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Evaluation of Community-Based Drinking Water Supply System Management in Ladogahar Village Sikka District East Nusa Tenggara

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Abstract
The Ladogahar Village Government established a Village Drinking Water Supply System (DWSS) to meet the water needs of its people. The Village Government gives responsibility to the community to manage the Village DWSS. Each hamlet has a person in charge of DWSS management. The clean water supply system in Ladogahar Village has several problems. One of them is that the existing community-based DWSS management has experienced a decline in performance in terms of technical, institutional, financial, and social aspects, so that water distribution is not optimal. Therefore, this study aims to evaluate Ladogahar DWSS so that problems with the it can be identified, assess the level of sustainability of DWSS management, and compile priority development factors so that village DWSS becomes more optimal. The method used in this study is to evaluate existing conditions and analyze community and stakeholder perceptions of the sustainability of village DWSS management. To determine the level of Drinking Water Supply System sustainability using the index formula, for important factors in DWSS sustainability using the Relative Importance Index (RII) and Confidence Interval (CI) tests, while compiling priority factors for DWSS development using the Development Priority Index (IPP). The results of the assessment of the sustainability of community-based DWSS management reviewed from technical, institutional, financial, and environmental aspects show sustainable results, while the social aspect shows sustainable results. Priority factors for development in community-based drinking water supply system management are the continuity of water received, the addition of public taps, manager performance, availability of raw water, service coverage, regularity of payment of fees, and quantity of water received. To create sustainable drinking water supply system management, various improvements and developments of DWSS are needed both from technical aspects (raw water units, distribution units, service units, quantity, continuity) and institutional aspects (institutions and finances).
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1. Introduction

The process of implementing community-based Drinking Water Supply System in Ladogahar Village is an activity that involves the community in every stage of its implementation. Starting from the preparation stage, planning stage, implementation stage, and management stage. After the construction implementation process is complete, the drinking water supply system assets that were built are handed over to the community to be managed. In this case, the community is tasked with maintaining the sustainability of drinking water supply system management, where the community itself plays a role in managing the Ladogahar Village drinking water supply system . The Ladogahar Village drinking water supply system consists of technical and non-technical aspects. Technical aspects include raw water units, distribution units and service units without water treatment processes. Meanwhile, non-technical aspects consist of institutional aspects, financial aspects, social aspects and environmental aspects.

The provision of clean water covers every hamlet of this village. Management carried out by the community is

prioritized in the process of implementing drinking water supply system management, where each hamlet has its own management. Management of clean water supply for the needs of the Ladogahar Village community has several quite complex problems. Management of clean water supply is still not carried out optimally, both from technical and non-technical aspects. In non-technical terms, especially in institutional aspects, clean water management in the two hamlets of this village, namely Dota hamlet and Rotat hamlet, only involves coordination with the officers in charge. Meanwhile, Natawulu hamlet already has structural and organized management. Every month the people of Natawulu hamlet pay a water fee of IDR 40,000. Some Natawulu hamlet residents complained about the fees. They feel that the fees set are quite large and they have difficulty paying them. Apart from problems in managing clean water supply in the institutional aspect, there are also problems in the technical aspect of water supply. People often complain that the water they get is not sufficient for their community's water needs. Apart from that, people also often complain about the quality of the water. The water obtained is not clear and looks cloudy. Based on interviews with village officials, clean water quality testing has never been carried out for the four water sources used by the community, either from the relevant agencies or other parties. The water sources used to meet community needs are several springs located around the village and the distribution of clean water has been going on for 24 hours. However, water services are not optimal because water distribution still uses public taps. Public faucets are available in several locations around residents' homes. The distance between residents' houses and public faucets ranges from 10 m to 500 m. So the community must provide containers and means of transportation to take water from public taps to their homes (Ladogahar Village Government, 2023). A public faucet is a means of clean water or drinking water that is made with a reservoir and a water intake faucet. Public faucets can be installed as a group service unit with water sources from springs that are channelled by gravity or from groundwater that is taken using a pump (Atang Sarbini, 2014). To meet the shortage of water needs, people are forced to buy tank water from private parties. Based on the various drinking water supply system problems in Ladogahar Village, it is necessary to evaluate the management of the clean water supply system in Ladogahar Village.

Studies on the management of clean water supply systems have been carried out in several studies in different areas. One of them is research regarding the Evaluation of Community-Based DWSS in Manyar District, Gresik Regency (Pitaloka and Marsono, 2020). Evaluation includes technical and non-technical aspects. Evaluation is carried out using scoring and weighting methods to assess and analyze existing conditions against a standard. This can provide recommendations to improve drinking water supply system performance to a more optimal level. Therefore, reflecting on the various existing drinking water supply system problems, this research aims to evaluate the Ladogahar Village drinking water supply system so that the problems with the drinking water supply system can be identified, assess the level of sustainability of drinking water supply system management, and develop priority development factors so that the Ladogahar Village drinking water supply system can be improved and improved to be more optimal.

2. Method

2.1 Type of Research

The type of research used in this research is evaluative and descriptive research. Evaluative research is used to determine the suitability of existing conditions with sustainability evaluation criteria, while descriptive research is used to determine the level of sustainability of management, determine important factors in sustainable management and develop development priorities.

2.2 Research Variables

The variables used in this research include the independent variable, namely drinking water supply system Ladogahar Village. Meanwhile, the related variables are evaluation aspects contained in statutory regulations, especially attachment IX of Minister of PUPR Regulation Number 27 of 2016 concerning evaluation standard documents with factors contained in research on the sustainability of drinking water supply systems in literature studies, including: technical, institutional , financial, social and environmental.

2.3 Data Analysis Techniques

2.3.1 Evaluation Analysis Of Existing Drinking Water Supply System Conditions

Evaluation is carried out by calculating existing conditions and observing whether drinking water supply system complies with statutory regulatory criteria.

2.3.2 Drinking Water Supply System Sustainability Level Analysis

The analysis of the level of sustainability comes from respondents' perceptions of the current state of sustainability of drinking water supply system management. The measurement scale used to measure attitudes, opinions and perceptions of a person or group of people regarding social phenomena is the Likert scale (Sugiyono, 2012). In this research, the scoring of answers uses a rating scale of 1 to 5.

2.3.3 Analysis of Important Factors in Sustainable Drinking Water Supply System Management

Analysis of important factors in the sustainability of drinking water supply system management using the Relative Importance Index test, this method is carried out by giving questionnaires to respondents with assessment variables in the form of factors for the sustainability of community-based drinking water supply system management that have been compiled.

Apart from using the RII test to obtain a sequence of important factors in the sustainability of drinking water supply system management. So a Confidence Interval test was carried out to support the research data and strengthen the ranking results obtained from the RII test. Confidence Interval is an interval based on sample observations and listed specified probabilities (Kamulyan, 2017).

2.3.4 Development Priority Analysis

Development priority analysis is a method of prioritizing factors that need to be developed so that these factors increase their sustainability. This analysis uses data from the analysis of the level of sustainability and analysis of important factors in the sustainability of drinking water supply system management (Wijayanto, 2014).

3. Results And Discussion

3.1 Evaluation of the Existing Condition of Drinking Water Supply Systems

3.1.1 Technical Aspects

- Raw Water Unit

Based on government regulation no. 122 of 2015 concerning Drinking Water Supply Systems. The ideal condition for raw water units must be equipped with facilities and infrastructure for collecting and/or providing raw water, including water storage buildings, intake/broncaptering buildings, measuring tools and monitoring equipment, and/or carrying facilities and equipment. Pipe accessories in the drinking water raw water transmission system include air release valves, pressure relief valves, wash-out valves, air ventilation valves (NUWSP, 2022).

For the three raw water units in Ladogahar village, there are water storage buildings and water intake/tapping buildings, the tanks are in good condition and can operate. Twice a year the community and Drinking Water Supply System management organizers carry out tank draining activities to maintain the quality of the water obtained. The discharge measurement equipment, pressure relief valve and air release valve are now damaged, while the drain valve and air ventilation valve are in good condition and can be used. Apart from the condition of infrastructure, the condition of existing springs also often experiences a decrease in discharge during the dry season. This is characterized by a decrease in the quantity of water obtained during the dry season. One of the things that influences the decline in discharge is because the trees around the springs are often cut down by local people so that the water catchment area is increasingly reduced. Apart from that, there is no drinking water treatment plant. Water from the spring is directly distributed to the reservoir.

- Distribution Unit

the distribution unit in community-based drinking water supply system consists of a reservoir and a pipe distribution network. the type of reservoir used in community-based drinking water supply system is ground reservoir. field observations showed that there were two drinking water supply system location units that experienced reservoir leaks and were unable to operate. to evaluate the drinking water supply system distribution network, it can be calculated by comparing the existing reservoir capacity with the calculated capacity.

Water from the source is channelled through a 2" transmission pipe with types of GIP and PE. For the distribution network, water from the reservoir is channelled through a 1 ½" GIP pipe to the public tap. The advantage of using GIP type pipes is their very high strength. Meanwhile, the advantages of using PE type pipes are that they are strong, leak resistant, flexible, high pressure resistant, corrosion resistant & easy to maintain. Determination of transmission and distribution pipeline routes is generally determined by following highway routes and choosing safe routes that do not require a lot of equipment. The drainage type uses a gravity system.

This method is appropriate, considering the topographic conditions at the source location and the relatively steep location of the reservoir. Good distribution piping has sturdy supports and is equipped with distribution master meters, air valves (NUWSP, 2022). However, the main pipe in Ladogahar village does not have a main distribution meter so it is not possible to know the amount of discharge and pressure in the pipe. The pipe is in good condition and can operate. However, most of the distribution network pipes are not planted and do not follow the standards of the Director General of Human Settlements, namely being installed in the ground to a depth of 80 cm, so that distribution pipes often experience damage. Based on field surveys and interviews with Village Government officials, several distribution pipes experienced narrowing due to calcification of the pipe walls.

- Service Unit

Ladogahar village's drinking water supply system, water distribution still uses public taps. Public faucets are located 5 to 20 meters from residents' houses. Water distribution is carried out for 24 hours. However, most of the public faucets are damaged and cannot operate. This requires the community to provide water storage containers and collect the water at the nearest public tap location. So that people cannot fulfill their needs optimally at all times.

- Evaluation of Fulfilment of 3K Elements

Evaluation of the fulfilment of the 3K elements consists of (1) the quality of the water received is colourless/clear, odourless and tasteless. The water obtained must be in accordance with Minister of Health Regulation No.492/MENKES/PER/ IV/2010, concerning drinking water quality requirements (2) The quantity of water received by users meets basic drinking water needs based on the criteria of Minister of Public Works Decree 14/2010, namely 60 Liters per people per day and (3) Based on Ministerial Decree 27/2016, water continuity guarantees water flow for 24 (twenty four) hours per day. The evaluation results show that the Ladogahar Village drinking water supply system unit for Natawulu hamlet drinking water supply system water quantity has met the applicable regulations, namely 60 Liters per person per day. where the availability of raw water in Natawulu hamlet is 1.5 l/second and the water requirement is 0.3 l/second with basic needs of 60 Liters per person per day. however, for drinking water supply system Rotat hamlet and Dota hamlet, the quantity of water received by users does not meet their water needs. where the available water discharge is smaller than the water requirement. for Dota hamlet drinking water supply system, the water availability is 0.1 l/second, while the water requirement calculated as a basic need of 60 liters per person per day is 0.13 l/second. for the Rotat hamlet drinking water supply system, the water availability is 0.2 l/second, while the water requirement with a basic need calculation of 60 Liters per person per day is 0.5 l/second. the water quality received by drinking water supply system users meets the water quality. requirements. Where the water received is of good quality, where the water is colourless/clear, odourless and tasteless. The results of the Sikka District Health Service Laboratory water quality test (2024) show that the quality of the three springs in Ladogahar village meets the requirements for drinking water regulations in accordance with Minister of Health Regulation No. 492/MENKES/PER/ IV/2010, concerning drinking water quality requirements. For continuity, Drinking Water Supply System, water is sufficient, water is distributed for 24 hours. However, the distribution system still uses public taps so that people cannot meet their water needs at any time. Where, to meet their water needs, people must take water using storage containers to the nearest operational public tap location.

3.1.2 Institutional and Financial Aspects

the type of community-based drinking water supply system management in Ladogahar village is management by community groups. managers can be said to be functional if they can carry out roles in management, administration, operations, maintenance and repair of clean water infrastructure (Whaley, 2017). examined from the institutional aspect for a sustainable drinking water supply system, things that need attention are in terms of organizational structure, funding and maintenance operations. examined from the institutional aspect for a sustainable drinking water supply system, things that need attention are in terms of organizational structure, funding and maintenance operations (Foenay, 2024). Ladogahar village drinking water supply system is managed by each hamlet manager. Natawulu hamlet drinking water supply system is managed by the Natawulu drinking water supply system manager who consists of a chairman, deputy, secretary, treasurer and 6 technical officers. according to the community, officers are quite good at carrying out their duties and responsibilities. however, sometimes complaint handling is still slow. every month the community pays a maintenance fee of IDR 40,000. the determination of this fee is carried out by the user and the management by consensus, considering operational and development cost needs. however, some people still feel that the stipulated fees are quite expensive and burdensome for the community. most people are often late in paying and sometimes are in arrears

in paying their contributions. the form of maintenance carried out is in the form of repairing damaged drinking water supply system infrastructure. meanwhile, Rotat and Dota hamlets do not yet have structured drinking water supply system management. management only takes the form of coordination from the hamlet head who acts as coordinator if there is damage to the drinking water supply system network. the coordinator will ask for contributions from the community if the pipe network is damaged and network maintenance activities need to be carried out.

3.1.3 Social Aspects

the community-based drinking water supply system provides space for the community to participate in every stage. community participation not only enables willingness to pay, but also involvement in the operation and maintenance of the drinking water supply system which is the key to long-term sustainability (Mcpherson, 1994 & Glennie, 1983 in Al Djono, 2011). active community involvement in every stage of management can create a sense of concern for the community-based drinking water supply system in Ladogahar village. the people of Ladogahar village are quite concerned about the existence of drinking water supply system. The community is willing to become drinking water supply system managers and is willing to pay contributions every month or even when there is damage to the pipe network which requires quite large financing. apart from that, the community is willing to help the management together in cooperation to repair the pipe network if the pipe is damaged and the reservoir is drained.

3.1.4 Environmental Aspects

the location where the water source is taken is in accordance with the applicable criteria, namely that the location where the water source is taken does not experience pollution either physically or microbiologically (Kurniawan, 2019). water sources must be protected from the threat of damage or pollution. community-based drinking water supply system development requires that the raw water source must have an ideal distance from the source of pollution. the results of raw water quality tests at three drinking water supply system unit locations show that the raw water produced does not contain dangerous physical and chemical substances and meets the requirements of pp 82/2001 concerning water quality management and water pollution control, especially for class i quality criteria, namely water for which it is intended can be used as raw drinking water. observations and interviews with respondents in the field showed that most respondents believed that the drinking water supply system water source was far away and protected from potential pollution. however, because the location of the water source has the potential for animal disturbance.

3.2 Drinking Water Supply System Sustainability Level

3.2.1 Drinking Water Supply System Sustainability Level Technical Aspects

in general, the process of providing water starts from taking a water source, namely a spring, then flows by gravity to a water storage area (reservoir), before then being distributed to public taps (users). by assessing the sustainability of technical aspects, it can be seen what the general condition of infrastructure performance is in community-based drinking water supply system in Ladogahar village

3.2.1.1 Sustainability of Raw Water

- Raw Water Quality

Structured interviews with users and managers produced data that the majority thought the raw water used was of fairly good quality. Water quality decreases slightly during the rainy season when the colour of the water becomes cloudier due to high rainfall and soil erosion which causes damage to pipes. The sustainability index in terms of raw water quality is 66.55%.

- Availability of raw water

drinking water supply system 's raw water source comes from springs. springs in the Sikka regency area generally appear on the ground naturally, due to the cutting off of groundwater flow by the local topography. the spring discharge in Sikka regency varies between 1-40 Liters/second. the discharge of these springs is generally small, which is caused, among other things, by the nature of the rocks which do not allow water to pass through and the slope of the land area is quite large, namely more than 40%. the existing springs generally come from hilly areas with water discharge decreasing in the dry season, so water demand in the dry season is a constraint in this area. the results of structured interviews with the majority of respondents were of the opinion that the availability of raw water at the community-based Ladogahar village drinking water supply system was inadequate. raw water is very scarce during the dry season. thus, the sustainability index in terms of raw water availability is 46.90%.

3.2.1.2 Sustainability of Distribution Units

- Reservoir Performance

The results of structured interviews show that the majority of water reservoir maintenance in the form of draining and maintenance activities is rarely carried out. Information from respondents stated that in general the reservoir will be drained after there are reports from users that the water they receive has become cloudy. To the question of leakage level, the majority of respondents answered that they had leaked once and repairs had been carried out. Thus, the reservoir performance factor sustainability index is 63.79%.

- Distribution Pipe

observation results showed that the Rotat and Dota drinking water supply system units experienced damage to the distribution pipe network. damage that results in leaks, if not followed up with repairs, results in the distribution network being unable to channel water to public taps. the results of interviews with respondents believed the majority of distribution pipes had experienced leaks. however, the leak can still be repaired by the manager so that the system can operate again. this is because the distribution pipes are not planted but are placed on the ground surface. which causes many external disturbances which result in damage to the piping network. the sustainability index for distribution pipe performance factors is 50.34%

3.2.1.3 Sustainability of Service Units

- Conditions and Additions to General Faucets

the addition of public taps is closely related to the satisfaction of drinking water supply system users in the area. likewise, vice versa, when there is damage to the public tap, it can be concluded that the water supply service through drinking water supply system is no better than provision from other sources. the results of the research obtained information that there are still users who use other clean water provider services. observations show that there are many public faucets that are damaged, especially at Natawulu drinking water supply system and Rotat drinking water supply system. the general decline in water use is due to damage to drinking water supply system infrastructure and failure of management institutions. the sustainability index for the addition of general faucets is 58.89%

- Scope of Services

service coverage is the percentage of how water services can reach the needs of the community in the area. the results of structured interviews with respondents believed drinking water supply system was less able to serve the water needs of their environment. this can be understood because the drinking water supply system service unit is built using a public tap where users do not get water every time they need it. users must provide a container to take water to the nearest public tap. however, the water obtained from drinking water supply system is of better quality and cheaper, so drinking water supply system remains the best choice. the sustainability index for service coverage is 46.29%.

3.2.1.4 Quality, Quantity, Continuity Fulfilment

- Quality of Water received

Most respondents think that the water received by users is clean/clear, and the water is suitable for daily consumption. The water that users get comes from raw water sources without undergoing physical or chemical processing and is directly distributed to public taps. However, during the rainy season, the water received by users tends to become cloudy due to high rainfall. The sustainability index in terms of the quality of the water received is 68.57%.

- Quantity of Water received

the condition of drinking water supply system infrastructure affects the quantity of water received by users. If the system is not damaged, then the water produced by drinking water supply system has a quantity that is able to meet user needs. apart from that, for Dota hamlet drinking water supply system and Rotat hamlet drinking water supply system, the availability of raw water is smaller than the water needs of the users. This is in accordance with the opinion of most respondents that the water they receive is not enough to meet their daily needs. The sustainability index for the quantity of water received is 48.29%.

- Continuity

Water distribution at every drinking water supply system in Ladogahar Village uses public taps and is supplied for 24 hours. Most respondents thought that the water they received was quite smooth. However, the Ladogahar Village drinking water supply system service unit still uses public taps, causing users to have to provide

temporary containers and get water from the nearest public tap. This is quite draining of the user's time and energy. The results of interviews and observations show that the continuity of water supply can be disrupted if the pipe network is damaged. The calculation results for the sustainability index in terms of water continuity are 39.71%.

3.2.2 Level of Sustainability of Institutional Aspects

To ensure that drinking water supply system is sustainable, it is necessary to establish institutions at the community level as drinking water supply system organizers. The existence of drinking water supply system management and maintenance institutions can create management and maintenance mechanisms. The existence of an institutional organization that manages drinking water supply system is the main factor in maintaining the sustainability of drinking water infrastructure. Identification of institutional sustainability is needed to know who manages and how drinking water supply infrastructure is managed. Sustainability identification in terms of institutional aspects includes management variables, management regulations and user satisfaction.

3.2.2.1 Management

Community-based management is carried out by community groups, which are representatives of the beneficiary communities, because they best understand their own water supply needs, such as the availability of water sources, etc. Community-based management that works well can ensure the long-term sustainability of water supply schemes in the area.

- Existence of Management

Field studies provide information that most respondents know that there are drinking water supply system infrastructure managers in their environment. However, for Ladogahar Village drinking water supply system, only Natawulu Hamlet drinking water supply system has a clear management structure and there is a distribution of responsibilities for each form of management activity. Meanwhile, for Dota and Rotat hamlet drinking water supply system, there is no management yet to manage the village water drinking water supply system. The Dota and Rotat drinking water supply system hamlet management only consists of the hamlet head as the drinking water supply system management coordinator in the event of damage to the pipe network. However, there were still respondents who stated that there were no drinking water supply system infrastructure managers in their environment. The absence of a manager causes the management process to not occur, resulting in the failure of the clean water supply program at that location. This is in accordance with field observations which show that drinking water supply system does not operate well because there is no manager. The sustainability index in terms of the presence of managers is 77.18%.

- Management Performance

Manager performance can be seen from the level of activity of managers in carrying out routine activities, including meetings, collecting funding from users, establishing water user regulations and carrying out maintenance and repair work (Whaley & Cleaver, 2017). The results of structured interviews show that for drinking water supply system Dusun Natawulu most managers are active in maintaining and carrying out contribution collection activities. However, drinking water supply system infrastructure maintenance activities are generally incidental, carried out at any time and if deemed necessary, while collection of contributions is routinely scheduled at the beginning of the month. Meanwhile, for drinking water supply system Dota and Rotat, management is carried out by the hamlet head, where management activities are only carried out if there is damage to the drinking water supply system network. Thus, the sustainability index in terms of management performance is 46.29%

3.2.2.2 Management Rules

- Management Transparency

The implementation of drinking water supply system is carried out based on the principles of transparency and accountability, the principle of transparency and accountability implies that drinking water supply system can be carried out openly and can be accounted for (PP 122/2015). The research results show that transparency in drinking water supply system management has not been implemented for the most part. Submission of financial reports has not been done openly, only in internal management forums. Observations at drinking water supply system locations also show that there are no financial information boards that can be accessed by the public. Thus, the drinking water supply system sustainability index in terms of the management transparency variable is 43.33%

- Existence of Regulations

The rules required in drinking water supply system management are mainly related to the preparation of the management structure and functions as well as financial regulations. The results of structured interviews revealed that there were opinions from respondents who considered the existence of regulations to be necessary. Apart from that, information was obtained that formal and informal sanctions if violations occur need to be applied. Violations in the form of late payment of fees by the user community will be tolerated until the community is able to pay the fees within a certain period. If they are not heeded, they will be given warnings and applicable sanctions according to mutual agreement in meetings with users. The results of the sustainability index, in terms of the existence of regulations, obtained a result of 73.71%.

3.2.2.3 User Satisfaction

User satisfaction is related to water quality and quantity, accessibility and reliability of supply. If the new water supply system is not better than the previous system, then the community's desire to manage and maintain the system will disappear. Apart from that, user satisfaction is correlated with the level of resolution of public complaints (Whaley & Cleaver, 2017).

- User Satisfaction

Good management and community involvement drive the reliability of the clean water supply system, which ultimately increases the level of community satisfaction (Kamulyan, 2017). The research results show that most community-based drinking water supply system users are less than satisfied with the services they receive. The sustainability index for the user satisfaction variable is 44.57%

- Respond to User Complaints

User complaints are actions that arise due to user dissatisfaction with water supply services by drinking water supply system managers. The research conducted showed that most respondents often made complaints. The complaint that is often made is that the water is not flowing due to damage to the pipe network. The sustainability index in terms of user complaints is 49.29%.

3.2.3 Level of Sustainability in Financial Aspects

The sustainability of a water supply system can be predicted from how well the operation and maintenance of the system is financed (Mukherjee, 1999). Identification of the sustainability of financial aspects was carried out to find out the role of contributions as a source of financing and to find out whether these contributions were able to finance community-based drinking water supply system maintenance operations in Ladogahar Village.

3.2.3.1 Dues

Calculation and determination of contribution amounts are based on the principles of: (1) affordability and fairness, (2) quality of service, (3) cost recovery, (4), water use efficiency, (5) transparency and accountability and (6) water protection and conservation standard. The proceeds from contributions to the community-based drinking water supply system in Ladogahar Village are mainly used to repair the pipe network. Based on the survey that has been carried out, there are differences in the contribution withdrawal mechanism. There is no monthly fee for drinking water supply system in Dota and Rotat hamlets. Contributions are collected by the hamlet head as the hamlet Drinking Water Supply System management coordinator only occasionally, if there is damage to the pipe network and repairs to public faucets. Meanwhile, another Natawulu hamlet drinking water supply system unit has established a mechanism for collecting fees of IDR 40,000.

- Existence of Community Contributions

The desire to finance drinking water supply system operations through fees shows an indication of the level of community commitment to drinking water supply system development (Jones, 2013). The results of interviews with respondents showed that the majority of respondents stated that there was a need for contributions to finance drinking water supply system operations. Thus, the sustainability index for drinking water supply system management for the existence of community contributions was obtained at 70.57%.

- Affordability of Contributions

Affordability is one of the basic principles in determining user community fees in maintaining the sustainability of community-based drinking water supply system. Tariffs meet the principle of affordability if household expenditure to meet basic drinking water standards does not exceed 4% (four percent) of the income of the user community (Permendagri 23/2006). The results of calculating the affordability of fees are not much different from the public's perception that the fees charged by the majority of respondents were answered as quite affordable. However, it is different for Dota and Rotat hamlet fees. Contributions are charged according to the amount of costs required for repair and maintenance activities. The sustainability index for the Contribution

Affordability Factor is 55.14%.

- Regularity of Contribution Payments

Contribution payments carried out regularly affect the availability of operational costs and maintenance of drinking water supply system infrastructure. Withdrawal of contributions is carried out by the manager by going door to door to the user's house. This method is considered quite effective because contribution payment transactions can be carried out at that time. The findings in the field show that users who are unable to pay when visited by the manager are given tolerance to pay at the next meeting. This is due to the high sense of kinship and understanding between community members. However, most users are often in arrears in payments for several months. Based on the structured interviews that have been conducted, the regularity factor for payment of contributions to community-based drinking water supply system has an index result of 43.14%.

3.2.3.2 Maintenance Operational Costs

Operational and maintenance costs are costs incurred because of implementing drinking water supply system management. Davis et al (1993) in Al Djono (2012) stated that money is needed to carry out operations and maintenance, whether carried out by the community or managers. The main source of funding comes from user community contributions. Data obtained from the survey shows that only the Natawulu drinking water supply system unit has fees for maintenance operations. a drinking water supply system unit with good financial management is demonstrated by the existence of fees that can finance maintenance operations and the availability of more funds for the management's cash. Operational and maintenance activities carried out in community-based drinking water supply system management in Ladogahar Village include collection of fees, maintenance of drinking water supply system infrastructure and repairs if there is damage. The following evaluation will determine the condition of maintenance operational costs and the suitability of contributions with maintenance operational costs. The results can be presented in the following discussion.

- Compliance of Contributions with Maintenance Operational Costs

Based on interviews with respondents, the results showed that Natawulu hamlet drinking water supply system respondents believed the monthly fees paid were in accordance with the operational needs for drinking water supply system maintenance. Research in the field obtained several information, including available funds are related to the length of drinking water supply system management and the intensity of damage to the drinking water supply system unit. The results of the interview show that for the Natawulu hamlet drinking water supply system, the available funds are sufficient to finance light maintenance on the system, if there is serious damage which requires greater costs, the community will collect funds outside of routine fees. Meanwhile, Dota hamlet drinking water supply system and Rotat hamlet drinking water supply system do not withdraw monthly fees. Contributions are collected if damage to the drinking water supply system network system occurs. The amount charged is adjusted to the amount of costs required for network system repair activities. The sustainability index in terms of the conformity factor of contributions with maintenance operational costs is 51.14%.

- Drinking Water Supply System Development Costs

The people of Ladogahar Village agree quite strongly regarding the increase in costs for drinking water supply system development. This is because many of the Ladogahar village drinking water supply system unit systems need to be developed, because their conditions are no longer in accordance with standards so that water distribution to users is not carried out optimally. The sustainability index in terms of drinking water supply system development cost factors is 61.14%.

3.2.4 Level of Sustainability of Social Aspects

Several studies include social aspects as one of the factors that influence the sustainability of community-based water supply systems (Schuringa, 1998; Mukherjee, 2001; Aslam, 2012; Rathnayaka, 2016). Community involvement in each of the stages above is an effort to foster a sense of belonging in the community towards drinking water supply system infrastructure. Identification of the level of sustainability The social aspect consists of two variables, namely community involvement and community awareness. The description of the results of the interview and survey can be presented as follows.

3.2.4.1 Community Involvement

According to IRC & WHO (2000) water supply services are said to be sustainable when service management involves the community (or the community itself manages the system). Brikke (2003) stated that one of the factors that weakens the sustainability of water supply services is when the program does not involve the community enough, so that they feel that the program does not belong to them. Involvement also holds

community members accountable for technology choices and makes them aware of the financial, managerial and technical implications of their choices, including operational maintenance tasks associated with those systems.

- Community Participation

Astuti and Rahdriawan's (2013) research on factors that are very influential in the success of managing drinking water supply programs are community participation factors and the role of drinking water supply system members. Participation can be assessed from community participation and involvement in the program either in cash or in kind, community activity in providing advice to managers, and involvement of target communities in program sustainability activities (Lasaa, et al., 2022) . The research results show that most drinking water supply system users participate sufficiently in drinking water supply system maintenance. Respondents answered two types of participation in the form of money and energy. Labor participation is given during drinking water supply system maintenance work and money is given for drinking water supply system maintenance costs. Thus, the management sustainability index for the community participation factor is 79.71%.

- Community Meeting

Community meetings are a medium for users to participate in managing drinking water services (Mukherjee, 1999). Organizations with good performance will hold regular meetings to discuss member selection and management responsibilities. The study results show that most respondents often attend community meetings discussing the socialization of the implementation of water supply activities and the sustainability of village drinking water supply system. Thus, sustainability in terms of the community meeting factor is 73.43%.

3.2.4.2 Public Awareness

The form of public awareness in managing clean water facilities can be manifested in their concern for the existence of drinking water supply system, the desire to continue drinking water supply system operations and the community's behavior in using water produced by drinking water supply system.

- Community Concern

The results of structured interviews with respondents show that most people care about the existence of drinking water supply system, their concern is manifested by contributing to management through paying drinking water supply system fees and playing an active role in repairing the drinking water supply system network if there is damage. Thus, sustainability in terms of community concern is 84.86%.

- Continuous Desire

Most respondents have the desire to continue drinking water supply system management operations. The desire to be sustainable arises because people really need water services provided by drinking water supply system at very affordable costs. The sustainability index in terms of the desire to be sustainable is 98.57%.

- Water Use Practices

Research shows that people quite often use the water provided by drinking water supply system as a water source to meet their basic daily needs. Thus, the sustainability index in terms of water use practices is 66.00%.

3.2.5 Level of Sustainability of Environmental Aspects

Environmental sustainability in this research is defined as how quality and quantity water sources are able to meet the water supply needs of built systems, as well as how these water sources are protected from potential water source pollution. The explanation of sustainability identification can be explained as follows.

3.2.5.1 Raw Water Protection

Groundwater contamination by bacteria from pollutant sources can reach 11 meters in the direction of groundwater flow, while chemical pollution can reach a distance of 95 meters in the direction of groundwater flow (Munthe, et al., 2021). The bacterial pollution variable is indicated by the presence of coliform bacteria in the water because some bacteriological pollutants come from human and animal waste. Suwito, W (2014) in his research concluded that the well water around the cages in Yogyakarta was almost entirely contaminated with Coliforms and E. Coli. Community-based drinking water supply system development requires that the raw water source must have an ideal distance from the source of pollution. Observations and interviews with respondents in the field showed that most respondents believed that the drinking water supply system water source was far away and protected from potential pollution. However, because the location of the water source has the potential for animal disturbance. Thus, the sustainability index in terms of raw water protection is 53.71%.

3.3 Status of Drinking Water Supply System Management Sustainability Level

Table 1 Level of Sustainability Technical Aspects

No	Factor	Code	Sub Factor	Index
1	Raw Water Unit	I.1	Raw Water Quality	66.55%
		I.2	Availability of Raw Water	46.90%
2	Distribution Unit	I.3	Reservoir Performance	63.79%
		I.4	Distribution Pipe Performance	50.34%
3	Service Unit	I.5	General faucet condition	58.89%
		I.6	Service Coverage	46.29%
4	Fulfillment of 3K Elements	I.7	Quality of Water received	68.57%
		I.8	Quantity of Water received	48.29%
		I.9	Continuity of Water received	39.71%
Average				54.64%

Source: Analysis Results (2024)

Based on the identification of the level of sustainability for each factor, a summary of the level of sustainability for each aspect is obtained. In the technical aspect, the highest index value is found in the quality factor of the water received, namely 68.53%, while the lowest value is the continuity of the water received, which is 39.71%. In general, the physical condition of Drinking Water Supply System is in poor condition, but has not yet passed the planning threshold, where the required planning age is 25 years (Ministry of Public Works Regulation 18/2007). Therefore, it is necessary to carry out a technical inspection of the drinking water supply system unit. The first is regarding the availability of raw water, whether it is able to meet the needs of its users. The calculation results show that the technical aspect has an average sustainability index of 54.64% and is in the quite sustainable category interval.

Table 2 Level of Sustainability of Institutional Aspects

No	Factor	Code	Sub Factor	Index
1	Management	II.1	Existence of Management	58.00%
		II.2	Management Performance	46.29%
2	Management Rules	II.3	Management Transparency	44.29%
		II.4	Existence of Regulations	73.71%
3	Customer satisfaction	II.5	Customer satisfaction	44.57%
		II.6	Respond to Customer Complaints	49.29%
Average				52.69%

Source: Analysis Results (2024)

Identification of the level of sustainability in the institutional aspect obtained the highest index result, namely the existence of regulations factor of 73.71%, while the lowest index was the Management Transparency factor of 44.29%. Interviews with managers show that management transparency is low because the management group has not found an appropriate mechanism for reporting financial conditions to the user community. The average sustainability index for institutional aspects is 52.69%. with the sustainability level status being quite sustainable.

Table 3 Level of Sustainability in Financial Aspects

No	Factor	Code	Sub Factor	Index
1	Dues	III.1	Existence of Community Contributions	70.57%
		III.2	Affordability of Contributions	55.14%
		III.3	Smooth Contribution Payments	43.14%
2	Maintenance Operational Costs	III.4	Compatibility of Contributions with Maintenance Operational Costs	51.14%
		III.5	Existence of Development Costs	61.14%
			Average	56.21%

Source: Analysis Results (2024)

Identification of the level of sustainability in the financial aspect resulted in the Operational Maintenance Cost factor having a lower index value than the Contribution factor. In general, the fees set are affordable, and the user community regularly pays the fees. However, the funds received from fees are only enough to cover light maintenance, if serious damage occurs, the community will collect funds outside of routine fees. Ideally, in determining the amount of the contribution, there are several components that must be considered, including: component replacement, facility repairs, management honorarium, depreciation of tools/facilities and cash reserves. This way, if sudden damage occurs, the problem can be handled immediately. The average sustainability index from a financial aspect is 56.21% with the sustainability level status being quite sustainable.

Table 4 Level of Sustainability of Social Aspects

No	Factor	Code	Sub Factor	Index
1	Social Engagement	IV.1	Community Participation	79.71%
		IV.2	Community Meeting	73.43%
2	Social Awareness	IV.3	Concern	84.86%
		IV.4	The desire to be sustainable	98.57%
		IV.5	Practice water use	66.00%
			Average	63.85 %

Source: Analysis Results (2024)

The community-based drinking water infrastructure provision program in Ladogahar Village has not been fully able to accommodate community involvement in its activities.

The community is involved during drinking water supply system unit maintenance in the form of collecting funds and personnel to repair damaged drinking water supply system units. To overcome these obstacles, community assistance is needed by empowerment experts/facilitators as well as adopting a similar water supply program activity flow outside DAK AM, such as the Community Drinking Water Supply and Sanitation Program (PAMSIMAS) or Second Water and Sanitation for Low Income Communities (WSLIC-2). The level of sustainability of drinking water supply system management in terms of social aspects is 63.85% with sustainable sustainability status.

The results of sustainability identification for environmental aspects showed that the factors assessed had a sustainability index of 53.71% with a sustainable sustainability status. Drinking water supply system water sources are far away and protected from potential pollution. However, the location of the water source has the potential for animal disturbance. Apart from that, maintenance and protection efforts are still needed so that the condition of water sources is always maintained, for example by conserving vegetation around water sources.

The recapitulation of the five aspects of sustainability of community-based drinking water supply system management shows that the social aspect is the aspect with the highest sustainability value, with an index value of 63.85% and the sustainability status is sustainable. Meanwhile, the aspect with the lowest index value is the institutional aspect, namely 52.69% and its sustainability status is quite sustainable.

3.4. Analysis of Important Factors in the Sustainability of Drinking Water Supply System Management

3.4.1 Relative Importance Index Test

Relative Importance Index (RII) analysis was carried out to obtain the level of importance and rank the factors that influence the sustainability of community-based drinking water supply system management. From the results of calculations and graphs of RII values, it is known that important factors influence the sustainability of

community-based drinking water supply system management with the highest RII values being the addition of public taps (I.5), the existence of community fees (III.1), community participation (IV.1), affordability. Fees (III.2), Quality of Raw Water (I.1), Availability of Raw Water (I.2), Quantity of Water received (I.8), Continuity of water received (I.9), Performance Distribution pipes (I.4), Existence of Managers (II.1)

3.4.2 Confidence Interval Test

The confidence interval test was carried out to support the data and strengthen the results obtained from the Relative Importance Index test. Determining the boundary of the rating line in the confidence interval is done by looking at the interval value. From the confidence interval test, the results showed that the factor for the existence of additional public taps (I.5) was ranked first, while for the existence of community fees (III.1) it was ranked second. The results of the relative importance index and confidence interval tests are as follows:

Table 5. Relative Importance Index and Confidence Interval test results

Code	Factors Assessed	Total Value	NP	RII	St Dev	BB	BA	CI
I.1	Raw Water Quality	263	4.534	0.907	0.37	4.439	4.630	2
I.2	Availability of Raw Water	262	4.517	0.903	0.19	4.469	4.565	2
I.3	Reservoir Performance	255	4.397	0.879	1.11	4.110	4.683	2
I.4	Distribution Pipe Performance	260	4.483	0.897	0.19	4.435	4.531	2
I.5	Addition of KU	266	4.586	0.917	0.93	4.347	4.825	1
I.6	Service Coverage	310	4.429	0.886	1.32	4.119	4.738	2
I.7	Quality of Water received	312	4.457	0.891	1.13	4.192	4.723	2
I.8	Quantity of Water received	316	4.514	0.903	1.03	4.273	4.755	2
I.9	Continuity of Water received	314	4.486	0.897	1.03	4.245	4.727	2
II.1	Existence of Management	313	4.471	0.894	1.07	4.221	4.722	2
II.2	Management Performance	308	4.464	0.893	1.03	4221	4.706	2
II.3	Management Transparency	286	4.086	0.817	0.52	3.965	4.207	3
II.4	Existence of Regulations	282	4.029	0.806	0.99	3.797	4.261	4
II.5	User Satisfaction	287	4.100	0.820	0.64	3.950	4.250	3
II.6	Respond to User Complaints	290	4.143	0.829	0.54	4.016	4.270	3
III.1	Existence of Community Contributions	320	4.571	0.914	0.85	4.373	4.769	1
III.2	Affordability of Contributions	318	4.543	0.909	0.51	4.424	4.662	2
III.3	Regularity of	288	4.114	0.823	0.70	3.949	4.279	3

Code	Factors Assessed Contribution Payments	Total Value	NP	RII	St Dev	BB	BA	CI
III.4	Compliance of Contributions with BOP	308	4.400	0.880	1.18	4.123	4.677	2
III.5	Existence of Development Costs	283	4.043	0.809	0.59	3.904	4.182	4
IV.1	Community Participation	319	4.557	0.911	0.68	4.399	4.716	2
IV.2	Community Meeting	307	4.386	0.877	1.35	4.069	4.702	3
IV.3	Community Concern	309	4.414	0.883	1.01	4.177	4.652	3
IV.4	Sustainable Desire	289	4.129	0.826	0.80	3.941	4.316	3
IV.5	Practice water use	284	4.057	0.811	0.52	3.936	4.178	3
V.1	Water Source Protection	308	4.400	0.880	1.18	4.123	4.677	2

Source: Analysis Results (2024)

Notatio: NP :Important Values. RII : Relative Importance Index, SD : Standard deviation, BB : Lower limit

BA : upper limit, and CI : Confidence Interval

3.4.3 Analysis of Development Handling Priorities

The key factors determined are factors that are considered important in the sustainability of drinking water supply system management. Data regarding important values and sustainability values can now be seen in the important values in the table 6. The important value used is the mean of the results of the influential factor analysis survey, while the current condition value is obtained from the results of the sustainability assessment survey.

Table 6 Current Importance and Sustainability Value

Code	Factor	Important Values	The Value of Sustainability Now
I.1	Raw Water Quality	4.53	3.33
I.2	Availability of Raw Water	4.52	2.34
I.3	Reservoir Performance	4.40	3.19
I.4	Distribution Pipe Performance	4.48	2.52
I.5	Addition of KU	4.59	2.27
I.6	Service Coverage	4.43	2.31
I.7	Quality of Water received	4.46	3.43
I.8	Quantity of Water received	4.51	2.41
I.9	Continuity of Water received	4.49	1.99
II.1	Existence of Management	4.47	2.90
II.2	Management Performance	4.46	2.31
II.3	Management Transparency	4.09	2.21
II.4	Existence of Regulations	4.03	3.69
II.5	User Satisfaction	4.10	2.23
II.6	Respond to User Complaints	4.14	3.11
III.1	Existence of Community	4.57	3.14
III.2	Contributions	4.54	2.76
III.3	Affordability of Contributions	4.11	2.16
III.4	Regularity of Contribution Payments	4.40	2.56
IV.1	Compliance of Contributions with BOP	4.56	3.99
IV.2	Existence of Development	4.39	3.67
IV.3	Costs	4.41	4.24
IV.4	Community Participation	4.13	4.93
IV.5	Community Meeting	4.06	3.30
V.1	Community Concern	4.40	2.69

Source: Analysis Results (2024)

Next, the importance value and current condition value are used to map key factors to be classified in relation to development priorities. The results of the mapping into the key factors quadrant can be seen in the following image illustration.

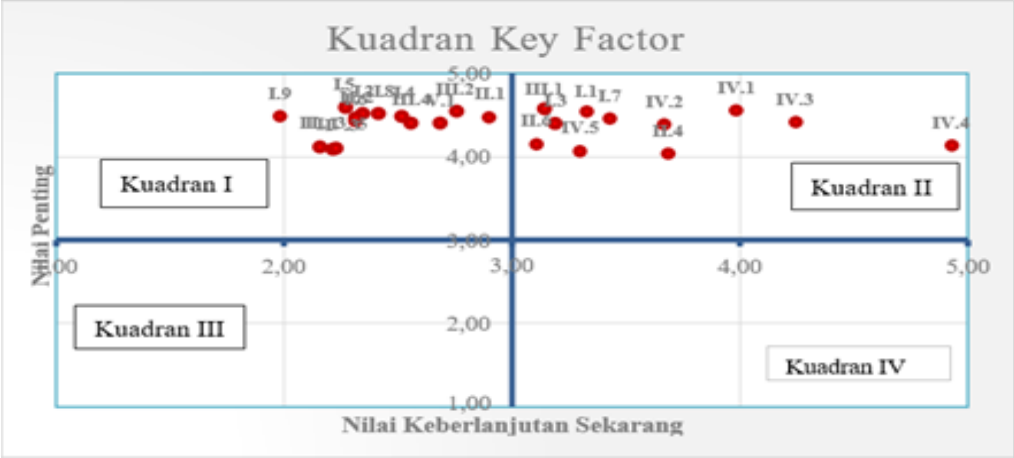

Figure 1 Key factor quadrant

Information:

Nilai Penting : Important Value

Nilai Keberlanjutan Sekarang : Current Condition Value

included in quadrant one, namely the development priority quadrant, including: Availability of Raw Water (I.1), Performance of distribution pipes (I.4), Addition of Public Faucets (I.5), Service Coverage (I.6), Quantity of Water Received (I.8), Continuity of Water Received (I.9), Existence of Managers (II.1), Performance of Managers (II.2), Management Transparency (II.3), User Satisfaction (II.5), Regularity of Contribution Payments (III.3), Compliance of Contributions with BOP (III.4), Water Source Protection (V.1). These factors are important factors for the sustainability of community-based drinking water supply system management, but the current condition of sustainability is still considered not good.

Tabel 7 Development Priority Index Table

Code	Factor	NP	NKS	NKSS	IPP
Quadrant 1					
I.9	Water Continuity	4.49	1.99	-2.52	-11.29
I.5	Accepted	4.59	2.27	-2.20	-10.10
II.2	Addition of Public Faucets	4.46	2.31	-2.16	-9.64
I.2	Management Performance	4.52	2.34	-2.13	-9.63
I.6	Availability of Raw Water	4.43	2.31	-2.16	-9.57
III.3	Service Coverage	4.11	2.16	-2.32	-9.54
I.8	Payment Regularity	4.51	2.41	-2.07	-9.35
II.3	Dues	4.09	2.21	-2.26	-9.23
II.5	Quantity of Water received	4.10	2.23	-2.24	-9.20
I.4	Management Transparency	4.48	2.52	-1.99	-8.90
III.4	User Satisfaction	4.40	2.56	-1.96	-8.60
III.2	Distribution Pipe Performance	4.54	2.76	-1.81	-8.24
V.1	Compatibility of Contributions with	4.39	2.69	-1.86	-8.16
II.1	Maintenance Operational Costs	4.47	2.90	-1.72	-7.71
Quadrant 2					
III.1	Existence of Contributions	4.57	3.14	-1.59	-7.27

Code	Factor	NP	NKS	NKSS	IPP
I.3	Public	4.40	3.19	-1.57	-6.89
I.1	Reservoir Performance	4.53	3.33	-1.50	-6.81
II.6	Raw Water Quality	4.14	3.11	-1.61	-6.67
I.7	Respond to Complaints	4.46	3.43	-1.46	-6.50
IV.5	User	4.06	3.30	-1.52	-6.15
IV.2	Quality of Water received	4.31	3.67	-1.36	-5.88
IV.1	Practice water use	4.56	3.99	-1.25	-5.72
II.4	Community Meeting	4.03	3.69	-1.36	-5.47
IV.3	Community Participation	4.41	4.24	-1.18	-5.20
IV.4	Existence of Regulations	4.13	4.93	-1.01	-4.19

Source: Analysis Results (2024)

Information:

NP : Important Value

NKS : Current Condition Value

NKSS : Present Sustainability Value

IPP : Development Priority Index

The smaller the IPP value per quadrant, the more priority these key factors become for improvement. Important factors in the Ladogahar Village drinking water supply system that are important to improve are the continuity of water received, the addition of public taps, management performance, availability of raw water, service coverage, regularity of payment of fees, quantity of water received, transparency of management, performance of distribution pipes, suitability of fees, protection. water sources, existence of managers. In line with the calculation results, based on the evaluation results of important priority factors, there are various problems that need to be followed up so that the Ladogahar village water supply system becomes more optimal and sustainable.

Continuity requirements, raw water at a location must always be available for 24 hours. Continuity means that clean water must be able to be taken continuously and stably, both during the dry season and the rainy season. Continuity can also mean that clean water must be available 24 hours/day or whenever needed. "Water continuity is one of the main factors in providing clean piped water and has an important role and big influence 24 hours per day" (Ramdanti, 2023). For continuity, Ladogahar Village drinking water supply system water has been supplied for 24 hours. However, it is not consistent for 24 hours, in the dry season the water flow often decreases so that water cannot be obtained continuously for 24 hours. And also during the rainy season, damage to the pipe network often occurs due to high rainfall and this results in landslides. Apart from that, the distribution system still uses public taps so that people cannot meet their water needs at any time. Where, to meet their water needs, people must take water using storage containers to the nearest operational public tap location.

Ladogahar village's drinking water supply system water distribution still uses public taps. Public faucets are located 5 to 20 meters from residents' houses. The condition of most public faucets is damaged and cannot operate. This requires people to look for other public faucets that can operate and requires them to queue. This condition is very ineffective and inefficient. Based on sustainable development goals, access to clean water must always be available at all times and easy to access. For this reason, it is necessary to check and repair and improve the distribution system for public taps to house connections.

The distribution pipe network is a section of pipe that carries water from the reservoir holding tank to the service network. Tri Joko (2010) believes that two important things that must be considered in the distribution system are the availability of sufficient water and sufficient pressure (continuity of service), as well as maintaining water quality. According to regulations, pipe networks must be buried in the ground. However, for the Ladogahar Village drinking water supply system pipe network, the pipe network is placed above ground level so it tends to frequently experience damage. The standard for planting distribution pipes from the Director General of Human Settlements is that they are installed in the ground at a depth of 80 cm for pipes on normal routes and 100 cm for pipes under highways (Kusmawardani, 2018).

Clean water quantity is the amount needed for clean water to fulfill daily life (Wlary, 2023). The clean water needs of the people of Ladogahar Village are served by spring water sources. According to Minister of Public Works Regulation No. 122 of 2015 concerning drinking water supply systems, capacity utilization is said to be optimal when it has 80% service and each person's minimum need for raw water for clean water per day is 60 liters/person/day or 0.06 m3. Based on calculations of the minimum water needs of the Ladogahar Village community, the Natawulu hamlet drinking water supply system water quantity has been met. Where the availability of raw water in Natawulu hamlet is 1.5 l/second and the water requirement is 0.3 l/second with basic needs of 60 liters per person per day. However, for drinking water supply system. Rotat hamlet and Dota hamlet, the quantity of water received by users does not meet their water needs. Where the available water discharge is smaller than the water requirement. For Dota hamlet drinking water supply system, the water availability is 0.1 l/second, while the water requirement calculated as a basic need of 60 liters per person per day is 0.13 l/second. For Rotat hamlet drinking water supply system, the water availability is 0.2 l/second, while the water requirement with a basic need calculation of 60 liters per person per day is 0.5 l/second.

Based on the various problems found in the drinking water supply system for the tennis aspect, it is necessary to carry out various improvements and development of the drinking water supply system. According to Republic of Indonesia Government Regulation Number 122 of 2015 concerning Drinking Water Supply Systems. drinking water supply system development is an activity carried out related to the availability of drinking water supply system facilities and infrastructure in order to meet the quantity, quality and continuity of drinking water which includes new development, improvement and expansion. Development activities can include adding alternative sources of raw water, improving piping networks, creating alternative piping networks, and changing the water distribution system from public taps to house connections.

Managers can be said to be functional if they can carry out roles in management, administration, operations, maintenance and repair of clean water infrastructure (Kamulyan, 2018). The existence of a manager accompanied by clear management and regulatory administration has a big influence on the sustainability of drinking water supply system management. For the management of Ladogahar Village drinking water supply system, Natawulu hamlet Drinking Water Supply System is managed by the Natawulu drinking water supply system manager consisting of chairman, secretary, treasurer and technical officers. Meanwhile, Rotat and Dota hamlets do not yet have structured Drinking Water Supply System management. Management only takes the form of coordination from the hamlet head if there is damage to the drinking water supply system network. For operational costs, it is only owned by drinking water supply system Natawulu hamlet. Every head of household who uses drinking water supply system pays a monthly fee of IDR 40,000 per month. The determination of this fee is carried out by the user and the management by consensus, taking into account operational and development cost needs. Meanwhile, drinking water supply system for Dota and Rotat hamlets does not have a monthly fee. However, if there is damage to the drinking water supply system network, the hamlet head who acts as the drinking water supply system coordinator will ask each family head for a contribution. These contributions are used to repair the network.

Several things need attention from the institutional aspect for a sustainable drinking water supply system, namely in terms of organizational structure and funding. Every drinking water supply system manager needs to have a clear organizational structure and be supported by human resources in accordance with their job responsibilities. Apart from that, funding needs to be arranged for operation and maintenance activities, as well as future development plans. In order for Ladogahar Village drinking water supply system to be sustainable, drinking water supply system development activities for institutional aspects also need to be carried out, especially for Dota hamlet and Rotat hamlet which do not have structured management. Therefore, it is necessary to establish a manager for drinking water supply system Dota hamlet and Rotat hamlet. Drinking water supply system development activities can be carried out based on the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 27/Prt/M/2016 concerning the Implementation of Drinking Water Supply Systems. Planning in implementing drinking water supply system by Community Groups can be done by planning independently or assisted by facilitators provided by the Central Government or Regional Government. Next, form a management unit or management institution that determines fees, determines the management institutional structure or AD/ART, as well as the composition of the management. Determination of contributions by the management unit or management institution is carried out by consensus taking into account operational and development cost needs

4. Conclusion

From the results of data processing and discussion, by referring to the research objectives several conclusions can be drawn, including:

1. The results of the evaluation of technical aspects show that drinking water supply system is not in accordance with Minister of Public Works Regulation 18/2007 concerning Implementation of Drinking Water Supply System Development. For raw water units, the availability of raw water for Dota and Rotat hamlets does not meet the needs of its users. The distribution unit for the pipe network does not comply with applicable regulations, this is because the distribution network pipes are not buried in the ground but are placed on the ground surface. The service units also do not comply with the regulations because the services still use public faucets, most of which have been damaged so that the service becomes ineffective and inefficient. In addition, each raw water unit, production unit and distribution unit is not equipped with a main water meter. Apart from that, the service unit is also equipped with customer water meters. The results of the evaluation of compliance with quality, quantity and continuity show that the quantity and continuity of the water received does not comply with applicable regulations. Water availability is smaller than the water demand for its use. And water continuity is not always 24 hours long and requires people to collect and queue for water at the public tap closest to their house, which is not in line with sustainable development goals which guarantee the right of every community to be able to meet their water needs whenever needed with easy access. Meanwhile, the drinking water supply system raw water quality test shows that the raw water produced does not contain dangerous chemicals and meets health requirements.

2. Assessment of the sustainability of community-based drinking water supply system management in Ladogahar Village in terms of technical, institutional, financial and environmental aspects shows quite sustainable results while the social aspects get sustainable results. Of the three drinking water supply system units that were the research object, two drinking water supply system s were found in the moderately sustainable category and one drinking water supply system was in the sustainable category.

3. The results of analysis using the Relative Importance Index method show that the condition and existence of public taps are the most influential factors in the sustainability of drinking water supply system management. Meanwhile, based on the analysis of the Development Priority Index, it can be identified the factors that require development in drinking water supply system management, with priority handling that needs to be carried out, namely: continuity of water received, addition of public taps, management performance, availability of raw water, service coverage, regularity of payment of fees, quantity water received, transparency of management, performance of distribution pipes, suitability of fees, protection of water sources, existence of managers.

4. Community involvement in the planning and implementation stages of development greatly determines the sustainability of drinking water supply system management. Apart from that, it is necessary to carry out various improvements and developments in the drinking water supply system both from technical aspects (raw water units, distribution units, service units, quantity, continuity) and institutional aspects (institutional and financial).

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