government agencies in the revision of municipal spatial

| Municipality     | Institution                                                                 | Support role                  | Content of supporting and assistance                                                                 |
|------------------|----------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------|
| Sidoarjo Regency | 1. BPLS (mudslide disaster task force)                                      | 1. SSP, SPP & CSU              | 1. Data on risk assessment of mudslide                                                               |
|                  | 2. Institute Technology Sepuluh November                                    | 2. SSP                          | 2. a. Data on victims’ housing preference                                                            |
|                  | 3. Local NGO; The Indonesian Forum for Environment (WALHI)                  | 3. SSP & SPP                    | 2. b. Suggestions at public hearings                                                                |
|                  | 4. Sidoarjo DRR Forum                                                       | 4. SPP & CSU                    | 3. a. Data on mudslide victims                                                                       |
|                  | 5. Community                                                                | 5. SSP & others                 | 3. b. Data on environmental impact of mudslide                                                       |
|                  |                                                                           |                                | 4. Supporting spatial data and reducing risks program                                                |
|                  |                                                                           |                                | 5. Input location for resettlements                                                                 |
| Yogyakarta Municipality | 1. Indonesia Institute of Science (LIPI), BAKOSURTANAL, Meteorological and Geophysical Agency | 1. SSP & SPP                    | 1. Spatial data on disaster prone area                                                               |
|                  | 2. Department of Geography and Geology Gajah Mada University, Department of Geography Veteran University | 2. SSP & SPP                    | 2. Disaster prone areas data (spatial data)                                                          |
|                  | 3. Yogyakarta DRR Forum                                                     | 3. SSP & SPP                    | 3. Data relating to a community who lives in disaster prone area, supporting data spatial and reducing risks program |
|                  | 4. National NGO: Indonesian Society for Disaster Management                 | 4. SSP, SPP & CSU               | 4. Technical assistance in spatial data analysis for DRR                                              |
|                  | 5. International NGO: UNDP, GTZ, CORDAID                                   | 5. SSP, SPP & CSU               | 5. a. Early warning system design                                                                   |
|                  | 6. Community                                                                | 6. SSP, SPP & others             | 5. b. Guidelines on how to integrate DRR criteria into spatial planning                              |
|                  |                                                                           |                                | 6. Community mapping and opinions for rehabilitation process                                          |
| Padang Municipality | 1. Bappenas                                                                | 1. Others                       | 1. Financial assistance                                                                           |
|                  | 2. Ministry of Marine Affairs and Fisheries                                  | 2. SSP, SPP & CPU                | 2. a. Evacuation building shelter plan data                                                           |
|                  | 3. Reconstruction and Rehabilitation Team Padang Earthquake 2009           | 3. Others                       | 2. b. Strategic disaster mitigation plan data                                                         |
|                  |                                                                           | 4. SSP, SPP & CSU               |                                                                                                     |
The stakeholders were concerned with municipality development, such as 1) development of infrastructure and facilities (roads, airports, office blocks, hospitals, etc.; 2) land use development; 3) disparities development, etc.

Table 4 shows the institutions that supported the revision of the municipal spatial plans and the nature of their assistance. The second column shows the range of institutions and agencies involved, such as governmental institutions, universities, and non-government organizations (NGO), and the third column displays the support and assistance provided with regard to the spatial structure plan, spatial pattern plan (SPP), control of spatial utilization (CSU), and other means such as support for the budget and DRR programs. The numbers in the third and fourth columns correspond to the number of institutions in the second column. Their support and assistance involved the supply of data and assistance with planning, as shown in the fourth column.

As already shown in Figure 1, the differing interests among stakeholders are also obstacles in the revision process of municipal spatial planning. It is desirable for municipalities to obtain external support for the revision of their municipal spatial plans so that the issues relating to DRR and competing interests can be addressed. The stakeholders were concerned with municipality development, such as 1) development of infrastructure and facilities (roads, airports, office blocks, hospitals, etc.; 2) land use development; 3) disparities development, etc.

Under DM 24/2007, a municipality is required to establish a Municipal Disaster Risk Management Agency (DM Article 180) [3]. This agency must engage in the following key tasks: a) formulate and issue DRR policies; and b) coordinate the implementation of DRR activities. However, none of the eight regencies and municipalities has established such an agency. The municipalities are required to establish the agency in response to DRR in the municipality spatial plan to coordinate the different interests among stakeholders.

4. Conclusion
   1. Spatial Planning Law number 26/2007 (SP 26/2007), Disaster Management Law number 24/2007 (DM 24/2007), and Regional Administration and Regional Fiscal Balancing Law
2. The questionnaire results from 52 municipality correspondents revealed two main obstacles to the revision of the municipal spatial plans from the viewpoint of DRR. The first was the differing interests among stakeholders, namely municipal officials, NGOs, private sectors, and the community. And second, a lack of spatial data was identified, with regard to 1) the classification of land as either cultivation areas or conservation areas, and 2) the expansion of residential, industrial, and agriculture areas and infrastructure in hazard prone areas versus DRR.

3. A document analysis of the eight municipal spatial plans from Sidoarjo Regency, Yogyakarta Municipality, Padang Municipality, Malang Regency, Lumajang Regency, Probolinggo Regency, and Sukamara Regency indicates that the eight plans were revised in response to DRR with regard to the spatial structure plan, spatial pattern plan, and the control of spatial utilization. Nevertheless, their application to DRR may be limited as a result of a lack of spatial data and a lack of understanding concerning the nature of disasters. Those municipalities that have experienced major disasters, such as Yogyakarta Municipality and Padang Municipality, have designed more detailed hazard maps than those municipalities that have not (such as Malang Regency, Lumajang Regency, Probolinggo Regency, and Sukamara Regency).

4. With regard to the Yogyakarta Municipal Spatial Plan and the Padang Municipal Spatial Plan, the central government, NGOs, and universities were useful in supplying additional data to fill in the gaps concerning spatial data and a lack of understanding of the nature of disasters.

5. DRR forums, which involve government staff, academics, NGOs, the Indonesian Red Cross, media, and community organizations in Padang Municipality, Yogyakarta Municipality and Sidoarjo Regency, play important roles in the revision of the municipal spatial plans and in supporting DRR management by supplying spatial data and DRR programs.

6. Although DM 24/2007 (Article 180) required municipalities to establish a Municipal Disaster Risk Management Agency, none of the eight municipalities has established an agency. The establishment of such an agency is desirable to coordinate the different interests among the stakeholders in DRR.

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