Analysis of Factors Affecting the Household Choice of Water Service Facility Management in Santa Cruz Bay, Laguna, Philippines

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Abstract: Santa Cruz Water Service Cooperative (SCWSC) is currently managing the CBNRM water project in barangay Santa Cruz, Bay, Laguna. Meanwhile, the Laguna Water District Aquatech Resources Corporation (LARC) is set to be the municipality's new water service provide. In order to assess the community's choice of water service provider, a multi-criteria household survey, key informant interview (KII), focus group discussion (FGD), and secondary data acquisition were conducted. It was hypothesized that socio-demographic, socio-economic, structural and contextual factors significantly affect the constituent's choice in terms of water resources services and management. Correlation analysis at 95% level of significance revealed that the socio-demographic (p=0.425) and socio-economic (p=0.626) characteristics of the households significantly determine the preference of the households in terms of water resources services and management. The low cost of water, payment adequacy, repair and maintenance services, client-friendly policies on disconnection, and the sense of ownership to water service facility are the factors that influenced the majority (87%) of the households' preference towards the CBNRM water project. Further, complex changes such as but not limited to environmental degradation, contamination and pollution, and population growth could impact the quality and quantity of the CBNRM water project in barangay Santa Cruz, thus institutions should develop and implement strategies that could mitigate the impacts of uncertainties and enhance the potentials of the available water resources in the community.

1. Introduction

Water is essential to life. It influences public health and living standards. However, water is unequally distributed throughout the world (United Nations Office for the Coordination of Humanitarian Affairs, 2010). Considering a safe water supply for domestic use is very important for rural sustainable development, thus, governments deal with the challenge of developing effective strategies for ensuring safe water supply (Jiang, 2009). Socio-demographic

factors such as but not limited to household size, income, and age primarily affects domestic water consumption. In theory, it can be projected that household water demand and consumption increase with increasing household size. However, Höglund (1999), observed that in household-scale economies, an increase in water demand may be proportionately less than the increase in household size. A similar resource-based problem was also encountered in Barangay Santa Cruz, Bay, Laguna.

One of the appropriate approaches in managing water demand and consumption in the community level is the Community-Based Natural Resource Management (CBNRM). This intends to enhance the capability of the institutions towards natural resources conservation. In addition, it also ensures sustainability in terms of water resources utilization through the transfer and devolution of water rights to the local community (Roe, Nelson and Sandbrook, 2009).

Majority of the domestic water supply in the Municipality of Bay is serviced by the Laguna Water District Aquatic Resource Corporation (LARC). However, in Barangay Santa Cruz, most of the households are dependent to nearby *barangay*s when it comes to water source and supply. In addition, some of the households gather water from nearby rivers and tributaries for domestic purposes. The intermittent water supply, unstable water source and the lack of an efficient water management system and/or water service provider in Barangay Santa Cruz makes the community vulnerable to health risks. A community-based water resources management system was developed, funded and implemented by the International Rice Research Institute (IRRI) in the 1980s. A total of 100 households benefited from the installation of a 5,000-gallon

tank with a motorized water pump. This study explores the effectivity and efficiency of the CBNRM Project in Barangay Santa Cruz in the Municipality of Bay.

1.1 Objectives

Generally, the study sought to undertake a household assessment on the management of water resource and service facility in Barangay Santa Cruz, Bay, Laguna.

Specifically, the study sought to (1) determine the factors affecting the household's decision in choosing the management entity of the water resource based on socio-demographic characteristics; and (2) determine the relationship between contextual/structural factors and choice of water service management entity of the respondents.

2. Methodology
2.1 Study Site

The study was conducted in barangay Santa Cruz, one of the 15 barangays within the Municipality of Bay. Bay is one of the component municipalities in the second district of the Province of Laguna. It has a total land area of 4, 160.76 hectares comprising of 15 barangays. It is bounded on the North by Laguna de Bay; East, by the Municipality of Calauan; West, by the Municipality of Los Baños; and South, by the Municipality of Sto. Tomas, Batangas. It is situated within 14°07'25.9"N and 121°15'11.6"E. Meanwhile, Barangay Santa Cruz (14°07'25.9"N, 121°15'11.6"E) has a total land area of 376.80 hectares with a population of 2,454. (Municipal Planning and Development Office of Bay, 2015).
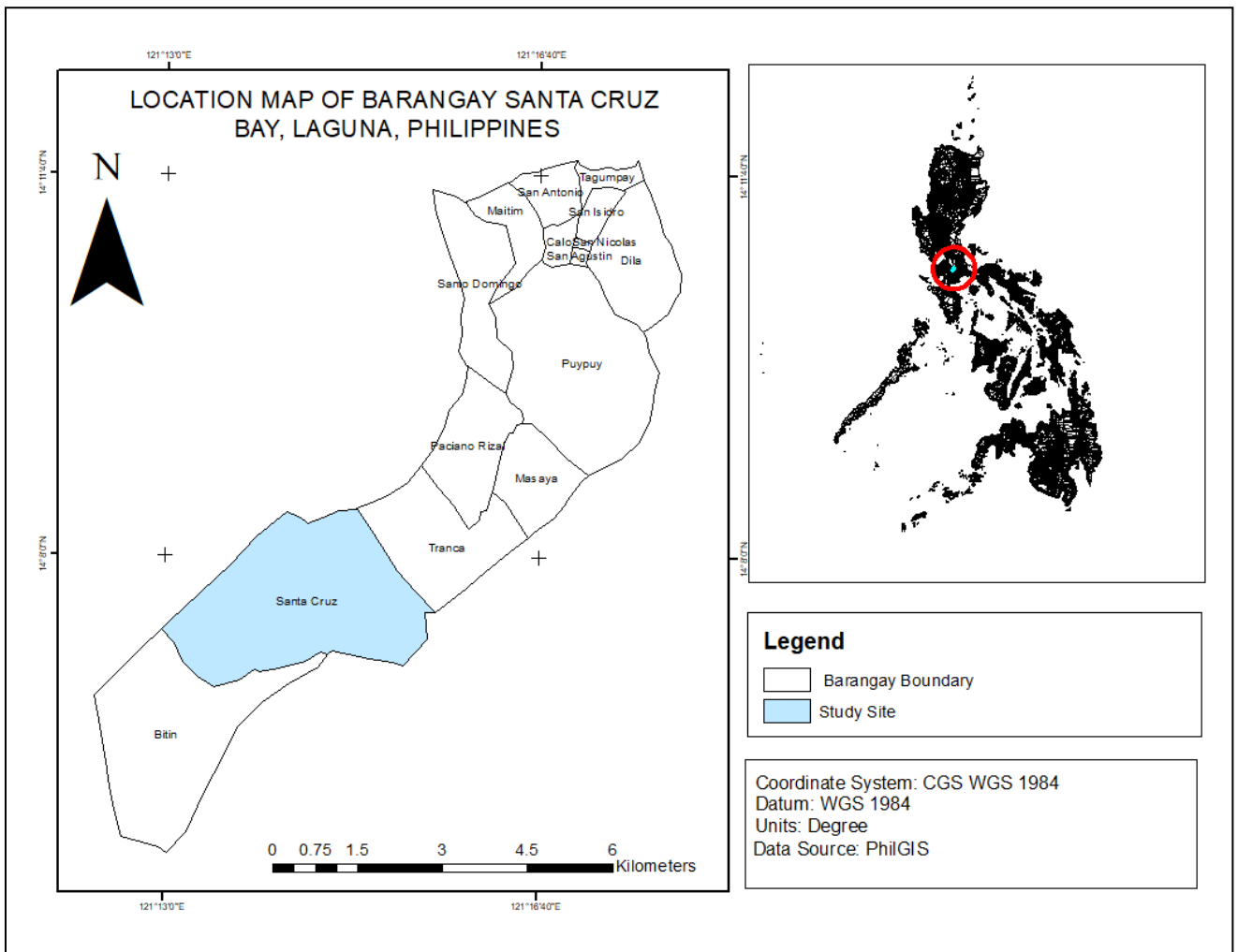
Figure 1. Location map of the study site.

2.2 Data Collection

2.2.1. Secondary Data Gathering

Secondary data were likewise obtained from the Municipal Planning and Development Office (MPDO), Sangguniang Barangay of Santa Cruz, Barangay Health Center and Santa Cruz Water Service Cooperative of Municipality of Bay.

2.2.2. Transect Mapping

Transect mapping was used to describe the bio-physical characteristics of the area. It is a tool use to describe location and distribution of resources, as well as land use types, and other features that characterized an area. For this study, existing topographic map from the Barangay Health Office was used as a guide. Transect walk with Global Positioning System (GPS) was used to locate different areas in the site.

2.2.3. House hold Survey

Socio-demographic and socio-economic data collection were measured using household survey method. The generated data included socio-demographic and socio-economic profile, water consumption practices and water management at the community level.

A multi-criteria analysis was employed in the study. A total of 238 samples was determined randomly using Cochran formula (Israel, 2003).

Equation 1

$$n = \frac{n_0}{\left[1 + \frac{(n_0 - 1)}{N}\right]}$$

where:

$$n_0 = \frac{Z^2 pq}{e^2}$$

Parameter	Value
Z	1.96
p	0.5
q	0.5
e	0.05

Note: Confidence level = 95%; α =0.05.

The calculated sample was further stratified using Slovin formula with 10% margin of error resulting to a total of 70 samples for the three *puroks* or sub-division. Furthermore, an average of five (5) samples was added for each of the *puroks* to include that are indirectly benefitting from the CBNRM Project.

Equation 2

$$n = \frac{N}{1 + N\ (e^2)}$$

where:

n = number of samples

N= total number of households

e = 10% error

Eighty-six out of the 623 households from the three (3) *puroks* or sub-divisions of Barangay Santa Cruz, were evenly identified as respondents. Table 1 shows the distribution of the total number of households' respondents per *purok*.

Table 1. Number of household respondents per purok.

Purok	Total no. of households* (N=623)	Total no. of respondents (n=86)	Percentage (100%)
1	230	31	36
2	209	28	33
3	194	27	31

Source: Barangay Health Center of Santa Cruz, Bay, Laguna (2015).

2.2.4. Key Informant Interview

In order to determine the institutional arrangements (e.g. policies, programs, issues) of the organizations and/or groups on water supply surrounding the area, a key informant interview (KII) was done.

2.2.5. Focus Group Discussion

To supplement and verify data gathered from the survey, further analysis using focus group discussion (FGD) was done. This was intended to compare water system management schemes under of Santa Cruz Water Service Cooperative and the Laguna Water District Aquatech Resources Corporation.

2.3 Data Analysis and Interpretation

Descriptive statistics was employed to analyze the socio-demographic and socio-economic characteristics of the respondents. In addition, correlation analysis was employed to establish the relationship between the (1) choice of water service facility provider with the household's socio- demographic and economic characteristics; (2) socio-demographic and economic factors with the contextual and structural factors. Encoding, processing, and analysis of data were done using Statistical Program for Social Sciences (SPSS) version 21.

3.0. Results and Discussion

3.1. Transect Mapping

Purok I, which has an elevation of 62 meters above sea level, is the lower part of the barangay. It is categorized as a commercial, an institutional, and a residential area. This area is commonly comprised of sari-sari-stores, bakery, school, church, barangay hall and houses. The vegetation cover of *Purok* I is paved, and it has partial trees and shrubs. *Purok* 2 is agricultural and partly residential. Thus, the vegetation cover of the area has some pavements. The water supply tank which serves almost all the households in the barangay is in this area. *Purok 3*, on the other hand, is the upper portion of the barangay. Land use in this area is categorized as agroforestry and grassland. A portion of this area is considered as part of the Makiling Forest Reserve (MFR). However, a dumpsite is in this area accommodating wastes to all barangays in the municipality and other neighboring municipalities.

Various zones which characterized the area such as residential, commercial, institutional, agricultural, agro-forestry and forestry, plays a major part in determining how the locality function. Each area relates to each other in a way that connections include but not limited to species interaction, landscape variation, and natural resources management. Basically, some examples of interaction within and among the different ecosystems are the exchange of human activities and the products and services provided by the ecosystem. Based on the transect map of Barangay Santa Cruz (See Figure 2), different population in distinct ecosystems exhibit interactions from residential, commercial, and institutional to agricultural, to agro-forestry up to forest zones.

AREA	PUROK 3	PUROK 2	PUROK 1
COORDINATES	N 14* 07' 21.5" E121* 15' 0.6.9"	N 14* 07' 28.7" E121*15' 17.2"	N 14* 09' 57.8" E 121* 14' 28.8"
ELEVATION (above sea level)	66 meters	64.1 meters	62 meters
LAND USE	Agroforestry, Grassland, Part of Makiling Forest Reserve	Sparse Residential, Agriculture, Watertank	Commercial (sari-sari stores, bakery), Institutional (school, church, barangay hall), Residential
VEGETATION COVER	Plantation area, Forested area, Grassland area, Dumpsite	Some pavements, more trees and grasses	Paved areas, partial trees and shrubs
PLANTS	Banana plantation, Lanzones plantation, Pineapple plantation, Some coconut, grasses	Fruit bearing trees (mango, rambutan, chico, banana), grasses	Fruit bearing trees (mango, rambutan, chico etc.), ornamental plants
ANIMALS	horses, dogs, insects	domestic animals (dog, cat, chicken)	domestic animals (dog, cat, chicken), insects

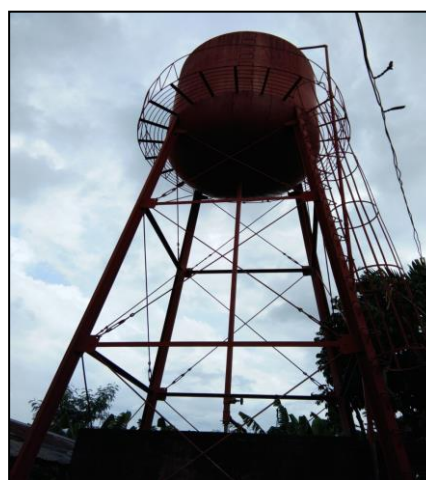**Figure 2.** Transect Map of Barangay Santa Cruz, Bay, Laguna.

Figure 3. Actual photo of SCWSC Water Tank Facility.

3.2. Comparison of the Current and Proposed Management Entities with Respect to Water Delivery Services Schemes

While both institutions usually provide water delivery services, they vary with respect to distribution schedule, cost of water per cubic meter, payment and penalty policy, collection efficiency, adequacy of facility and issues encountered. At present, the water tank with 7.5hp motor capacity can hold 5000 gallons of water. It is in a 76 square meters land and is servicing more or less 600 households with 400 units of water meters distributed in Barangay Santa Cruz.

Water Distribution Schedule. Water is available only at day-time due to energy inefficiency of the transformer. Thus, to be able to allocate the community's scarce resource, the cooperative created a scheduling scheme. In terms of water delivery schedule, the area was divided into two clusters: the lower part and the upper part. The residents on the lower part receive water service from 4:00 AM to 2:00 PM, while residents living in the upper part can avail the service from 2:00 PM to 6:00 PM. The differences between the lengths of service are due to geographical considerations and size as well as the proximity of the areas from the water source. Meanwhile, LARC provide water supply on a 24-hour basis.

Cost of Water. Cost of water per cubic meter is much less in the cooperative which costs PhP100 than LARC which costs PhP196.85. This can be associated with the argument that water delivery system in the cooperative is community-based and basically managed by a non-profit cooperative or organization, making the cost of water cheaper than LARC which is a private institution that derives profit from its services and that provide a 24-hour supply of water to its customers.

Payment and Penalty Policy. Payment and penalty policy also differ from both institutions. For the cooperative, non-compliance of payment after three (3) months shall result in disconnection of water service with a reconnection fee of PhP100. On the other hand, LARC's water supply disconnection is after two months of unpaid dues and is subjected to a 10% water bill tax. LARC has a shorter period for disconnection than the Santa Cruz Water Service Cooperative. The reconnection charge of LARC is also higher at PhP250.

Collection Efficiency. Furthermore, both institutions encountered various problems as a service delivery agency. The cooperative's major problem is the payment collection from the residents or clients in the area wherein most of them are not complying despite its cheaper amount. Only about 30% of the households comply with the monthly payment of water bill on time. Based from the data gathered from the survey as presented in Table 2, households has an average monthly income of PhP5,851, way much lower than the Region IV poverty threshold level which is PhP 12,452. Around 12% of the wage earners belong to the group with a monthly income of PhP1,999 or less. Majority of the respondents whose monthly income ranged from PhP5,000 to PhP9,999 makes up 27% of the total respondents. The low household income date largely explains the low collection payment of the cooperative.Primary source of income of the residents are usually from livelihoods that cannot provide a regular wage income among the residents. The usual types of livelihood are lowland rice farming and labor contractor. Others depend on small scale businesses such as carpentry, drivng, accepting laundry services and

retailing (sari-sari stores). LARC on the other hand, has a higher collection efficiency in the Municipality of Bay, which is comprised of 88.70% of the households comply with the payment set of the entity on time. This can be attributed to the strict policy of the LARC on payment and disconnection policy in compared with the cooperative.

Other Issues. Similarly, the cooperative also faced problems or complaints from the clients. Inadequate supply of water during dry or summer season is a major problem cited. This can be directly linked with the low capacity of water tank. Meanwhile, illegal tapping is one of problem faced by the Laguna Water District Aquatech Resources Corporation as a water service delivery agency. While LARC allows tapping of at least five (5) households from source but, this must be requested from and certified by them. Non-compliance with the said request and certification is considered as illegal tapping. Moreover, LARC also receives rare complaints from clients when it comes to water quality, inadequate supply of water, and leakage. According to the informant, inadequate supply of water especially during mornings from 6:00 AM to 8:00 AM and weekends is attributed to the fact that most of the households do their usual activities (i.e. taking a bath) during mornings, and house chores (i.e. laundry) during weekends.

In February 2015, the Cooperative has received complaints from several community members petitioning that water delivery operation of the Cooperative be cancelled. The complainants demanded that the local water district assume the services currently rendered by the Cooperative. To address this complaint, the Cooperative together with the Barangay LGU held a meeting with the whole community. The possibility of awarding the LARC management of their water resources instead of the Cooperative was laid down to the constituents. Everybody was given the chance to choose their preferred service provider. The meeting ended up with only 17 signatures (8%) who voted for the water district while more than 200 (92%) voted for the Cooperative.

According to the Cooperative Manager, Mrs. Evangeline Punzalan, the community still entrusts them their water resources despite the current quality services that they are offering. *"Kasi mas gusto pa rin nila yung sistema na iyon (cooperative) kahit di ganon ka-efficient,"* she claimed (Because they still wanted that system [cooperative] even if it is not that efficient). This is primarily due to the low cost of water, accessible payment area and repair and maintenance and that the community's ownership to the facility. Some of the residents were also reluctant about the intervention of water district in the delivery of water. They have consistently pointed out that even though water availability from the water district is far better than their water system, they have the advantage of a lower cost water supply. Also, to commemorate their efforts as a community, Mr. Lamberto Del Mundo, who was then the Barangay Chairman when the project materialized gave give importance to the project given to them. During the interview, he said that keeping the water system project is their responsibility. *"Ayaw naming mawala na lang yang pinaghirapan namin"* (We worked hard for this; we do not want this to simply disappear).

3.1. Socio-Demographic and Economic Characteristics of the Household

Socio-demographic and economic analysis reveals that majority of the respondents were female (57%) and only 43% were male. This is because males were at their workplace during the conduct of the survey. Meanwhile, in terms of the age distribution, majority of the respondents belong to the labor force (80%) and approximately 75% are married. In addition, the household has an average size of 4 to 6 members (64%) and 75% were already residing in Barangay Santa Cruz for nearly three decades. This also indicates that majority of the households have already benefited from IRRI's water pump project since 1980.

In terms of educational attainment, results showed that majority of the respondents were high school (38%) and elementary (22%) graduates. The rising cost of tertiary education in the Philippines have opted households to prioritize their basic needs over tertiary education (8%). As a result, majority of the households were unemployed (34%) while a considerable number have menial jobs (32%) such as laborers, drivers and factory workers. Meanwhile, the average household monthly income PhP5, 851 which is almost half the poverty threshold of P10,000.00 monthly (PSA, 2015) (See Table 2).

Table 2. Socio-demographic and economic characteristics of the households.

	FREQUENCY (n=86)	PERCENTAGE (%)
Sex		
Male	37	43
Female	49	57
Age		
20-29	9	10
30-39	24	28
40-49	19	22
50-59	17	20
60-69	12	14
70 and above	5	6
Civil Status		
Single	14	16
Married	64	75
Widowed	8	9
Years of Residency		
1-5	6	7
6-10	9	11
11-15	1	1
21-25	3	4
26 and above	65	75
Average	36.55	

Table 2. Continued…

	FREQUENCY (n=86)	PERCENTAGE (%)
Educational Attainment		
Elementary Level	7	8
Elementary Graduate	19	22
High School Level	11	13
High School Graduate	33	38
Vocational	4	5
College Level	5	6
College Graduate	7	8
Occupation		
Housewife	29	34
Laborer	16	19
Business Owner	13	15
Farmer	12	14
Driver	9	10
Government Employee	4	5
Factory Worker	3	3
Monthly Income		
<1,999	10	12
2,000-2,999	11	13
3,000-3,999	21	24
4,000-4,999	5	6
5,000-9,999	23	27
10,000-14,999	12	14
15,000-19,999	2	2
>20,000	2	2

3.2. Water Services Provider Preference

In terms of management, majority (87%) of the households still prefer the SCWSC over the LARC (13%) (See Figure 4). This is basically due to the following factors considered by the households: (1) cost of water (93%) which is only P100.00 as compared to LARC's P196.85 for 10m^3 of water; (2) sensorial attribute (70%), majority of the household's perceive that LARC's water is being treated with high concentration of chlorine thus affecting its taste and potability; (3) policy on disconnection service (62%), SCWSC's 3-month non-payment disconnection policy is more lenient and client-friendly as compared with LARC's which is 2-month with 10% penalty charges; (4) accessible repair, maintenance and payment services (60%) since the households could spare at least P60.00 of travel cost going to the LARC main office; and (5)strong ownership to the water services facility provided in the area (55%), majority of the households view the SCWSC as a product of their community's

hard work and perseverance (See Figure 5).

Meanwhile, households who prefer the services and management of LARC considered efficiency and effectivity in terms of water treatment (47%) and that the corporation is technically managed (82%) with a 24-hour water distribution schedule (100%) (See Figure 6) .
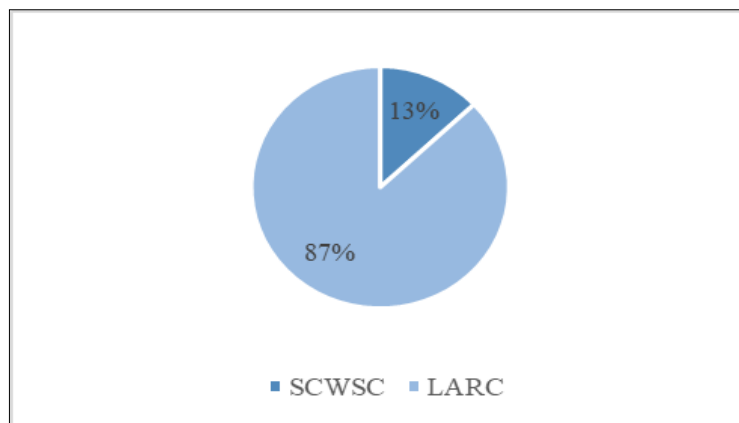

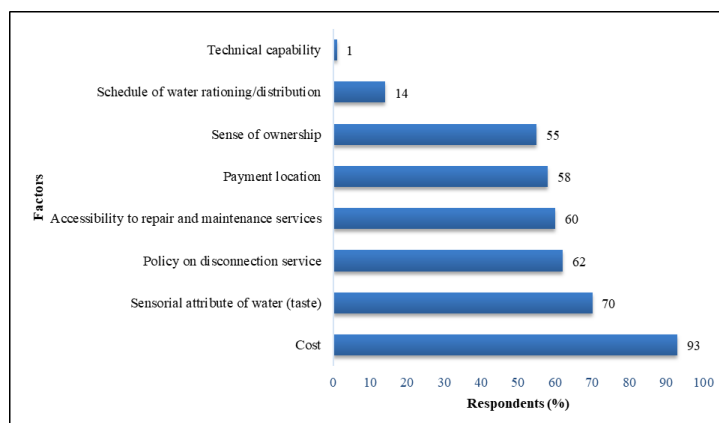**Figure 4.** Water service provider preference of households.

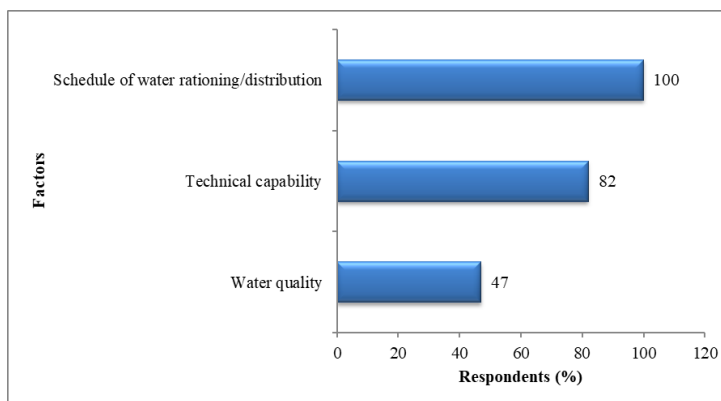**Figure 5.** Factors considered in choosing SCWSC.

Figure 6. Factors considered in choosing LARC.

3.4. Correlation Analysis of Socio-Demographic and Socio-Economic Characteristics of the Respondents

Correlation analysis was conducted to further understand the factors that influence the household's decision in water management service provider. Results revealed that the socio-demographic (p=0.425) and socio-economic (0.626) factors determines the household's choice in terms of water resources services and management. Household income and the cost of water are the probable reasons for such preference. Table 3 shows the result of Spearman's Rho Correlation at 95% level of significance.

Table 3. Spearman's rho correlation results showing the socio-demographic and economic factors influencing the household's preference.

VARIABLE	SIGNIFICANCE	REMARKS
Years of residency	0.425**	Positively correlated
Monthly income	0.626**	Positively correlated

*** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).*

3.5. Correlation Analysis of Contextual and Structural Factors in Water Service Facility Management

It was also hypothesized that the contextual and structural factors such as the cost and sensorial attribute of water, proximity to the water service provider in terms of payment and maintenance and repair services, technical capability, ownership to water management, water distribution schedule and water conservation practices influences the decision of the households. Spearman's rho correlation analysis at 0.01 level of significance, revealed that eight out of ten (8/10) variables significantly influences the preference of the households. These include the cost of water, proximity of water service provider, adequacy to repair and maintenance services, policy on payment and disconnection, schedule on water distribution or rationing, technical capability, sense of ownership, and treatment on water supply (See Table 4). According to the corresponding interpretation of correlation coefficient, the cost of water, technical capability, schedule of water distribution, have a strong correlation to the respondent's preference.

Table 4. Spearman's rho correlation results showing the contextual and structural factors influencing the household's preference.

VARIABLE	SIGNIFICANCE	REMARKS
Cost of water	.756(**)	Positively correlated
Proximity to payment location	.403(**)	Positively correlated
Adequacy to repair and maintenance services	.420(**)	Positively correlated
Policy on payment and disconnection	.375(**)	Positively correlated
Sensorial attribute of water	.210	Not significant
Schedule of water distribution and rationing	-.630(**)	Inversely correlated

Technical capability	-.796(**)	Inversely correlated
Sense of ownership	.384(**)	Positively correlated
Water conservation practices	.186	Not significant
Water treatment	-.330(**)	Inversely correlated

*** Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed).*

4.0. Conclusion

The households prefer the CBNRM Project over the LARC. The low cost of water, its proximity, pro-consumer policies on payment and disconnection, adequacy to repair and maintenance services, and the community's sense of ownership contributed significantly to the household's preference. Meanwhile, households that preferred the LARC over the CBNRM Project highlighted its efficiency in terms of water distribution schedule, technical capability and effective water treatment processes.

It can also be concluded that institutions play a vital role in the utilization of water resources, especially in ensuring the welfare of the community. It is essential that institutions complement each other in order to optimize potential water resources in the community. The *Sangguniang Barangay* and the SCWSC are the institutions responsible for the management the CBNRM Project in Barangay Santa Cruz. Although the CBNRM approach in water resources management is geared towards sustainability, it also poses constraints in terms of the population size, land area, low number of people involved in management, limited earnings, availability of local skills, development changes, financial resources and culture. In addition, several complex changes in Barangay Santa Cruz such as but not limited to environmental degradation, contamination and pollution, and population growth, could significantly affect the quality and quantity of its available water resources.

Moreover, it was observed that one of the key issues in the area is the presence of a nearby open dumpsite, located approximately 200m from the CBNRM Project. Leachates originating from the dumpsite could cause the contamination of the water table and could lead to health complications. Therefore, constant water quality testing and monitoring should be conducted.

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