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Community Satisfaction Evaluation of Urban Flood Control Project Toward Sustainable Flood Mitigation (A Study at River Normalization Project in Bendung Watershed Palembang City, Indonesia)

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ABSTRAK

Abstrak: Proyek pengendalian banjir perkotaan merupakan salah satu upaya mitigasi risiko banjir perkotaan, dan diharapkan dapat mengurangi dampak bencana banjir di perkotaan. Sebagai proyek mitigasi banjir yang tetap memperhatian aspek berkelanjutan; baik secara berkelanjutan dalam pengurangan banjir maupun berkelanjutan pada dataran banjir seperti aspek sosial, ekonomi, lingkungan dan kelembagaan, oleh karena itu mitigasi risiko banjir melalui proyek pengendalian banjir perkotaan tidak hanya tentang mengurangi banjir saja tetapi diharapkan mempertimbangkan dampak proyek pada dataran banjir untuk mencapai proyek mitigasi banjir yang berkelanjutan. Penelitian ini bertujuan untuk mengukur kepuasan masyarakat atas kinerja / dampak proyek pada proyek normalisasi sungai di DAS Bendung Kota Palembang. 22 variabel terkait aspek mitigasi banjir berkelanjutan digunakan untuk mengevaluasi kinerja / dampak proyek dari sudut pandang masyarakat. Analisis kepuasan yang dilakukan dalam penelitian ini menggunakan tiga metode, yaitu metode indeks kepuasan masyarakat (*Community satisfaction index*), analisis kesenjangan (*gap analysis)*, dan metode analisis kinerja kepentingan (*Importance Performance Analysis*). Hasil analisis menunjukkan nilai indeks kepuasan pelanggan (CSI) sebesar 69,23%, dan skor rata-rata untuk tingkat kepuasan adalah 3,44 (skala 1-5). Selanjutnya dari metode IPA variabel yang menjadi prioritas utama untuk perbaikan guna meningkatkan kepuasan masyarakat, meliputi 4 variabel kinerja yaitu pemindahan paksa, tempat / peluang rekreasi, partisipasi penduduk setempat, dan pemeliharaan proyek Secara keseluruhan dapat disimpulkan bahwa masyarakat telah puas dengan kinerja proyek.

Abstract: *The urban flood control project is one of the efforts in urban flood risk mitigation, and is expected to reduce the impact of flood disasters in cities. As sustainable flood mitigation project that involves both sustainable in flood reduction and sustainable on the floodplain such as social, economic, environmental and institutional aspects, therefore flood risk mitigation through urban flood control project is should not about reducing flood only but expected to consider impacts of the project on the floodplain for achieving sustainable flood mitigation project. This study aims to measure community satisfaction on project performance/impacts at river normalization project in Bendung watershed Palembang City. 22 variables related to sustainable flood mitigation aspects are used to evaluate project performance/impacts from points of view of community satisfaction. Analysis carried out in this research using three methods, namely the community satisfaction index (CSI), gap analysis, and importance performance analysis (IPA) method. The analysis results reveal that the customer satisfaction index (CSI) value was 69.23%, and the average score for the level of satisfaction was 3.44 (1-5 scale). Furthermore, from the IPA method, variables which are the main priority to be improved in order to increase community satisfaction, includes 4 performance variables namely; involuntary displacement, recreational place/opportunities, participation of locals, and project maintenance. Overall it can be concluded that community have been satisfied with project performances.*

A. INTRODUCTION

Urban flood control project in Palembang city in this study is the normalization of the bendung river located in the Bendung watershed which has succeeded in reducing inundation in several locations. Since the normalization of the Bendung river, several inundation locations have been successfully resolved both from the number of inundation and inundation depth. On the other hand, the construction of urban flood control projects also raises several adverse impacts on the environment, social and economic problems.

Several flood control projects in Palembang City have been constructed over the last few years. Some examples of flood control projects that have been built are river normalization, retention ponds and the most recent one currently under construction is the construction of pumps. The success of urban flood control projects in

minimizing the impact of flood disasters has been felt in recent years. The number of flood sites and inundated houses during the rainy season decreased over time as flood control projects were constructed. According to a report issued by the National Board for Disaster Management of Indonesia, the number of building or houses flooded reached 500 houses in 2014 before normalization project and significantly decreased remaining only 100 houses in 2018 after project constructed.

Meanwhile, implementation of sustainable flood mitigation has become a worldwide concern in recent years, and many research relate to sustainable flood mitigation have been carried out. However, there are only a few researches that deal with the perceptions of the community at the location of the project to evaluate the impacts of the project in terms of sustainability aspects.

Previous studies on evaluation of the flood control project have highlighted only the engineering/technical aspects of the project. Mostly, studies only focus on evaluations to reduce the volume of flood, and less considering the evaluation of the impacts of the projects in terms of sustainability aspects. Even though in project planning, there are socialization and hearing audience on before construction to anticipate negative impacts of the projects but sometimes between planning and the application during the project construction, is not in line.

Based on that reason, the evaluation of the project through measuring community satisfaction toward the impacts of the project in terms of sustainability aspects is needed. Sustainable flood mitigation is not only about reducing floods but also has to consider the impacts in terms of sustainability aspects, by one of the ways through measuring the community satisfaction for improvement of the urban flood control project in the future.

B. METHOD

1. Research Area and Data Collection

Figure 1 shows the location of Bendung watershed in Palembang City. Bendung watershed is one of the eighteen watersheds in Palembang City, and the area of the watershed is about 14.5 km2.

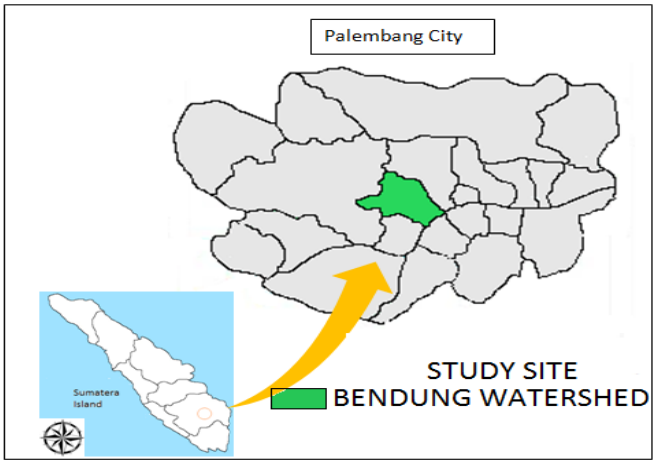

Figure 1. Location of Bendung watershed in Palembang City

Palembang City is low land area with an average height of 8 meters above sea level and is crossed by the Musi River and its tributaries. Based on topographical conditions, the city of Palembang is always vulnerable to floods during the rainy season. Both central and local government since years have constructed some urban flood control projects, such as retention pond, river normalization and water pump. The project has been proven to reduce the number of points and flood depths significantly.

The study site located in Bendung watershed in Palembang City that located in 9 sub districts that are directly adjacent to the Bendung River. Twelve sub districts that are located in Bendung watershed are Sekip jaya, Pahlawan, 20 Ilir, Pipa Reja, Talang Aman, Ario Kemuning, 10 Ilir, 11 Ilir Kuto Batu, Duku, 9 Ilir and 8 Ilir.

A deductive quantitative approach applied to achieve the research objectives. The data collection method in this research is to take a sample from the population and using a questionnaire as the main instrument for collecting data. Primary data collection conducted by distributing questionnaires to local residents. Questionnaire-based research was conducted to obtain the primary data as a social demographic and residents' opinions. Questionnaires are used in the classification and weighting process the level of satisfaction and importance, and will describe the satisfaction of local residents.

The total population consisting of local residents aged between 20 and 64 years in the study area was 175,059 who lived in 12 sub districts that are located within Bendung watershed; Sekip Jaya, Pahlawan, 20 Ilir II, Pipa Reja, Talang Aman, Ario Kemuning, 10 Ilir, 11 Ilir, Kuto Batu, Duku, 9 Ilir and 8 Ilir. Ensuring representation of the population, all sub districts will have representation as respondents, and also both respondents that live both adjacent the river and far from the river will have representation as respondents.

The selection of respondents was done by proportional random sampling method. In addition, primary supporting data was obtained through field observations. Meanwhile, secondary data was collected from data provided by the local government, Central Bureau of Statistics of Indonesia, and other sources relevant to this study.

The questionnaire was adapted from Aminur's research questionnaire (Aminur et al., 2017b) with the addition of new variables according to the characteristics of the study site in Bendung watershed in Palembang City. The first part of questionnaire consists of social demographic data of respondents, such as gender, age, sub district, district, educational level, length of domicile and type of livelihood. The second part contains 28 questions/statements and each question/statement represented one variable measured using five-point Likert scale (1=very dissatisfied/very unimportant, 2=not satisfied/not important, 3=quite satisfied/quite important, 4 = satisfied/important, 5 = very satisfied/very important).

The aspects of the study are divided based on flood damage reduction aspect plus four aspects of sustainability in accordance with the concept in sustainable flood mitigation, namely flood damage reduction ,economic, social, environmental and institutional aspects/indicators (Aminur et al., 2016).

2. Community Satisfaction Index (CSI)

Community Satisfaction Index (CSI) is used to determine the level of respondent satisfaction thoroughly with an importance-level considering approach of the measured project performance variables. The value will

be measured in range to measure the performance of the project.

3. Gap Analysis

Evaluation of community satisfaction on project performance is also carried out with gap analysis. On this analysis method, the level of suitability is obtained by comparing the satisfaction with importance level, resulting in a percentage level of suitability. While on this gap analysis calculates community satisfaction by calculating the difference (gap) between satisfaction and importance level for each project performance variables. Before calculate the gap analysis (gap), the frequency interval was made to assess project performance variables, where the calculation of the value of this frequency interval is influenced by the large number of respondents, which will affect the calculation the highest gap score and the lowest gap score.

$$Interval = \frac{Highest\ gap\ score - Lowest\ gap\ score}{Number\ of\ interval} \quad (1)$$

4. Importance Performance Analysis

The data collected from the questionnaire were analyzed to conclude the results evaluation of community satisfaction on the river normalization project, including what variables have been satisfying the population and any variables that need to be improved. Importance analysis method performance analysis is used to map the perceptions of the population on several variables that affect community satisfaction (Supranto, 2001). There are several steps in using the IPA method as follows: (1) Making a map of the Importance Performance Analysis (IPA) position. Based on the data collected, the average satisfaction level and importance level were calculated based on point of view of residents which will then be described the level position satisfaction and importance level on the import quadrant diagram performance analysis, where the axis intersects (x, y) where the horizontal axis (x) from the Cartesian diagram is the level of satisfaction and the vertical axis (y) of the Cartesian diagram is the level of important of respondents; (2) The Cartesian diagram of IPA is divided into four parts bounded by two lines that intersect perpendicular to the points (X,Y), where X is the average of the satisfaction level score and Y is the average score of the importance level of all measurement variables; and (3) Next, plot the analysis result of each variable of the level of satisfaction and importance into a Cartesian diagram which is divided into four quadrants as the following:

a. Quadrant A

Variables that are in this quadrant need to prioritized / increased, because the existence of these variables is very important based on respondents, while the level of implementation is still not satisfying.

b. Quadrant B

The performance of the variables in this quadrant are good and also need to be maintained, because expectations toward these variables are also high based on respondent's opinion.

c. Quadrant C

The variables in this quadrant are considered less important to respondents, while their performance is quite good. The variables in this quadrant are not a priority for the population and their performance is not required.

d. Quadrant D

The variables in this quadrant are considered excessive in their implementation, this is because the respondent thinks these variables are not very important, while their performance is very satisfying.

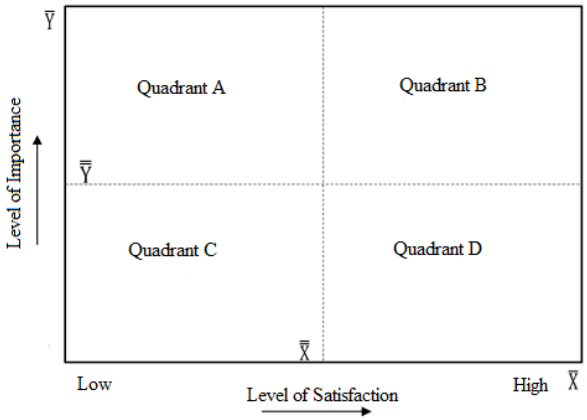

Figure 2. Diagram of Importance Performance Analysis

C. RESULTS AND DISCUSSIONS

1. Community Satisfaction Index (CSI) toward the project

Table 1. Community Satisfaction Index (CSI)

Var.	Mean Score of Importance	Weighting Factor	Mean Score of Importance	Weighting Score
a	b	c=b/btotal	d	e=c*d
V1	4.44	4.77%	4.00	0.19
V2	4.04	4.35%	3.34	0.15
V3	4.04	4.35%	3.65	0.16
V4	4.53	4.87%	3.95	0.19
V5	4.42	4.76%	4.05	0.19
V6	4.39	4.72%	3.97	0.19
V7	4.38	4.71%	4.01	0.19
V8	3.70	3.98%	3.00	0.12
V9	4.38	4.71%	4.00	0.19
V10	4.36	4.69%	2.24	0.10
V11	4.59	4.94%	4.32	0.21
V12	3.84	4.13%	3.39	0.14
V13	3.70	3.98%	3.04	0.12
V14	3.74	4.02%	3.22	0.13
V15	4.20	4.51%	3.60	0.16
V16	4.40	4.73%	3.96	0.19
V17	4.46	4.79%	3.84	0.18
V18	4.40	4.73%	3.41	0.16
V19	3.92	4.21%	2.74	0.12
V20	4.49	4.83%	2.51	0.12
V21	4.06	4.36%	2.54	0.11
V22	4.53	4.87%	3.01	0.15
	92.99	100%		
Weighted = Weighted Score				3.46
Satisfaction Index = (Weighted Total/Scale (5))* 100%				69.23%

Community satisfaction index (CSI) is used to determine the level of respondent satisfaction thoroughly

with an importance-level considering approach of the measured project performance variables. Based on the results calculations in table above, the CSI results for the project performance variable are 69.23%. These values are in a range of values of Community Satisfaction Index (CSI) is that between (60% <CSI ⩽ 80%) which means that respondents are satisfied with the performance the project. The project performance is expected to continue improving its performance to achieve a better level of community satisfaction. The following table is the Community Satisfaction Index (CSI) calculation obtained from a comparison between the levels of importance and the level of satisfaction.

2. Gap Analysis

The frequency interval was made to assess project performance variables, where the calculation of the value of this frequency interval is influenced by the large number of respondents, which will affect the results of the calculation of the score the highest gap score and the lowest gap score. Based on the results of the calculation of the frequency interval, the satisfaction criteria for gap analysis are as follows:

Table 2. Frequency Interval for Gap Analysis

Frequency Interval	Satisfaction Assessment
261 – 215.6	Very Dissatisfied
215.6 - 170.2	Dissatisfied
170.2 - 124.8	Quite Satisfied
124.8 - 79.4	Satisfied
4.00	Very Satisfied

Based on the results of the gap analysis, the level of satisfaction and importance assessments as shown in Table 3, the highest gap is found in the variable of project does not cause involuntary displacement of local residents (V10) with score of 261, and the lowest gap is in the variable of project increase land value (V11) with score of 34. It can also be seen that the majority of respondents have high expectations that is greater than 4 (rating scale 1-5) with average of 4.23. Whereas for project performance the majority of respondents were quite satisfied that can be seen from the assessment of respondent satisfaction greater than 3 with average of satisfaction level is 3.44. Respondents have been satisfied with the project performance by obtaining a mean value of satisfaction is 3.44, but they expect performance improvement where this condition can be seen by obtaining the mean value of expectation is 4.23.

Table 3. Gap Analysis of Variables

No.	Variables	Gap score	Assessment
V1	Project minimize public and private facilities damage due to flooding	54	Satisfied
V2	Project reduce traffic accident hazards due to street flooding	86	Satisfied
V3	Project eliminate loss of life due to flooding	48	Satisfied
V4	Project reduce frequency and size of flooding	71	Satisfied
V5	Project increase the resilience of local residents toward flooding	46	Satisfied
V6	Project increase accessibilities within region	52	Satisfied
V7	Project increase quality of life	46	Very Satisfied
V8	Project reduce crime rates	86	Satisfied
V9	Project increase convenience	47	Very Satisfied
V10	Project does not cause involuntary displacement of local residents	261	Very Dissatisfied
V11	Project increase land value	34	Very Satisfied
V12	Project increase benefits for industries of local residents	55	Satisfied
V13	Project increase income of local residents	81	Satisfied
V14	Project create (job) opportunities	64	Satisfied
V15	Project attract investments in the region	73	Satisfied
V16	Project contribute in better waste management	54	Satisfied
V17	Project improve aesthetic of environment	76	Satisfied
V18	Project create recreational place/ opportunities	121	Dissatisfied
V19	Project involve participation of local residents during the planning of project	145	Dissatisfied
V20	Project involve participation of local residents during the construction of project	243	Very Dissatisfied
V21	Project involve participation of local residents during the maintenance of project	186	Very Dissatisfied
V22	Project is continuously maintenanced by government	187	Very Dissatisfied

3. Importance Performance Analysis of the project

In order to know more clearly about the project performance, then the Cartesian diagram analysis can be used for importance performance analysis). With this Cartesian diagram analysis, it can be seen classification which is divided into four namely quadrant A, B, C and D. Where the horizontal (x) axis from Cartesian diagram is the level of satisfaction of the project performance and the vertical axis (y) is the level of importance/expectation. Based on calculations previously obtained the average value of satisfaction level and importance level of each performance measurement variable.

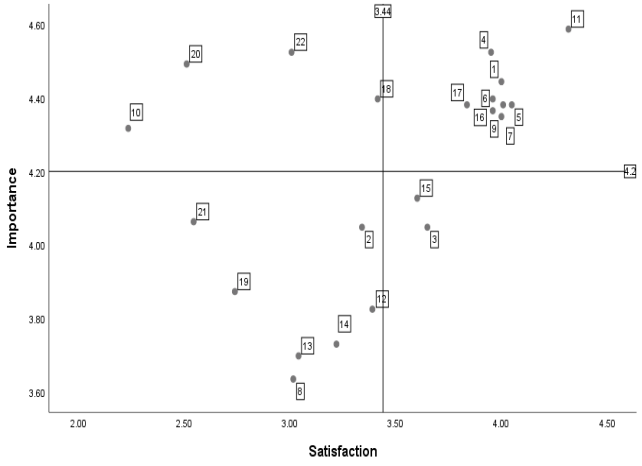

Figure 3. Cartesian Diagram of Variables

From the Cartesian diagram above, each variable of performance measurement project are classified into four diagrams quadrant A, B, C and D. The following will explain the meaning of each quadrant along with project performance variables included in the quadrant as follow:

a. Quadrant A of Cartesian Diagram (Concentrate here / Priority for Improvement)

In quadrant A, this Cartesian diagram shows areas that have low satisfaction level while the level of importance/expectations from community is high. The project performance variables in this quadrant need to be prioritized / improved in its handling, because of the existence of these variables considered very important, while in practice it is still not satisfying. The variables included in this quadrant as shown in Table 4 below.

Table 4. Variables in quadrant A

Var.	Statements	Variables
V10	Project does not cause involuntary displacement of local residents	Involuntary displacement
V18	Project create recreational place/ opportunities	Recreational opportunities
V20	Project involve participation of local residents during the construction of project	Participation during construction
V22	Project is continuously maintenanced by government	Project maintenance

From the Table 4, it can be seen that there are four project performance variables that their performance can still be improved for improve the performance of the project.

b. Quadrant B of Cartesian Diagram (Keep up the good work/performance)

In quadrant B, this Cartesian diagram shows areas that have level satisfaction and high importance, in other words the community is already satisfied. The project management performance variables in this quadrant in handling performance needs to be maintained, because in general the level of implementation has been according to the expectations of the community, so that the satisfaction of the community has been reached.

Table 5. Variables in quadrant B

Var.	Statements	Variables
V1	Project minimize public and private facilities damage due to flooding	Involuntary displacement
V4	Project reduce frequency and size of flooding	Flood reduction
V5	Project increase the resilience of local residents toward flooding	Resilience
V6	Project increase accessibilities within region	Accessibility
V7	Project increase quality of life	Quality of life
V9	Project increase convenience	Convenience
V11	Project increase land value	Land value
V16	Project contribute in better waste management	Waste management
V17	Project improve aesthetic of environment	Aesthetic of environment

From the Table 5, it can be seen that there are nine project performance variables which has satisfied the respondent, and its handling is necessary to maintain its performance. Majority of performance variables projects are in this quadrant and so it can be said that respondents already feel satisfied with the majority of project performances.

c. Quadrant C of Cartesian Diagram (Low Priority)

Quadrant C of Cartesian diagram shows areas that have low satisfaction level while the level of importance is also low, in other words the respondent do not really expect performance improvements for this quadrant variable. The handling of project performance variables in this quadrant is not needs to be prioritized/improved and included as low priority, because it is still considered less important for respondents, while the quality of the implementation is normal/ sufficient.

Table 6. Variables in quadrant C

Var.	Statements	Variables
V2	Project reduce traffic accident hazards due to street flooding	Traffic accident
V8	Project reduce crime rates	Crime rates
V12	Project increase benefits for industries of local residents	Industry benefit
V13	Project increase income of local residents	Local income
V14	Project create (job) opportunities	Job Opportunity
V19	Project involve participation of local residents during the planning of project	Participation on planning
V21	Project involve participation of local residents during the maintenance of project	Participation on planning

From the Table 6, it can be seen that there are seven project performance variables performance that does not need to be improved / included in low priority category.

d. Quadrant D of Cartesian Diagram (Over performances / possible overkill)

Quadrant D of Cartesian diagram shows areas that have high satisfaction while the level of importance is low. In other words, respondent

satisfied with the performance but did not consider these variables important. For this reason, these variables don't need to be prioritized.

Table 7. Variables in quadrant D

Var.	Statements	Variables
V3	Project eliminate loss of life due to flooding	Loss of life
V15	Project attract investments in the region	Investments

From the Table 7, it can be seen that there are two project performance variables that do not need to be prioritized for their performance as these variables are not considered important by respondents.

D. CONCLUSIONS

Based on the findings of this study, several conclusions can be drawn. First, the level of satisfaction among local residents regarding the project's performance is reflected in the Community Satisfaction Index (CSI), which reached a value of 69.23%. This figure falls within the CSI range of 60% to 80%, indicating that the community is generally satisfied with the project's outcomes and impacts. The gap analysis revealed that the highest gap score was associated with the variable "The project does not cause involuntary displacement of local residents" (V10), with a value of 261, while the lowest gap score was found in the variable "The project increases land value" (V11), with a value of 34. Furthermore, the average satisfaction score reported by respondents was 3.44 on a 1–5 scale, while the average importance score was 4.23, suggesting that the community holds high expectations for improved project performance. The Importance-Performance Analysis (IPA) also indicated that several variables deemed important by residents fall into quadrant B, highlighting areas that require performance improvements.

Based on these findings, several recommendations are proposed. The evaluation of project performance and impacts presented in this study may serve as a valuable reference for government authorities in enhancing flood mitigation initiatives, particularly in the context of sustainable flood management. While this study focused on river normalization projects, future research may consider evaluating other types of infrastructure projects, such as buildings, roads, and bridges, given their distinct characteristics. Additionally, subsequent studies could explore contractor performance, which plays a critical role in influencing the overall outcomes and impacts of sustainable flood mitigation projects.

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