Flood Waste Management Preparedness Indicators: Learning from Semarang Flood 1990s

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Flood Waste Management Preparedness Indicators: Learning from Semarang Flood 1990s

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Abstract. Flood waste such as waste generating after flood, see inundation, high rains must be handling quickly and proper. The acceleration of management is one of key point in the following respond and reconstruction. Since Flood waste treatment, need more than 30 % of emergency budget, the performance should be improved. This research proposed a method to set indicators in disaster waste management preparedness. By using GIS and SPPS statistical tools this research examine some basic indicator for independent variable namely normal waste generation, number of temporary waste collection, number of informal waste picker, demography, waste infrastructure, and governmental program and the dependent variable is waste treated and recycle. Semarang 1990s flood is selected study to examine the model. model result shown that all indicators are possible to set as basic indicators for flood waste management preparedness.

Keywords: *Flood waste, Preparedness Indicators, Semarang Floods 1990s, GIS*

1. Introduction

Disaster waste management is a process to manage any waste generate by disaster [1]. Such as other planning, disaster waste preparedness need to evaluate regularly. The evaluation of preparedness is need to assess the indicators for increasing the quality of disaster waste management [1]. Controlling damage natural and manmade infrastructure such as disaster waste is one of the significant role in the evacuation and safety life of disaster management. Affected people face unpredictable infrastructure loss and damage when they try to safe their life. Rescue, search and volunteer teams in process of safety life, also facing many infrastructure damage. Since that in the emergency respond, disaster waste handling need more than 27 % of budget allocation, the indicator of process should be improve and evaluate to reduce the cost [2]. Moreover, in developing countries, evaluation of preparedness is very needed not only for increasing their planning but also for increasing their intention to handling disaster waste [3].

This study proposed basic indicator for flood waste management preparedness. Flooding is very common disaster both for developed and developing countries. Flood waste management preparedness is very importance since this is often attach worldwide. Depending on the type of flood disaster, such as flood, inundation, high rains, flash flood, the characteristic of flood waste generation may different. Learning from the huge flood in Bangkok Thailand 2011, that government and stakeholder found many difficulties to overcome the problem of flood waste generation, the preparedness of flood waste

also need to evaluate and improve regularly [4]. This indicator is very importance not only for disaster itself but also for climate hazard in coastal region.

The goal of this study is to examine several indicators for disaster waste management preparedness evaluation. The indicator selected refers to importance factor of waste management both in normal condition and in disaster event, especially for flooding condition [3, 4]. The indicators that will be examine namely: normal waste generation, number of temporary waste collection, number of informal waste picker, demography, waste infrastructure, and governmental program. All the independent variable will be examined to detect the dependent variable namely waste treated

2. Methods

2.1 Disaster of waste management preparedness Indicators

The indicator of disaster waste management preparedness is examined by using basic element of linear regression by using formula: **Y = aX + b**. If the indicators can be perform within the basic formula mean that the indicator selected is accepted, while when the statistical criteria is not achieved, mean that the indicator is rejected. Table 1 describes the indicator selected in this study for flood disaster waste preparedness.

Table 1. Indicator, Weight and Score of Variable

Flood Waste Management Preparedness Indicator	Code	Criteria	Score	Value reference
Waste Treated and Recycled	Y			
Waste Generation in normal Condition	X1	Low	3	0-150
		Moderate	2	150-200
		High	1	>200
Number of Temparaty station	X2		3	99%-146%
			2	49%-98%
			1	0-48%
Number of Informal Recycle Worker	X3	Low	3	<0.5%
		Moderate	2	0,50%
		Hight	1	>0.5%
Population Dencity	X4	Low	3	<150 person/ha
		Moderate	2	150-400 person/ha
		Hight	1	>400 person/ha
Waste Management Collection and Transport Infrastructure	X5	High	3	>88
		Moderate	2	45-88
		Low	1	0 - 44
Land Use Cange	X6	safe	3	50-72
		Moderate	2	73-95
		Dengerous	1	96-115
Govenmental Program	X7	Hight	3	>3
		Moderate	2	3
		Low	1	<3

2.2 Study Area

This study select Semarang's flood 1990s as basic event to set indicators in preparedness of disaster waste management. Today, Semarang is one of the 100 resilience cities network concerning to the climate change hazard. that facing and inundation hazard. This hazard have been detected since more than many decade ago. Recently, the climate hazard influx have been detected in Semarang Up town doe to the climate change migration [5].

2.3 Data Collection

This study using statistical data from Board of Development and Planning Semarang City and the statistical data of Semarang in 1990 [6, 7]. Table 2 describes the data concerning to the waste treated, waste generation, temporary facility, informal waste picker and population in Semarang 1990.

Table 2. Data for Flood Waste Management Preparedness Indicator in Semarang 1990

Sub distric	Y	X_1	X_2	X_3	X_4
	waste treated (m3)	Waste Generation (m3)	Temporary Facility (unit)	Informal waste picker (person)	Population Density Person /ha
Semarang Tengah	218,81	225,57	41	147	0,25
Semarang Utara	288,00	514,28	16	335	0,13
Semarang Timur	549,11	653,71	17	425	0,07
Semarang Selatan	399,16	654,37	75	426	0,03
Semarang Barat	420,77	809,18	20	526	0,08
Semarang Genuk	186,76	321,99	8	209	0,02
Semarang Gn. Pati	8,99	128,48	-	84	0,01
Semarang Mijen	12,65	115,04	-	75	0,01
Semarang Tugu	99,68	158,22	5	103	0,01

Table 3 describes data for flood waste preparedness indicator for infrastructure, land use change, and program developed to fostering the service of waste management. both in Table 2 and Table 3, the condition of the data is selected base on the condition for normal waste service and management.

Table 3. Data for Flood Waste Management Preparedness Indicator in Semarang 1990

Sub distric	X_5					X_6	X_7
	truck	Bin	Depo	container	total infrastructure sarpras	Land use change	program
Semarang Tengah	4	8	3	8	23	40	1
Semarang Utara	9	16	16	47	88	65	1
Semarang Timur	7	0	20	33	60	110	1
Semarang Selatan	7	0	15	31	53	95	1
Semarang Barat	20	120	96	131	367	95	1
Semarang Genuk	7	0	24	37	68	50	1
Semarang Gn. Pati	8	0	20	30	58	87,5	1
Semarang Mijen	3	7	29	19	0	107,5	1
Semarang Tugu	0	0	0	0	0	115	1

3. Result and discussion

3.1 Statistical Assessment of Waste Management Preparedness Indicator in Semarang 1990

Table 4 shown the result of the statistical assessment for each indicators. Refers to the table the indicator accepted for the model are; temporary facility, Informal Waste picker, Infrastructure of waste management and land use change. The indicator that rejected namely waste generation, population density and program of government. refers to the statistical assessment, the model of flood waste management preparedness can be formulated as follow:

$$\mathbf{Y = -153.750 + 5.231\ X2 + 4.118\ X4 - 1.015\ X6 + 1.184\ X7}$$

The constanta of (X6) is negative, mean that if the infrastructure is increases, it is not associated with the increasing for waste treated

Table 4. SPSS Result of Waste Management Preparedness Indicator in Semarang 1990

Model Indicator	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	b	Std. Error	Beta			Tolerance	VIF
(Constant)	-153.750	230.499		-.667	.541		
Temporary Facility	5.231	4.535	.671	1.153	.313	.083	12.045
Informal waste picker	4.118	.957	.939	4.303	.013	.590	1.696
Infrastructure	-1.015	.980	-.595	-1.035	.359	.085	11.759
Land use change	1.184	2.047	.136	.578	.594	.509	1.966

Dependent Variable: Waste Treated

3.2 Preparedness Degree for Flood Waste Management for Each Sub District in Semarang 1990.

Refers to the Table 1, the analysis of the preparedness degree for flood waste management for each sub district in Semarang 1990 is shown in Figure 1.

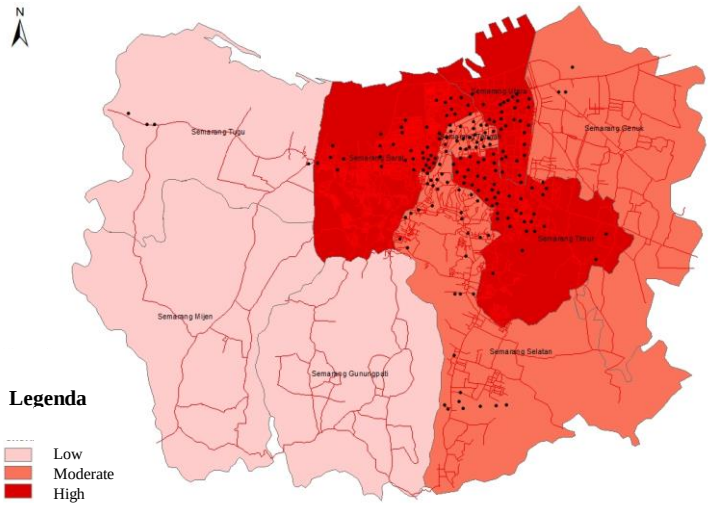

Figure 1. Preparedness Degree in Flood Waste Management in Semarang 1990

By using the criteria, score as shown in table 1, the study result shown that in 1990, subdistrict with high preparedness degere are Semarang Utara, Semarang Timur and Semarang Barat. The other sub ditrict conditon describe in Table 5 below.

Table 5. Preparedness Degree in Flood Waste Management in Semarang 1990.

Sub Distric of Semarang	Preparedness Degree for Flood Waste Management
Semarang Tengah	Moderate
Semarang Utara	High
Semarang Timur	High
Semarang Selatan	Moderate
Semarang Barat	High
Semarang Genuk	Moderate
Semarang Gn. Pati	Low
Semarang Mijen	Low
Semarang Tugu	Low

3.3Indicator Missing, why?

As shown in part 3.1, this study using statistical tools and criteria to evaluate the indicator that influence degree of flood waste management. From the 7 indicator proposed, 4 indicator accepted and 3 indicator rejected. The missing of the indicator is probably the data is not consistent and comparing to the other data. There are four data in basic statistical analysis, first is nominal data, second ordinal data, third interval data, and the last is rasio data. According to the Table 2 and Table 3, type of the data is ratio, so that the there is no error in data classification, so that the indicator missing is purely statistical assessment. Waste generation in normal condition is indicator for waste management in peace time not for disaster waste generation so this indicator is rejected. However this indicator is very importance for flood waste preparedness [8]. since the data concerning to the government program similar so the indicators is also rejected. Even though the indicator is also importance in disaster waste management process [8].

4. Conclusion

Flood waste management preparedness should be evaluate to get more advance and quick respond during the event. The indicator that should be improving and evaluate for flood waste management are; Waste Generation, Temporary Station, Population Density, Waste Infrastructure, Land Use Change, Informal Waste Picker, and governmental program.

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