

Economic Valuation for Water Resources Development

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Economic Valuation for Water Resources Development

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Abstract

Watershed control is visible as a price center that does not offer tangible economic benefits for the improvement and development of human beings's welfare. market mechanisms fail in assessing the general resource, but this time there was a alternate in the monetary valuation of the environmental benefits and herbal sources indispensable for policymaking and financial evaluation of task pastime. This brought about the observe performed to evaluate the whole monetary value of environment offerings and water resources to evaluate the capacity of customers to pay for water aid development DAS Mahat Hulu, with substitute price calculation strategies and contingency. customers or beneficiaries in this have a look at are confined simplest to the rice farmers inside the upstream, floating internet cages farmers, travelers reservoirs, energy customers <450 watts, and power users> 450 Watts. Respondents have been decided on by means of random sampling multistory. several respondents regulate the prevailing population. The results show that the total financial fee of water sources could be very large upstream watershed Mahat is Rp. fifty three.72 M / year or Rp. 1,882,636. according to ha comprising Rp.51.38 economic fee and willingness to pay (WTP) Rp. 2:34 M / yr. WTP cost this yr is lots greater than the Reforestation Fund Kabupaten Lima Puluh Kota 5 (price range yr) is most effective Rp. 1.five M. percent is paying too high at 89.5%, even though its cost remains low as compared with the VAT tax legal responsibility with the aid of 10% at the same time as only four.5% WTP. overall monetary fee can be used as the cost of the minimum compensation when land within the watershed could be transformed. further, this price can be the premise of the overall performance appraisal watershed control more accountable. increasing the overall monetary price of the watershed carried out a very good and wholesome even as decreasing the whole financial fee of the watershed suggests the performance of the watershed down and bad.

Keywords; total economic value, economic valuation, reforestation fund, contingency

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I.INTRODUCTION

Currently expected at thirteen% or sixty two of 470 watershed basins in Indonesia are in critical circumstance. To deal with those crucial watersheds, numerous soil and water conservation sports in watershed control are long overdue (Priyono and Cahyono, 2003). Failure in the course of this watershed changed into a result of the immoderate emphasis at the biophysical factors of the social thing. As a end result, watershed control is less public aid because it does now not offer tangible economic blessings, is much less able to deal with degraded land, and is considered failed. One issue overlooked via experts on the watershed is the essential monetary aid values inside the watershed (Dixon and Easter, 1986). application of

environmental economics right into a coverage for the protection and development of the environment, consisting of watershed management has a few issues, such as the identity and quantification of environmental affects, valuation of environmental fees and advantages, and the discount component (discounting thing). The environmental impact of watershed control has a excessive complexity, and trouble in integrating and quantifying the effect (specially off-site) and evaluation of attachment relationships impact upstream and downstream. This problem might also occur because of the watershed management applications frequently encountering the upstream and downstream separation application so hardly ever integrated management of the gains received downstream to upstream management blessings. experience in Costa Rica, wherein the bills.

Carrier has been strolling through the watershed remains studied in addition so as best a treasured lesson for Indonesia towards an era wherein reputation and praise are given to folks who can be a company of environmental services watershed even though it is notion the decreased availability of water is taken into consideration as it is not inviolable (unalienable rights).

The economic advantages of a aid evaluation are one of the elements that decide the sustainability of assets. The low useful resource costs result in a much less efficient allocation in which the charge of manufacturing or extraction turns into large than it have to be. Adger et al. (1995) argue that the mistake in calculating the wide variety of products and services produced by using forests (for example) encourages the use of wooded area damage. similarly said that market transactions do now not offer a entire photo of the whole economic fee of sources. Ecosystems (consisting of ecosystem inside the watershed) provides a selection of treasured items and offerings for human well-being. goods and offerings have to be quantified and measured by means of the size of the public. that is the focal point of resource, and environmental economics is the way to check the environmental blessings in monetary terminology (Venkatachalam, 2006).

Quantification of surroundings items and services is important to make certain the social recognition and approval of the public in dealing with ecosystems (Wilson and chippie, 1999) and sources. If quantification is taken into consideration beneficial and essential enter in choice-making, the quantification and financial valuation technique have to be decided on and achieved. The cost of the economic blessings of safety and watershed control rarely quantification become no longer accomplished in full or in complete. There are only some monetary valuations of watershed benefits, including Acharya and Barbier (2000).

The value of environmental items and offerings can be labeled into (1) the value used (use-fee), and (2) the value of the unused (non-use price). the choice cost is based on how a great deal an person evaluation is inclined to pay (willingness to pay) for an option to defend the surroundings. Bequest value is primarily based at the man or woman's information of the benefits of a resource within the future. life price is based at the understanding of the

life of these assets. Many research conducted on the use-of values with a limited technique. This observe aimed to evaluate the total financial price, and willingness to pay environmental offerings for users within the watershed Mahat Hulu. at the technique of overall monetary value, goods and offerings within the watershed might be calculated in financial terms, each tangible and intangible very well. the overall method of evaluation of an existing program that benefits each the marketplace cost and isn't always presented in figure 1

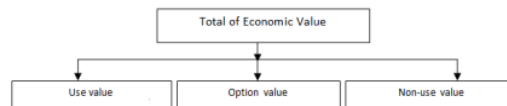


Fig.1 Total economic value of environmental services (Tietenberg.T, 2003)

II. METHOD

The experiment was conducted in the Mahat Hulu watershed (28,535 ha) as part of the Mahat watershed governance administratively located in Mahat Hulu in the Lima Puluh Kota District, West Sumatra Province. Its downstream was in Kampar district in Riau Province. Mahat Hulu catchment basin is located at 0 0 05 '25" - 0 0 04' 33" South latitude and 100 0 29 '10" - 100 0 34' 19" East Longitude. Materials used such as; map RBI, administrative boundary map, population distribution map, land use map, and interview material for respondents in the form of questionnaires and tools stationery office

The data collected in this study are primary and secondary data, primary data of socio-economic data (value / economic benefits of water), which is directly obtained through interviews of questionnaires that have been prepared. Meanwhile, secondary data such as demographic data, the data farmers' wetlands, floating net cages the data owner, the data traveler reservoirs, as well as data obtained from customers PLN Lima Puluh Kota district Government and relevant agencies Kampar through agencies.

Mainly used for primary data analysis with contingent valuation technique (contingency method) or willingness to pay (willingness to pay).

In practice, using this method is that the user (user) directly asked their willingness to pay to obtain and use water, to dig deeper into the information environment of users, will use a list of questions (questionnaire) by the intended respondent. The number of respondents varies and is considered sufficient when it represents.

DAS produces goods and services that can be marketed, and some can not be marketed. Marketable products are direct benefits that can be felt from a watershed management system, for example, agriculture, fishing, timber, and non-timber forest products, both commercial and non-commercial. Indirect use-value is derived from direct use. Indirect benefits are perceived benefits indirectly to the goods and services produced by a watershed, for example, barrier erosion, sedimentation, hydrological water providers, and soil-forming. In addition, there is also the option value, existence value, and the value of its inheritance are not yet affecting the sustainability of watershed resources.

Techniques to calculate the total economic value and the valuation of resources have been described for the case of Indonesia, among others, by (Sihite, 2001) and Suparmoko (2008). In general, the total value of the upstream water catchment Mahat is formulated as follows:

$$TNA = UV + OV + NUV \text{ or } TNA = (DUV + IUV + NUV + OV) \text{ in which:}$$

TNA = total value of water whereas, UV = use-value, DUV = direct use value (direct use values), IUV = Indirect use value (the value of direct useless), OV = option value (value selection), and NUV = non-use value (value not in order)

In this study only indirectly the value of water is used for electric power, cage fish farming, irrigated fields, and tours of the watershed reservoirs of Koto Panjang Mahat Hulu. In connection with this study the value of non-use of water catchment Mahat Hulu does not count, this is due to the high level of

subjectivity in the evaluation process, so it is feared that will lead to bias in the determination of planning decisions for Mahat Hulu watershed management based on its economic value.

Estimating the value of water Mahat Hulu watershed. Based on the scope of the value of water restrictions to be calculated, the total value of water to be counted is formulated as follows:

Total Value of Water

$$TNA = NAL + NAI + NAS + NAW$$

TNA = total value of water
NAL = value mains water
NAI = Value water fish
NAS = Value paddy water
NAW = Value tourist water

Estimating the value of PLN customer water use formula is as follows:

$$NAL = (RT \times KRT \times HLR)$$

NAL = Customer Value PLN (USD / year)

RT = Number of Households Subscribers PLN

KR = Consumption Per House Ttangga electricity (KWH / month))

HLR = TDL Price (USD / KWH) for Household

Estimating the value of water fish cage farmers is formulated as follows:

$$NAI = (BIK \times HIK \times JMK) / \text{harvest}$$

BIK = Weight of fish

HIK = price of fish/kg CTR

= number of cages

Calculated for each harvest and subsequently in total for 1 (one) year management.

Estimating the value of water to the rice fields using the following formula:

$$NAW = LUT \times BPA \times MT$$

Naut = value of water for farming rice (Rp / year)

LUT = farm size (ha)

CPA = cost of procurement of paddy water (Rp / ha / season)

MT = rice garden season (season/year)

Estimating the value of water to a tourist destination with Koto Panjang appeal reservoirs using the following formula:

$$NAW = . HT$$

NAW = Value water sites (Rp / year)

JP = the average number of monthly visitors (people / month)

BP = costs (USD / person)

HT = admission price (USD / person)

III. RESULTS AND DISCUSSION

Total economic value (NET) watershed water resources Mahat Hulu is the combination of the value of water use for tilapia: 1 rice farming, 2) reservoir tourists 3) floating net cages, and 4) electrical household. The magnitude of the economic value of water resources Mahat Hulu watershed is presented in Table 1

Table 1. The total economic value of water resources

No.	Use of Type	Value (USD / M)	%
1	Rice farming	0.676	1.32
2	Tourism reservoir	5.628	10.95
3		9.849	19.17
4	Floating net cages	22.180	43.17
5	Household electricity (>)	13.046	25.39

450)		
Household electricity (<450)		
Number	51.381	100

The data above shows that the economic value contribution consecutive upstream watershed Mahat is the greatest power of the household sector (users with power > 450 Watt and <450 Watts) and then followed by a floating net cage and most low rice agriculture. Power users with power > 450 Watt have an economic value of Rp.22.180 M (43.17%) followed by power users with power <450 Watt for Rp.13.046 M (25.39%). Contribution of the economic value derived from the electrical installation of the new value, and the monthly fees in one year, from the second item, turned out to have a monthly levy the highest percentage contribution to the economic value of electricity. Obtained high scores because it is an obligation that must be fulfilled. Forward this value will be higher due to the power sector having become a staple (Table 1).

Economic and population growth will affect the power demand is increasing, according to Mukhlis and Purnama (2008). Projected electricity demand from 2003 till 2020 was the Department of Planning System PT PLN and Team Energy BPPT, seen that during this period the average electricity demand in Indonesia grew by 6.5% per year with electricity growth in the commercial sector being the highest, which is about 7.3% per year, followed by the domestic sector electricity demand growth at 6, 9% per year. Further disclosed, the magnitude of the average electrification rate in Indonesia in 2003 reached 54.8% in 2008 and is estimated to be 63.5%, and by 2013 is expected to increase to 75%. Electrification ratio data for West Sumatra in 2013 is expected to reach 94.3% and reached 56.9%.

The economic value of water uses the third-largest Mahat Hulu watershed from floating net cages in the amount of Rp. 9.849 M (19.17%). Cage procurement costs and production costs are items that cause the high economic value of the environmental services of water users. All it proves is that they desperately need water and require that water is available at all times for the sake of their business, that they are willing to pay a high enough value and expect forest rehabilitation in the upstream run well.

Tourism reservoirs have a total economic value of 5.628 M (10.95%). In this study, was ranked fourth. It contributed the greatest contribution to it by the replacement cost of transportation and a fishing pole year. This activity will only be a joy but be ready to pay for could keep fishing while traveling. To that end, the upstream region should be maintained properly, and forest and land rehabilitation should be done so that this region remains a tourist destination.

The economic value of the wetland Rp.0.676 M (1.32%) is the smallest value of the economic valuation of watershed Mahat Hulu. The greatest contribution of this wetland is the cost of processing and the provision of means to enter the water. While of the ability to pay the cost of replacement water resources is relatively small because the exchange rate is also small for farmers. However, in a survey carried out, cultivating the fields will continue to be done as a family staple. To that end, they expect once the water is a key element for the growth of rice they are available at all times.

Value of Willingness To Pay (WTP) of Water Resources

Willingness to Pay (WTP) is the individual's willingness to pay for an environmental condition or valuation of natural resources and natural services to improve the quality of the environment. WTP calculated how far each individual or society has to pay or spend money to improve the environmental conditions to conform to the required standards. The value of each user's willingness to pay for water shows the level of concern of every user of water for environmental sustainability that can ensure their comfort to enjoy uninterrupted

water.

Based on the concept of economics, economic value includes the concept of usability, satisfaction, or pleasure derived by the individual or the society not limited to the goods and services that are gained from buying and selling, but all the goods and services that can provide benefits for human welfare. So that both public goods and private goods will benefit the community. Thus the presence of water as an ecological benefit is essentially also an economic benefit because disrupted ecological functions will lead to disadvantages or the loss or damage caused by the disaster.

It is thus also related to the availability of water is not always maintained regardless of the condition of the natural resources that govern the presence of water. In general, the presence of water that can be used can not be separated from the function. If the watershed degraded the quality, quantity, and distribution of water would be too distracted. To keep the watershed continue to work the natural resources should be maintained. Watershed conditions that have been disturbed should be fixed. Forest and land rehabilitation measures immediately.

Programs should be developed, and funds should be provided as well as integrated institutions should be set up to make this happen. The allocation of funds for the rehabilitation/improvement of hydrological functions that are conserving water resources then WTP is needed. In detail, the value of willingness to pay (WTP) rehabilitation costs is presented in Table 2

Table 2 WTP value forest and land rehabilitation costs

No.	Type of Use	Value (USD / M)	(%)
1	Rice farming	0,029	1.24
2	Tourism reservoir	1.11	47.73
3	Floating net cages	0,014	0.6
4	Household electricity (> 450)	0.705	30.14
5	Household electricity (<450)	0.481	20.56
	Total	2,341	100

Contribution to the willingness to pay tourist reservoir forest and land rehabilitation costs Mahat Hulu is a watershed; greatest Rp. 1:11 M or 47.73% of the total WTP. Proving that the hydropower dam has become a tourist destination, for both Riau and West Sumatra communities. Tourist destination not only enjoys the natural scenery is also fishing. The second reason is that they are willing to pay to encourage a well-maintained environment (Table 2).

The power users were still willing to pay more in addition to the fees already incurred each month. Households with power > 450 Watts have accumulated contributions for forest and land rehabilitation of Rp. 0705 M (30.14%) and home power users <450 Watt Rp.0.481 M (20:56%). The rehabilitation finance of household electrical value is less than reservoirs tourist, meanwhile, the value of economic, tourist household electricity is much greater than the reservoir tourist, this is because users generally assume that household electricity they use is already paid through accounts each month for it all needs related to other operations is the government's obligation in this regard state electricity company.

The willingness to pay of water users for paddy rice is Rp.0.029 M (1.24%) values were calculated for 2 (two) times the processing of rice in 1 (one) year. Production, in general, enjoys itself with family, even if they are selling it in the form of rice. Income derived from rice farming is not sufficient for a decent living. Because of the difference in selling them with small production costs. But for the sake of the availability of sustainable water and land to rehabilitate the farmers are aware of the importance and are willing to pay.

Farmers depend on floating net cages all their lives from hydroelectric reservoirs. A productive effort that has been running since 2002 developed so rapidly. This is evident from the data cage's development from year to year. They realize that the quality and quantity of water in the reservoir must be continued. For that, they are willing to pay to help keep forest land and conservative treatment, which will be utilized on any upstream farmer's yields, which in this case all three (3) months and calculated for 1 (one) year. WTP values floating net cages farmers Rp 0.014 M (00:06%), it's nominal individually large enough, but the overall look small because the number of farmers is also at least compared to other users.

Total Economic Value (NET) Utilizing Water Resource Services

The total economic value of water resources is a merger between the total economic value of water and every sector's added total willingness to pay (WTP) of each sector. In detail, the total economic value of water resources upstream of watershed Mahat is presented in Table 3. Table 3 showed that the average percentage of the value of willingness to pay (WTP) of forest and land rehabilitation costs DAS Mahat Hulu from all sectors is (5.47%). How much percentage of the fair value of the willingness of rehabilitation of a total economic value of water resources has been no determination of the value of its guidance due to the amount of compensation given to the users of environmental services

provider in the economic environment, the value of the benefit is not having market value (non-marketable); it is due to the nature of externalities, in which the profits or benefits of environmental management or losses and environmental damage costs are out of the market system. Application of environmental economics in the protection and improvement of the policy environment faces some problems, such as difficulty in identifying and quantifying environmental services, the difficulty of valuation gains, and the high cost and the time factor (the discount), including the assessment of environmental services based on people's willingness to pay for better environmental services (compensating variation) or willingness to accept payment when services are obtained more inferior (equivalent variation). However, if the percentage of willingness to pay (WTP) rehabilitation cost is compared with the value-added tax (VAT) on goods or services that are enjoyed by consumers by 10%, then the percentage of willingness to pay (WTP) of consumers beneficiaries of environmental services, especially water catchment Mahat Hulu is still very small. As well as research results of Pramod AA (2009) in which the WTP analysis shows that public awareness of the environmental benefits of forests is still low. When compared with the respondent's income in Sub Cisarua WTP value is only 0.18% of their income and in the Mega Mendung District, only 0.21% of the family income. This suggests that the appreciation in Hulu DAS Ciliwung of environmental services is very low. They tend to be short-sighted (myopic view), on the condition that they feel at this moment, and do not consider the risk of the loss of forest for their living environment in the future.

Table 3: Total economic value of water resources

No.	Type of Use	Value oak.(Rp / M)	WTP value (USD / M)	Value oak. Total (Rp / M)	Value of oak. (%)	WTP / EKT (%) *
1	Rice farming	0.676	0,029	0.705	1.31	4:11
2	Tourism	5.628	1.11	6,738	12.54	16.47
3	reservoir	9.849	0,014	9.863	18.36	0.14

4	Floating net cages	22.180	0.705	22.885	42.60	3.08
5	RT power (> 450)	13.046	0.481	13.527	25.18	3.56
	RT power (<450)					
	Number	51.381	2,341	53.722	100	

IV. CONCLUSION

There are several conclusions made. First, watershed management has many benefits for human well-being; either can be used directly or not directly utilized. Use the value of watershed management that does not directly include the use of water for agriculture, control of erosion, sedimentation, flooding, landslides, air conditioning, waste recyclers, and absorbent carbon from the atmosphere. Direct benefits can be consumed by people and could be marketed among other products of food crops, horticulture, medicinal plants, and wood. Second, the total annual economic value of water resources Mahat watershed upstream of Rp. 51.381 M, is the contribution of the electricity sector RT (> 450 watts) of Rp. 22.180 M, electric RT (<450 Watts) Rp.13, 056, floating net cages Rp 9.849 M, tourist Rp.5 reservoirs, 628 M, and agricultural wetlands Rp.0.676 M. The amount of total economic value can be used as the minimum value that must be compensated if the watershed land will be converted or utilized as well as a performance assessment basis watershed management more accountable. Increasing the total economic value of the watershed showed a good performance and a healthy watershed while decreasing the total economic value of the watershed basin showed a decrease in performance and criticality. Third, the rehabilitation value of willingness to pay (WTP) of Rp 2,341 M / year, which is the contribution of the electricity sector RT (> 450 watts) of Rp. 0.705 M / yr, Electrical RT (<450 Watts) Rp.0, 481 M / yr, floating net cages Rp 0,014 M / yr, reservoirs tour Rp1, 11 M / yr and wetland agriculture Rp.0.029 M / yr. Peneraan WTP amount is much more than the virgin reforestation Bedar Government allocated

only Rp 1.5 M in 5 years (Rp 300 million / yr) indicates the magnitude of downstream and upstream cooperation opportunities for better watershed management. Fourth, public understanding of environmental services downstream water resources is very high as evidenced by the level percentage, which agreed to pay more to save water resources average of 89.4%.

As the suggestions, first, the total economic value of the watershed can be used as a minimum value of compensation for land use in the watershed, and as a basis for watershed management performance assessment can be justified scientifically. Second, the magnitude of the total economic value of watershed resources can be integrated into the calculation of the domestic product and watershed areas that sustainability management

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

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PAGE 6

PAGE 7

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