

Characteristics and Water Usage Pattern of Karstgroundwater User Communities of “Spamdus Genjahan” in Wonosari Basin

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ABSTRACT

“Spamdus Genjahan” is a karst groundwater management system in Genjahan village which include in Ledok Wonosari basin. Smart water quality monitoring and management system based on the internet of think (IOT) is a new innovation that will be applied to the operation of “Spamdus Genjahan”. The application of new innovations really needs to understand the character and water consumption patterns of the people who are candidates for using these innovations. Therefore, this study aims to explore the characteristics and patterns of use of karst groundwater in the community who use water from this system. The population of this research is the entire community of water users managed by Spamdus Genjahan. Data is taken through observation and interviews. Data were analyzed through the mean analysis method and presented using tables and graphs. The results showed that the majority of the people who use Spamdus Genjahan water have a low to medium level of education with the main job in the non-formal sector, namely farmers or laborers and odd jobs. In line with this, the level of community knowledge regarding water quality is relatively low. Most of the family members who use this water are 4 to 5 people in one family. Most of the use of water is used for washing, bathing, cooking and drinking water.

Keywords: Karst groundwater, Water use pattern, Characteristics of karst water user communities

1. INTRODUCTION

Water is a vital resource for human life. The Gunungsewu karst community in general uses water to meet their drinking water needs, bathing and washing as well as feeding livestock [1, 2, 7]. Sources of meeting water needs in karst areas during the rainy season when there is no access to water network often use water from rainwater reservoir or lake water [2, 7, 16, 17].

Genjahan Hamlet is geomorphologically included in the Wonosari Ledok area. The characteristics of karst bedrock that have many fractures trigger water scarcity on the surface, especially during the dry season. A joint effort from the Dusun Genjahan community for water management has been carried out so far to ensure its availability for the community. Similar efforts are also carried out in other

places [8, 9]. Water is sourced from karst groundwater pumping and distributed throughout the community through pipelines. The system in this research area is called “Spamdus Genjahan”. The system is implemented simply and manually. Increasing the efficiency of the Spamdus Genjahan system management is carried out by implementing a Smart water quality monitoring and management system based on the internet of think (IOT). This system is in the form of an automatic system for sensor-based water quality monitoring and an internet-based and application-based water management system.

The application of innovation requires understanding and knowledge regarding the characteristics of the people who will use the innovation. Understanding these characteristics is related to the knowledge and needs of the community for this innovation. A good understanding of the

characteristics of the community of potential users of innovation is expected to be the basis for improving the method of implementing the innovation. Furthermore, it is hoped that the performance and work results of this innovation can be maximized. In line with this, this study aims to explore the characteristics and patterns of karst groundwater utilization in water user communities managed by Spamdus Genjahan.

2. METHODS

2.1 Population and samples

The population used in this study is the entire community of water users managed by Spamdus Genjahan. Samples are taken proportionally based on the administrative location of the residence of the water user. Based on this, a sample of 102 respondents was obtained spread in the hamlets of Genjahan, Ngrombo 2, Jetis, and Silingi. Respondents from the Genjahan hamlet had the highest number of 78 respondents or 76% of the entire sample. This is because the majority of the water users from the Genjahan Spamdus are in the Genjahan hamlet. The next respondents came from Silingi hamlet which amounted to 15 respondents, Jetis hamlet 5 respondents, and Ngrombo 2 hamlet with 4 respondents.

2.2 Data and analysis

The data taken in this study include education, occupation, type of consumption, number of families, patterns of water use, and the level of knowledge of the population about water quality. Data obtained through direct observation and interviews. Direct observations were made to ensure the correctness and uniformity of the size of data collection tools such as buckets used for water collection. Data is recorded through google form and analyzed using the mean percentage of each parameter. The results of the analysis are presented descriptively with tables and graphs.

The education level of the respondents is classified into elementary school (SD), junior high school (SMP), senior high school (SMA), and Bachelor/undergraduate (S1). This data is used to determine the number of respondents who have completed primary, secondary and higher education. The type of work is classified into odd or irregular, farmers or laborers, traders, civil servants, and the troops or police. The number of family members is calculated based on the number of people who live permanently in the house. Types of consumption are analyzed based on the type and amount of expenditure to meet the needs of rice as a staple food, side dishes, transportation, health, and other needs. The pattern of water utilization is analyzed based on the type of utilization and the amount of water used for each type of water utilization. Respondents' level of knowledge related to water quality was identified by questionnaire about water quality parameters recorded by the Smart water quality monitoring and management system, namely pH, TDS,

turbidity, and temperature. Respondents are considered to have high knowledge if they can answer all the questions correctly. On the other hand, respondents are considered to have low knowledge if they provide correct answers with a number of less than 20% of the number of questions or choose the option of not answering more than 80% of the number of questions.

3. RESULTS AND DISCUSSION

3.1. Result

3.1.1. Community education level

The results showed that the education level of the Spamdus Genjahan water users was at the lower middle level. The majority of the education levels completed by the population are at the senior high school, junior high school and elementary school levels. The number of residents who completed the high school education level had the highest number, namely 40 people or 39.2% of all respondents. The next largest number is the population with a junior high school education level, which is 33 people or 32.4% of all respondents.

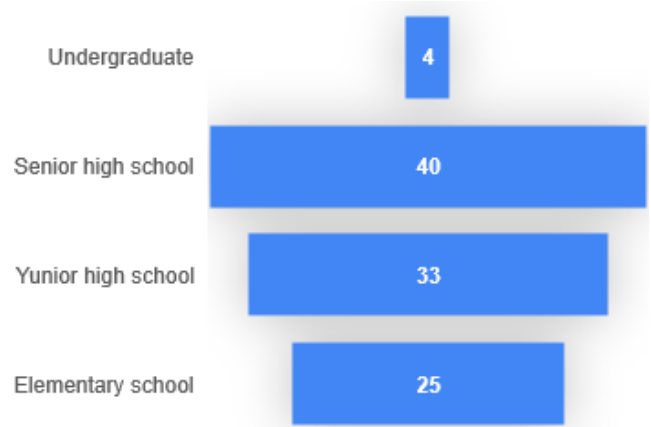


Figure 1 Respondent education

The education level of senior high school and junior high school is categorized at the level of secondary education. The number of people who have an elementary education level is as many as 25 people or as much as 25% of all respondents. Elementary level is categorized as basic or low level of education.

The number of people who have successfully completed higher education up to the undergraduate level is only 4 people or 3.9% of all respondents. This number is relatively small compared to the number of people who have secondary and low levels of education. Based on this data, it can be seen that the majority of water users have lower secondary education levels.

3.1.2. Occupation

Based on the results of interviews, it is known that the types of work of the water user community from Spamdus Genjahan there are four types of work, namely farmers or laborers, odd or uncertain, traders, and civil servants. Farmers or laborers are the types of work carried out by most of the people in the research area. The type of work as a farmer or laborer has the highest number of 48 respondents or 47.1% of all respondents. Farmer is carried out in the form of dry land agriculture by relying on rainwater as a source of irrigation. Palawija or crop planted such as peanuts, soybeans, and corn are staple crops that are planted in rotation according to seasonal conditions. Cassava plants are cultivated as border crops on the edge of agricultural land. The harvest is sold as a source of basic income. Some people sell their harvests in the form of raw materials or semi-finished materials. Considering that the source of irrigation comes from rainwater, the success of community agricultural businesses is highly dependent on seasonal conditions.

Table 1. Respondent job type

Job	sum	percent (%)
Odd Job	42	41.2
Farmer / labour	48	47.1
Merchant	8	7.8
Government employees	4	3.9

Source: calculation results

The number of respondents with odd jobs or not necessarily amounted to 42 people or 42% of the total number of respondents. This type of work is also the dominant type of work carried out by the community. The work carried out is not necessarily in accordance with the existing demand. In general, this work is in the form of helping with farming, helping with housework, to helping with building construction. During the growing season, many of these odd jobs help with farming work such as hoeing, clearing land, or planting. During the dry season, many of these casual workers turn to building construction or other work.

Farmer, labor, and odd jobs are the dominant types of work in the research area. In total, the percentage of the two types of work reaches 88.3% and is evenly distributed throughout the existing hamlets. The data illustrates that most of the people in the study area depend on their source of income from non-formal sector work.

Other types of work, namely traders and civil servants, are only carried out by a small part of the community. Traders are only carried out by as many as 8 people while civil servants are only 4 people. Trading work in the form of opening a grocery shop, staple food or culinary on a small to medium scale. Work is carried out in a self-owned or rented kiosk. Most of these trading business locations are located around the wage market which is the center of buying and selling in the research area.

3.1.3. Consumption type

Based on the interview results, it is known that the types of consumption carried out by the Spamdus water users are in the form of purchasing rice as a staple food, purchasing side dishes, fulfilling transportation needs, health needs, and other needs. The calculation results show that the expenditure for the purchase of side dishes is the largest type of expenditure. The need for fulfilling side dishes in the majority is in the range of 500 thousand to 750 thousand rupiah, which is 48% of the total respondents. 24% of respondents have a higher level of spending on side dishes, which is above 750 thousand. Meanwhile, the population whose consumption of side dishes is between 250 thousand and 500 thousand is around 27.5% of the total respondents.

Consumption expenditure for the purchase of rice ranges from 5 kilograms to more than 20 kilograms. Most people consume more than 20 kilograms of rice. This number reached 44.1% of the total respondents. The second group that has a large number of respondents is consuming between 15 to 20 kilograms of rice. The number of respondents reached 35.3%. If these two groups are combined, it can be seen that most people consume more than 15 kilograms of rice per month per family.

Other needs, namely transportation, health, and other needs, receive a small allocation. The majority of people allocate funds of less than 250 thousand rupiah for each of these needs. This group is in the range of 75.5% to 86.3% in each of these types of needs. Only a small part of them spend consumption for these needs above 250 thousand rupiah.

3.1.4. Number of family

The number of family members is linearly related to the amount of water consumption. Every family member needs water for their basic needs. Most families using Spamdus Genjahan water have a family of 4 or more people. Based on calculations, groups that have family members as many as 4 people or more reach as many as 64 respondents or reach 62.4% of the total number of respondents.

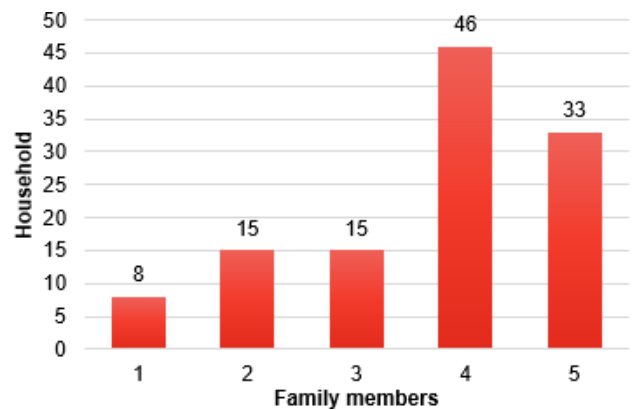


Figure 2 Distribution of respondent's family members

Figure 2 shows a fairly clear difference in the number of families with 3 and below members and families with 4 and above members. In total, there are 38 families with 3 or less members. Meanwhile, families with 4 members and above are 79 families. Based on the percentage, the respondent's family that has 2 to 3 family members is only 25.4%. The remaining 7.8% live alone in the family. The total number of families with 3 members and below is only 33.2%. This data shows that the majority of respondents' families are large families. This number is very likely to have an influence on the amount of water consumption in each of these families. The more family members it is possible to use more water.

3.1.5. Water usage pattern

Water from Spamdus Genjahan is used to fulfill basic family needs. These types of needs are for drinking water, bathing, washing and drinking water for livestock. Before being used, some people collect water in a large reservoir. This reservoir functions as a reservoir as well as a water reservoir. The collected water is then channeled through a network of pipes into houses such as kitchens, bathrooms, and other parts. Some other communities use water directly without holding it. Water from the Spamdus network is directly channeled into the pipe network inside the house.

Some people have other water sources apart from water that comes from the Spamdus Genjahan network. This source is in the form of dug wells around people's homes. One dug well is used by more than one family together. Water is drawn using a pump or bucket.

The largest amount of this water use is in the use of water for washing. There are variations in the frequency of washing from twice a week to seven times a week. Based on calculations, it is known that the majority of the washing frequency is done seven times and four times a week. Each use for washing, the amount used on average is more than five 15 liter buckets.

The next use is for bathing purposes. Based on interviews, it is known that almost all respondents take bath 2 times a day, namely in the morning and evening. The amount of water used for bathing is 2 to 3 buckets measuring 15 liters. The water used for bathing is accommodated in a tub. Most of the bathing process is done by pouring water on the body using a dipper.

The next use of water is for cooking purposes. The majority of the use for cooking uses 2 buckets of 15 liters of water. The number of respondents in this group reached 94.1%. This condition describes almost the same pattern of most of the Spamdus water users in cooking activities. Others use more water, but the number of respondents in this group is only 3.9%. The water used for cooking is taken directly from the faucet connected to the Spamdus Genjahan system.

There are other uses of water carried out by the community using Spamdus Genjahan water, namely the use of drinking water for livestock. Types of livestock that

require a lot of water are goats and cows. Other livestock kept by the community are chickens, but the number for the purpose of feeding chickens is so small that it is neglected in this study. The amount of water used to feed the cattle is 3-4 buckets of 15 liters per head per day. Meanwhile, the amount of water used to feed goats is 2-3 buckets of 15 liters per day.

3.1.6. Knowledge level about water quality

Knowledge of water quality is very important in the use of water, especially karst groundwater. The calculation results show that most of the people who use Spamdus Genjahan water do not have the correct knowledge regarding water quality parameters. In general, more than 95% of the people chose the no-answer option on questions related to pH, turbidity, TDS, and temperature parameters.

Based on depth, the pH parameter tends to be the most widely known by the public compared to other parameters. In this question regarding the meaning of pH, there are 23.5% correct answers. This number is much larger than the correct answer regarding the other parameters. However, knowledge of the pH conditions in Spamdus Genjahan water which has been used so far, the correct answer fell to 17.6%. This shows the need for a tool such as a Smart Water Quality and Management System that will be applied to this Spamdus Genjahan system. This application is expected to increase understanding regarding the condition of water quality used by the community in real time.

Questions about TDS parameters have 2.9% correct answers. This number is smaller than the correct answer to questions related to pH parameters. Other respondents, 97.1% chose the option not to answer. This number shows that most people do not know the meaning of this TDS parameter.

Questions about temperature parameters gave correct answers as much as 8.8%. This number is greater than the correct answer regarding the TDS parameter, but still lower than the correct answer regarding pH. Other respondents chose the option not to answer that is equal to 91.2%. This data also shows that most people do not know the meaning of the temperature parameter.

Meanwhile, the question about the turbidity parameter does not give the correct answer. 97.1% chose the no answer option, while 2.9% were wrong answers. From this data it means that all respondents do not know the meaning of this turbidity parameter.

3.2. Discussion

The results showed that most of the education levels of the Spamdus Genjahan water users were at the lower middle level, the majority of the occupations were farmers, laborers and casual workers, with more than 4 family members. The type of expenditure carried out is for the purposes of side dishes and the purchase of rice as a staple food, and a small portion is for transportation, health and other needs. Water is used by the community for washing, bathing and cooking in

varying amounts. Almost the entire community of Spamdus Genjahan water users have not received sufficient knowledge regarding water quality. The pH parameter is the parameter most familiar by the public. Meanwhile, the turbidity parameter is a parameter that has not been understood by the public.

Findings regarding education level are in line with [3] where the level of public education in the Gunungsewu area is generally low. However, the findings of this study indicate that the average level of education is higher than the level of education in the study area in the reference [3]. The same thing happened in the research area [4] namely Kemiri village where the majority of the population only finished elementary school. This condition is also strengthened in the exposure of the information conveyed by the reference [14] and findings from references [19]. The level of community education has an important role in efforts to conserve water resources [10 - 12, 15].

The main types of people's work found in this study are the majority as farmers or laborers. This condition is in accordance with findings in other areas in the Gunungkidul district [4, 14]. Several changes in the form of work from agriculture to other occupations such as fishing and trading occur in several places. However, work as a farmer is still carried out as an effort when the results of other work are not in good condition [5, 6]. This work as a farmer is a form of work that the community can best do, in line with their level of education. A small proportion of people with higher levels of education have jobs as civil servants, traders, troops or police.

The type of consumption in the largest community is consumption to meet the needs of side dishes and rice. This condition describes the pattern of needs that are still in meeting basic needs. There is not much variety of activities carried out by the community in the research area. Reference [19, 20] shows examples of conditions in other areas in Gunungkidul Regency which show similar consumption patterns of the population. Dependence on rice is very high for people in the Gunungkidul Regency area until now.

Community families in the research area generally have a large number of members. The number of family members disclosed in this study is in line with the findings [20] which states that on average each family head bears 4 family members. It was further stated that the more the number of family members, the greater the household expenditure. The number of family members can have an influence on family conditions. Reference [18] states that the number of family members can have an influence on family food security.

The pattern of water utilization in the research area is generally the same as the pattern of water use in the Gunungsewu karst area. The main use is for drinking or cooking, bathing, washing and feeding livestock. Utilization of water for drinking, cooking, bathing and washing is the use carried out by every family. Meanwhile, the use to feed livestock is only carried out by families who own livestock. Not all families own livestock. The same thing was said by [1, 7, dan 10]. The difference found compared to the

reference is that the people in the research area only use water from wells and Spamdus Genjahan. There are no people who use water from karst lakes and rainwater reservoir. This is because the research area is flat and is included in the Wonosari Ledok area which does not have many lakes. Thus, the need for water fulfillment is completely piled up from water originating from Spamdus Genjahan and several wells that still have water. Some of the water in the residents' wells has a different discharge depending on the location and season.

The level of knowledge of the Spamdus Genjahan water users is at a low level. This is known from the lack of correct answers to questions about water quality parameters that are monitored through the Smart water quality monitoring and management system. This fact also occurs in other communities in the Gunungsewu karst region as revealed by [3 dan 10]. However, this low level of knowledge about water quality does not affect the level of community participation in the conservation of karstic underground water resources. Public attention to efforts to conserve water resources is quite high.

4. CONCLUSION

Based on the results and discussion above, it can be concluded as follows.

1. Characteristics of the community using Spamdus Genjahan water can be characterized through the parameters of education level, type of work, type of consumption, number of family members, water usage patterns, and level of knowledge about water quality.
2. Based on these parameters, it is known that in general the education level of the community is at the lower middle level, the occupation is a farmer or laborer and is not permanent, the largest type of consumption is for the needs of side dishes and rice, has a family of 4 to 5 people, uses water for washing purposes. bath and cook and water livestock, and have low knowledge of water quality.

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