

A STUDY OF CAPABILITY AND WILLINGNESS OF LOCAL SOCIETY TO FUND THE OPERATIONAL AND MAINTANANCE OF POLDER IN BANGER RIVER SEMARANG

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ABSTRACT

East Semarang District deals with a very serious problem for flood and robs threat. Rob is caused by high tide in the sea, while flooding caused by heavy rainfall. Banger River conveys run off flow from East Semarang District to the sea. Banger Polder System comprises dike surrounding Banger Polder and also dam aimed to protect it from rob attack, pump Station to control the water level, and retention pond used also as fishpond. To maintain urban polder management and flood protection system, society participation is highly. The purpose of this research was to determine the willingness and capability of communities to pay the operational and maintenance of polder system. Research focused on Banger Polder Area located at 10 Sub Districts in East Semarang District with the scope of discussion is to assess the society willingness-capability to pay the operational and maintenance of polder system. Primary data were collected by Contingent Valuation (CV) sample survey method using closed ended referendum elicitation format (Bidding game format), or closed questions by providing an alternative of answers choice. Society willingness in funding the operational and maintenance of polder can be determined by maximal costs that have been paid by society required to cope with flood and inundation problem in Semarang District. Society capability in funding polder operational and maintenance can be showed as a relation between total income and maximal capability of society in funding polder operational and maintenance. Result of data analysis showed that 87% society is categorized as capable society, and 12.67% society is incapable in funding polder operational maintenance. Result of data analysis showed that 81.33% society having the willingness, and 18.67% as the rest in paying the operational and maintenance of polder. Percentage of society which has the willingness and capability is approximately 72%. Income, building and land asset were used as decision variable in estimating participatory rates, fair, equitable, and independent which is expected to be sustained.

Keywords: Social willingness, social capability, polder operational and maintenance costs.

1 INTRODUCTION

Flood is a disastrous phenomenon which caused by interaction of both natural and human behavior factors. Flood occurrence in Semarang has become a routine every rainy season, and occurs mostly in the coast or downstream areas. The population growth and rapid urban development increases the need of settlement areas. This condition leads to changes in land use due to land exploitation for housing and urban activities needs. This phenomenon increases the number of buildings, and reduces the number of open land. Hence the amount of runoff flow is increased which affects the increase in soil erosion. The sediments settled in the river will also be increased every year, so that it will accelerate the silting in drainage channels and reducing the capacity of the channels causing the overflow and leads to flooding as well.

The East Semarang District is facing solemn problems regarding the flood and robs. Rob is caused by the ocean tide; meanwhile flood is caused by the high rainfall. Banger River conveys run off flow from East Semarang District to the sea. Banger Polder system consists of dike surrounding Banger Polder and also dam aimed to protect it from rob attack, pump Station to control the water level, and retention pond used also as fishpond. In the time of heavy rainfall, the water level increases, yet rarely overflows to the surface. Nowadays, due to the subsidence of the ground level, riverbed elevation of Banger River is decreasing yet the water level remains the same. Rob and flood come mostly on the rainy season since a lot of areas are located below the water level of Banger River. Ground level subsidence which occurs continuously will increase the flooding issues in Banger area.

To protect the inhabitant in the Banger Area from rob and flooding, a pilot project is done by Semarang City Government in collaboration with the Dutch Water Board *Hoogheemraadschaap van Schieland en Krimpenerwaard* (HHSK) and an engineering consultant company Witteven+Bos. Pilot Project of Banger Polder will be located among Kali Baru, Kali Semarang, Brigjen Katamso Street, and The North Highway, including all districts in East Semarang area. Banger Polder system comprises dike surrounding Banger Polder and also dam aimed to protect it from rob attack, pump station used to control the water level, and retention pond used also as fishpond (Witteven+. To maintain urban polder management and flood protection system, society's participation is highly necessary. The society is expected to be willing to fund the operational and maintenance of the polder system. Thus, the management of the polder system can be done effectively and sustainably to cope with the flood in the shore area of Semarang city. The aim of this research is to know the capability and willingness of the society in funding the operational and maintenance cost of the polder system.

2 METHODOLOGY

The research is located in the Banger Polder area, among 10 districts in the East Semarang area. Primary data collection was conducted using Contingent Valuation (CV) survey sample method. The questionnaire format was Closed ended referendum elicitation format (Bidding game format), or in other words closed question by giving alternative answers option. Questionnaires were distributed to 150 inhabitants of Banger Polder area which include in the East Semarang district administration area. To find out the willingness of the society in funding the operational and maintenance of the polder, the maximum costs incurred by the society to cope with flooding and inundation. The capability of society determined using the income and maximum expenses that can be issued to fund the polder. Whilst the willingness and the capability of the society were analyzed together using double regression by including the income level variable, land assets ownership, building assets ownership as an independent variable and maximum amount to be paid by the society as a dependent variable, to deliver the prediction of operational and maintenance costs. The research flow method is described in Figure 1.

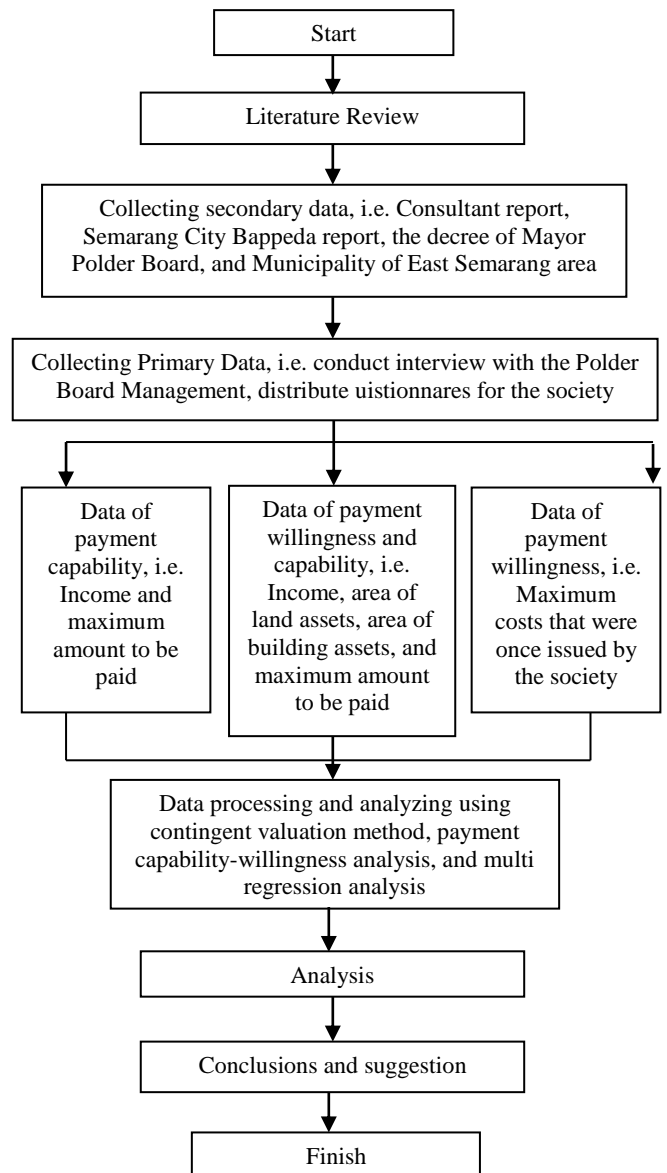


Figure 1. Research flow chart.

The questions in the questionnaires are used to illustrate the relationship between the society's capability represented by the income level variable, ownership of land and building assets as an independent variable. Then last the willingness of the society to fund the operational and maintenance cost of polder that translated into the maximum costs capable to be paid by the society as a dependent variable. The analysis of the relation between capability and willingness of the society were using the multi regression analysis, which will be transformed into the equation as follow.

$$Y_{MU} = a_1X_P + a_2X_{LT} + a_3X_{LB} + E \tag{1}$$

where Y_{MU} is society's willingness in funding the operational and maintenance of the polder, X_P is income level, X_{LT} is ownership of land assets, X_{LB} is ownership of building assets, a is coefficient of regression, and E is residue.

The first equation was developed by dividing each of the variables into 3 categories. Income level variable were divided into more than 2 million rupiah level of income (x_{p1}), 1 - 2 million rupiah level (x_{p2}), and less than 1 million rupiah level (x_{p3}). Land assets ownership were divided into 3 categories, which is more than 200 m² land ownership (x_{lt1}), 100 - 200 m² land ownership (x_{lt2}), and less than 100 m² land ownership (x_{lt3}). Building ownership assets variable were also divided into 3 categories, which is more than 200 m² ownership (x_{lb1}), 100 - 200 m² building ownership (x_{lb2}), and less than 100 m² building ownership (x_{lb3}). Thus, the first equation transformed into the second equation as follow.

$$Y_{MU} = a_{11}X_{P1} + a_{12}X_{P2} + a_{13}X_{P3} + a_{21}X_{LT1} + a_{22}X_{LT2} + a_{23}X_{LT3} + a_{31}X_{LB1} + a_{32}X_{LB2} + a_{33}X_{LB3} + E \quad (2)$$

3 RESULTS AND ANALYSIS

3.1 Interview with the Banger Polder Management

The interview was conducted to 2 (two) caretakers of BPP (Polder Management Board) including Vice president of BPP and member of BPP. From the interview, information such presented in Table 1 were obtained. Polder Management Board in Banger river area, so called *Badan Pengelola Polder Banger Schieland Krimpenerwaard* Semarang (BPP Banger SIMA) was established based on Semarang Mayor Regulation No. 060/89/2010 dated February 19th, 2010. AD/ART (Based Rules and Statutes) of BPP Polder SIMA has also been arranged.

Polder Banger construction were planned to be ended on December 2013. It was expected that Banger Polder would start to operate on January 2014. On relation with the operational of the polder system in Banger river area, operational and maintenance costs play an important part. The operational and maintenance costs will be used to support the needs of electrical energy and pumping fuels, salaries of pumping operators, dike maintenance, and salaries of dike's caretaker. BPP Banger SIMA plan to involve the society and all stake holders in Polder Banger area in the operational and maintenance fund. The operational and maintenance funding phase will be presented on the table below. In the final phase, the society is expected to be able and willing to pay the entire operational and maintenance costs.

Table 1. Operational and maintenance financing percentage of Banger Polder

No.	Phase /Year	Financing Percentage (%)	
		Society and Stakeholders	Government
1.	I/2014	0	100
2.	II/2015	25	75
3.	III/2016	50	50
4.	IV/2017	75	25
5.	V/2018 - etc.	100	0

Based on the interview, it is known that the management of Banger Polder has completely formed with a strong legal protection. The Banger Polder organization has been effectively worked since it had a based ground rules to manage the organization frame work.

In the following years, the operational and maintenance of the polder will be managed by a professional institution which appointed by the Management Board and will be named as *Pelaksana Harian* (Daily Practitioner). The Daily Practitioner will be structurally formed with a Chair Person, Secretary, General Board, Financing Board, Trash-Sediment Management Board, Pumping Management Board, and Dike Management Board. Training has also been done to the recruit of pump operator, superintendent and operator of dike and trash.

The operational and maintenance costs imposed to the society and stakeholder have not been determined. The local government and BPP Banger SIMA require an intensive approach and socialization to the society and also to stakeholder so that the aim of the operational and maintenance costs can be clearly delivered and receive a positive response. If it can be properly socialized, the affordable costs in funding the polder operational and maintenance then can be determined.

3.2 Society Financial Capability to Fund the Operational and Maintenance of Banger Polder

Questionnaires were distributed to 150 inhabitants of the Banger Polder which include in the East Semarang district administration area. The questions in the questionnaires are used to describe the percentage of the maximum cost that can be paid by the society considering the total income. If the maximum amount that can be paid is more on equal to 1% from the total income, then the society is considered capable to pay the fees. However, if the maximum amount that can be paid by the society is less than 1% from the total income, then the society is considered incapable to pay the fees. The analysis results are shown in Figure 2.

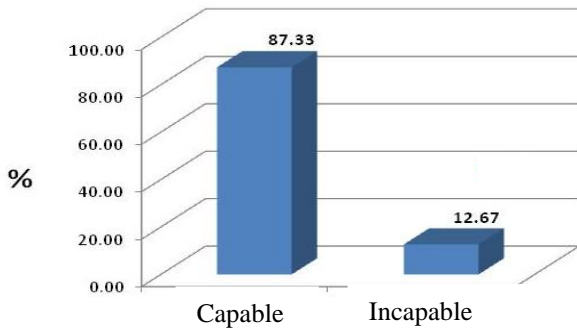


Figure 2. Percentage of society financial capability.

The research and analysis data of the society's capability to fund the operational and maintenance of the polder can be described as relations between the income and the maximum costs that are affordable. In the questionnaires, income level parameter were divided into 3, which is the one with income more than Rp.2,000,000,-, the income between Rp.1,000,000,- to Rp.2,000,000,-, and the one with income between Rp.500,000 s/d 1,000,000,-. If the maximum costs that can be paid by the society is more or equal to 1% from the total income, then the society is categorized as capable to pay. The data analysis shows that 87.33% of the society is capable to pay, and 12.67% of the society categorized as incapable to pay the operational and maintenance of the polder.

Based on the analysis, it is known that 87.33% of the capable society stated that they are capable to pay the Rp.7,500 for the lowest amount,- . Meanwhile, the 12.67% of the incapable society stated that they are capable to pay Rp.5,000,- for the lowest amount.

3.3 Society's Willingness to Fund the Operational and Maintenance of Banger Polder

To understand the willingness of the society in funding the operational and maintenance of Banger Polder, some questionnaires were distributed to the society. The questionnaires contain questions to understand the willingness of the society by describing the maximum payment that were once paid by the society to cope with the flooding event or inundation. If the maximum payment that were once paid by the society is more or equal to Rp.500,000,- , then the society is considered to be willing to pay. Data analysis results are shown in Figure 3.

Society's willingness to fund the operational and maintenance polder cost of can be defined as the maximum costs that were once paid by the society to cope with the flood and inundation. If the maximum amount that was paid by the society was more than or equal to Rp.500,000,- then the society is categorized as willing to pay. The data analysis shows that 81.33% of the society has the willingness, while the

18.67% of the society has no willingness in funding the operational and maintenance of the polder. The society that is not willing to pay is the one that has never experienced flooding in their area. Therefore, they never pay anything to cope with flooding. The society that is willing to pay is the one that have experienced flooding and have paid some money to cope with flooding.

Part of the society stated that they have spent the lowest costs to embank their house. Another part of the society has paid some money to elevate the road with the minimum cost of Rp.50,000,- per month. And the other part of the society spends the highest costs to elevate their houses (3 million rupiah were spent only to buy 15 dump of solid ground). The society with this classification will be willing to pay if the operational costs are less than what they once paid.

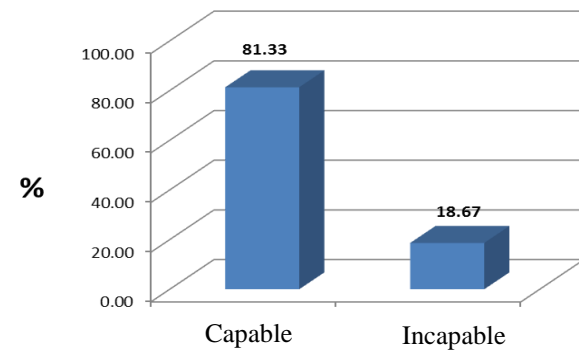


Figure 3. Percentage of society's willingness.

3.4 Society's Willingness and Capability to Fund the Operational and Maintenance Banger Polder

The society's willingness and capability data are resulting in 4 combinations of categories, which is 72% of the society are capable and willing to pay, 15.33% of the society are capable but not willing to pay, 9.33% of the society are incapable but is willing to pay, and 3.33% of the society are incapable and not willing to pay (see Figure 4). Hence, it is concluded that only 72% of the society that potentially capable and willing to pay the operational and maintenance costs.

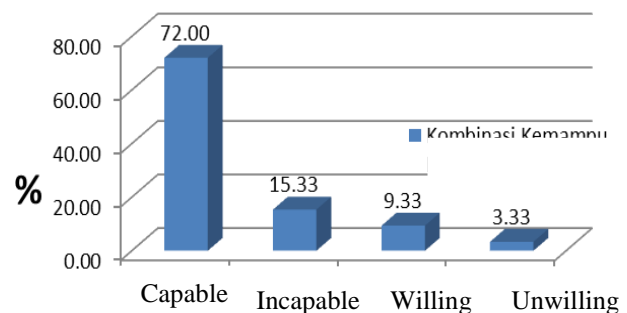


Figure 4. Percentage of society's willingness and capability.

Based on the questionnaires data to 150 samples, the equation of the regression model are translated as follow.

$$Y_{MU} = 17290.26 x_{P1} + 12906.60 x_{P2} - 294.01 x_{P3} - 5910.36 x_{LT1} - 5910.36 x_{LT2} - 13279.28 x_{LT3} + 2397.77 x_{LB1} - 7308.20 x_{LB2} - 15046.79 x_{LB3} + 36222.32 \quad (3)$$

The results of multi regression analysis toward the equation above showed that the value of $r^2 = 0.834$, which described that the maximum costs that can be afford by the society to fund the operational and maintenance of the polder are closely related to the level of income, land assets ownership, and building assets ownership. Furthermore, the obtained

regression equation was used to predict and measure the willingness of the society to fund the operational and maintenance cost of polder based on the capability. The results are shown in Table 2.

The research and analysis of capability and willingness data collectively resulting into four categories combination, which is 72% society that capable and willing to pay, 15.33% society that capable but unwilling to pay, 9.33% society that incapable yet willing to pay, and 3.33% society that incapable and unwilling to pay. Hence, it is save to conclude that only 72% of the society is potentially capable and willing to pay the operational and maintenance of the polder.

Table 2. Estimation of society's willingness in funding operational and maintenance of polder based on capability

Number of Category	Income (Rp)			Land Asset (m ²)			Building Asset (m ²)			Affordable Fee (Rp/month)
	>2 million	1-2 million	<1 million	>200	100-200	<100	>200	100-200	<100	
1	1	0	0	1	0	0	1	0	0	50000.00
2	1	0	0	1	0	0	0	1	0	40294.02
3	1	0	0	1	0	0	0	0	1	32555.43
4	1	0	0	0	1	0	1	0	0	50000.00
5	1	0	0	0	1	0	0	1	0	40294.02
6	1	0	0	0	1	0	0	0	1	32555.43
7	1	0	0	0	0	1	1	0	0	42631.07
8	1	0	0	0	0	1	0	1	0	32925.09
9	1	0	0	0	0	1	0	0	1	25186.50
10	0	1	0	1	0	0	1	0	0	45616.34
11	0	1	0	1	0	0	0	1	0	35910.36
12	0	1	0	1	0	0	0	0	1	28171.77
13	0	1	0	0	1	0	1	0	0	45616.34
14	0	1	0	0	1	0	0	1	0	35910.36
15	0	1	0	0	1	0	0	0	1	28171.77
16	0	1	0	0	0	1	1	0	0	38247.42
17	0	1	0	0	0	1	0	1	0	28541.44
18	0	1	0	0	0	1	0	0	1	20802.85
19	0	0	1	1	0	0	1	0	0	32415.72
20	0	0	1	1	0	0	0	1	0	22709.74
21	0	0	1	1	0	0	0	0	1	14971.15
22	0	0	1	0	1	0	1	0	0	32415.72
23	0	0	1	0	1	0	0	1	0	22709.74
24	0	0	1	0	1	0	0	0	1	14971.15
25	0	0	1	0	0	1	1	0	0	25046.79
26	0	0	1	0	0	1	0	1	0	15340.81
27	0	0	1	0	0	1	0	0	1	7602.22

The classification of categories which based on the income level, land assets ownership, and building assets ownership is an approach method done by the writer to the theory of taxation which participative, equitable, and independence (participative, fair and independent) and expectedly to be sustainable.

The multi regression analysis toward the above equation shows that $r^2 = 0.834$. This number explains that the maximum costs that can be paid by the society is closely related or have a correlation with the income level, land assets ownership, and building assets ownership. It means that the income level, land assets ownership, and building assets ownership which are representative of the society's capability can be used as a determining variable to estimate the willingness of the society to pay the operational and maintenance of the polder.

Based on the processed research data, 27 different categories are obtained with different prediction of the level of willingness to pay. This result can be used as a recommendation to the amount of fees that will be charge to the society to fund the operational and maintenance of the polder.

Table 2 which shows the calculation result towards the society's category with the lowest capability indicates the prediction of the amount that society is willing to pay. The amount is Rp. 7,602,- (seven thousands six hundreds and two rupiahs). If it is calculated with 72% of the house holder in East Semarang district which is capable and willing to pay the operational and maintenance of the polder, then the calculated amount of money collected by the society is Rp. 7,602,- x 12 months x 23,075 KK (householder) x 72% = Rp.1,515,595,536,-.

Based on the budget plan stated in operational and maintenance of Polder budget plan at chapter V, it is estimated that polder operational and maintenance expenses is Rp. 1,485,000,000,- /year. The calculation above shows that with an assumption of 72% society's willingness that categorized as the lowest capability, the society still can fund the operational and maintenance of Banger Polder. However to create a participative, fair, and equitable tax system, the

amount of fees are required to be determined based on the society's capability. If the category system can be implemented in the future, then the operational and maintenance fund form the society can be larger than the calculation above.

3.5 Calculation Cost that Can Be Collected by the Society

If the 72% of the society which categorized as willing-capable and 9.33% of the society that categorized as willing-incapable participated in funding the operational and maintenance of the polder. Based on the research and analysis of society's capability and willingness data altogether, the potential people that can afford to pay is 72% of the society categorized as capable and willing, and 9.33% of the society categorized as incapable yet willing to pay. Therefore, the costs overviews that can be collected by the society per year are shown in Table 3.

Based on the calculation as provided in Table 3, if the society that categorized as willing but incapable are also pay the operational and maintenance fees, then there will be a surplus of Rp. 139.433.850,- per year. The surplus amount can be used as investment in polder construction.

If 87.33% of the society categorized as capable and 12.67% of the society categorized as incapable are willing to pay the operational and maintenance of the polder. The data analysis shows that 87.33% of the society is categorized as capable, while the 12.67% of the society is categorized as incapable to pay the operational and maintenance of the polder. If the society has the willingness to pay, then the amount of money collected from the society will be increased. Hence, the overview of the money collected from the society can be seen in Table 4.

Based on the calculation shown in Table 4, if all of the society categorized as capable and incapable have a willing to pay the operational and maintenance of the polder, then there will be a surplus of Rp. 504.041.925,- per year. The surplus amount can be used as an investment to build a polder in other places.

Table 3. Estimation of collected society fund based on capability and willingness

Society's Category	Affordable Cost (Rupiahs)	Percentage (%)	Total Household	Collected fees per year (rupiah)
Willing and Capable	7,500	72.00	23,075	1,495,260,000,-
Willing but Incapable	5,000	9.33	23,075	129,173,850,-
Total amount collected				1,624,433,850,-
Operational and maintenance budget				1,485,000,000,-
Surplus				139,433,850,-

Table 4. Estimation of collected society fund based on capability

Society's Category	Affordable Cost (Rupiahs)	Percentage (%)	Total Household	Collected fees per year (rupiah)
Capable	7,500,-	87.33	23,075	1,813,625,775,-
Incapable	5,000,-	12.67	23,075	175,416,150,-
Total amount collected				1,989,041,925,-
Operational and maintenance budget				1,485,000,000,-
Surplus				504,041,925,-

4 CONCLUSIONS AND SUGGESTIONS

4.1 Conclusions

Based on the aim of the research, the data analysis can be concluded to several points as below.

- a) The capability of the society in funding the operational and maintenance of the polder can be described as a relation of the total income with the maximum amount that can be afford by the society to pay the operational and maintenance cost of polder. If the maximum amount that can be paid by the society is more than or equal to 1% from the total income, the society then categorized as capable to pay. The analysis data shows that 87.33% of the society is categorized as capable, and 12.67% of the society is categorized as incapable to pay the operational and maintenance of the polder.
- b) The willingness of the society in funding polder operational and maintenance cost can be defined as the maximum amount has ever been paid by the society to cope with flood and inundation problem. If the maximum amount that were once paid by the society is more than or equal to Rp.500.000,- the society then categorized as willing to pay. The analysis data shows that 81.33% of the society is categorized as willing to pay, and 18.67% of the society is categorized as unwilling to pay the operational and maintenance of the polder. The society that categorized as not willing to pay are the one that never experience flooding in their areas, so that they have never pay anything to cope with the flooding events.
- c) The capability and willingness of the society altogether resulting in four combination of categories, which is 72% of the society categorized as capable and willing to pay, 15.33% of the society is categorized as capable but unwilling to pay, 9.33% of the society is categorized as incapable but willing to pay, and 3.33% of the society is categorized as incapable and unwilling to pay. Hence, it can be concluded that only 72% of the society that have a potential to be willing and capable to pay the operational and maintenance of the polder.

- d) The level of income, land assets ownership, and building assets ownership which are the representatives of the society's capability can be used as a determining variable to predict the willingness of the society to pay the operational and maintenance of the polder as a fees that participative, fair, and independent and hopefully sustainable.
- e) By using an assumption that the willingness of the society had the lowest capability, then 72% of the society can be said to be able to pay the operational and maintenance of Banger Polder. However to create a tax system that participative, fair, and equitable, then the fees determination need to be based on society's capability. If the category system can be implemented in the future, then the larger income for operational and management can be obtained.

4.2 Suggestions

Some suggestions that can be given in refer to this research are as follows.

- a) In order to increase the willingness of the society to pay the operational and maintenance of the polder, it is required to give a socialization about the use of polder system to cope with flooding is indeed needs an operational and maintenance fees, such as pump electricity fees, the salaries of pumps employees and dikes supervisors, repairs costs, and maintenance costs.
- b) This research only uses one variable to determine the willingness of the society to pay the operational and maintenance of the polder. The author hopes the continuation and completion of this study by adding other variables to determine the willingness of the society.
- c) This research uses the bidding game method with closed questions format. In order to gain results or information that can reflect the capability and willingness of the society in one area, then it is necessary to have survey officers that understand the principle and methodology of this research.
- d) It is required to have a coordination, training, and direct practice before the survey officers can conduct a survey. The level of success of this research is dependent to the capability of the

survey officers in explaining the existing problems and the capability to offer an affordable amount. If the survey officers are not equipped with such capability, then the problem and aim of the research will not be delivered clearly to the respondent and the offered costs will not be fitted to the capability and willingness of the respondent.

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