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BENEFIT AND SUSTAINABILITY OF COMMUNITY WATER SERVICES NEARBY FOREST IN BESAI WATERSHED, LAMPUNG, INDONESIA

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Abstract: Community clean water services are critical in remote rural areas near forests because they provide necessary water for residents. This basic service is mostly organised by the Community Water Service Groups. (CWSGs). The objectives of the study are to investigate (1) the benefits to local communities from this service and (2) the sustainability of this service. The study used a survey method involving 100 family respondents from 4 CWSGs. This study was carried out in the Besai Watershed, West Lampung, Indonesia. Objective 1 was measured by counting the volume of water received daily, service charges, and consumer surpluses. Objective 2 was analysed by measuring 5 aspects of sustainability, namely: (1) institutional, (2) financial, (3) participation, (4) technical, and (5) environmental aspects. The study suggests that families received 2545 *l* per day of water, while the average consumption of water per family was 771 *l* per day. Therefore, a surplus of 1,700 l per day was obtained by the family. The fee for water ranged from IDR80,000 to IDR100,000 annually per family, suggesting hefty surpluses gained by the community. The study concluded that 5 aspects of sustainability are perceived very positively by members suggesting that the water services are sustainable.

Keywords: water services, sustainability, benefits.

Introduction

Forest areas are areas that have various benefits for the environment, such as environmental services to humans, local communities and the wider community (Pilli & Pase, 2018). Forest areas provide hydrological functions, such as water supply, water purification, and water supply control for the surrounding area or watershed (Santos *et al*., 2014). Forest areas are also biodiversity hotspots and participate in the global carbon cycle, climate patterns, national incomes, and the livelihoods of millions of people around the world. (Oldekop *et al*., 2020)

The provision of water from forest areas to surrounding communities makes the forest area vital for the lives of the surrounding community. This function is very helpful to people living around the forest, as described by the research of Abidin *et al*. (2017) in Eswaran Regency, Lampung. The role and function of clean water for communities around forest areas is an important factor for preserving forest areas because water plays a role in forest conservation efforts and represents a basic need for humans and the community. Therefore, springs in forest areas should be protected from damage. Moreover, interrelations are observed among forests, land use, and water quality (Shepherd, 2017).

Affordable and quality clean water and environmental cleanliness are important goals for development in Indonesia following Goal No. 6 of the Sustainable Development Goals (SDGs). The description in Goal 6 states that water and sanitation affect 40% of the world's population because the world is getting warmer, and although a 20% increase in sanitation conditions has been observed, the condition of clean water is still inadequate. One in 4 people in the world experiences problems with limited water (UNDP Indonesia, 2023). Meeting the need for clean water for all Indonesian people will come at a very high cost. To date, only 72.5% of Indonesia's clean water needs have been met, which is still far below the SDG target of 100%.

Law No. 23 of 2014 concerning the regional government stated that government affairs that are basic in nature are mandatory, including the provision of affordable and healthy clean water.

Various efforts have been made to develop the PAMSIMAS 'programme (Community-Based Drinking Water Supply) by the Ministry of PUPR; however, these efforts have not been able to overcome the gap associated with the real needs of the Indonesian people, both in urban and rural areas. The impact of the COVID-19 pandemic on the water and sanitation sector includes the reduced consumption of non-household users due to the decline in economic activity. In addition, the government's ability to conduct the construction of clean water facilities is constrained by its efforts to address the COVID-19 issues. (Purwanto, 2020).

The issue of sustainability of clean water service near forest areas is very important. Sustainability means the ability of a system to overcome internal and external shocks (Conway & Barbier, 1990) and to ensure that the benefits should not only be for today's generation, but also future generations as stated by the Brundtland Report (WCED, 1987). These two issues are particularly challenging as the population in the study area is increasing that creates more pressure on the forests nearby.

The Besai watershed has an area of approximately 44,700 ha and covers 5 subdistricts, with most of them located in the West Lampung Regency. Various models have been developed for clean water services, including (a) a purely community-based model, (2) a model managed by the local government-owned company for water services (PDAM), (3) a model supported by the PAMSIMAS 'programme, and (4) an individually developed model (Abidin, 2011). This service was developed because of the spring located in a protected forest, namely, Register 45, West Lampung, and it is estimated to benefit more than 8000 households living near the protected forest. This model helps many poor families in obtaining clean water daily.

In Indonesia, research on community-based water services dominantly focuses on government ' programme's, namely PAMSIMAS ('programme Air Minum dan Sanitasi Masyarakat) funded by GOI. After being developed, this facility was then handed over to the community as studied by (Herlinda *et al*., 2020) in Riau Province, and (Istiyani & Shohibudin, 2021) in Central Java Province. In other developing nations, such as Africa, a study on community-based water service is different where water shortages are the main issue due to drought. However, the sustainability of such service is also a serious concern as suggested by Kativhu *et al*. (2021) in Zimbabwe, Africa. This model is unique in several aspects (1) this facility is developed and organised by CBO of communities residing near the forest, (2) the service charge for water is set by the community through community meetings, and (3) it also involves community forest in maintaining water resource up in the forest. Hence, the study of this model is novel and strengthens Ostrom's argument about the importance of the local community in determining local resources in terms of managing and pricing of common resource pool.

This study aims to analyse the benefits of clean water services to the recipient community, especially to communities with self-help management.

Methodology

Study site

This research was carried out in the Besai Watershed system of Lampung Barat District, approximately 160 km away from Bandar Lampung City, the capital city of Lampung Province. The Besai watershed area covers 5 subdistricts, namely, Sumber Jaya, Kebun Tebu, Gedung Surian, Air Hitam, and Way Tenong subdistricts. The study focuses on 3 villages in the Air Hitam Subdistrict and 1 village in the Gedung Surian Subdistrict.

The study area is a mountainous area with an altitude between 800 and 1500 meters above

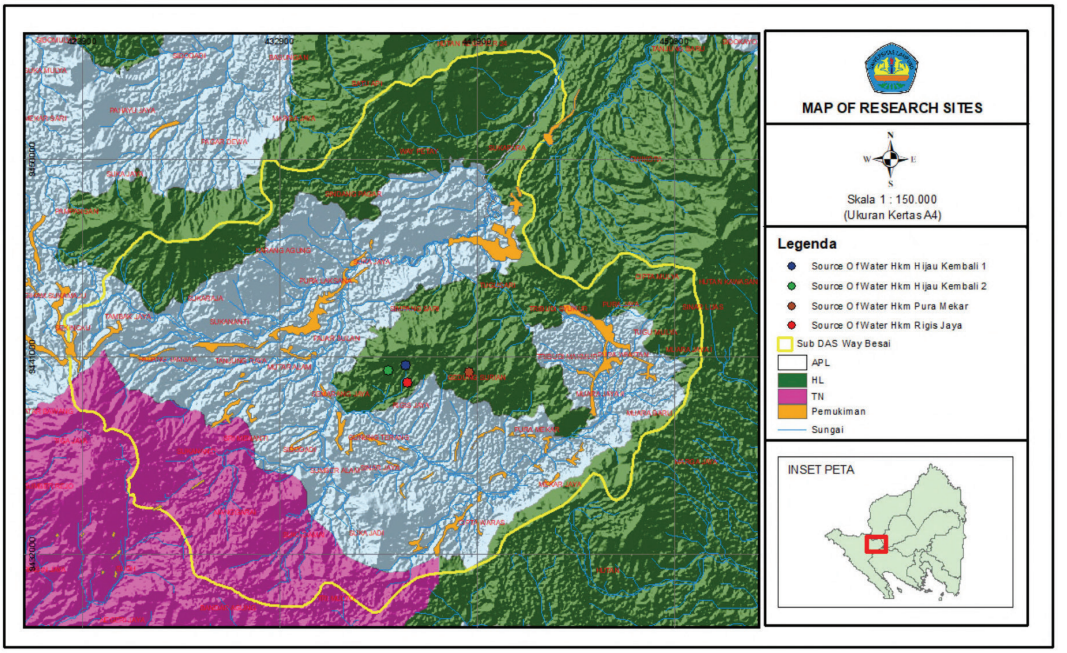

Figure 1: Area of research site

sea level; thus, the air is temperate, and the landscape is hilly. Coffee-based agroecosystems are the dominant agroecosystems, and they may have a monoculture pattern or an agroforestry pattern.

The Besai Watershed has been a long-term research area for researchers from CIFOR, Brawidjaya University, Lampung University, and several other universities from Indonesia and abroad from the 1980s-1990s to early 2000. Some of the major outputs of research in this area are the introduction of the concept of social forestry, which culminates in the emergence of government policies to overcome the problem of the large number of people who have made protected forest areas a place to live and do business. The concept of community forestry developed into and was finally known as social forestry.

The development of environmental services as a poverty alleviation strategy was also introduced in the study area by ICRAF researchers in the PES (payment for environmental services) concept (Suyanto *et al*., 2007). An agroforestry model was also developed by ICRAF researchers in conjunction with a multi-story model with coffee trees (van Noordwijk *et al*., 2004). Water resources have been investigated by several researchers, such as Maryanto *et al*. (2014), who calculated the supply and demand of water resources in Way Besai. Researchers from the World Agroforestry Centre studied the relationship between rainfall and land use (van Noordwijk *et al*., 2017). Few studies have been carried out by the community on the use of drinking water services as indicated by the reports summarised by Abidin (2013). Thus, this research is an effort to strengthen the scientific data on the use of clean water services with a model managed by the community.

Respondents

The study site includes 4 community water services groups from 3 villages and 2 subdistricts. The population of all community that received water services were estimated at 8000 families. The respondent is a family who has received water services from CWSGs, and the sample size is determined using the (Isaac & Michael, 1995) approach as follows:

$$n = \frac{NZ^2\sigma^2}{Nu^2 + Z^2\sigma^2} \quad (1)$$

where:
N: population of the community that received water service = 8000
n: expected sample size
Z: *Z* distribution at 95% = 1.96
σ: standard deviation with default at 0.25
u error at 5% = 0.05

Using the above values, the sample size was 95 respondents and rounded to 100. Respondents were selected using random sampling and were distributed equally to 4 CWSGs of which each CWSG was allocated 25 respondents. Since all respondents are families who similarly received water service, we then assumed that all respondents represented the population. The sample is distributed into in 4 CWSGs, as presented in Table 1.

In addition, the study interviewed CWSG organisers and performed focus group discussions. FGDs represent a tool for understanding the CWSG organisation, management, challenges, and how they overcome challenges.

Analysis

In this research, a descriptive qualitative analysis is performed in the form of narrative observations, group discussions, data tabulation and results interpretation. According to (Kim *et al.,* 2017), the characteristics of qualitative descriptive analysis are as follows: (1) derived from a natural perspective and the phenomenon as it is, (2) less theoretical than other qualitative research, (3) data collection occurs in semi-structured interviews and focused on individuals and certain groups, (4) purposive sampling is performed by testing the maximum variation to obtain more in-depth information, (5) quantitative descriptions may be used to explain the condition of the sample, and (6) study findings are described directly and presented properly so that they can be accepted by the reader.

To complete the analysis, this study tested the validity and reliability of the respondents' attitudes to questions assessing the sustainability of clean water service management. The validity test assesses whether the measuring instrument used is consistent with what will be measured (Teherdoost, 2016), while the reliability test assesses whether the respondents' answers or measuring instruments used in this research are consistent, stable, and repeatable (Seltiz *et al.,* 1976). Cronbach alpha is used to measure the reliability or consistency of each item/question (Tavakol & Dennick, 2011). Test of validity and reliability are important to ensure the trustworthiness of the research results (Golafshani, 2003).

Validity and reliability tests were carried out in other groups that had the same socio-economic characteristics, namely, the Air Putih Group, Tanjung Raya Village, of Way Tenong District. The test was carried out by interviewing 30 respondents, and the questions used sustainability indicators as suggested by Andini, 2011; Li *et al*., 2019.

This study analyses the attitude of the community toward the performance of management based on sustainability aspects adapted from (Aslam, 2013), i.e.: (1) institutional,

Table 1: Study sites and respondents

Sub-districts	Village	CWSG	Respondents
Air Hitam	Gunung Terang	Wana Tirta	25
	Sinar Jaya	Jaga Tirta	25
	Rigis Jaya	Tirta Kecana	25
Gedung Surian	Pura Mekar	Tirta Wacana	25
Total			100

(2) financial, (3) participation, (4) technical, and (5) environmental aspects. From these 5 aspects, 20 questions were compiled to assess the attitudes of the community toward sustainability performance. People's attitudes were measured using a Likert scale from 1 to 4, namely, 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree. Respondents for the validity and reliability test were in CWSG Air Putih, which was in a different village from the study target group. Test validity was used to determine whether the questions in the test suggested we valid. The findings showed that 14 questions were valid while 6 questions were not; hence, these 6 questions were removed from the questionnaire (Table 2).

Table 2: Validity and reliability test on community perceptions of institutional sustainability of water services

Questions	r	CA
A. Institutional aspect		
1. Do you agree that community water service (CWSG) is needed?	.818 (v)	.866 (r)
2. Do you agree that CWSG has done their job?	.735 (v)	.869 (r)
3. Do you agree CWSG has set rules?	.373 (v)	.884 (r)
4. Do you agree that you have been informed about CWSG activities?	.302 (nv)	.887 (r)
B. Financial aspect		
1. Do you agree that the service fee is mandatory?	.091 (nv)	.887 (r)
2. Do you agree that the water service fee is suitable for members?	.745 (v)	.872 (r)
3. Do you agree that the CWSG's financial status is transparent to members?	.625 (v)	.875 (r)
4. Do you agree the members have complied with the service fee payment?	.694 (v)	.874 (r)
5. Do you agree that the service fee is an incentive for organisers?	.756 (v)	.871 (r)
6. Do you agree that the organiser has managed the financials well?	.389 (v)	.880 (r)
C. Members' participation aspect		
1. Do you agree that all members have participated in working together?	.572 (v)	.877 (r)
2. Do you agree that water infrastructure is maintained by members?	.343 (nv)	.881 (r)
3. Do you agree there should be sanctions for those who have not participated?	.768 (v)	.865 (r)
D. Technical aspect		
1. Do you agree that local NGOs have trained organisers?	.363 (nv)	.882 (r)
2. Do you agree that the organiser has sufficient technical skills?	.571 (v)	.876 (r)
3. Do you agree that the organiser should be trained by the government?	.673 (v)	.870 (r)
E. Environmental aspect		
1. Do you agree that forests are important for water resources?	c (nv)	c
2. Do you agree that the water resources will be maintained together?	.496 (v)	.878 (r)
3. Do you agree that the water resources are in good condition?	.872 (v)	.868 (r)
4. Do you agree that the community has conserved water resources?	.288 (nv)	.882 (r)

Note: v= valid; nv = not valid if r < 0.367; CR = Cronbach's alpha; r (dependable) if CA is >0.5; c = constant.

The steps of the study are summarised in Figure 2.

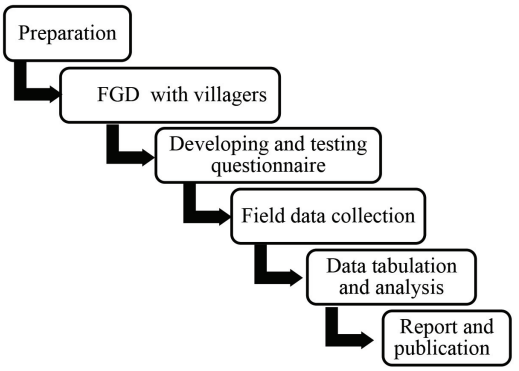

Figure 2: Steps of undertaking the study

Results and Discussion

Characteristic of Respondent

The characteristics of the respondents were arranged to reveal the background of the respondents in terms of age, education, family size, and ethnicity. The benefit of describing the characteristics of the respondents is to provide a more detailed understanding of the characteristics of the community in the research location. The characteristics of the respondents are described in Table 3.

In terms of education, the community receiving clean water had good results because most residents have attended senior high school, which is quite different from the general population of the village, where the majority of the population have attended elementary school. It seems that there has been a transition in the level of education at the study sites. In terms of age, the majority are middle-aged, while only a few are old or very young. In terms of ethnicity, the majority are Javanese who came to the study area in the 1980s-1990s to cultivate land in the protected forest area.

In terms of the number of family members, the majority have small families of less than 3. This finding differs from the general

Table 3: Characteristics of the respondent

Characteristic	Wana Tirta	Tirta Kencana	Tirta Wacana	Jaga Tirta
A. Age (year)				
< 35	2 (8)	3 (12)	6 (24)	5 (20)
35-50	16 (64)	15 (60)	11 (44)	14 (56)
> 50	7 (28)	7 (28)	8 (32)	6 (24)
B. Education				
Elementary school	8 (32)	10 (40)	9 (36)	8 (32)
Junior High Sch	4 (16)	6 (24)	7 (28)	4 (16)
Senior High Sch	13 (52)	9 (36)	8 (32)	12 (48)
University	0 (0)	0 (0)	1 (4)	0 (0)
C. Ethnicity				
Java	18 (72)	23 (92)	5 (20)	10 (40)
Semendo	5 (20)	0 (0)	18 (72)	13 (52)
Sunda	2 (8)	2 (8)	1 (4)	1 (4)
Palembang	0 (0)	0 (0)	1 (4)	1 (4)
D. Farm members (person)				
< 3	9 (36)	18 (72)	14 (56)	16 (64)
3-5	15 (60)	7 (28)	11 (44)	9 (36)
> 5	1 (4)	0 (0)	0 (0)	0 (0)

Note: number in () is the percentage of each CWSG

characteristics of families in Indonesia, where the number of family members is generally large.

Water Service Scheme and Governance

Community-based clean water services have existed since the 1990s. The water supply uses the gravity model, in which water flows from higher areas to lower areas. In the 1990s, some settlers occupied the study area in a fragmented settlement pattern in small groups of 4-5 families. Bamboo is used to drain water because bamboo trees are available in the protected forest areas around them while PVC pipes were difficult to obtain and must be bought in the city. At that time, the location of the study site was difficult to reach by public transportation, particularly the hamlet location around the protected forest area.

The services were initiated by neighbouring communities working together to create clean water networks using bamboo that served small communities. The community built a kind of small dam in a water source located on a hill. The use of bamboo is less efficient than PVC because it often breaks and leaks and thus needs continuous maintenance.

Along with the improvement of regional infrastructure in the early 2000s with asphalt roads, the economy increased and building material shops developed in Sinarjaya Village to serve Gunung Terang and Rigis Jaya villages and Pura Mekar market to serve the needs of the people in the Gedung Surian District. Emerging markets include building material stores, which have provided access to PVC pipes; thus, in 2000, bamboo pipes were replaced with PVC. The use of PVC pipes is more efficient, and the clean water network can be extended to village settlements. Thus, these services have reached an increasing number of households in the village centre.

Water governance is a set of social relationships or systems that determine who obtains water services, as well as when and how these services are provided. Therefore, good governance is very important in improving water access and hygiene (Karlsson, 2021).

The governance of clean water services involves 3 organisations at the local level, namely, the CWSG, the community forest group, and the village government. The functions of each of these institutions are listed as follows.

(1) The community forest group is the holder of community forest management rights, which includes the management of environmental services, such as clean water. The word "management" relates to utilising resources, developing businesses, and ensuring conservation. Forest management, which is the mandate of the HKm group, also involves the participation of HKm members. For this role, HKm receives a service fee from CWSG with a value varying from IDR 500,000 to IDR 600,000 per year.

(2) CWSG functions to manage water from springs to community/household consumers in the village. Managing water includes making or repairing tamping tanks, maintaining and repairing pipes, providing explanations to members, collecting water service fees, initiating cooperation and network repairs in case of serious damage, managing money, preparing activity plans, and cooperating with village governments and community forest groups. Group administrators are selected by members based on the deliberation method, namely, local figures that are trusted by the residents. The management also commits to work voluntarily because the incentives from member fees are not a lot.

(3) The village government serves as a coordinator and protector of several CWSGs. The role of the village is very important when there are serious problems in the clean water network that the CWSG cannot solve. For this role, the village receives a fee from the CWSG of IDR 100,000.00 per year. The cooperation scheme is presented in the following figure.

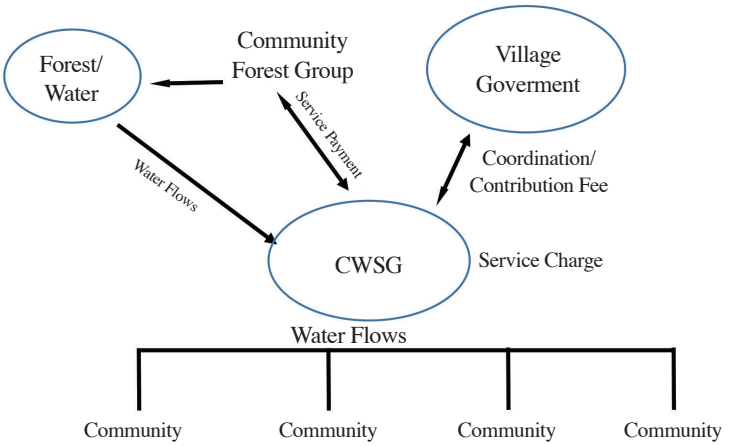

Figure 3: Schematic diagram of community water service

Benefits of Community Clean Water Services

The benefits of water services are very broad and include all direct and indirect benefits enjoyed by users, consumers, and the public. However, in this study, the benefits are limited to the (1) water supply received by the community, (2) water consumption, and (3) price of water services set by the community.

(1) The water supply flows to community houses daily without stopping all year round. Within a house, the community allows water to flow with no equipment to control water. Although water discharge per m^3 is not so high, the supply per day always exceeds the family's needs.

(2) In terms of water consumption, the above table suggests that all four CWSGs obtain more clean water than they consume daily. The surplus ranges from less than 1 m^3 per day to more than 2 m^3 per day. However, most of the surplus water supply is not used for other purposes. Only 7% take advantage of the excess water by building fishponds that are approximately 4x6 m and have a depth of 0.8 cm. The reasons for not utilising excess water in the form of fishponds are that (1) investment is required, (2) sufficient time needed is not available, and (3) whether the results are worth the cost is not clear. Regent Decree No B 351/

Table 4: Supply and consumption of water for families

CWSG	Supply (m^3/day/family)				Consumption (m^3/day/family)				Surplus
	Mean	Min	Max	Std	Mean	Min	Max	Std	m^3/day/family
Wana Tirta	1.7	1.0	3.2	0.6	0.9	0.4	1.4	0.3	0.8
Tirta Kecana	2.1	1.0	8.1	2.6	0.7	0.8	1.3	0.2	1.4
Tirta Wacana	2.9	1.1	8.6	2.1	0.6	0.4	1.1	0.2	2.3
Jaga Tirta	2.6	1.0	6.8	1.9	0.7	0.4	1.2	0.2	1.9
Total	2.5	1	8.6	1.9	0.7	0.4	1.4	0.3	1.8

Note: According to the Department Permukiman dan Prasarana Wilayah (2002), the minimum requirement for water consumption per day for rural communities is 60-100 l/capita/day or approximately 0.3-0.5 m3/family/day with the assumption that one family consists of 5 people.

KPTS/04/2019 stated that the price of water for households managed by the Regional Water Owned Company, PDAM Limau Kunci, is IDR 1,008/m3. When referring to this price, the value of water received by the community ranges from IDR 1,736 to IDR 2,963 per day per family or from IDR 625,464 to IDR 1,066,968 per year per family. Meanwhile, people pay an average of only IDR 100,000 per year. Thus, there is a consumer surplus of between IDR 525,464 and IDR 906,697 per family per year. The table above also indicates that the average water consumption of the people in the Way Besai watershed is above the minimum water requirement of Indonesia. The lowest consumption was 0.4 m^3 per day, and the highest was 1.4 m^3 per day.

(3) The price of clean water services is determined after deliberation by group members. Deliberations are generally held in December every year. By involving members of clean water service recipients, village governments, and community forest groups. This deliberation model is the model mentioned in Ostrom's argument against Hardin's "The Tragedy of the Common" model in terms of natural resource issues. Ostrom uses the term common resource pool. The CGIAR Institute cites Ostrom's argument that natural resources are better managed if the beneficiaries are those who are close to the natural resources. Decisions and policies of local communities, farmers, village governments, and NGOs. For these natural resources, the bottom-up approach was appropriate (CGIAR, 2021). The clean water service development scheme at the study site is a model identified by Ostrom as resource pool management.

Policies on prices, clean water service governance, routine problems, participation, technical aspects, and bottom-up policies are discussed in group and stakeholder meetings. The determination of the price of IDR 100,000 per year was agreed upon by considering the coffee harvest, other crop harvests, and the economic conditions of the members. Funds for clean water services are allocated by the management for (1) honorarium for the management consisting of the chairman, treasurer, and water supervisor locally named *ili-ili* in each distribution tank, (2) services to community forest managers and village government, and (3) tactical funds to address minor damage. After the management services are agreed upon, then the group members pay in cash in December or January. Payment compliance rates are generally above 90% or better.

The above discussion indicates that (1) the community-based water service has served the community well for years, (2) water surpluses have not been utilised optimally by the community, and (3) the service shows how the community benefits from its resources using a bottom-up model and by collaborating closely with community forestry and village government.

Community's Attitude Toward the Sustainability of the Water Service

Overall, the community feels very strongly that the institution of water services is sustainable because the majority strongly agree that the need for water is essential to the survival of the community. This statement provides a strong basis for the sustainability of institutions. Respondents strongly agree that clean water management agency has conducted its work well. There are only very few who think that the CWSG management has not worked as expected. In addition, the respondents strongly agree that the CWSG already has rules. From these results, CWSG has strong institutional indicators for its sustainability because (1) the institution is needed, (2) it has done a good job, and (3) it already has regulations. The institution is an important aspect of ensuring the sustainability of community-based clean water services. This finding is consistent with a clean water study in Sudan (Ibrahim, 2017).

Table 5: The attitude of the community to questions on institution sustainability

Statement	Respond (%)			
	SA	A	D	SD
A. Institutional Aspect				
1. Do you agree that the community water service (CWSG) is needed?	86	14	0	0
2. Do you agree that the CWSG has done their job?	66	31	3	0
3. Do you agree that the CWSG has set rules?	69	29	2	0
B. Financial Aspect				
1. Do you agree that the water service fee is suitable for members?	81	19	0	0
2. Do you agree that the CWSG's financial status is transparent to members?	69	28	2	1
3. Do you agree that the members have complied with the service fee payment?	75	25	0	0
4. Do you agree that the service fee is an incentive for organisers?	81	19	0	0
5. Do you agree that the organiser has managed the financials well?	69	29	2	0
C. Members' Participation Aspect				
1. Do you agree that all members have participated and worked together?	59	39	1	1
2. Do you agree there should be sanctions for those who do not participate?	43	39	15	3
D. Technical Aspect				
1. Do you agree that the organiser has sufficient technical skills?	75	25	0	0
2. Do you agree that the organiser should be trained by the government?	70	23	6	1
E. Environmental Aspect				
1. Do you agree that water resources should be maintained together?	85	15	0	0
2. Do you agree that the water resources are in good condition?	83	15	2	0

Note: SA = strongly agree; A= agree; D = disagree; SD = strongly disagree

Another key element for sustainability is community participation. According to Hove *et al*., (2019), community participation in clean water management in South Africa is very important and has been carried out since the country was established. By using the participatory action research (PAC) method, they found that the participation and involvement of stakeholders are very important in ensuring the success of sustainable water and sanitation management. Table 4 suggests that there is strong agreement on the need for sanctions to enhance participation. However, approximately 1 out of 5 disagreed about applying sanctions for those who did not participate in community water services.

In terms of member participation, the attitude of the community is more "critical" compared to the previous assessment. The community saw that several community members were less participatory in clean water management activities.

From the technical aspect, the majority strongly agrees that management has the technical capabilities in implementing clean water management. The majority also stated that there is a need for training from the government in clean water management. To date, there has been no training provided by the government for clean water administrators.

From the environmental aspect, the majority strongly agree that the condition of water sources needs to be preserved. Additionally, majority of members strongly agreed that the condition of the water sources is good. In summary, the CWSG has high sustainability indicators because the community's attitude is very positive in assessing the performance of management according to the 5 aspects of sustainability.

On Java Island, community-based water services face challenges in sustainability, mostly due to the high operational costs, technical difficulties, water sources (during the dry season), and institutional limitations, such as a lack of participation and awareness of the community (Andini, 2011; Widhiyastuti *et al.,* 2017).

In addition, some challenges remain: Water services depend on the condition of the forest managed by the community forestry group. Such services can disrupt the sustainability of the system if cooperation with forest groups is not conducted properly. Problems often arise in areas that can be freely accessed by the public, and such areas are rapidly degrading, which is known as the tragedy of the commons (Hardin, 1968). Thus, forest and land degradation occur when common areas do not have good management. The technical issue that must be addressed is how the excess water can be used by the community. Although the development of fishponds represents a good strategy, such projects are still underutilised. Thus, the efficiency of water use is still low. The lack of government financial and technical support makes the service underdeveloped.

Conclusion

Communities have gained huge benefits from community water services, as shown by the fact that they obtain water daily and obtain consumer surplus. The community benefits are even greater because the charge for the service is very low, and a surplus is provided for the community. Institutionally, this service has shown strong support from the community and hence is sustainable. However, some challenges remain, such as potential forest degradation, because the population pressure is high and job opportunities are few. In addition, government support is lacking, and formal training and aid has not been provided for the CWSG.

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