Beyond Vulnerability Assessment: Impact of Developments toward Local Adaptive Capacity in Kemijen City Village, Semarang City

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Abstract. Vulnerability Assessment is usually used for assessing the ability of an area on facing disaster. In previous studies, the study of Vulnerability Assessment applied only quantitative method to show the vulnerability level. Therefore, this study attempts to add information reviews using qualitative method. Kemijen City Village is one of the administrative areas in the northern part of Semarang City affected by climate change. The residents have to adapt it by renovating and elevating their houses and other infrastructures to avoid floods. There are some development programs held by government, NGOs, and corporations such as Banger Polder Development, PLPBK, etc. It is interesting to know how big the vulnerability level of Kemijen on facing flood disasters, then how the projects can affect local adaptive capacity. To answer it, this research uses mixed-method approach. Vulnerability Assessment uses quantitative method by scoring indicators of Exposure, Sensitivity, and Adaptive Capacity, while the development impact uses qualitative method. The data were collected through interviews and FGD conducted in Joint Studio Course between Diponegoro University and University of Hawaii in October 2016. Non-physical programs such as community empowerment have more positive impacts on local adaptive capacity in Kemijen. Community participation is important for environmental sustainability that can not be done in a short time to educate the people.

Keywords: Vulnerability assessment, local adaptive capacity, Semarang City

1. Introduction

Kemijen City Village is located in the northeast part of East Semarang Sub District which is one of the slum areas in Semarang City. This is accordance with the Decree of Mayor of Semarang No. 050/801/2014 about The Location Determination of Housing and Slum Area in Semarang City. The area has many environmental and social degradations, including floods, land subsidence, waste, etc.

The floods in Kemijen were caused by the surge of sea water/ tidal floods [1] due to climate change. As Yousef & Ghonem [2] mentioned that climate change is a situation when the climate patterns of the world are permanently shifting either upwards or downwards of the average. This phenomenon is causing the changes in season length. Some climate change impacts are the rise in sea
levels and erratic rainfall. There are two factors causing floods in Kemijen i.e lack of water catchment areas that made high density of the water in a watershed and local floods caused by sedimentation from the accumulation of garbage and poor drainage system [3]. It happened every day and damaged infrastructures especially roads [4]. In terms of health, it can cause diseases, and in terms of economy, it can disrupt community activities that can lead to financial losses for both the government and the community side [5]. Beside floods, land subsidence also be one of the problems in Kemijen. The land subsidence in Kemijen is approximately about 6-8 cm/year [6] which generally caused by natural soil consolidation and the excessive ground water extraction. This condition worsens the floods. The waste problems in Kemijen also decrease the environment and need special handlings.

This location is unique because most of the population do not want to move to another place and keep on staying in that location with all of the risks [7]. They have their own adaptive capacity to ensure their life sustainability, social activity and quality of life[8,9], and minimize climate change vulnerability [10, 11]. Adaptive capacity (AC) is an ability to adjust, take advantage of opportunities, or cope with consequence [10,12]. The adaptive capacity in Kemijen is formed by institutional and social factors, including strength, culture and the ability of people to engage in collective strategies and actions to address environmental problems [13]. Successful adaptation is closely connected with social groups’ ability to act collectively, but many social-ecological challenges exceed local adaptive capacity which needs help from the government [13]. As Wolfson [14] mentioned, the main contribution in developing an area is providing a mechanism for developing, sharing, and consider information. In this case, the local government has been running the programs to help people in preparing and recovering from floods, especially in the East Semarang Sub-District. The programs are the Community Disaster Alert, Banger Polder System, Neighborhood Development (PLPBK), and other programs. The government program that has an enormous impact is the Banger Polder System.

Polder as a system which serves to prevent floods should consist of retention and drainage system [15]. On the polder system, its condition doesn’t let the water flows from the outside area [16]. According to the results of interviews, before Banger Polder System was operated (approximately on August 2016), the floods happened almost everyday as high as 10 to 40 centimeters. These floods could be defined as a small scale flood which was related with low water depths (i.e. < 0,5 m). These floods could occur when there was insufficient retention for water in the polder [15]. But after it was operated, the floods never happened in the area that protected by the polder system. The Banger Polder should protect the East Semarang Sub District, including Kemijen City Village, but now still only limited areas have the benefit of the polder. Those are RW 6, RW 7, RW 8, RW 9, and RW 10 in Kemijen City Village.

The Banger Polder System has been started since 2001 through socialization to the community and has been built on 2010. Although it was operated on August 2016, but not all of the components have built such as retention basin (planned to build in RW 4 and RW 5); the permanent closing dam of the Banger River; and the secondary canal improvements along the Banger Polder System project. The main obstacles of this development are the land ownership and community empowerment.

A development has to be measurable, which will be very significant and will be the presence of uncertainty. The uncertainty will play an important role in the predevelopment and the development stage of a project [17]. In some previous studies, the study of Vulnerability Assessment applied only quantitative method to show the vulnerability level. Therefore, this research tries to add information reviews using qualitative method. It is expected to find how the development program that has been running affected the local community adaptive capacity. This research also will compare the before and after conditions to know the impact of development program. In addition, will be known the factors that affect the development and the recommendations for the sustainability of these conditions.
2. Methodology

This article applies the scoring analysis and descriptive qualitative. The scoring analysis was used to assess the vulnerability of Kemijen city village area, while the descriptive qualitative was used to determine in-depth information related to the impact of development program toward local adaptive capacity. The research variables refer to the statement mentioned by USAID [18], consisting of exposure, sensitivity and adaptive capacity. Table 1 below shows the variables and indicators to assess the vulnerability. Therefore, the variable of the development program impact is referring to Adger [19] statement that the social adaptive capacity of the government's role in adaptive capacity building have an important role and supported by local potentials that can help accelerating adaptive capacity of the communities.

| Variables      | Indicators                          | Methodology     |
|----------------|-------------------------------------|-----------------|
| Exposure       | Flood (F)                           | Quantitative Method |
|                | Land Subsidence (LS)                |                 |
|                | Waste (W)                           |                 |
| Sensitivity    | Near River                          |                 |
|                | Near dumping side                  |                 |
|                | Flood area                          |                 |
|                | Slum area                           |                 |
|                | High rate of Land Subsidence        |                 |
| Adaptive Capacity | Flood                           | Qualitative Method |
|                | Land Subsidence                     |                 |
|                | Waste                               |                 |
|                | Experience                          |                 |
|                | Knowledge                           |                 |

Vulnerability assessment is based on the formula presented by Turner and Kasperson [20]

\[
\text{Vulnerability} = \frac{\text{Exposure} \times \text{Sensitivity}}{\text{Adaptive Capacity}}
\]

The assessment of exposure was assessed based on three main problems in the region which are floods, land subsidence, and waste. Each region was assessed with a score range from 1 to 3 with score 1 for low exposure, score 2 for medium exposure and score 3 for high exposure. Elements of sensitivity based on how many assets, regions, or groups, influenced by the exposure to danger. In this study, each region was assessed according to the following location categories which are near the river, near the dumping site, flooded area, slum area and the area that has high rate of land subsidence. The sensitivity is high when locals tend to have a dependence on natural resources or ecosystems. The Adaptive Capacity Assessment was classified into individual, community and government capabilities on 3 main issues. This stage also equipped by qualitative method with in-depth interview to explore experience and knowledge from community leaders. This method is used to find out how much vulnerability projects implemented by the government can affect the adaptive capacity of the community.

The quantitative data were collected based on the questionnaires. The sampling provides a numeric description of trends and opinion of Kemijen populations. This research used random
sampling, where each individual in the population has an equal probability of being selected. The number of population in Kemijen area are 11,936 inhabitants which consist of 3,603 households and spreads into 11 RWs. The sampling was using random sampling on RW’s household. According to Frankel and Wallen [21], the minimum number of samples taken in a study is 100 samples and the detail of the number of household’s sampling can be shown in the table below.

| No. | RW | Number of Households | Number Of Sampling |
|-----|----|----------------------|-------------------|
| 1   | I  | 451                  | 13                |
| 2   | II | 386                  | 11                |
| 3   | III| 370                  | 10                |
| 4   | IV | 75                   | 2                 |
| 5   | V  | 498                  | 14                |
| 6   | VI | 328                  | 9                 |
| 7   | VII| 435                  | 12                |
| 8   | VIII| 310                 | 9                 |
| 9   | IX | 229                  | 6                 |
| 10  | X  | 286                  | 8                 |
| 11  | XI | 235                  | 6                 |
|     |    | **Total**            | **3,603**         | **100**          |

Source: Analysis Result, 2017

Qualitative data were obtained through FGD results conducted on communities in Kemijen. In FGD activities, the community is directed based on the aspects of their experience and knowledge about the flood disaster that occurred in Kemijen. In addition, an in-depth interview was conducted at BPP SIMA (the initiator of the Polder Banger development) to define adaptive capacity conditions of communities before and after the construction of the Banger Polder. Basically, there are two types of data used in this research. The data are the primary data obtained from the observation and structured interviews. In this method, the sampling technique used is the snowballing technique.

3. Data and Analysis

The terminology of vulnerability in this article refers to the notion by Turner [20], focusing on the vulnerable area that affected by vulnerabilities as the result of the disaster risk, and for the impact of vulnerability in social aspect such as experience of the community and knowledge is referring to Folke [22]. The discussion in this article will be divided into 2 parts. The first is the explanation about the vulnerability assessment based on the components of exposure, sensitivity and adaptive capacity. The second is the Kemijen development, describing about the impact of the development in Kemijen city village after the programs were finished toward the community adaptive capacity.

3.1 Vulnerability Assessment

3.1.1. Exposure

Exposure refers to the inventory of elements in an area in which hazard events may occur. Hence, if population and economic resources were not located in (exposed to) potentially dangerous settings, no problem of disaster risk would exist [23]. Furthermore, Cardona [24] explained the difference between exposure and vulnerability. Semarang City has historically faced hazards such as drought, land subsidence, landslides, and floods, many of which are likely to become more severe and frequent as a result of climate change [25]. This variable classified into three types of exposure:
a. **Flooding.** Based on the history, floods in Kemijen were caused by the disturbance in the upstream area, sedimentation by the accumulation of garbage and poor drainage system, sea level rise and land subsidence. Tidal period in Kemijen occurs every day where the inundation can be as high as an adult’s knee, indubitably affecting their socio-economic set-ups and daily activities. A study from Anggraini [26] found that based on personal interview with the locals, most of the respondents recalled the large floods which possibly caused a total shut down in the area were happened in 2006, 2005 and also in 1990 even though the tidal flood happens every year. With the height of 50 cm until 2 meters, depending on the location and the condition of drainage. With such disruption happens every day and every year, some locals could not continue their daily activity effectively since the access to workplace is frequently flooded. This condition was worsened by the bad sanitation and water supply in the area.

The social condition in Kemijen have low level of education, which proven by 34% of the people was not graduated from primary school [27]. Whereas the low education leads to low knowledge about how should they handle the risk of tidal flood thus provision of knowledge from government and/or NGO become important. For example, before the announcement and socialization of the Banger Polder project, people in Kemijen did not seem to be disturbed as long as it (the flood) did not affect directly, in this case was the intrusion to their houses [28].

While the economic condition in Kemijen are dominated by the low-income communities (MBR) with the income is below Rp 2,100,000,- per month with a percentage of 84%, tidal floods threats perceived as nuisances which the negative impacts seen to have damaged their properties rather than directly threaten their lives [26]. Because of the increasing of the tidal floods in Kemijen, the burden of public expenditures were higher. This is due to the additional needs on improving their homes and vehicles. Based on the conditions, the scoring results show that some part of Kemijen such as in RW 3, 4, and 5 are having higher exposure which experiencing floods with height more than 25 cm.

b. **Land Subsidence.** In Kemijen City Village, land subsidence is generally caused by natural soil consolidation and the excessive ground water extraction. More towards the North, the level of land subsidence is getting higher, so the worst area that affected by land subsidence is the northernmost of Kemijen, which is RW 4, 5, and 6. Land subsidence in Kemijen affected the people who live in that area and the infrastructure such as streets and houses.

c. **Waste and Sewerage.** There are two types of waste, i.e. solid waste and water waste. Solid waste in Kemijen City Village comes from several places: the textile factory outside Kemijen city village, upstream communities, the market on the southern border of Kemijen City Village, and the communities inside Kemijen City Village itself. Solid waste management in Kemijen city village is very good at the household level. Most people reported that waste was collected from their home every 1-2 days. This is done informally by community members for an IDR 7000-10000 a month. But people also reported that the waste will not be collected by the government and moved out of Kemijen city village. People in Kemijen City Village thought that the drainage should be cleaned more frequently because it makes the flood worse. Also, this water is not treated before it is pumped into the neighboring East Flood Canal and so far there has been no environmental impact assessment of the polder system. It is still dangerous as untreated water waste has a negative impact on environment and ecosystem. The High exposure of waste area in Kemijen, which doesn’t have retrieval facility so still put the wastes in the neighborhood area, are located in RW 5 and 7.

Based on the three elements of exposure (i.e. Flood, Land Subsidence, and Waste and Sewerage), were found several places which are exposed in term of vulnerability assessment in Kemijen. These places are related to the level of the exposure. Table 3 shows the scoring analysis for the Exposure assessment in Kemijen.
### Table 3. Scoring Analysis for Exposure

| RW | Floods Exposure Level | Land Subsidence Exposure Level | Wastes Exposure Level | Total Score of Exposure |
|----|-----------------------|-------------------------------|-----------------------|-------------------------|
| 1  | 2                     | 1                             | 1                     | 4                       |
| 2  | 1                     | 1                             | 1                     | 3                       |
| 3  | 3                     | 2                             | 2                     | 7                       |
| 4  | 3                     | 3                             | 1                     | 7                       |
| 5  | 3                     | 3                             | 3                     | 9                       |
| 6  | 1                     | 3                             | 1                     | 5                       |
| 7  | 1                     | 2                             | 3                     | 6                       |
| 8  | 1                     | 1                             | 1                     | 3                       |
| 9  | 1                     | 1                             | 1                     | 3                       |
| 10 | 2                     | 1                             | 1                     | 4                       |
| 11 | 2                     | 1                             | 1                     | 4                       |

*Source: Analysis Result, 2017*

#### 3.1.2. Sensitivity

Sensitivity is always linked with exposure in the respect of vulnerability assessment. Measuring sensitivity is rather difficult than measuring exposure. Sensitivity measures the effects of perturbations or external stresses to a system directly and/or indirectly, as referred by Adger [29]. Other researchers describe sensitivity as susceptibility/fragility that influences the tendency of environmental physical, human, and infrastructure in the region [30]. It means when a dangerous phenomenon (e.g. floods) struck one region then the system within this region (i.e. environmental physical, human, and infrastructure) will collapse or experience major harm and damage since its lack of resistance and predisposition of society and ecosystems. Thus, sensitivity assessment in Kemijen based on three elements: 1) location; 2) people, and 3) access to infrastructure.

**a. Location.** In term of location, the impact of climate change and all the problems that are happened in Kemijen possibly caused by land use change in Kemijen. Land use change is one of the aspects that is sensitive and could indirectly affect due to the frequent floods occurred in Kemijen. For example, areas that are very prone to flood-affected land use may be changed from settlement become other land use. Related to Banger Polder plan, some parts of the nearby swamps, as on the RW 3,4, and 5, are planned to be used as retention basin. Due to this plan, it will change the existing land use from settlements become retention basin by relocating houses.

**b. People.** Sensitivity assessment may focus on a few specific segments of the population. Sensitivity that affects people is related to their socio-economic aspect because this aspect also come into affected indirectly. This socio-economic aspect will talk about people who are sensitive in Kemijen based on age groups and levels of their economy. In term of social aspect, it can be known that the residents who are sensitive to problems in Kemijen are the residents in a non-productive age group, i.e., the age groups of children (0-14 years) and the age group of the older population (65 years and above) rather than productive age (15-64 years). Specifically, more sensitivity felt by old women.

Meanwhile, sensitivity to People element in term of economic aspect related to livelihoods. The population with the poor economic condition are judged more sensitive to the problems occurred in Kemijen. As the chart shown below, the inhabitants of Kemijen are rated quite sensitive in terms of the economy because the majority of the population worked as laborers and merchants who have income under the UMR (Regional Minimum Salary). Thus, based on the combination of social and economic aspects, is known that old women with low economic condition are relatively the most sensitive people in Kemijen.
c. Access to Infrastructure. Physically, the infrastructure assets utilized by the inhabitants of Kemijen are having a direct exposure as already described in the previous discussion, while the sensitivity is the access to the infrastructure because the residents will feel difficult indirectly in accessing infrastructures such as roads and water supply networks.

Based on the three elements of sensitivity (i.e. Location, People, and Access to Infrastructure), were found several places which are sensitive in term of vulnerability assessment in Kemijen. These places located near the river, near dumping site (both formal and informal), flooded area, slum area, and the area with high rate of land subsidence. Table 4 shows the scoring analysis for Sensitivity assessment in Kemijen.

| RW | Near River | Near Dumping Site | Flooded Area | Slum Area | High LS | Total Score of Sensitivity |
|----|------------|-------------------|-------------|----------|--------|---------------------------|
| 1  | V          | V                 | V           | V        | V      | 2                         |
| 2  | V          | V                 | V           | V        | V      | 2                         |
| 3  | V          | V                 | V           | V        | V      | 4                         |
| 4  | V          | V                 | V           | V        | V      | 4                         |
| 5  | V          | V                 | V           | V        | V      | 5                         |
| 6  | V          | V                 | V           | V        | V      | 3                         |
| 7  | V          | V                 | V           | V        | V      | 2                         |
| 8  | V          | V                 | V           | V        | V      | 3                         |
| 9  | V          | V                 | V           | V        | V      | 3                         |
| 10 | V          | V                 | V           | V        | V      | 2                         |
| 11 | V          | V                 | V           | V        | V      | 2                         |

Source: Analysis Result, 2017

3.1.3. Adaptive Capacity

Adaptive capacity will provide an analysis to show the level of adaptability in Kemijen City Village to overcome the problems. There are several adaptive capacity levels according to Adger and Vincent [19], ranging from individual, community, and nation level. In its implementation, adaptive capacity is more easily done at the individual level than the national level. Adger and Vincent [19] mentioned that the ability of adaptation of society is determined by the economic ability, knowledge, experience and community response to environmental conditions. According to the exposure mentioned before, there are 3 problems in Kemijen Area, which are floods, land subsidence, and waste that classified into three types of adaptive capacity:

a. Individual Adaptive Capacity (IAC)

Individual adaptive capacity is the act of an individual or family in an effort to protect the livelihoods and assets from the possible problem of climate change.

b. Community Adaptive Capacity (CAC)

Community Adaptive Capacity is an ability or action by certain groups. The emphasis is on the collective rather than individual or family.

c. Government Adaptive Capacity (GAC)

Government Adaptive Capacity is the ability of adaptation refers to the organizational ability. The realization of this adaptation can be a program, policy, regulatory, human resources and technical expertise from both local and central government, and civil society groups. The scale of the adaptation is quite spacious, and very systemic aims, as well as the long term.

The big problems found in Kemijen were floods, land subsidence, and waste. Adaptive attitude is needed to solve the problems. Each adaptive capacity to overcome the floods, land subsidence, and waste problems is shown in the table below.
Table 5. Adaptive Capacity Activities in Kemijen

| IAC | FLOODS | LAND SUBSIDENCE | WASTE |
|-----|--------|----------------|-------|
|     | • The ability of household to prevent water from entering into the house by giving sand bags on their doorsteps. | There is no specific individual adaptive capacity for land subsidence. | The waste management is very good on household level. Every household keeps clean their surroundings such as house and street, but they dump the waste in open area which are close to the river or into the fish ponds. |
|     | • The ability of people to buy the individual pumps for their house | | |
|     | • The ability of household to elevate their houses. | | In Kemijen City Village, all the people have own adaptive capacity to cope waste problems. |
|     | • The ability of household to raise their house into 2 or more floors. | | |
| All the people have own adaptive capacity to cope the floods. | | |
| CAC | The community set up their pumping houses in each RT. Some households in Kemijen City Village buy a pump that aiming to pump water from their RT. | There is no specific community adaptive capacity for land subsidence: | In RW 1, RW 2, RW 3, RW 4, RW 6, RW 8, RW 9, RW 10, and RW 11, most of the waste collection system on the RT level is actually very good. Most people reported that waste was collected from their home every 1-2 days. This is done informally by community members for an IDR 7.000-10.000 a month. |
|     | • RT has a contribution from the community used for maintenance and operation of that pumps. The contributions are varied, among IDR 2,500 – IDR 15.000. There are also neighborhood who do not contribute regularly, so they will contribute only if the pump was broken and in need of repair | | But in RW 5 and RW 7, they have no retrieval facility. So they still put the waste in the neighborhood area. |
|     | • The community initiates to help the others, because of their sense of mutual help for unable people. The community collect money to buy individual pumps for unable people. | | |
| From 11 RWs in Kemijen, there are 2 RW that did not have that CAC, there are RW 3 and RW 4 | | |
| GAC | Community disaster alert | Government adaptive capacity for land subsidence is by making policy or regulation to limit the ground water extraction | The GAC for waste is just in RW 9, which The Government take the trash from the temporary disposal to the final disposal. |
|     | The government formed a community disaster alerts. | | |
|     | Banger Polder System | | |
|     | It will protect more than 84,000 inhabitants in the area of 527 Ha. It will also protect the assets of some prominent stakeholders such as Indonesia Railway Company, state owned oil company Pertamina, and other major companies inhabiting Banger area. The companies as well as the inhabitants of Banger area will be benefited from the project, particularly to be free from the daily floods which has been enormously disturb their assets. | | |
| Currently the implementation of Banger Polder System is about 25%, in which only affected for RW 6, RW 7 RW 8, RW 9, and RW 10. | | |

Source: Analysis Result, 2017
The scoring calculation is based on the indicators of these variables. All RWs in Kemijen City Village have adaptive capacity, although there are some RWs that have low abilities of adaptive capacity. Here is the summary of adaptive capacity from 3 problems in each RW:

| RW | Individual AC | Community AC | Government AC | Total Score Of Adaptive Capacity |
|----|---------------|--------------|---------------|----------------------------------|
|    | Flood Land subsidence | Waste Flood Land subsidence | Waste Flood Land subsidence |                      |
| 1  | 1 0 1 1 0 1 0 1 0 | 5               |               |                                  |
| 2  | 1 0 1 1 0 1 0 1 0 | 5               |               |                                  |
| 3  | 1 0 1 0 0 1 0 1 0 | 4               |               |                                  |
| 4  | 1 0 1 0 0 1 0 1 0 | 4               |               |                                  |
| 5  | 1 0 1 1 0 0 0 1 0 | 4               |               |                                  |
| 6  | 1 0 1 1 0 1 1 1 1 | 6               |               |                                  |
| 7  | 1 0 1 1 0 0 1 1 0 | 5               |               |                                  |
| 8  | 1 0 1 1 0 1 1 1 0 | 6               |               |                                  |
| 9  | 1 0 1 1 0 1 1 1 1 | 7               |               |                                  |
| 10 | 1 0 1 1 0 1 1 1 0 | 6               |               |                                  |
| 11 | 1 0 1 1 0 1 1 1 0 | 6               |               |                                  |

Source: Analysis Result, 2017

Human adaptive behavior toward things can be formed after going through some of the events they have experienced. The experience of the flood disaster has been felt by the community in Kemijen since years ago. The elevation of the houses and roads is done every five years as a form of adaptation of local communities. Affected by floods especially during the rainy season also makes people have pumps to pump water out of the settlement environment. Up until now, there is at least one pump in each RT to pump water from houses to rivers. By looking at these development needs, communities are also increasingly experienced in finding development funds and submitting aid proposals to government or CSR firms around Kemijen.

Initially, the people of Kemijen did not have sufficient knowledge about disaster response and how to adapt to the flood. The level of education is also still relatively low, by seeing that the majority of the population of Kemijen is an elementary school graduate. After some development in Kemijen City Village involving the community, adaptive capacity of the community has increased. The development is not only from the government, but also from NGOs and government CSR programs. The development involving the community includes the construction of Banger Polder, PLPBK (Neighborhood Development), village improvement program by Hysteria, etc.

3.1.4. Scoring Result

After being discussed and assessed at every stage of Exposure, Sensitivity, and Adaptive Capacity, then they are summed up to obtain an assessment of identified vulnerability. Based on the all scoring calculations in each component of vulnerability assessment, then being calculated the vulnerability assessment using the previous formula. The result can be seen in the table below:
Table 7. Scoring Result to Identified Vulnerability in Kemijen

| Area  | Exposure (E) | Sensitivity (S) | Adaptive Capacity (AC) | Vulnerability = (ExS)/AC |
|-------|-------------|----------------|------------------------|--------------------------|
| RW 1  | 4           | 2              | 5                      | 1.6                      |
| RW 2  | 3           | 2              | 5                      | 1.2                      |
| RW 3  | 7           | 4              | 4                      | 7                        |
| RW 4  | 7           | 4              | 4                      | 7                        |
| RW 5  | 9           | 5              | 4                      | 11.25                    |
| RW 6  | 5           | 3              | 6                      | 2.5                      |
| RW 7  | 6           | 2              | 5                      | 2.4                      |
| RW 8  | 3           | 3              | 6                      | 1.5                      |
| RW 9  | 3           | 3              | 7                      | 1.3                      |
| RW 10 | 4           | 2              | 6                      | 1.3                      |
| RW 11 | 4           | 2              | 6                      | 1.3                      |

Source: Analysis Result, 2017

The scoring result stated that RW 5 is the most vulnerable region compared to other neighborhoods. Additionally, RW 3 and RW 4 also have a fairly high susceptibility values. Because of Exposure and Sensitivity assessment, this area is quite exposed and sensitive to the issues, while it is still lack of Adaptive Capacity.

Figure 1. Map of Vulnerability Level in Kemijen
3.2 Kemijen’s Development

Some of the developments are carried out by the government, NGOs, and CSRs, that bring impact to the local people of Kemijen. The impact is felt by the community starting from the time of development of Polder Banger System which mostly exists in Kemijen. Afterward, Kemijen became one of the pilot projects of PLPBK (Neighborhood Development) in Semarang City on 2014. There are pros and cons on such physical development, such as road elevation activities in PLPBK. In terms of aesthetics, they look good, but less supportive on environmental. The elevation of roads leads to drowning homes and not providing solutions for floods. In order to flood prevention, it is important to pay more attention to the drainage network of settlements rather than merely elevating the road periodically. On the other hand, non-physical programs such as the establishment of Disaster Preparedness Group (KSB), trainings and socializations are considered to be more supportive and encourage community participation to engage in environmental conservation in Kemijen. The establishment of the Banger Polder Management Board (BPP Banger SIMA) also has an impact on the formation of local adaptive capacity. Residents are involved in the Banger Polder Board and in the management of Banger Polder System. This is done to increase knowledge and empower the community so that people aware to protect their environment.

The Banger Polder Management Board created a mission and vision of “dry feet for all” with the auspicious goal of ridding the residents of Kemijen from coastal inundation and rainwater floods. In order to achieve this goal, the board did socialization to the residents of Kemijen since 2001. Due to the board is a non-profit organization, they sought a way how to held socialization to the residents in the effective and smart way. In this case, they approached the local women’s organization in Kemijen, called Empowerment of Family Welfare or Pembinaan Kesejahteraan Keluarga (PKK). Every month, PKK held a regular meeting in order to increase knowledge and educate women in the neighborhood.

Based on the interview, the board explained the reason they choose the local women’s organization as following: 1) generally, women have responsibility to keep their family and children; 2) women also have responsibility to manage their family’s financial; 3) women hold responsibility to keep the cleanliness of their neighbourhood (e.g. person usually throw garbage to the river is woman); 4) women usually work to gather neighbourhood’s data voluntarily; and 5) empower women to participate maintaining the environment in their neighbourhood.

Since then, the municipality and NGOs also held a program in order to increase the involvement of local community in the planning process. Each city village has one community organization called Badan Keswadayaan Masyarakat (BKM). This organization acts as leading sector and coordinator of the other organizations in the city village (i.e. PKK, youth community group, disaster preparedness group). In Kemijen, BKM already well functioned and have regular activities in order to improve their neighborhood. For example, when the municipality gave fund for improving the infrastructure in Kemijen, all the community groups held a discussion about the locations that need to improve and how to do it. Thus, all of the neighborhood will get the beneficiaries.

4. Conclusion

The assessment of disaster-affected areas is to provide an understanding of disaster risk and management in decision-making for regulation and disaster management. Based on the results of the research, Kemijen is a vulnerable area due to the flood disaster and rain. After the developments were done in Kemijen area, the impact is felt by the community. But it is not affect much in some RWs such as RW 3,4,5 in Kemijen city village which still has a high level of vulnerability. This applies to environmental conditions that are still susceptible to flooding and low adaptive capacity. One of the physical development programs that have been done so far is the elevation of roads, but the program will be less effective from the environmental aspect because it is less support to reduce the impact of the flood.
The more influential impact in Kemijen city villages is non-physical aspects through the socialization and involvement of community participation in disaster management. The existence of such non-physical development has helped to increase public participation not within a short time. Community participation in Kemijen City Village involves more on women, that can be seen from the role of woman local organization (PKK). It conducts regular meetings in order to increase knowledge and educate women in the neighborhood. To maintain sustainable environmental conditions, it needs community participation and cooperation from government, corporations, NGOs in the decision-making of development activities.

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