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QUANTIFYING THE ENVIRONMENTAL VALUE IN WESTERN COAST OF SEMARANG CITY, CENTRAL JAVA, INDONESIA

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Abstract. *Coastal zone in Semarang City is facing climate change impact namely coastal inundation and sea level rise. These area are place of residents, visitors, large nursery area for coastal fauna resulting in many economic activities such as fishery, tourism and industrial development. However, the high concentrations of economic activities in the coastal zone contribute to higher potential of degradation of coastal ecosystems which are known as highly changeable environment. This study aims to estimate the monetary value of coastal environment in two selected coastal wetlands such as beaches and estuary. The data collection has been done through non-site surveys and interviews with several respondents. Economic valuation approaches and techniques have been applied to quantify the value of coastal ecosystems including net factor income, hedonic price and contingent choice method. The highest economic contribution of coastal ecosystems was Fishery value accounts at Rp 23,340,352,861, followed by Amenity value at Rp 439,002,861, and Research value in a range Rp 238,868,000 and Rp 492,870,000. While, the lowest environmental value was estimated as Art value at Rp 214,045,150. For the two selected beaches and estuary, the Recreational/Tourism value was estimated at Rp 19,010,974,803, and Rp 1,011,087,200, respectively.*

Keywords: *climate change impacts, coastal ecosystems, economic valuation, Semarang coastal area*

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1. *Introduction*

Coastal zone is the most vulnerable area in Semarang City whereis greatly exposed to coastal inundation and sea level rise. According to the vulnerability analysis of coastal area in Semarang, it stated that these areas are predicted to be flooded due to the sea level rise projecting by the next 20 years by 16 cm height and 2,672.2 Ha width. Accordingly, impacts of climate change will cause more degradation in the services and goods provided by coastal ecosystems in the near future (Diposaptono 2009).

Based on the calculation of sea level rise at average of 8 mm/year with 20 years simulation, 16 cm sea level rise would increase the wave Set-up and Wave Run-up at 4.1 cm or 10.59 % and at 7.7 cm or 1.51 % respectively. If it is calculated over the next 100 years when there is 80 cm SLR, Wave set-up and run-up will rise by 10 cm or 51.73% and 1.6 m or 31.64 respectively (DKP 2008).

Land subsidence in part of coastal area of Central Java Province generally occurs due to the groundwater withdrawal as well as natural consolidation of alluvium soil and subsidence induced by the load of construction (ACCCRN 2010). High rate of subsidence up to more than 10 cm per year is occurring in several spots of Semarang low lying area.

Considering the whole aforementioned threats, coastal zone of Semarang area are home to large and growing numbers of residents, visitors, large nursery area for coastal fauna resulting in manyeconomic activities such as fishery, tourism and industrial development. However, the high concentrations of economic activities in the coastal zone contribute to higher potential of degradation of coastal (environmental) resources that drive these economics.

Therefore, in development plan of Semarang coastal zone, there is a need for economic valuation of coastal environment to reach the objective of coastal development scheme in more efficient way.

The objective of this studyis to quantify themonetary value of coastal ecosystems and their provided services in two existing coastal wetlands as one estuary and two beaches in the western coastal zone of Semarang City

2. Research Methodology

2.1. Area of Study

The area of study in this research is located in the flooding area with the elevation 3 meters above sea level namely Tugu district and West Semarang district as two selected areas. These districts are chosen because these regions are adjacent directly with Java Sea, threatened considerably by flooding and high rate of coastal erosion. In addition, this study will focus on two coastal wetlands as an estuary in Tugu district and two beaches in West Semarang district. The existing

coastal ecosystems aimed to be economically valued will be described in detail in the next chapter.

2.2. Conceptual Framework

As the methodology of this study, there are five important steps considered to answer the research questions and reach the objective of this study. These steps are as follows:

Step 1. Specifying the target wetlands and its characteristics in study area

This step mainly determines the wetlands and exact boundary of the zone aimed to be studied including its ecosystems. Data availability and wetlands accessibility are two important criteria for this step.

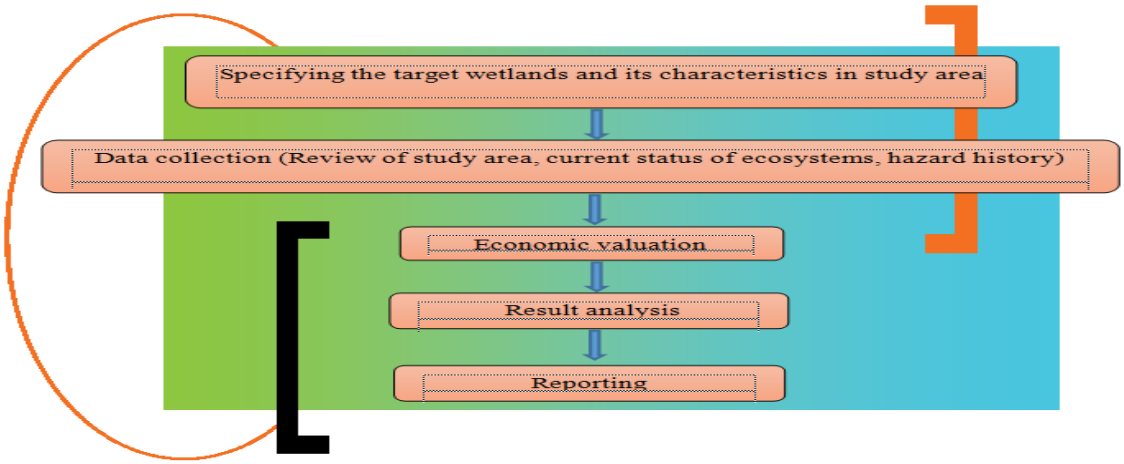


Figure 1. Research Methodology

Step 2. Data collection

When the area of study and the wetlands are clearly specified, comprehensive information will be collected including an overview of the existing and current status of the coastal ecosystems, observing the site, hazard history, environmental threats and etc. There are couple of ways to gather data on the ecosystem services namely participatory approaches, interviews and expert opinions (Ranganathan et al. 2008). The researcher collected primary and secondary data to support this research as follows:

a. *Primary Data*

Primary data was collected directly in the site by researcher. This was obtained by using two different ways of data collection as interviews and site observation. Observation is a way of recording data in a pre-determined coastal area and its associated wetlands (in this research two beaches and one estuary). Site observation provides a real data over the current status of ecosystem, existing hazard, environmental threats and etc.Interviews provide a basic source of information as a form of on-site survey. Interview is one of data collection ways to ask questions directly to the respondent. For this part a questionnaire is arranged in advance for respondents. The questionnaire consists of general information, environmental aspects and choice questions that ask people to state their willingness to pay 'WTP' for a certain ecosystem service or good that is assumed to be lost or degraded caused by climate change impacts and other causes of coastal hazards in Semarang. These questions are in terms of beach width, beach tranquillity, diversity of beach species, shore water quality, coastal climate status and estuary landscape. Some of these questions are described in detail as follows:

1) Beach width: Suppose you are losing 25% of the beach area, how much are you willing to pay to not lose 25 % of the beach area (25 % beach regression)?
2) Beach tranquillity: Suppose you cannot swim 50% of the time due to the storm, how much are you willing to pay for that to not happen (it means how much are you willing to pay to be able to swim in 50% of the time)?
3) Diversity of beach species: Suppose 100% of the beach species are being disappeared, how much are you willing to pay to not lose 100% of the species?
4) Shore water quality: Suppose 20% of the water quality is decreasing, how much are you willing to pay for that to not happen? (relative to current status)
5) Coastline climate status: Suppose the climate of the area is changing, how much are you willing to pay to have more sunny/ warm days? (If not the same as current status) or how much are you willing to pay to have less rainy/hurricane/changeable weather?
6) Estuary landscape: We would like to know how much you intend to pay to not lose the landscape of estuary (view of mangroves)?

b. Secondary Data

This information was obtained from the several sources such as newspapers, books, journals, and previous researches associated with the coastal environment of Semarang. The secondary data also include fishery data including the caught volume per year, market prices, fishing costs and etc.

Step 3. Economic valuation process

This is the main step of methodology in which the economic valuation methods will be used to price the coastal ecosystem services and goods presenting their monetary value to people. The type of services dominates which method to use. For example, contingent choice method is mostly applicable for cultural services that do not have an explicit market price. Table 1 shows an overview of the used economic valuation methods relevant to the ecosystem services and goods in this study.

According to Table 1, market based method (net factor income approach) is one of the technique to quantifythe value of ecosystems services including fishery value, research, art value and tourism/recreational value (partly used). In addition, hedonic pricing method is used to estimate the amenity value of coastal ecosystems. Apart from the market based method, Stated preference methods (CCM) have been used for cultural services (tourism and recreational value in this study) using different questionnaire, on-site surveys, interviews and other way of getting people's willingness to pay for the existing ecosystem services and goods provided in the Semarang coastal areas.

Step 4. Results Analysis and Discussion

The results are based on estimated values either by using contingent valuation method or other valuation approaches shown in Table 1.

Results of valuation studies will be presented in tables, graphs and other ways. The outcomes of surveys, interviews and other obtained results will be analysed when all data are collected and valuation methods are applied. Several analysis and comparison will be presented among the results to determine how assumptions and estimated values can be reliably presented in such way to be useful for decision makers and stockholders in the future.

Step 5. Reporting

As the final of this study, a clear report is expected covering all data sources and assumptions used for this study. In addition, the economic valuation methods including the weaknesses, uncertainty and strength will be summarized and discussed to have a better overview of the outcomes of this research. For all the practical steps, a clear description from the beginning of the valuation process leading to the outcomes is stated. A transparent analysis of the economic methods including the surveys, interviews, and any other methods that have been used to quantify monetary value will be clearly mentioned. At the end, a conclusion and recommendation for further similar studies will be drawn that basically answers the objective of this study.

Table 1. Overview of the used economic valuation methods relevant to the ecosystem services and goods in this study

Coastal wetlands	Coastal Ecosystems	Ecosystem Services		Economic Valuation Techniques	Calculation Methods
Beaches and Estuary	Mangrove	Cultural	Art	Net Factor Income	Sum Up
	Beach flora		Research	Net Factor Income	Sum Up
	Live coastal and marine species		Amenity	Hedonic pricing	Average
			Recreational/Tourism	Net Factor income and Contingent Choice	Sum Up
		Provisioning	Fishery	Net Factor income and Contingent Choice	Sum Up

3. Result and Discussion

3.1. Fishery Value

The fishery value is estimated by using one of the market based methods called "net factor income" method. The total fishery value is estimated by adding up producer surplus and consumer surplus as two fundamental economic concepts.

a. Producer surplus

Producer surplus is assuming that production cost similar to marginal cost (supply curve). The assumption of this curve could be represented by fishing cost and market price by producer acceptances. To calculate the producer surplus, first the total gross revenue generated in 2014 is obtained based on the market value of fishes and production volume in Semarang market. Then the annual production cost is calculated which include the boat costs and other side costs related to the commercial fishing. This value is subtracted from the gross revenue giving the annual net revenue made by fishery. In the next step, the ecosystem-related fishery has been assumed to estimate how much the fishery is dependent on the healthy condition of the relevant ecosystems such as mangroves, seagrasses and the quality of marine water. Fishermen interviews revealed that roughly 40% of the total annual revenue is ecosystem related (this is an assumption and cannot be precisely quantified). Thus the producer surplus for fishery value is estimated by multiplying the net revenue and the percentage of ecosystem-related fishery. Table 2 shows the calculation of producer surplus in more details with an estimated value. of Rp 22,498,072,958.

b. Consumer surplus

Consumer surplus is obtained by the maximum m amount that each respondents is willing to pay for the fishes subtracted from what he/she actually pay in the market per kilo. The highest price used is the highest price for each consumer representing willingnes to pay (WTP) or demand curve.According to this definition, the researcher interviewed approximately 20 respondents to know how much they are willing to pay per kilo for the whole types of fishes caught in Semarang. Table 3 shows the calculation of consumer surplus of fishery value in more detail resulting in the total estimated value of Rp 842,279,903.

c. Total fishery value

The total fishery value is estimated by adding consumer surplus and producer surplus as the final fishery value of coastal ecosystems in western Semarang.This value is calculated Rp 23,340,352,861 in total (Table 4).

Table 4. Total fishery value/year of Semarang coastal area

Total Fishery value per year (in 2014)	
Producer surplus (net income)	22,498,072,958
Consumer surplus (WTP)	842,279,903
Total Fishery value	23,340,352,861

Table 2. Calculation of producer surplus for estimating fishery value of Semarang coastal area

No	Name of fish	Average WTP/kg (Rp)	Production/year (kg)	Total (Rp)
1	Manyung	1.750	8.781	15.366.235
2	Bawal putih	9.150	4.316	39.490.852
3	Belanak	1.650	3.869	6.384.615
4	Beloso	10.550	1.042	10.990.765
5	Cumi-cumi	10.625	31.551	335.229.489
6	Peperek	3.025	72.925	220.596.630
7	Tongkol Krai	19.650	893	17.546.529
8	Kembung	2.125	38.695	82.226.101
9	Layur	7.650	43.606	333.584.967
10	Lemuru	1.425	1.637	2.332.840
11	Rajungan	3.100	24.854	77.046.973
12	Selar	1.800	7.441	13.394.297
13	Tembang	675	82.747	55.854.218
14	Tengiri	14.525	1.935	28.101.979
15	Teri	4.625	101.573	469.777.062
16	Tiga Waja	1.200	4.465	5.357.719
17	Udang putih	8.350	22.175	185.161.273
	Total			**842.279.903**

Table 3. Calculation of consumer surplus and average WTP for each type of fish caught in Semarang coastal area

No	Fishing gear (Rp)	Cost/unit (Rp)	Gross Revenue /unit/year Rp	Net Revenue /unit/year Rp	Number of fishing gear	Ecosystems-related	Total (Rp)
1	**Seine nets**						
	Payang	106.900.000	311.848.402	204.948.402	20	0,4	1.639.587.217
	Danish seine	114.530.000	379.715.488	265.185.488	16	0,4	1.697.187.121
	Beach seine	58.666.667	112.437.466	53.770.799	60	0,4	1.290.499.179
2	**Gill nets**						
	Set gillnet	10.300.000	18.841.344	8.541.344	40	0,4	136.661.507
	Trammel net	265.500.000	1.432.148.488	1.166.648.488	36	0,4	16.799.738.234
3	**Lift nets**						
	boat/raft lift net	17.750.000	108.934.909	91.184.909	12	0,4	437.687.561
4	**Traps**						
	Portable traps	20.775.000	93.820.903	73.045.903	17	0,4	496.712.140
			Total				**22.498.072.958**

3.2. Willingness to Pay/WTP States for Beaches and Estuary

a. Beach width (only for beaches)

This aspect is related to the beach area which indicates important criteria for tourists who visit the beach. Based on methodology, Figure 2 state that all the respondents have the willingness to pay to avoid beach regression caused by climate change impacts and coastal hazards. They pay more if the percentage of the beach regression becomes higher. The visitors intend to pay from Rp 2 million to Rp 12,000 million. The results show that the average

WTP presented by people to avoid 100% loss of beach width (beach regression) is calculated Rp 1,636,000.

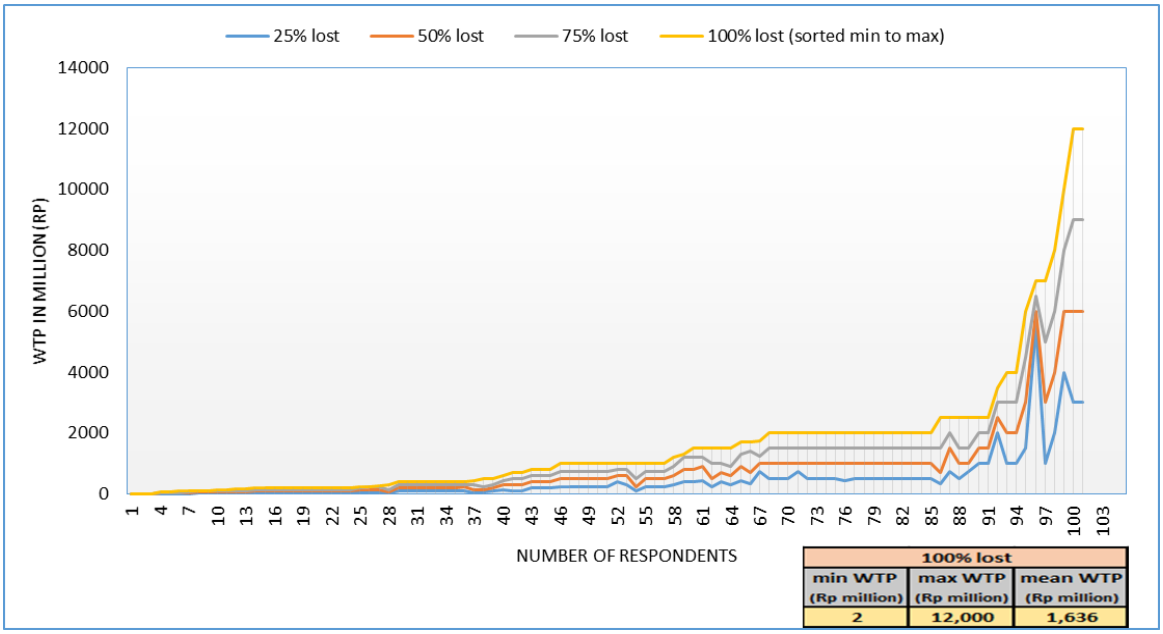


Figure 2. WTP on beach width with different rate of regression, 25% in blue, 50% in orange, 75% in grey, 100% in yellow

b. Beach and estuary tranquality

Climate change can intensifies storm surges in the coastal area interfering the tranquillity of the beaches and estuary. So a particular question has been presented to the visitors asking them how much they are willing to pay for having less storminess situation in the coastal region that mentioned at methodology.

Figure 3 reveals that not all the visitors are willing to pay for having more tranquillity; however they are aware of the coastal environment services. Approximately 8% and 32% of respondents preferred to choose "no contribution" in terms of having more beaches and estuary tranquillity. The rest of respondents were willing to pay if coastal hazards disturb the beach tranquillity (in term of storminess). They will pay more if the percentage of stormy period is increased. The minimum WTP has been recorded Rp 4 million (beaches) and Rp 10 million (estuary), while maximum WTP was estimated for both beasches and estuary at Rp 200 million. The results show that the average WTP presented by people to not lose 100% of the beach tranquillity is calculated Rp 77,000,000 for beaches and Rp 70 million for estuary respectively.

c. Diversity of Beach and Estuary Species

The presence of the beach and marine species play an important role to attract visitors to the coast for recreational activities.Due to the impact of climate change on the coastal environment, diversity of the coastal and marine species such as birds, coastal and marine species can be affected by the destructive effects of the coastal hazards. The obvious impact is rising sea water temperature that has an impact on living species in shore area. They should adapt themselves to the new temperature (when it is higher than usual) to survive in the water. Species which cannot adapt might be died in a long term period. all the respondents had willingness to pay if climate change impacts influence the diversity and quantity of the coastal species. They intend to pay more if the quantity/diversity percentages of the species become less. The visitors intend to pay in range between Rp 12 million – Rp 250 million (beaches) and Rp 70 million – Rp 900 million. The results show that the average WTP presented by people to not lose 100% of the diversity among the species is calculated Rp 114,000,000 and Rp 320,000,000 for beaches and estuary respectively.

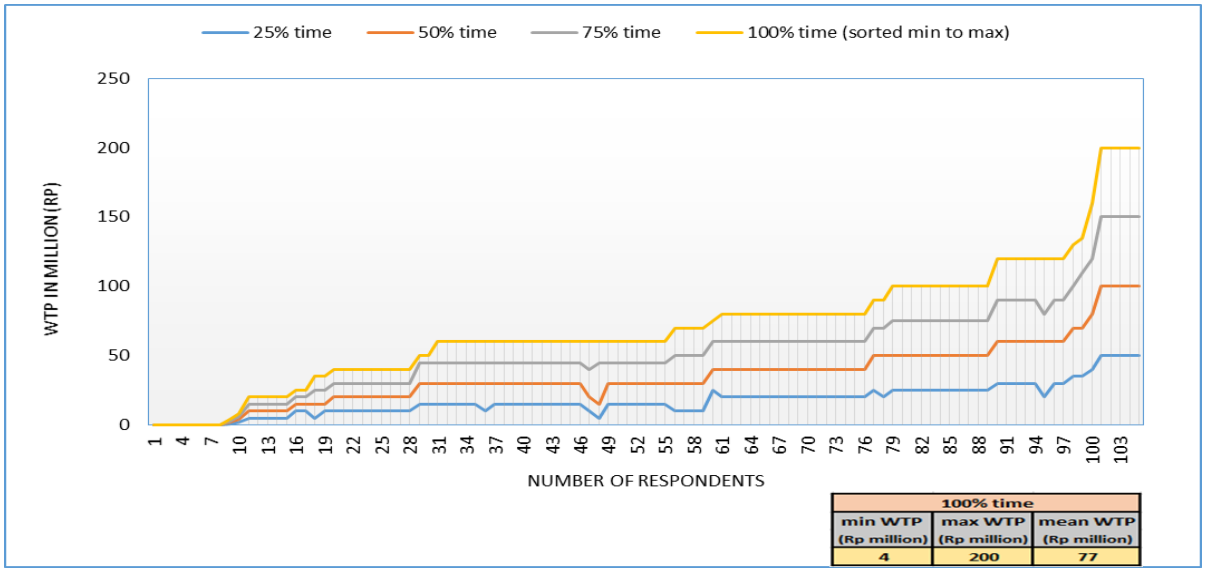
d. Shore water quality for beaches and estuary

The quality of coastal water has been considered in the questionnaire as one of the important services that coastal and marine ecosystems provide naturally. This aspect is indirectly interlinked with the climate change impacts on marine area. By looking to the WTP on shore water quality shows that all the interviewed visitors had willingness to pay to avoid having bad shore water quality. They tend to pay more if the shore water quality becomes worse (quality decreased from 20% to 60%) as results of coastal hazards and climate change effect. The reason is that if the water quality continues to decline, visitors cannot do their recreational (marine) sport activities such as swimming, diving, snorkelling and fishing. The respondents intend to pay with range Rp 5 million – Rp 150 million and and Rp 30- Rp 1000 million for beaches and estuary. The results show that the average WTP presented by people to not decrease 100% of the shore water

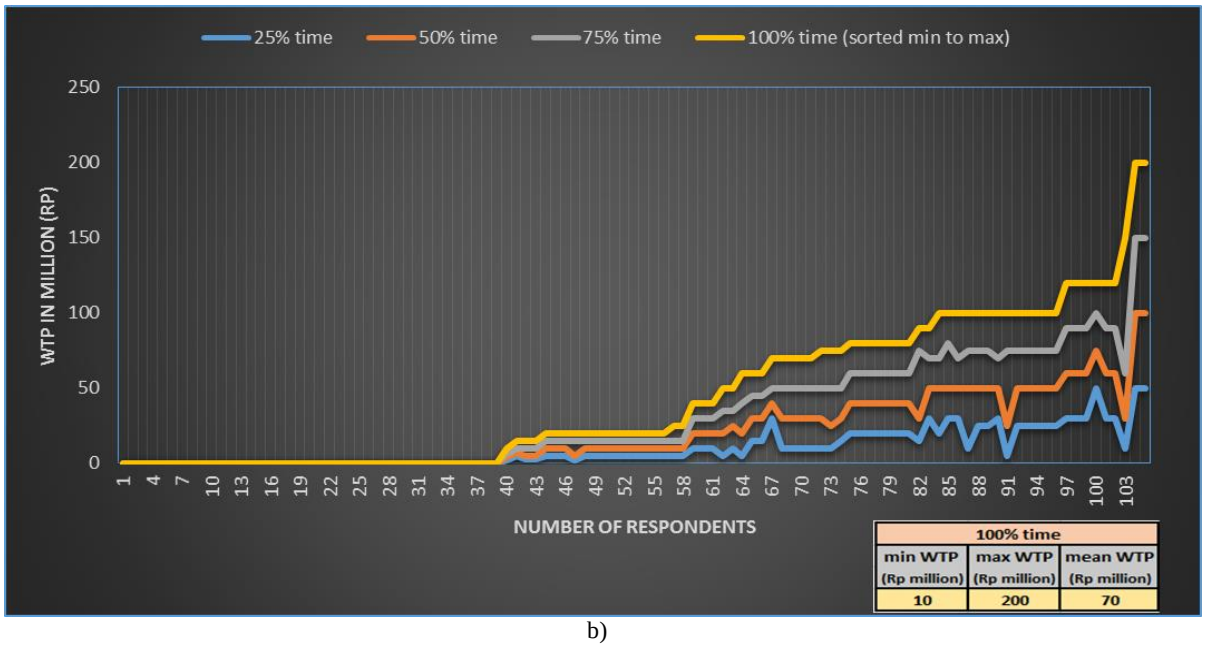
quality is calculated Rp 48,000,000 and Rp 360,000,000 for beaches and estuary respectively.

e. Climate status for beaches and estuary

According to the questionnaire the beaches visitors tend to pay more to have more cloudy/chilly than either sunny/warm or less rainy weather. The result shows that there is not much difference among the presented WTP between having more sunny/warm days and less rainy/hurricane/changeable weather. The visitors are willing to pay to have a desired climate status (cloudy/ chilly weather) at average value about Rp 60 million with minimum and maximum estimated at Rp 3 million and Rp 100 million respectively. On the other hand, The estuary respondents indicate that the average WTP for this aspect is estimated at Rp 61,000,000 if they want to have a desired climatic status such as more cloudy/chilly days. In addition, the respondents intend to pay maximum and minimum WTP at Rp 100 million and Rp 5 million, respectively.



a)



b)

Figure 3. a) WTP on beaches and estuary) tranquillity while 25% (in blue), 50% (in orange), 75% (in grey), and 100% (in yellow) of the tranquillity is assumed to be lost due to storminess

f. Estuary landscape

Natural landscape in the estuary can attract the visitors to visit this area. There are four natural landscape considered in the Plumbon estuary due to the existence of sandy area as well as mangroves, tidal flats, and ponds. A question has been presented to

the visitors to indicate how much they tend to pay to not lose the landscape of four natural areas. The result shows that respondents value the mangroves and ponds landscape, more than sandy and tidal flat areas. The average WTP is estimated Rp 79,000,000 for not losing the ponds landscape with minimum and maximum WTP at Rp 10 million and Rp 150 million, respectively.

3.3. Tourism Value on Semarang Beaches and Estuary

The total economic value is estimated by adding up the value of Producer Surplus (PS) and Consumer Surplus (CS) as two fundamental economic concepts. This approach is similar to the used method in the studydone by (Kerkhof et al., 2014) for calculating the tourism value on St-Eustatius Island in the Dutch Caribbean.

a. Prosucer surplus (PS) beaches and estuary

The net factor income method is used to calculate the Producer surplus. The meaning of PS is the net income that is earned by the visitors and tourists in the western beach of Semarang. Although the beach in Semarang provides ecosystems services/goods, but not all expenditures and activities are related directly to these ecosystems. Based on this fact, the researcher divided all tourist expenditures into direct and indirect values.

b. Consumer surplus (CS) beaches and estuary

The CS is determined according to the total average (annual) WTP quantified for the beaches and estuary as indicated in table 7 and 8. This value represents how much respondents tend to pay to conserve and get benefit of the coastal ecosystems. In other words, what is the monetary worth of coastal nature in Semarang's beaches and estuary to still provide the recreational and touristic attractions.

Table 5. Calculation of Producer surplus (net factor income method) for estimating the tourism value of West Semarang estuary

Values	Added value (%)	Factor Ecosystem Dependence (FED)	Average Expenditure per day (Rp)	Added value (Rp)	Net factor ecosystem benefit (Rp)
Direct values					
Indirect values					
Transportation	25%	60%	17.000	4.250,00	2.550,00
Food and beverages	25%	60%	25.600	6.400,00	3.840,00
Total			**42.600**	**10.650**	**6.390**
Total per year (times 13,200 visitors in 2014; times 1,4 days per stay)			**787.248.000**	**196.812.000**	**118.087.200**

Table 6. Calculated Producer surplus (net factor income method) for estimating the tourism value of Semarang beaches

Values	Added value (%)	Factor Ecosystem Dependence (FED)	Average Expenditure per day (Rp)	Added value (Rp)	Net factor ecosystem benefit (Rp)
Direct values					
Boat rental	25%	25%	4.167	1.041,75	260,44
Indirect values					
Entrance ticket	25%	60%	4.415	1.103,75	662,25
Food and beverages	25%	60%	42.713	10.678,25	6.406,95
Transportation	25%	60%	29.979	7.494,75	4.496,85
Acommodation	25%	60%	235.833	58.958,25	35.374,95
buoys rental	25%	60%	4.375	1.093,75	656,25
mats rental	25%	60%	2.552	638,00	382,80
Total			324.034	81.009	48.240
Total per year (times 252,840 visitors in 2014; times 1,4 days per stay			**114.700.259.184**	**28.675.064.796**	**17.075.974.803**

Table 7. Total average WTP presented by the visitors for the environmental aspects/services of the beaches in West Semarang

Aspects that are interlinked with the coastal Environment (Beaches) and climate change impacts	Average WTP (Rp)
Beach width	1,636,000,000
Beach tranquillity (in terms of storminess)	77,000,000
Diversity of beach species	114,000,000
Shore water quality	48,000,000
Coastline climatic status	60,000,000
Total WTP	1,935,000,000

Tablel 8. Total average WTP presented by the visitors for the environmental aspects/services of the estuary

Aspects interlinked with the estuary environment and climate change impacts	Average WTP (Rp)
Estuary tranquillity (in terms of storminess)	70,000,000
Diversity of estuary species	320,000,000
Shore water quality	360,000,000
Estuary climatic status	61,000,000
Estuary landscape	79,000,000
Total WTP	890,000,000

c. Total tourism value on Semarang beaches and estuary

The total tourism value is found by adding the producer and consumer surplus. The value reveals the economic worth of ecosystems exist in the beaches and estuary including mangroves, estuary flora and fauna

Table 9. Total Tourism value of West Semarang Beaches in Rupiah

Total Tourism value of the coastal ecosystems (in the beach)	
Producer Surplus	17,075,974,803
Consumer Surplus (WTP)	1,935,000,000
Total tourism value (in Rp)	19,010,974,803

Table 10. Total Tourism value of Semarang's Estuary environment

Total Tourism value of the estuary environment	
Producer surplus (net factor income)	118,087,200
Consumer surplus (WTP)	890,000,000
Total tourism value (in Rp)	1,008,087,200

3.4. Art Value

One who cares about art sometimes needs inspiration from surroundings. This is also the case for the selected beaches and estuary on Semarang coastal area, where beautiful natural scenery of the area encourage people and artists to get inspiration from the coastal nature and present it in their art works.

Hence, a survey was conducted in the Semarang coastal area interviewing the book stores, painting and photo shops to see how the coastal wetlands and its ecosystems influence people who are dealing with art. The art value of the ecosystem is quantified by knowing how much they earn by selling their artistic works in which coastal nature is directly or indirectly presented.

Table 11 reveals the summary of results estimating the total value of art works associated with coastal nature in Semarang. The largest contributors to the art value are paintings pieces. Authors generate the second contribution to this monetary value. The total art value of coastal nature produced by artists including photographers, authors and painters is estimated at Rp 214,045,150.00.

Table 11. Total estimated art value per year related to coastal nature in Semarang

Category	Amount	Gross value Rupiah	Coastal nature link	Art value of Semarang coastal area (Rupiah)
Painting art	411	129,215,400	100%	129,215,400.00
Photography	184	3,641,600	100%	3,641,600.00
Books	1,462	81,188,150	100%	81,188,150.00
Total value		214,045,150		214,045,150.00

3.5. Research Value

Semarang coastal area provides important services/goods for research and educational purposes. Due to the importance of the common hazards in Semarang such as land subsidence, tidal flooding and coastal erosion, a large group of academic researchers that work in the institutions and universities are interested to conduct innovative researches about Semarang coastal area, the hazards and coastal environment aspects.

The research value is estimated in a rather simple way. All research expenditures in 2014 and ongoing researches in 2015 for Semarang coastal area are included in this survey. The amount of funds that they are spending on the research related to coastal environment of the Semarang city represent a proxy for coastal nature's value. Data is collected from several respondents such as governmental and non-governmental academic sectors to know the title of each research topic and the budget of their researchs.

As results showed, research value spent by the local research organizations and universities, students visiting and external research organizations has been estimated at between gross value in Table 12.

Table 12. Total estimated research value of coastal nature in Semarang

Parties	Rupiah in 2014
Local Research organisations in Semarang	73,948,000 - 131,936,000
Researchers and students visiting Semarang coastal area	117,446,000 - 272,958,000
External research organisations	47,474,000 - 87,976,000
Total	238,868,000 - 492,870,000

3.6. Amenity Value

The amenity value of Semarang coastal area has been estimated by using hedonic pricing method. This method considers the amenity value of coastal wetlands by knowing the property prices close to the coast as a representative of the coastal environment amenity provided to people who choose to live close to the coast to enjoy the beautiful scenery of the beach and marine area.

The amenity value of coastal ecosystems provide by the environment such as fresh air, good scenery and beach landscape are the important factors that is assumed to be affected in the price of coastal properties.

According to this hypothesis, the researcher did a site survey in two selected coastal wetlands in Semarang to know the contribution of these ecosystems to the aesthetic service and scenic service of the coastal environment which this study labels it as amenity value.

The value of those ecosystems could be represented by the property's price for different place of Semarang, extending from the closest place to the sea (at the beach) to the city centre with a certain distance to the beach. By asking housing agencies, the researcher included 35 cases from different data source. According to these data, all the 35 houses represent mostly a single family house with similar structural characteristics. The value is estimated as weighted average value divided into 6 categories as a function of distance to coastal area (Table 13 and Figure 4).

According to Figure 4, the trend of average price of houses is decreased when the property is located further away from the coastline. The price of properties near the coastal area is higher than the price of property far away from the coastal area in most of the cases.

Overview of Results

This is the final section of this study presenting an overview of monetary value of coastal ecosystems and environmental services provided to the Semarang inhabitants. Table 14 presents the ecosystem services, valuation approaches that have been used and total economic value of the coastal ecosystems per Hectare of the coastal area in Semarang.

The "total" and "per Hectare" environmental value is presented in Indonesian currency (Rp) as well as Dollar with the exchange rate (Dec. 2015) mentioned in Table 14. It should be noted that the calculation of estimated value is dependent on the area for which the valuation has been done. As the table shows, except the tourism/recreational value which is estimated for two selected beaches and the estuary, other ecosystem services have been valued for the whole coastline of Semarang which is 4,575 Ha.

Table 13. Average price of houses depending on the distance range to the sea (km)

Range of distance (m)	Average Price (Rupiah)
1-4	549,993,500.00
5-10	481,660,666.67
6-15	429,993,000.00
16-20	496,662,000.00
21-25	435,708,000.00
30-35	240,000,000.00

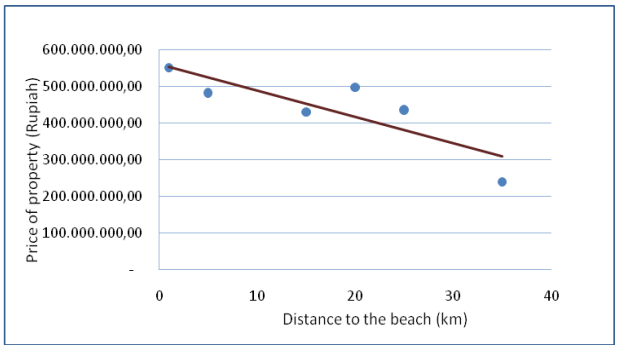


Figure 4. Average price of properties as a function of distance to the sea

This study estimated the monetary value of coastal environment in two selected wetlands of western coastal area of Semarang city, Indonesia. These two wetlands have been considered as one system including two beaches called Marina and Maron and an estuary of Plumbon River.

In order to calculate the environmental value, several scientific sources have been used such as journals, articles and governmental data and statistics. This research also used different approaches and concepts of economic valuation of environmental ecosystem services and goods to estimate the art, fishery, amenity, research and recreational/ tourism value of coastal environment in Semarang.

In this study, the data collection phase has been done within approximately two months (July and August 2015). A varied group of students, researchers, fishermen, housing agencies, photo shops, painting and book stores as well as 210 visitors have been considered and interviewed in this research to implement the economic valuation methods including contingent choice, hedonic price, and net factor income method.

Table 14. The environmental value per year (in 2014) of Western Coast of Semarang

Ecosystems service	Valued service	Valuation approach	Total estimated value (Rp)	Total estimated value (Rp) per Ha	Total estimated value (Dollar) per Ha *
Cultural	Art	Net factor income	214,045,150	46,786 (Total coastal area)	3.12 (Total coastal area)
	Research	Net factor income	238,868,000 - 492,870,000	52,212 - 107,731 (Total coastal area)	3.48 - 7.18 (Total coastal area)
	Amenity	Hedonic pricing	439,002,861	95,957 (Total coastal area)	6.39 (Total coastal area)
	Recreational/ Tourism (beaches)	Net factor income and Contingent Choice	19,010,974,803	602,312,256 (Marina beach) 8,123,493,506 (Maron beach)	40,154 (Marina beach) 541,566 (Maron beach)
	Recreational/ Tourism (Estuary)	Net factor income and Contingent Choice	1,011,087,200	43,412,933 (Plumbon Estuary)	2,894 (Plumbon Estuary)
Provisioning	Fishery	Net factor income and Contingent Choice	23,340,352,861	5,101,716 (Total coastal area)	340 (Total coastal area)

** Exchange rate Dollar / Rp = 15,000.00*

The data was obtained through surveys and interviews consisting of general information of study area, respondent's characteristics, environmental aspects, and a questionnaire including questions interlinked with the coastal environment and effects of coastal hazards on these areas. For the Tourism/Recreation value as well as fishery value, the total economic value (TEV) of each ecosystem service and good has been estimated by adding up the producer surplus and consumer surplus as the main economic concept in valuation studies. However, a different approach called net factor income has been used to estimate the art and research value.

Generally, the results show that the value and popularity of the beach area and its provided ecosystem services is much higher than the estuary, since the visitors of beaches have given a higher monetary value to the beach area. The hypothesis might be the difference in level of respondent's environmental awareness on two selected coastal wetlands resulting in varied contribution by people.

It is necessary to mention that some regulating and supporting services such as erosion protection (provided by mangroves and beach plants), improvement of shore water quality (by sea grasses) or providing a habitat for coastal live species and its diversity (by mangroves and beach plants) has been implicitly valued by people through the questionnaire. But due to data scarcity on the exact (above mentioned) services provided by these ecosystems, these regulating and supporting services have not been included in this study.

In this study, the estimated value of environmental services provided by certain coastal ecosystems (mangroves, beach vegetation and live marine and coastal species) presents an index of coastal environment importance and its ecological benefits to people including local visitors as well as residents of Semarang city.

According to the results, fishery value accounts for the highest contribution to the coastal ecosystem services as estimated at $340 per hectare of the coastal area. On the contrary, the lowest contribution on coastal ecosystems value can be seen in art value at $3.12 per hectare; however the majority of respondents perceived the importance of coastal nature for artistic work. This outcome is slightly in line with Beukering and Wolfs (2012) representing that the importance of art goes far beyond money, revenues and profits.

The art value of the coastal environment are strongly dependent on the number of respondents and quantity of the sold art works, since the total art value were estimated based on the number of art works that are sold in the market. Therefore, the researcher tried to have a good coverage of all the places in Semarang where are dealing with the photos, paintings, and books inspired by the coastal area, the existing ecosystems and its characteristics. Another issue is that there might be some uncertainty for the presented linkage of art works to the coastal environment which were mentioned (100%) by the sellers and artists, although is assumed to be an exact and correct percentage in this study.

The important hypothesis considered in this research is that it considers the effects of climate change and coastal hazards on the economic value of the coastal ecosystems and its services in the Semarang coastal region. The results mostly show that more the coastal ecosystems are degraded, higher the respondents are willing to pay to not lose the ecosystems and its associated services. However, this perception is not similarly conveyed for other aspects. As it has been differently revealed for estuary landscape, the visitors have higher willingness to pay to not lose mangrove and ponds, while WTP is less for other wetlands such as sandy and tidal flats.

Additionally, the other example is related to beach tranquillity and storminess condition. According to the results, some people indicated that if storm occurred in coastal area, they tend to choose "no contribution" for having tranquillity and less storminess condition,

whereas some others are willing to pay to not lose tranquillity. They intend to pay more if the percentage of stormy periods is increased.

The important issue which is implicitly affects the presented WTP by people is that the destructive effects of coastal storms not only affect the coastal environment, but also the living area of inhabitants causing to present higher WTP for also not losing their properties.

The results prove that the estimated fishery value and production volume of fish (ton) on North Java Sea is greatly contributed and affected the coastal society well-being. This industry generates a considerable income and job opportunities for local residents as well.

Supplement information as the outcomes of the interviews such as public environmental awareness, purpose of visit, educational background, monthly income and the most enjoyed coastal aspects among the visitors provided better insight to analyse the ecosystems valuation results as well as reliability of the respondents. Mostly, the respondents who have higher level of education are well aware of the coastal environment and stated higher value consequently. Similarly, it is found that the monthly income of respondents influence the WTP results where the majority of the visitors who obtain higher income intend to pay more for getting benefit of the coastal environment.

Most of the estimated values have been averaged, since the average value is a reliably representative of the whole sample size. Only in the case of Art and Research value, the total value is the sum of prices for all the art works and funds that are being spent on the related researches, thus taking average value has not been considered for these two services.

The economic value of ecosystems may be affected by the several aspects such as tourism industry. The development of such industry creates the added value that have to be taken into account in economic valuation. Due to the lack of information on cost of services provided to the tourists such as coasts of recreational facilities in the beaches, the researcher used the statement from Schep et al., (2012) to consider 25% of the total expenditures as the services costs (added value) provided to the visitors.

The economic valuation on the coastal area of Semarang would have been more precise if other ecosystem services such as coastal protection have also been included in two selected coastal wetlands. This would have given an approximation of natural protection services of mangroves and sea grasses against waves and storm surges, although this was not included in the study because of data scarcity regarding the cost of onsite coastal protection structures.

Fishery and Tourism/recreational value have used the WTP concept to calculate the Consumer surplus (CS). The willingness to pay (WTP) has been derived from the respondents representing their maximum WTP for not losing a certain ecosystem service or to improve the quality of that. On this value, the researcher obtained quite low and high value than presented by respondents. To avoid this bias, the extreme high/low values were excluded from the dataset while averaging was taken.

By way of comparison between the values presented by visitors as WTP for both wetlands, the highest average WTP has been represented for beach width. However, other aspects in beach showed less average WTP than estuary. For example, the visitors intend to pay more to not lose the diversity of species on estuary than beach. This is similarly resulted for more tranquillity, better shore water quality and more stable climatic status in estuary compared to the beach area.

The attitude of the visitors about the importance of the coastal area, with longer duration of stay, is different than the visitors who stayed a short time and did not plan to only visit the Semarang.

In terms of hedonic pricing method, property's price does not fully reflect the amenity value of the coastal area, since it has been seen that the rise in a property's price can be due to other factors than only enjoying the tranquillity or beautiful landscape of coastal area. According to the Beukering and Slootweg (2010), not only environmental attributes affect the property's price, but also property's characteristics (number of bedrooms, year of construction, floor numbers, accessibility to the shopping centre, schools, security of the neighbourhood and etc.) may influence the property's price. This discussion is also applicable for this study.

Although the coastal wetlands in Semarang provide ecosystem services and goods, but not all expenditures, activities and incomes are related directly to these ecosystems. For this study, boat rental is the only source of income as the direct recreational value on the beach. The dependency level of boat rental on the coastal ecosystems is assumed at 25% since this activity has a little dependency on ecosystems and would not considerably affect tourism value of the beach if the degradation of ecosystems happens.

The indirect values that have been calculated in the beach were estimated higher than estuary. These expenditures include the costs of entrance ticket, food and beverages, transportations, accommodation, buoys and mat rental. These revenues are considerably (60%) contributed to the coastal ecosystems, although it is not directly dependent on the healthy condition of the ecosystems.

4. Ilustration

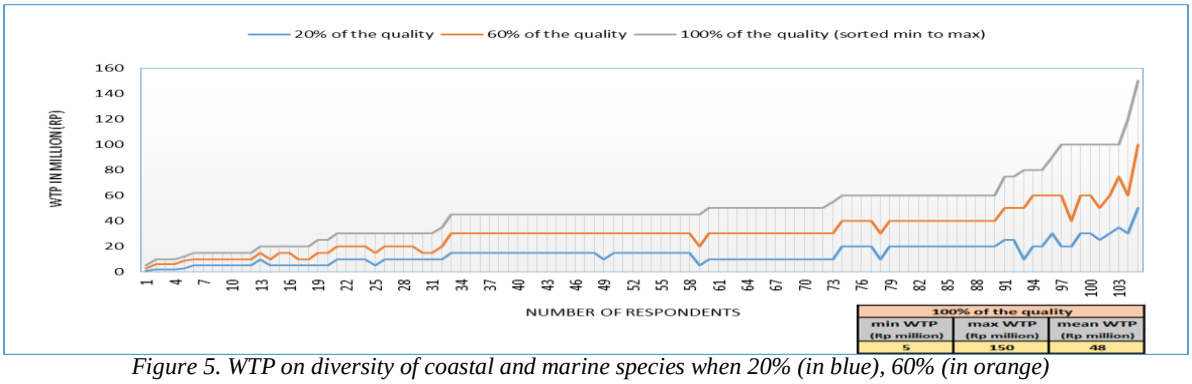


Figure 5. WTP on diversity of coastal and marine species when 20% (in blue), 60% (in orange) and 100% (in grey) are assumed to be lost

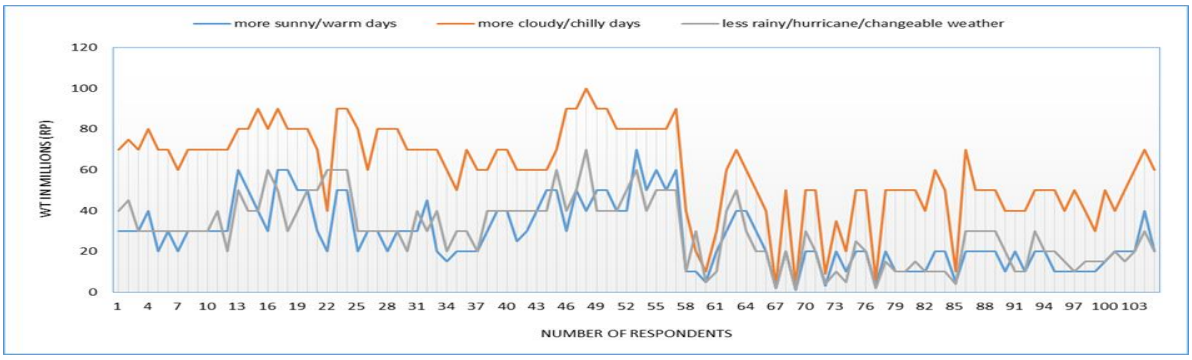


Figure 6. WTP on shore water quality when 20% (in blue), 60% (in orange) and 100% (in grey) of the water quality assumed to be decreased

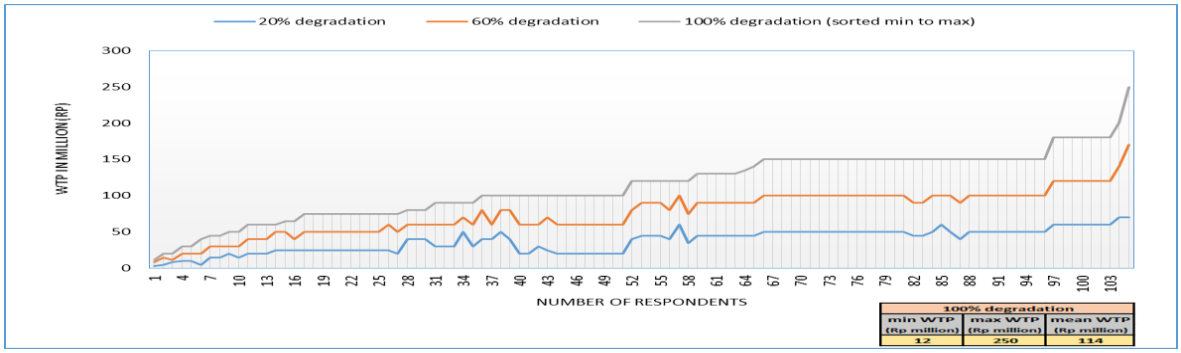


Figure 7. WTP for different beach climatic status, more sunny/warm days (in blue), more cloudy/chilly (in orange), and less rainy/hurricane/changeable weather(in grey)

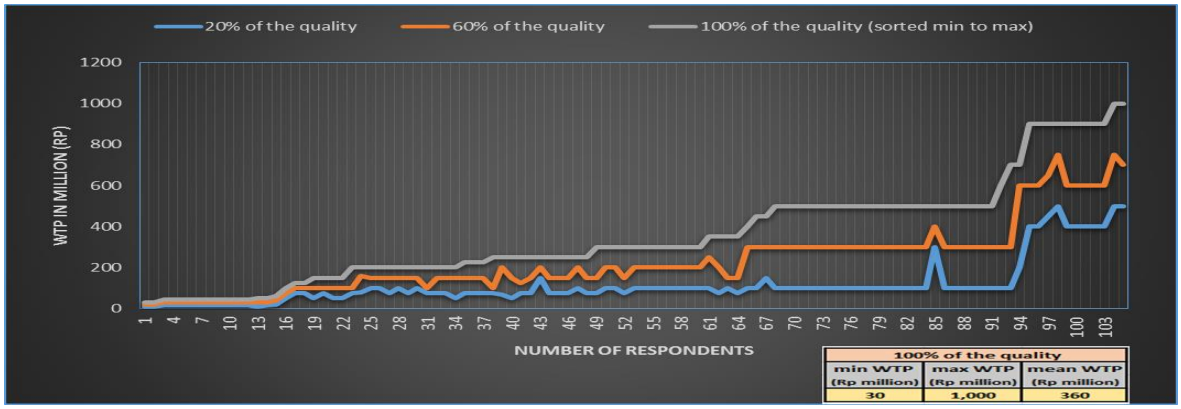


Figure 8. WTP on diversity of estuary's species for 20% lost (in blue), 60% lost (in red) and 100% lost (in grey)

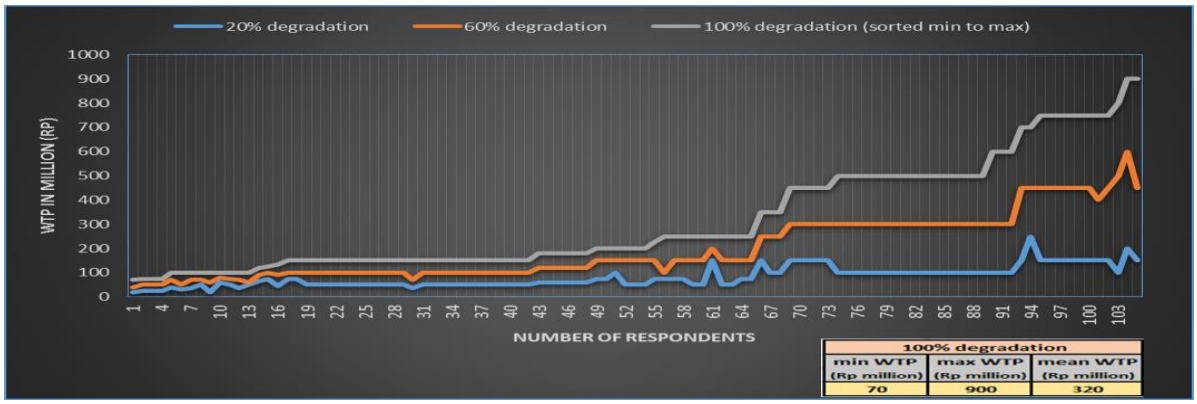


Figure 9. WTP on estuary water quality for20% decrease (in blue), 60% decrease (in red) and 100% decrease (in grey)

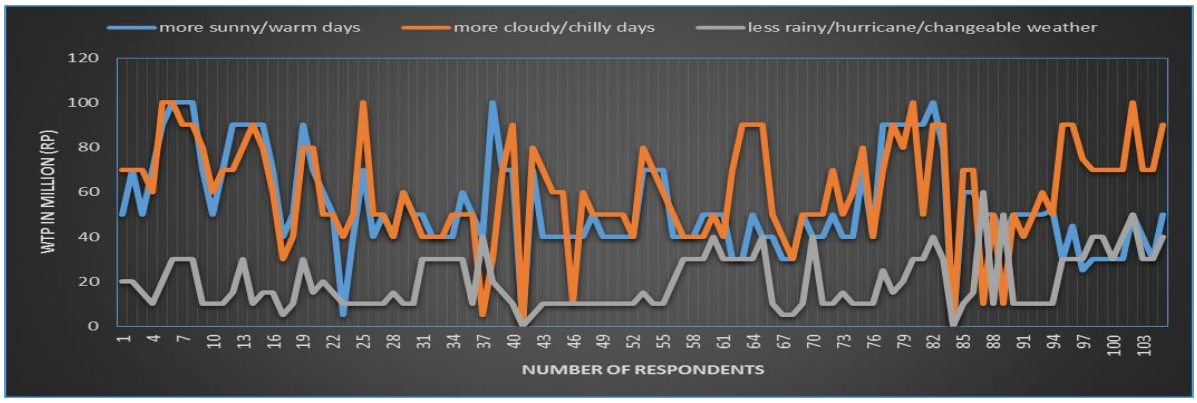


Figure 10. WTP for different estuary climatic status, for more sunny/warm day (in blue), more cloudy/chilly days (in orange) and for less rainy /hurricane/changeable weather (in grey)

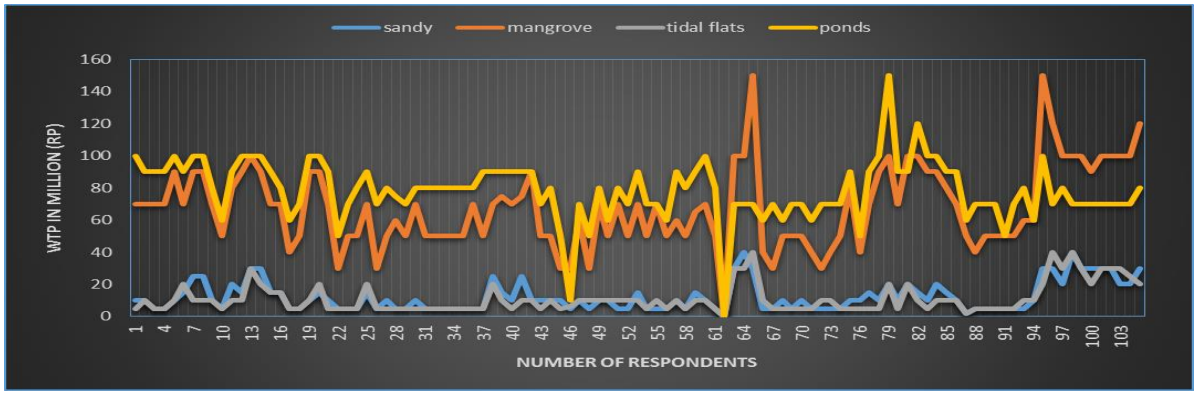


Figure 11. WTP for not losing the landscape of four natural areas exist in the estuary, sandy (in blue), mangroves (in orange), tidal flat (in grey) and ponds (in yellow)

5. Conclussions and Recommendation

Recently, several environmental restoration and preservation projects have been developed by the stockholders and governmental authorities to avoid more environmental loss in the future. One of these plans is building with nature that creates a green belt restoring mangrove forests in Semarang.

Thus, the valuation results of this study provide useful information to take a right decision about the common challenges of managing the coastal zone and the trade-offs between economic development and maintaining the capacity to provide ecological services in the longer time. These results can make a good recipe for doing cost benefit analysis per year of coastal zone in Semarang for further studies. For example, one of the applications can be the analysis of economic losses or gained benefits when a coastal settlement or an industrial complex is planned to be constructed in the coastal areas where a large area of mangrove forest should be destructed as a result of that. As it already mentioned, this study also provides a key insight in decision making process to prioritize between restoration and conservation of environmental projects.

At the end, the main conclusion is that Semarang coastal area has a considerable value of environmental

assets, although the resulted value per year for each ecosystem service might not fully depict the real worth of that particular ecosystem. As mentioned above, there are some uncertainties while linking the environmental services to its monetary values to people. Considering the "data limitation" and "data collection costs" as two important issues at the initial phase of this research, this study tried to minimize these uncertainties and estimate a reliable economic value of coastal environment for the Semarang coastal region.

As a recommendation, it is worth if this study is done annually or even in other seasons to see how different temporal scale affects the outcomes of the valuation. The outcomes of this study can be used as a good ground for doing further study of quantifying the environmental risk value and estimating damage lost value of Semarang coastal region. In terms of data collection, it is better to gather the on-site data and do the interviews by a group of researchers rather than individually, since it needs a lot of effort when presenting the questionnaire to the visitors as well as other people such as fishermen, authorities, stakeholders and etc. This will lead to have a bigger sample size which makes the results more reliable.

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