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Water Economic Valuation and Community Engagement in Catchment Area Management of Way Sekampung Dam, Lampung

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ABSTRACT

This study aims to identify and calculate the total economic value of water resources in the Way Sekampung Dam Catchment Area, and to analyze the willingness to pay (WTP) of water users for forest rehabilitation costs as part of a water resource conservation strategy. The methods used include an economic valuation approach for the Regional Drinking Water Company (LGWU), agricultural irrigation, Hydroelectric Power Plant (HPP), and tourism. The results show that the largest economic value of air comes from the HPP sector (IDR 66.2 billion/year), followed by the agricultural sector (IDR 7.4 billion/year), LGWU (IDR 4.9 billion/year), and tourism (IDR 240 million/year). The highest willingness to pay (WTP) comes from LGWU consumers and tourist visitors, respectively IDR 265.6 million and IDR 128.3 million per year. Conservation strategies such as forest rehabilitation, application of soil and air conservation techniques (SCA), and increasing vegetation cover have been proven to reduce erosion from 141.55 tons/ha/year to 19.9 tons/ha/year. Integration of ecological and economic approaches is important to realize sustainable watershed management. Keywords: Economic valuation, water resources, willingness to pay, community involvement, watershed management

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1. INTRODUCTION

Watersheds are ecological systems that play a strategic role in supporting the availability of clean water, ecosystem stability, and various socio-economic activities of the community. Watershed functions as a life support and foundation for regional sustainability, both in terms of the environment and economy. In the context of sustainable development, watershed has a broad contribution: from flood control, water supply for agriculture and households, to being a source of energy and tourism [1,2].

One of the areas experiencing ecological pressure and requiring attention is the Way Sekampung watershed, especially in the upstream part which is the catchment area of the Way Sekampung Dam. Changes in land use, deforestation, and economic activities without ecological planning have triggered accelerated erosion, increased sedimentation in the dam, and decreased the quality and quantity of available water. As a result, the main function of the dam as a water provider for irrigation, power generation, and domestic needs is threatened. A report from the Sumatera VIII River Basin Center shows that upstream area degradation is the main cause of increasing sediment loads and decreasing dam efficiency in recent years.

Another important problem in watershed management is the low understanding of the community and policy makers regarding the economic value of water as part of environmental services. Water is often considered a free resource (free goods), whereas economically, water has marginal value and a very

significant contribution to the productivity of various sectors. Calculating the economic value of water quantitatively is very important to assess how much real contribution water makes in supporting the economy of sectors such as agriculture, drinking water, energy, and tourism. This approach provides a rational basis for the formulation of incentive policies, allocation of conservation budgets, and formulation of fair and sustainability-based water tariffs [3,4]

In addition, the Willingness to Pay (WTP) approach is a relevant instrument for measuring public awareness and commitment to environmental conservation. Through WTP, it can be identified to what extent the community or economic sector actors are willing to contribute voluntarily to conservation efforts, which can ultimately be used to finance watershed rehabilitation programs. The Study [5] shows that WTP is an important basis for the implementation of an effective payment for ecosystem services (PES) scheme, especially in the management of vulnerable watershed upstream areas.

This study aims to:

1. Identify and calculate the economic value of water from various sectors (local government-owned water utility, hydropower plant, agriculture, and tourism) in the catchment area Way Sekampung Dam.
2. Assess the willingness to pay (WTP) of the community from each sector as a form of participation in supporting watershed environmental conservation.
3. Formulate conservation strategies based on economic valuation and participatory ecological approaches to control land degradation.

The benefits of this research are not only theoretical, namely enriching the study of the economic valuation of ecosystem services and community-based watershed management, but also practical. The results of this study can be used as a basis for formulating environmental incentive policies such as payment for ecosystem services (PES), setting fair and sustainable water tariffs, and strengthening local institutions in watershed conservation. Thus, watershed management can be directed towards a more participatory, efficient, and sustainable system.

2. METHODOLOGY

This study uses a descriptive quantitative approach with a water economic valuation method based on the Contingent Valuation Method (CVM) to estimate the total economic value (TEV) of water resources in the Way Sekampung Dam catchment area. The analysis was conducted on four main user sectors: local government-owned water utility (LGWU), agriculture (AGRI), Hydropower Plant (HPP), and tourism (TOUR).

Area Study

The research was conducted in the catchment area of Way Sekampung Dam. Administratively, the downstream part is in Pringsewu Regency, Lampung Province and the upstream part is in Tanggamus Regency which was carried out in February -May 2024. The Way Sekampung Dam Catchment area is geographically located at 104 ° 55' 12.25 " East Longitude and 5 ° 20' 2.82 " South Latitude which has an area of 32,333.85 Ha.

Data Analysis

Estimation of Economic Value of Water

Economic value assessment is conducted based on direct use value, including:

- Domestic water use value (DWV)
- Agricultural use value (AGRI)
- Hydropower Plant use value (HPP)
- Tourism use value (TOUR)

Formula for calculating the total economic value (TEV) of water:

TEV=DWV+AGRI+HP+TOUR
With:

DWV = RT × JA × KP × HA
DWV = Value of LGWU customer water (IDR/year)
RT = Number of LGWU customer households (Head of Household)
JA = Average number of family members (People)
KP = Average water consumption per capita (person/day/m^3)
HA = LGWU water price (IDR/m).

AGRI = LUT × BPA × MT
AGRI= Value of water for rice farming (IDR/year)
LUT = Area of rice farming (Ha)
BPA = Cost of rice water procurement (IDR/ha/season)
MT = Rice planting season (planting season/year)

HP = DL × WL × HA
HP = Value of water for HPP customers (IDR/year)
DL = Electricity power (kWh)
WL = Operating hours (hours)
HA = Product price (IDR/kwh)

TOUR= $\sum_1^{12}$ TW × P × HT
TOUR= Value of tourist water (IDR/year)
TW = Number of tourist destinations (Unit)
JP = Average number of monthly visitors (Person/month)
HT = Entrance fee (IDR/person)

Willingness to Pay (WTP) Measurement
The willingness of the community to pay for conservation costs is calculated using the Willingness to Pay (WTP) approach through the distribution of questionnaires. WTP reflects the extent to which each user is willing to contribute to forest rehabilitation and watershed conservation programs. The questions are open-ended and directed at exploring preferences and perceptions of water values from the perspective of direct users.

Scope of Economic Value
This study only calculates use value and does not include non-use values such as existence value and bequest value, to avoid subjective bias in assessment and maintain the objectivity of water economic-based policies.

3. RESULTS AND DISCUSSION

Total Economic Value (TEV) of Water Resources in the Way Sekampung Dam Catchment Area
The economic value of water calculated at the Way Sekampung Dam in this study includes four main components, namely DWV (Water Value from Way Sekampung LGWU Customers), AGRI (Water Value for Farming Businesses, especially rice fields), HP (Water Value for Hydroelectric Power Plant/HPP Customers), and TOUR (Water Value for Tourism). These four components represent the direct use value of water resources, namely the economic benefits obtained directly from the physical use of water in various productive activities. DWV reflects the value of water based on income from the distribution

of clean water for household needs, AGRI refers to the contribution of water to the agricultural sector through the irrigation system, HP shows the role of water in supporting energy production in hydroelectric power plants, and TOUR describes the economic potential of water in supporting tourism activities around the dam. This assessment does not include indirect use values such as ecological functions and environmental services (e.g. flood control and ecosystem buffers), or non-use values such as existence value or option HP value. Therefore, this approach is still partial and pragmatic, but remains important as a basis for managing water resources economically.

Water Value of Local Government-Owned Water Utility (LGWU) Way Sekampung Customers

The economic value of water utilized by LGWU Way Sekampung customers shows the strategic role of the dam in supporting the provision of clean water for domestic needs of the community in Pringsewu Regency, Lampung. Based on LGWU data, the total economic value of the water produced reaches IDR 414,102,000 per month or equivalent to IDR 4,969,224,000 per year. The details show that Pringsewu District contributes the highest economic value of IDR 304,512,000 per month (73.54%), with a total of 2,928 families and an average consumption of 10 m^3 per month. Meanwhile, Gading Rejo District contributes IDR 109,590,000 per month (26.46%) from 843 families of customers with the same average consumption. Table 1 presents details of the economic value of water based on the location of LGWU distribution. The economic value of LGWU water can be seen in Table 1

Table 1. Economic value of water for LGWU Way Sekampung Dam customers

No	Location	Number of Users (Family)	Average number of family members	Consumption (m^3/ month)	Water Price (IDR)	Value (IDR)	%
1	Pringsewu	2,928	4	10	2,600	304,512,000	73.54
2	Gading Rejo	843	5	10	2,600	109,590,000	26.46
Total		3,771				414,102,000	100
Annual Economic Value of Water for LGWU Customers						4,969,224,000	

Source: Primary Data (processed), 2025.

The availability of water from the Way Sekampung Dam is a key factor that ensures the sustainability of the LGWU operation, while supporting socio-economic development in the area. A study by [6] emphasized that strong institutional governance in watershed management is essential in ensuring the sustainability and sustainability of water supply. In addition, environmental economic approaches such as calculating the economic value of water serve as the basis for policies in determining water tariffs and allocations, as well as making investment decisions in water infrastructure.

In a global context, the economic valuation approach to water has been widely applied to support water resource conservation. [7] hows that assessing the economic value of clean water can encourage public investment in water management and reduce the risk of water disasters, including droughts and floods. Similar to [8] which emphasizes that the economic valuation of water is crucial in encouraging efficient distribution and equity in water access.

In addition to its economic value, the use of water by LGWU also influences long-term water management policies. With increasing pressure on water resources due to climate change and population growth, an integrative approach is needed that combines technical efficiency, environmental conservation, and community awareness. Implementation of nature-based solutions and capacity building of local water institutions to address the risk of decreasing raw water availability in the future, including in areas such as Lampung which are dam-based

Sustainable and efficient use of water from the Way Sekampung Dam is important for LGWU and local governments in maintaining water availability, which is expected to continue to support socio-economic development and water security in the area. Similar studies related to the economic value of water can be found in research on water resource management and environmental economics, which emphasize the economic benefits of access to clean water and the importance of conserving water resources for long-term

Water Value for Farming, Especially Rice Fields

The use of water for rice fields in the Way Sekampung Dam irrigation area, which has a planting area of 214.4 hectares, makes an important contribution to local food needs. This area is cultivated by 631 farmers who often face the challenges of limited land ownership and high costs to obtain adequate water. In these conditions, assessing the economic value of water becomes important, especially for planning more efficient water resource management.

The economic value of water for rice fields is calculated using the approach of water procurement costs per hectare per planting season, where the total value is obtained by multiplying the area of land cultivated, the frequency of planting seasons, and the costs incurred for water procurement. These cost components generally include labor wages, materials or pipes for water channels, and maintenance costs. With this approach, the resulting economic value can reflect the potential for sustainable water utilization for the agricultural sector, while supporting fairer and more effective resource allocation planning for local farmers. The economic value of water for farming can be seen in Table 2.

Table 2. Economic Value of Irrigation Water in The Sekampung Irrigation Command Area (ICA)

No	Location	Number of Farmers	Rice Field Area (ha)	BPA (IDR/ha/MT)	Average (MT/ year)	Value (IDR)	%
1	Podasari	344	114.4	180,000	2	41,184,000	46.28
2	Bumiarum	287	100	215,000	2	43,000,000	48.32
3	Bumiayu	150	10	240,000	2	4,800,000	5.39
Total		781	214.4	635,000		88,984,000	100
Average			0.34	211,667			

Note: MT : Planting Season

Source: Primary Data (processed), 2025.

The highest distribution of economic value comes from Bumiarum (48.32%) and Podasari (46.28%), which shows the dominance of areas with larger land areas and more efficient water procurement costs. Bumiayu, despite having the highest BPA, only contributes 5.39% due to limited land area. This difference in economic value reflects variations in the cost and efficiency of irrigation water management, as well as structural challenges such as small land ownership and limited access to irrigation infrastructure.

In addition to the Sekampung Irrigation Area, the Way Sekampung Dam also serves the Rumbia Irrigation Area covering an area of 17,334 hectares, with an economic value reaching IDR 7,338,060,000 per year. When combined, the total economic value of irrigation water from these dams reaches IDR 7,427,044,000 per year, as summarized in Table 3.

Table 3. Economic value of irrigation water from Way Sekampung Dam

Location	Rice Field Area (ha)	Average BPA (IDR/ha/MT)	Average (MT/ year)	Value (IDR/year)
ICA Sekampung	214.4	211,667	2	88,984,000
ICA Rumbia	17,334	211,667	2	7,338,060,000
Total				7,427,044,000

Source: Primary Data (processed), 2025.

The economic value of water for agriculture not only shows its direct contribution to rice production but also indicates an urgent need for efficient water use in the agricultural sector. A study by [9] in Agricultural Water Management emphasized that the use of efficient and technology-based irrigation systems can increase water productivity by up to 30%, especially in tropical areas with high water stress. On the other hand, [10] showed that a water margin cost-based approach can be used to optimize agricultural water allocation in situations of limited supply.

Conditions in Way Sekampung that show variations in BPA and productivity indicate that intervention policies need to be directed at increasing the efficiency of water distribution and empowering farmers in irrigation management. According to [11] he application of the Water Accounting+ approach to quantitatively assess the economic benefits of water in the agricultural sector to support food security and national irrigation sector investment planning. This is relevant to the Indonesian context, where most irrigation systems are still conventional and face the risk of decreasing water availability due to climate change [12]. The economic value of water in the rice farming sector in the Way Sekampung Dam area is an important indicator in planning fair and efficient water allocation. Strengthening farmer capacity, improving irrigation infrastructure, and conservation-based incentive policies can be the main strategies in supporting the sustainability of agricultural water use in this area.

Water Value for Hydropower Plant (HPP) Customers

Water utilization in the Way Sekampung Dam is not only limited to the agricultural sector, but is also utilized to support the provision of electrical energy through the Hydropower Plant (HPP). As shown in Table 4, this dam has a power generation capacity of 5.4 megawatts (MW) and is designed to operate for 8,760 hours per year, or equivalent to full operation for one year without stopping. Assuming a selling price of electricity to the grid of IDR 1,400 per kilowatt-hour (kWh), the economic value of the total electrical energy produced in a year reaches IDR 66,225,600,000.

Table 4. Water values for HPP

Location	Electrical power	Operating Hours (Hours/year)	Price per kWh (IDR)	Value (IDR)
Way Sekampung Dam	5.4 MW	8,760	1,400	66,225,600,000

Source: Primary Data (processed), 2025.

The economic value not only illustrates the potential income from electricity sales, but also reflects the strategic role of dams in supporting the energy transition towards cleaner and more sustainable sources. HPP is considered one of the most efficient forms of renewable energy, with a low carbon footprint and long operational life. According to (IEA, 2023), global HPP contributes more than 50% of the world's renewable energy and makes a significant contribution to reducing dependence on fossil fuels, while strengthening energy security in remote areas.

In addition, the use of water for power generation provides high economic added value from the same water resources. When compared to the use of water for irrigation, the economic value per unit volume of water for HPP is much greater, considering that the conversion of energy from water requires a relatively small volume but produces high sales value in the form of electricity [14]. Thus, optimization of dam water utilization must consider the efficiency of cross-sector allocation between agriculture, energy, and other domestic needs.

On the other hand, the success of HPP operations is highly dependent on the availability of water in terms of quantity and quality throughout the year. The threat of climate change and catchment area degradation can affect river flow discharge, which in turn has an impact on electricity generation capacity. Therefore, sustainable watershed management is a key factor in ensuring the sustainability of the economic value of water for HPP [15].

Revenue from the electricity sector like this can also be allocated for conservation programs, improving energy infrastructure, and expanding access to clean energy-based electricity to the community. In many developing countries, the multifunctional dam utilization model has been proven to be able to improve local welfare, reduce carbon emissions, and support the achievement of SDGs targets, especially goals 7 (Affordable and Clean Energy) and 13 (Addressing Climate Change) [16].

Water Value for Tourism

The water tourism economy around Way Sekampung Dam, which includes tourist attractions such as Lana Kila, Cakra, Senja, and Doro Putri, represents an economic value that does not only come from direct transactions in the form of ticket sales or merchandise, but also from indirect benefits felt by visitors in the form of natural beauty, ecosystem quality, and recreational experiences offered by tourist attractions. The economic value of water for tourism can be seen in Table 5.

Table 5. Economic value of water for tourism

No	Tourism Object	Number of Visitors (person/ month)	Ticket Price (IDR)	Value (IDR)	%
1	Lana Kila	800	15,000	12,000,000	60
2	Cakra	200	15,000	3,000,000	15
3	Senja	200	15,000	3,000,000	15
4	Doro Putri	200	10,000	2,000,000	10
Amount		1,400		20,000,000	100
Economic value of water for tourism per year				240,000,000	

Source: Primary Data (processed), 2025.

This economic value can be estimated by using the entrance ticket price approach multiplied by the number of visitors, which shows the estimated direct income from tourism activities. Based on 2024 data, the number of visitors to this area reached around 1,400 people per month, generating an economic value of IDR 20,000,000 per month or IDR 240,000,000 per year. Lana Kila is the tourist attraction with the highest contribution to the total economic value, which is 60%, followed by Cakra and Senja each with 15%, and Doro Putri with 10%.

Recent research supports that water tourism around the Way Sekampung Dam makes a significant contribution to the economic welfare of the local community. A study by [17] found that the development of water tourism significantly increased the income of the community in Pekon Bumi Ratu which is around the dam. This is reinforced by the findings of [18], which showed significant changes in the social and economic conditions of the community after the development of the dam tourism area, including increasing public facilities and household income. These studies confirm that good water resource management contributes directly to the economic well-being of local communities through improving the tourism sector.

Furthermore, the economic value of ecotourism cannot be separated from the important role of environmental services provided by the Way Sekampung watershed. Environmental services such as the provision of clean water, regulation of the hydrological cycle, and preservation of biodiversity are the main foundations in supporting the sustainability of tourism activities in this area. If the ecological quality of the watershed declines, such as water pollution or vegetation damage, then the tourist attraction will also decline, which ultimately has an impact on the decline in the number of visitors and local economic income. [19] emphasizes that natural ecosystems provide environmental services that indirectly become important capital in the development of a sustainable tourism sector. This concept is in line with the idea [20] regarding ecosystem economics, which highlights the importance of preserving ecological functions as a basis for improving community welfare.

Economic Value of Water in the Catchment Area of Way Sekampung Dam

The economic value of water in the Catchment area of Way Sekampung Dam reflects the important contribution of various sectors that utilize water resources to support community activities and the local economy. The economic value of water resources in the Catchment area of Way Sekampung Dam can be seen in Table 6.

Table 6. Economic value of water in the Way Sekampung Dam catchment area

No	Type of Use	Economic Value (IDR/year)	%
1	Water Company	4,969,224,000	6.3
2	Paddy Field Farming	7,427,044,000	9.4
3	Hydroelectric Power Plant	66,225,600,000	84.0
4	Tourism	240,000,000	0.3
Amount		78,861,868,000	100

Source: Primary Data (processed), 2025.

The economic value of water in the Way Sekampung Dam catchment area is obtained from various sectors that utilize water resources, with a total contribution of IDR 78,861,868,000 per year. The distribution of this economic value shows that the dominant sector is the Hydropower Plant (HPP), which provides the largest contribution, namely IDR 66,225,600,000 per year or around 84.0% of the total value. This figure confirms that the energy sector is highly dependent on the availability of water to support sustainable HP power generation operations, as also emphasized in research [21] which shows the importance of optimizing dam water capacity in supporting water resource-based energy security in Indonesia.

The Regional Drinking Water Company (LGWU) sector contributes IDR 4,969,224,000 per year or 6.3%, reflecting the high economic value of providing clean water for household and domestic sector needs. This is in line with the findings of [22], which highlighted the increase in the economic value of water as the coverage of clean water services in the downstream areas of the watershed increased. Meanwhile, the rice farming sector generated an economic value of IDR 7,427,044,000 per year or around 9.4%, which indicates that although water use in this sector is very large, its economic value per unit of water is relatively lower than the energy sector. This is consistent with a study by [23] which explains that the efficiency of water use in agriculture is still a challenge, especially in conventional irrigation systems.

The contribution of the tourism sector to the economic value of water in the Way Sekampung watershed is only IDR 240,000,000 per year or around 0.3% of the total economic value of water. Although relatively small, this sector has significant growth potential through the development of community-based ecotourism. This is in line with the findings of [24] which show that the utilization of the watershed for tourism activities such as resorts and rafting can go hand in hand with environmental conservation, especially through the application of the principles of spiritual, social, and ecological harmony. Thus, although the tourism sector has not become a major contributor, increasing investment in tourism infrastructure and promoting the natural potential around the dam can strengthen the diversification of economic benefits from water resources.

Overall, these data show the importance of the Way Sekampung Dam catchment area function in supporting various economic sectors that are highly dependent on water supply. Effective watershed management, including land conservation and rehabilitation activities, has the potential to increase the sustainability of water supply and economic value across sectors in the future [25]. Therefore, the integration of economic, technical, and ecological approaches is key to ensuring the long-term benefits of water resources in this area.

Willingness to Pay (WTP) Value for Forest Rehabilitation in the Way Sekampung Dam Catchment Area

The willingness to pay (WTP) values of various water users—LGWU customers, rice farmers, and tourists—in the Way Sekampung Dam Catchment Area indicate significant potential for participatory funding for forest rehabilitation activities. Table 7 presents a recapitulation of the WTP values of the three groups.

Table 7. Willingness to Pay (WTP) value for forest rehabilitation in The Way Sekampung Dam catchment area

No	Type of Use	Number of Respondents	Average WTP (IDR)	Willingness Pay (%)	Annual WTP (IDR)
1	Customers LGWU	3,771 families	7,616.95 / month	80%	265,613,508
2	Paddy Farmer	781 people	7,419.04 / season plant	72%	7,134,703
3	Tourist Visitors	1,400 people	7,464.08 / month	90%	128,265,970
	Total Potential WTP				401,014,181

Source: Primary Data (processed), 2025.

The total annual WTP value reached IDR 401,014,181, indicating that forest conservation through participatory mechanisms is economically feasible. LGWU consumers are the largest contributors, reflecting their high dependence on clean water [17]. Lowland rice farmers, although having lower WTP in aggregate, show increasing ecological awareness, especially in areas with high drought risk [26]. Meanwhile, WTP from tourist visitors is a reflection of the perception of environmental value in maintaining natural tourist attractions [27–29].

Studies in various developing countries have shown that WTP based on direct benefits from ecosystems encourages greater participation in forest conservation [30]. Therefore, the implementation of a WTP-based funding scheme in the Way Sekampung Dam area not only has the potential to reduce the government's fiscal burden but also strengthen the role of communities in sustainable watershed management.

Total Economic Value of Water Resources in the Way Sekampung Dam Catchment Area

The total economic value of water resources in the Way Sekampung Dam Catchment Area reflects the contribution of cross-sectors—households, agriculture, energy, and tourism—to water utilization and their willingness to contribute to forest conservation through the willingness to pay (WTP) mechanism. The total economic value of water resources in the Way Sekampung Dam Catchment Area and its surroundings can be seen in Table 8.

Table 8. Total Economic Value of Way Sekampung Dam Catchment Area

No	Type of Use	Economic Value (IDR)	WTP Value (IDR)	Total Economic Value (IDR)	%*)
1	LGWU	4,969,224,000	265,613,508	5,234,837,508	5.1
2	Paddy Field Farming	7,427,044,000	7,134,703	7,434,178,703	0.1
3	HPP	66,225,600,000	_	66,225,600,000	0.0
4	Tourism	240,000,000	128,265,970	368,265,970	34.8
Total		78,861,868,000	401,014,181	79,262,882,181	10.0**

Information : %*) percentage of WTP against mark total economy each sector; **) average

Source: Primary Data (processed), 2025.

Based on data recapitulation, the total annual economic value reached IDR 79.26 billion, of which IDR 401 million or around 10% came from voluntary contributions from users through WTP. This shows the potential for participatory financing in the rehabilitation and preservation of watershed ecosystems [31].

The HPP sector contributed the largest portion of the economic value, which was IDR 66.22 billion per year. However, there was no WTP value from this sector because the direct environmental service payment scheme from energy corporations had not been implemented (Arief & Setyawan, 2022). On the other hand, the LGWU customer sector showed an economic value of IDR 5.23 billion per year, with a WTP contribution reaching IDR 265.6 million. This reflects the high level of public concern for the sustainability of the clean water supply they consume every day. Research [32] confirms that the level of public awareness of the importance of clean water quality is directly proportional to their willingness to pay additional costs to support forest rehabilitation in the upstream watershed.

The tourism sector recorded an economic value of IDR 368.2 million, with the highest WTP percentage reaching 34.8%. This high participation shows that tourists not only appreciate the beauty of nature, but are also ready to be financially involved in environmental conservation. [33] stated that the success of an ecotourism program is largely determined by environmental sustainability maintained through a direct contribution scheme from visitors. In the rice farming sector, a total economic value of IDR 7.43 billion was obtained with a relatively small WTP contribution, which was only IDR 7.13 million (0.1%). This low contribution was due to the limited financial capacity of farmers, although awareness of the importance of forest rehabilitation to ensure the availability of irrigation water remains high. Studies by [23,34] show that farmers are willing to be involved in upstream watershed conservation activities if given incentives or institutional support.

In aggregate, the collaboration of these four sectors provides an illustration that the WTP-based approach can be an effective alternative source of funding in watershed conservation efforts. This is in line with the findings [35,36] which emphasize the effectiveness of the payment for environmental services (PES) approach as an incentive-based conservation strategy. Thus, the integration of economic and ecological values in the management of the Way Sekampung Dam watershed is important to support the sustainability of the ecosystem as well as the welfare of local communities.

4. CONCLUSION

This study shows that water resources in the catchment area of Way Sekampung Dam have an annual economic value of IDR 78.86 billion, dominated by the HPP sector (IDR 66.22 billion/84%), followed by agriculture (IDR 7.43 billion), LGWU (IDR 4.97 billion), and tourism (IDR 240 million). This confirms the strategic role of the dam in supporting energy security, clean water, food, and the local economy.

In addition to direct benefits, this study reveals the potential for community participatory contributions through the Willingness to Pay (WTP) approach, with a total value of IDR 401 million per year (around 10% of the economic value of water), especially from LGWU customers and tourists. However, the HPP sector has not contributed to the environmental service payment scheme.

These results emphasize the importance of implementing an integrated approach in watershed management, including the integration of economic value, ecological conservation, and public participation through schemes such as Payment for Environmental Services (PES), to support the sustainability of water supply and long-term community welfare.

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