

EFFECTIVENESS OF DOMESTIC WATER SUPPLY SYSTEM BY PDAM NORTH TORAJA IN RANTEPAO SUB-DISTRICT

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ABSTRACT

Individual water supply is a problem faced by people of Rantepao Sub-district, especially in droughts. On the other hand, communal water supply through pipeline system by PDAM North Toraja that serves the capital of North Toraja District has not satisfied the expectation. Other than the target of service area coverage stated by the government in its local development program which has not yet been achieved, the customer satisfaction has not yet been attained. It is indicated by the number of customer complains related to the basic service parameters of water supply, i.e. quality, quantity, continuity, affordability, and accessibility. This study aims to obtain a description of customers' condition and opinions that can be used as an initial step to find solution upon parts of the problems faced by PDAM North Toraja. The study area was eleven villages in Rantepao Sub-district where primary data were collected through questionnaires and interviews with respondents. Other than from the main respondents who were customers of PDAM North Toraja, the data were also collected from respondents who are non-customers in the service areas and non-service areas. The data analysis was done using descriptive analysis and two-sample proportion test. Secondary data were collected from various sources and related institutions. The results showed that customers' opinion upon PDAM's water quality was good, PDAM's water quantity was moderately good, while PDAM's water continuity was bad. It was also found that the additional reasons of not-to-be-customer between groups of non-customers at service areas and non-service areas are significantly different. These findings should be useful for PDAM North Toraja in determining the priorities of solutions to solve problems and the strategies of extension of service area coverage.

Keywords: customer, parameters, PDAM, service area, water supply

1. INTRODUCTION

Despite the fact and understanding that water is a basic need of human life, the World Health Organization (WHO, 2011a) stated that approximately "1.1 billion people globally do not have access to improved water supply sources". In addition to that, various studies have found that in different parts of the world, the poor has to pay more for water. They are especially "the populations in developing countries, people who are living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants." Similar situation applies to the communal piped water supply system; those who have limited access to it must spend considerable amount of their income for water through water vendors, although in general the households have to pay around 1-2% of their average annual income for water. (The Water Dialogue, 2009)

In addition to accessibility, WHO (2011b) states the other four surveillance parameters of adequacy of supply that have to be met. They are (1) quality, (2) quantity, (3) continuity, and (4) affordability. Those parameters apply to both individual and communal water supply systems. Communal system is needed especially to overcome the problem of individual system. Among the available alternatives of communal system, to some extents, the piped system is preferably developed in many areas.

2. PROFILE OF STUDY AREA

Rantepao Sub-district is the capital of North Toraja Regency and located 328 km northern Makassar, the capital of South Sulawesi Province. Its 10.29 km² area is a combination of low land/flat and hilly areas and divided into eleven villages as shown in Figure 1. Eight out of the eleven villages are located in low land/flat area, i.e. Laang Tanduk, Karassik, Rantepao, Singki, Rantepasele, Penanian, Malango, and Mentirotikku. The rest of them that lay on the hilly area are Pasele, Limbong, and Saloso. Population number and density in Rantepao Sub-district are the highest and its population growth is relatively higher than other sub-districts in the district. Their water supply has been served by PDAM North Toraja for 30 years. However, the level of coverage in the service area is still relatively low, i.e. 61% (2,711 connections out of 4,455 households) in nine out of eleven villages in the sub-district, excluding

Limbong and Saloso Villages with 365 and 223 households respectively. Those two villages are still uncovered by the service due to the far distance and difficult terrain to be reached.

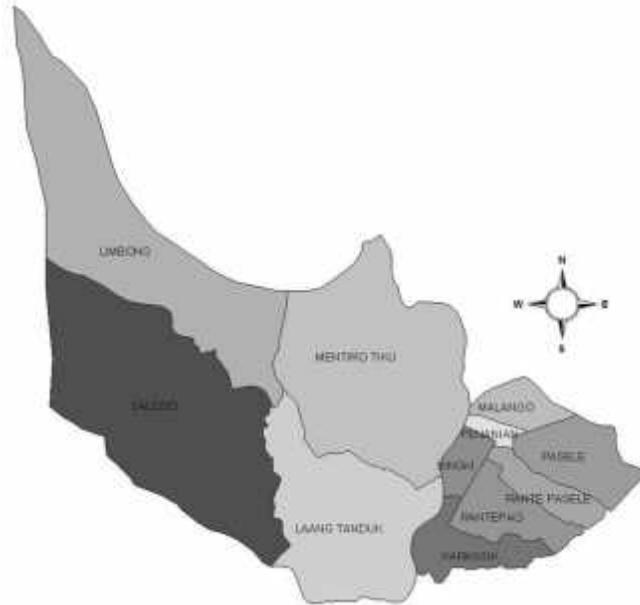


Figure 1. Administrative map of Rantepao Sub-district

Currently, the water distributed by PDAM North Toraja is resulted from three water treatment plants for river water, i.e. *IPA (Instalasi Pengolahan Air) Bolu* (20 l/sec), *IPA Rura* (20 l/sec), and *IPA Pasele* (25 l/sec), and two seasonal springs, i.e. Limbong and Nanggala. The piped system of PDAM North Toraja is a combination between gravitational (Limbong and Nanggala springs as well as *IPA Pasele*) and pumping (*IPA Bolu* and *IPA Rura*) systems. In addition to the water treatment plants, it also consists of intake from river, reservoirs for water from both springs and water treatment plants, and pipelines of transmission (made of steel and PVC with diameter of 6-10 inches), distribution (made of PVC with diameter of 2.5-4 inches), and tertiary (made of PVC with diameter of 1-2 inches) networks.

Customers with at least 15-year-old membership are mostly in Karassik, Pasele, Malango, and Mentrotiku; 6 to 14-year-old in Laang Tanduk, Singki, and Penanian; and less than 6-year-old in Rantepao and Rantepasele. There are more than four people in most households in the service area (79.63%) with average daily water consumption of most customers (67.54%) is not more than 86.4 litre/capita, even 36.57% consume water less than 60 litre/capita. However, this is slightly different in Karassik and Penanian in where 60% of its PDAM customers consume water 86.4-110 litre/capita/day and more than 110 litre/capita/day respectively.

The presence of household reservoirs with various capacities is relatively significant as much as 77.41% of the PDAM customers. In Laang Tanduk, Singki, and Karassik, it varies from 57% to 67% while in the other eight villages from 80% to 93%. Small capacity reservoirs (less than 1 m³) are available mainly in Singki, Malango, and Mentrotiku (42% to 60%) while bigger capacity reservoirs (1-3 m³) in Rantepao, Rantepasele, and Penanian (67% to 89%). Reservoirs whose capacities are more than 3 m³ are available mainly in Karassik (67%).

3. METHODOLOGY

Data collection

Both primary and secondary data were collected in this study. Primary data were collected using questionnaires and interviews. One respondent represented one household. Stratified random sampling was applied and thirty samples (respondents) were taken from each stratification, i.e. villages, both the served and unserved ones. The unserved respondents were from both service and non-service areas. Different questionnaires were distributed in those groups. Using the questionnaire for first group, i.e. served respondents, the following data were collected: (1) respondent's identity (i.e. personal data), (2) household's profile (including water consumption), and (3) domestic water supply condition related to the studied parameters. On the other hand, using the questionnaire for the second group, i.e. unserved respondents, the collected data were: (1) respondent's identity (i.e. personal data), (2) household's profile (including water consumption), (3) reason(s) of being non-customer and interest to be customer.

Secondary data were collected from relevant agencies/institutions regarding geographical and demographical data as well as PDAM North Toraja's water supply system especially water sources capacity and distribution pipeline, also customer data.

Data analysis

Two types of data analysis were applied to the primary data, i.e. descriptive analysis (i.e. percentage) and inferential analysis (i.e. hypothesis test for two-sample proportion). The descriptive analysis was applied especially to the data obtained from the first group of respondents (i.e. the served ones) regarding the domestic water supply condition related to the studied parameters; while the inferential analysis (i.e. two-sample proportion test) was applied especially to the data obtained from the second group of respondents (i.e. the unserved ones) regarding the reason(s) of being non-customer and interest to be customer. The two-sample proportion was aimed to see whether significant difference was available regarding the reason(s) of being non-customer and the interest to be customer between the group of non-customer respondents in non-service area and in service area.

4. RESULTS AND DISCUSSIONS

The expected number of samples (answered questionnaires) was able to be collected, as follow.

- § 270 answered questionnaires from 9 villages (@ 30 customer respondents) in service area;
- § 30 answered questionnaires by non-customer respondents from 9 villages in service area; this number was difficult to be exceeded due to the limited number of non-customer households in the service area;
- § 60 answered questionnaires by non-customer respondents from 2 villages in non-service area, i.e. Limbong (30 respondents) and Saloso (30 respondents).

Quality aspect

The questions related to quality aspect were asked to customer respondents. There were eight questions and the respondents' answers will describe the condition/quality of water supplied/distributed by PDAM North Toraja as summarized by Table 1. Presence of dirt and change in colour are subject to the keeping of water overnight; presence of crust is subject to the presence of lime when the water is boiled; presence of chlorine is subject to its smell in the water. The options of answer for clarity ranges from very clear (= very good) to very turbid (= very bad); while for the other questions, they range from none (= very good) to most/very much (= very bad).

Table 1. Frequency distribution and average score of sub-parameters of water supply system's quality aspect

QUALITY Aspects	Very good Score = 4	Good Score = 3	Bad Score = 2	Very bad Score = 1	Average Score
Clarity	6	192	72	0	2.76
Dirt	27	207	35	1	2.96
Crust	166	102	2	0	3.61
Odour	197	71	2	0	3.72
Chlorine	80	162	25	3	3.18
Taste	225	42	3	0	3.82
Colour	204	58	6	2	3.72
Mud (in rainy season)	82	144	30	14	3.09
AVERAGE					3.36 (Good)

In answering open questions, a number of respondents complained that distributed water is turbid and dirty during rainy seasons. However, through interviews, other respondents explained that it normally occurs in the beginning or first day of rainy seasons but then it is back to normal (clear) afterward. According to PDAM's staff, the presence of dirt/sediment at bottom of bucket or tub of overnight water is due to high turbidity of river water in rainy seasons. On the other hand old machines of the water treatment plants cannot completely process the low quality water. The machines need to be replaced with new ones. Excessive addition of chlorine and alum into water during its treatment process caused the presence of crust at bottom of bucket or tub of overnight water as well as the smell of chlorine. However, it does not frequently happen, similarly with the presence of odour in the water due to dirt or bacteria. PDAM's staff confirmed that the distributed water is sometimes salty, bitter, or other tastes due to high level pollution of garbage and human/animal waste. According to the respondents, in this case, they are afraid to consume the water and will use it only for washing. Similarly to the change of colour, when the water turns to be greenish or brownish within several days, respondents will use it for watering plants or even do not use it at all and dispose it instead.

The above situation goes inline with Roger et al. (2009) who determines three acceptability aspect of drinking water, i.e. taste, odour, and appearance. It was stated as follow.

“The provision of drinking-water that is not only safe but also acceptable in appearance, taste and odour is of high priority. Water that is aesthetically unacceptable will undermine the confidence of consumers, will lead to complaints and, more importantly, could lead to the use of water from sources that are less safe. To a large extent, consumers have no means of judging the safety of their drinking-water themselves, but their attitude towards their drinking water supply and their drinking-water suppliers will be affected to a considerable extent by the aspects of water quality that they are able to perceive with their own senses. It is natural for consumers to regard with suspicion water that appears dirty or discoloured or that has an unpleasant taste or smell, even though these characteristics may not in themselves be of direct consequence to health.”

Quantity aspect

The questions related to quantity aspect were asked to customer respondents. There were two questions and the respondents' answers will describe its condition related to water supplied/distributed by PDAM North Toraja as summarized by Table 2. “Sufficiency” refers to the amount of collected water to meet the daily needs of the household which is actually interrelated to the discharge as well as frequency and duration of supply. The last two are sub-parameters of continuity aspect.

Table 2. Frequency distribution and average score of sub-parameters of water supply system's quantity aspect

QUANTITY Aspects	Very good Score = 4	Good Score = 3	Bad Score = 2	Very bad Score = 1	Average Score
Discharge	2	139	116	13	2.48
Sufficiency	20	198	47	5	2.86
AVERAGE					2.67 (Moderately good)

Most respondents commented that the discharge is good but a significant number of respondents said that it is bad. Low discharge occurs especially in dry seasons when the discharge of river as PDAM's water source, decreases. Discharge influences the sufficient amount of possible water collected by customers. If most respondents considered it sufficient particularly because they have alternate source of water, i.e. wells.

Continuity aspect

The questions related to continuity aspect were asked to customer respondents. There were three questions and the respondents' answers will describe its continuity of water supplied/distributed by PDAM North Toraja as summarized by Table 3. The options of answer provided for question regarding “schedule” are anytime (= very good), every 4-6 hours (= good), every 12 hours (= bad), and uncertain (= very bad); regarding “duration” are more than 6 hours (= very good), more than 3 to 6 hours (= good), 1-3 hours (= bad), and uncertain (= very bad); regarding “supply in dry season” are continuous (= very good), relatively continuous (= good), discontinuous (= bad), none (= very bad).

Table 3. Frequency distribution and average score of sub-parameters of water supply system's continuity aspect

CONTINUITY Aspects	Very good Score = 4	Good Score = 3	Bad Score = 2	Very bad Score = 1	Average Score
Schedule/frequency of supply	40	31	5	194	1.69
Duration of supply	11	4	61	194	1.37
Supply in dry season	5	43	216	6	2.17
AVERAGE					1.75 (Bad)

In answering open questions, a number of respondents complained that water supply is not continuous especially during dry seasons. According to most of the respondents, the schedule and duration of water supply by PDAM are very unsatisfactory since for them it is not certain when and how long the water will be flowing out or it flows out only in a short time (1-3 hours). It leads to insufficient amount of water they can collect. It is even worse during dry seasons; some respondents mentioned that they always get no water for 2-3 days and the water is dirty once it flows out afterward. Limited amount of river water, especially in dry seasons, requires PDAM to arrange distribution schedule over the whole service area in order to distribute water as equal as possible to all customers. Hence, water distribution schedule is applied differently among service areas/zones. In result, different villages get water at different times while respondents wish to have 24-hour supply. According to PDAM's staff the main cause of that uncertainty is the old pump and amount of available water in reservoirs of IPA, especially IPA Rura and IPA Bolu.

This is even worsened by the not-well-planned distribution pipe network. Also still some respondents complain about unequal distribution among customers or service areas.

Accessibility aspect

It is clear that the service of PDAM North Toraja has not yet been accessible by everyone or every household in Rantepao Sub-district. Two villages, i.e. Limbong and Saloso, are still completely uncovered by the service and the same case with 1,743 households (39%) in service area. People in Limbong and Saloso completely rely on groundwater which is accessed through their wells while non-customer of PDAM in service area rely on well (79.17% respondents) and spring (20.83% respondents). Yet, most of them stated that they are interested to be PDAM's customers and suggested PDAM to expand its service. According to PDAM's staff the main cause of no service in those areas so far is difficult topographical condition; the two villages are located in hilly and rocky areas although they are not far from current available pipelines network.

The above situation is actually representing the bigger picture of Indonesia's situation which is statistically elaborated by Rogers et al. (2009) as follow.

“Access to improved drinking water sources in urban areas in Indonesia has been in a slow gradual decline since 1990, based on a broad definition of “access.” Such access has declined from 92% to 89% between 1990 and 2002, and according to the WHO-UNICEF joint monitoring program, to only 87% in 2004. Using a narrower definition of access, restricted to household connections, access in urban areas is much lower, although steadily increasing, with coverage estimated to be 34% (WHO/UNICEF JMP 2008). The rural situation is worse with only 7% coverage for household connections, although it is about 70% using a broader definition of “access”. The MDG improved drinking water target of 86% by 2015 is scarcely on track (World Bank 2008).”

Affordability aspect

Open questions of the questionnaires as well as interviews revealed that some customer respondents considered the price of water sold by PDAM is relatively expensive compared to the service which is irregular and insufficient especially in dry seasons. These are considerable factor that influencing them to be non-customer since they cannot afford it. Some other respondents complained that the record of water meter by PDAM's staff is not accurate; hence, it is a disadvantage for customers. They do hope for improvement of PDAM's administration and management. In contrast, PDAM's staff explained that the cause of problem is not from PDAM's side but from the leak in the house pipelines.

Institution and management aspect of PDAM

Some respondents provided additional information by answering open questions of the questionnaires. They mentioned ubiquitous leakage and it is confirmed by PDAM's staff stating that the cause of leakage in main pipelines is due to low quality of pipe material. Hence, anyone who finds out leakage of PDAM's pipes is suggested to immediately report it. Respondents also suggested PDAM to provide service for customers' complains and be responsive to them. They advise PDAM to increase the number of facilities such as reservoirs, pipes, and water tank truck, in order to improve its service. It is also recommended that PDAM increase the supply to anticipate the population growth. On the other hand, interview with PDAM's staff revealed that PDAM is lack of human resources.

Another issue is people in Limbong and Saloso realize that they will not get any service by PDAM before problems of water supply in the 'city' are solved. It is obvious since pipeline is already installed for ten years but has not yet been operational. Specifically in Saloso, people rely on groundwater as their water source which is accessed through well. Big springs are available in Saloso but land acquisition for pipelines installation is a problem.

The above problems are not surprising since Robinson's (2005) statement confirmed the situation as follow.

“Water supply development requires a high level of technical knowledge, thus must involve external institutions with strong engineering skills and experience...Water supply programs also need to establish relatively complex systems for the management of shared infrastructure, thus must engage with local leaders, develop community level institutions, and build finance and operational capacity.”

However, in contrary, he also stated that “...it proved difficult to recruit suitably qualified and motivated staff to implement these specialist activities.”

In the project of Support on Water and Sanitation Sector Analysis and Program by USAID (Rogers et al., 2009), PDAM capacity building was given the highest rank of potential intervention whose focus in performance and governance includes PDAM staffing improvement, financial operating procedures including billing system improvement, and responsiveness to customers including consumer satisfaction surveys, etc. The program also

identified the major “gaps” that exist in urban areas in term of water supply, i.e. “inadequate institutional capacity to deliver needed services, inadequate total coverage, inadequate inclusion of the poor, and lack of financial resources.”

It is apparent that PDAMs in Indonesia including PDAM North Toraja requires assistantship in improving their management system. It is confirmed by Rogers et al. (2009) that despite the various performance capacities among PDAMs in Indonesia, none of them is free of serious challenges, none has “financial capacity to expand as much as is needed” which partially related to “insufficient support by local government.”

Non-customers in service and non-service areas

Two-sample proportion test was used to see whether significant difference was present between non-customers in service areas and the ones in non-service areas in terms of possible reasons to be non-customer. The proportionality was actually taken to normalize the difference number of respondents between the two groups as well as the opportunity to choose more than one options of answer. The results are summarized in Table 4. The same test also applied for same purpose in term of water source and desire or intention to be customer.

Table 4. Result of two-sample proportion test between non-customers in service areas and non-service areas

	Reason or Criteria	Non-customer		Difference
		in service area	in non-service area	
REASON	Insufficient amount of distributed water	18.75%	15.05%	Not significant
	Irregular schedule of water distribution	35.42%	12.09%	Significant
	Dirty water	0.00%	0.00%	Not significant
	Odorous water	0.00%	0.00%	Not significant
	Taste in water (salty, bitter)	0.00%	0.00%	Not significant
	Colour in water (greenish, brownish)	0.00%	0.00%	Not significant
	Expensive price	43.75%	8.60%	Significant
	Groundwater as water source	100%	79.17%	Significant
	Spring as water source	0.00%	20.83%	Significant
	Desire or intention to be PDAM customer	83.33%	98.33%	Significant

The above result in Table 4 indicates that both groups of respondent considered similarly upon the insufficient amount of distributed water by PDAM as a reason not to be customer. Meanwhile, regarding the irregularity of schedule of water distribution and expensiveness price of the water, both groups responded differently. This might be due to information of their neighbours' experiences. Respondents in service area might have heard or informed by their neighbour who are customers, regarding the irregular schedule and expensive price that they experienced. On the other hand, such situation is not present in non-service area since none is customer. This potentially leads to the different desire or intention to be PDAM customer with higher desire is present in respondents in non-service area.

Additional information is regarding alternate water source. Both groups of respondents similarly have alternate water sources to fulfil their needs, although non-customer respondents in service area completely rely on groundwater while their counterparts in non-service area rely on groundwater and spring as their water source. Related to their desire or intention to be PDAM customer, this condition is not a trigger for them to be customers.

5. CONCLUSION

In term of quality that can be considered as the first and most important aspect of water supply, the effectiveness of service by PDAM North Toraja is relatively high since customers considered that it is good. In term of quantity, the effectiveness of service of PDAM North Toraja can be considered of moderate since customers considered that it is moderately good. In term of continuity, the effectiveness of service of PDAM North Toraja is still low since customers considered that it is bad. In term of accessibility, it is obvious that the service of PDAM North Toraja is not yet completely effective since the level of coverage is only 61% and two out of nine villages in service area are still completely not served. In term of affordability, the service of PDAM North Toraja is not yet effective since customers considered that the price is relatively high for such effectiveness of quantity and continuity aspects. However, it is not the case for non-customers in non-service area since their needs for water is beyond its price.

In general, characteristics of non-customers of PDAM North Toraja in service area and non-service area are significantly different, except in term of insufficient amount of supplied water as a reason to be non-customer. Both non-customers in service and non-service area proportionally agreed about it. Regarding the desire or intention to be customer, non-customers in non-service area show higher proportion compared to those in service area. Other than

the above five parameters, PDAM North Toraja faces management problems including human resources capability that has significant influence on its effectiveness of service.

6. RECOMMENDATION

In order to improve the effectiveness of its service, PDAM North Toraja needs to improve its capacity. It does not mean only the number of served people or households or water supply utilities but also commitment and financial resources. Private sector involvement might be one option for speeding up the improvement process.

Referring to Rogers et al. (2009), a pro-poor and poor-inclusive strategy is recommended since it will benefit not only the poor, but also the general population. It requires that the poor does not become an after-thought for the utility, but rather to be benefited from the improved capacity of the utility.

A new paradigm need to be introduced to and implemented by local governments as the owner of PDAM by do not tend to view PDAM as a source of revenue, rather than a public service which the local government should help to support, instead of vice versa. Local governments should not constrain the financial viability of their PDAM by both taking revenue from them, and limiting the tariffs they can charge to insufficient amounts. (Rogers et al., 2009)

REFERENCES

- Robinson, A. (Dec. 2005). "Indonesia National Program for Community Water Supply and Sanitation Services-Improving Hygiene & Sanitation Behavior and Services". <http://siteresources.worldbank.org/INTWSS/Resources/Indonesia.pdf> retrieved on 17 Aug. 2011. World Bank.
- Rogers, J., Karp, A., Nicholls, R., Sukarman, R., Bimo, Andharyati, P. (Jan. 2009). "Support on Water and Sanitation Sector Analysis and Program". Final Report. <http://www.ehproject.org/PDF/ehkm/washta-indonesia.pdf> retrieved on 17 Aug. 2011. USAID.
- The Water Dialogues Indonesia. (May 2009). "Contextual Analysis in Water Supply and Sanitation Sector". <http://www.waterdialogues.org/documents/8.6ContextualAnalysis.pdf> retrieved on 17 Aug. 2011. Jakarta, Indonesia.
- World Health Organization (WHO). (2011a). "Water Sanitation and Health: Water Supply, Sanitation, and Hygiene Development". http://www.who.int/water_sanitation_health/hygiene/en/ retrieved on 17 Aug. 2011.
- World Health Organization (WHO). (2011b). "Guidelines for Drinking Water Quality". Fourth Edition.