International Journal of Sustainable Development and Planning
Vol. 17, No. 8, December, 2022, pp. 2421-2426
Journal homepage: http://iieta.org/journals/ijsdp

Model of Sustainable Drinking Water Governance at Tirta Kualo Regional Drinking Water Corporate in Tanjungbalai City, Indonesia

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https://doi.org/10.18280/ijsdp.170809

Received: 30 August 2022
Accepted: 3 December 2022

Keywords:
sustainable, drinking water governance, corporate

ABSTRACT

Tirta Kualo is the only regional drinking water corporate (herein after PDAM Tirta Kualo) that provides drinking water to the people of Tanjungbalai city, which has yet to be able to serve the entire community. The purpose of this study was to determine the potential availability of the Silau river, to meet the water needs of the people, to know the condition of drinking water supply governance of PDAM Tirta Kualo, and to design a model of sustainable drinking water governance at PDAM Tirta Kualo, Tanjungbalai city. A mixed method approach was used in this study. The population was customers of PDAM Tirta Kualo who have been domiciled in Tanjungbalai city for more than 10 years. The analysis shows that based on the area of Tanjungbalai city around 60.62 km^2 with population 169.367 inhabitants and coverage services of PDAM Tirta Kualo in 2019 was only 68.86%. The projection of drinking water supply demand for each house connection in the next 5 years, assumed to be 2% increase, is an average of 14.79 liters/second. The condition of drinking water supply governance in PDAM Tirta Kualo is still low, and it is proven that there are still many issues in all working units. The design of a sustainable water supply governance model in PDAM Tirta Kualo refers to the regional spatial plan of Tanjungbalai city year 2013 until 2033.

1. INTRODUCTION

Water utilization will undoubtedly be closely related to the availability and types of water used, such as domestic use of water, agriculture, fisheries, livestock, industries, and others. With the increasing of agricultural activities, decreased of rainfall, and uneven development, groundwater has become the main source of irrigation and drinking water for the last 2 decades [1]. Water encourages economic development to improve social justice, fresh water is discussed explicitly in the sustainable development goals (SDGs) to ensure access to drinking water and sanitation for all mankind [2]. Water and the Sustainable Development Goals (SDGs) has close relationship as it is essential for life and plays a crucial role in many other areas of development. The SDGs recognize the importance of water by including several targets related to water resources management and access to clean water. These targets include: increasing the availability and sustainable management of water and sanitation for all; improving water quality by reducing pollution; and protecting and restoring water-related ecosystems.

The issue of scarcity and unequal access to clean water is of course related to many things, one of which is the problem of managing world's clean water resources for drinking. Drinking water crisis occurs due to an increase of human population, social, economic, cultural, and technological developments which have caused the increasing of drinking water needs. The level of water intake influenced by demographic, physiological, social and economic factors [3]. Water availability is a major problem that must be maintained every year and continue in the coming years [4].

In urban areas with rapid levels of development and high population growth, the rate of water leakage, increased industrialization and agriculture severely damages water availability [5]. Water crisis occurs not only because of climate change but also because of urban growth and exponential population development which has created strong demands for society to respect their rights, one of the most basic and necessary is to have access to safe and secure drinking water, access universal and equal rights to water which are elements of great geopolitical value [6]. As cities continue to expand, the demand for water increases, often leading to overuse and depletion of water resources. Additionally, the infrastructure required to meet the needs of growing populations, such as treatment plants and distribution networks, can be expensive and may not be implemented in a way that is sustainable or equitable. To address the water crisis, it is important to consider both the impact of climate change and the challenges posed by urbanization.

The sustainability of drinking water supply requires a good governance. Whatever form of company ownership, be it private, government, or non-profit, requires good governance of its activities [7]. Governance or corporate Governance is a series of mechanisms to direct and control corporate managers and in line with stakeholder expectations [8]. Good governance requires the participation of all stakeholders in the decision-making process. This includes governments, communities, businesses, and non-governmental organizations. By involving all stakeholders, it is more likely that solutions will be found that are sustainable and meet the needs of all those affected. To conclude, the sustainability of drinking water supply requires good governance to ensure that

it is managed in a way that meets the needs of present and future generations. This includes fair distribution, effective planning and management, transparency, and the participation of all stakeholders.

Water resources management and drinking water supply are not only global and national issues, but also local ones that affect communities and individuals. While governments and international organizations play a crucial role in addressing these issues, it is also important for local communities to be involved in the decision-making process and to have a say in how water resources are managed. This is particularly important in rural and remote areas, where access to clean drinking water may be limited and the impact of poor management can be severe. This issue is also a crucial in the region in Tanjungbalai city located in North Sumatra Province, Indonesia. Based on data from PDAM Tirta Kualo, raw water is a major issue as the only water corporate in Tanjungbalai city, North Sumatra, Indonesia. It happens because water reserves are always decreasing. Water resources that can be used as raw water sources are increasingly limited.

In line with the increasing need of drinking water due to the large population of Tanjungbalai city, PDAM Tirta Kualo experienced difficulties in fulfilling drinking water needs of the entire communities. Currently, it is only able to serve 71.37% of the entire community of Tanjungbalai city.

PDAM Tirta Kualo utilizes Silau river discharge as the only source of raw water, which has a fluctuating flow of water that is an average of ± 95.47 m^3/s. However, this abundant water resource is not evenly distributed both in location and time to fulfill customer needs. Urban areas are classified as sufficient in fulfilling water, both in quantity and quality. Taking into account population growth and the accompanying water needs, the future water balance, the availability of water resources infrastructure and services are likely to be very imbalanced and sensitive, it requires good management of water resources so that the existing potential can provide maximum benefits for the benefit of society in all areas of life [9]. Ensuring a high quality drinking water supply that can meet water needs for the entire community is a big challenges because of climate change, contamination of groundwater, surface water and the needsof drinking water that continues to increase and is costly [10]. This study is also different from previous studies such as done by Fauziah et al. [11-18].

The need for clean water will increase every year with the growth rate of population and customers. Comparison of the total customer demand for clean water with the potential for clean water in PDAM Tirta Kualo must be studied in order to analyze a comparative picture between demand and existing water resources. The increasing demand for water, due to economic development and intense population growth combined with water management practices will affect sustainability [19]. To analyze water governance systems, it is necessary to focus on water avaibility, water use, decision making on water distribution [20].

In addition to elaborating related to the model of sustainable clean water governance in Tanjungbalai city, this research also seeks to draw empirical generalizations related to lessons that can be learned from the results of searches and analyzes of human behavior who have the authority to make policies. This study brings novelty by analyzing the potential availability of raw water of Silau river as the only water source of PDAM Tirta Kualo, the increasing demand of drinking water for the people of Tanjungbalai city, analyzing the exsisting condition of water suppy governance at PDAM Tirta Kualo, and formulating the model of sustainable drinking water governance referring to the Tanjungbalai city spatial planning 2013-2033.

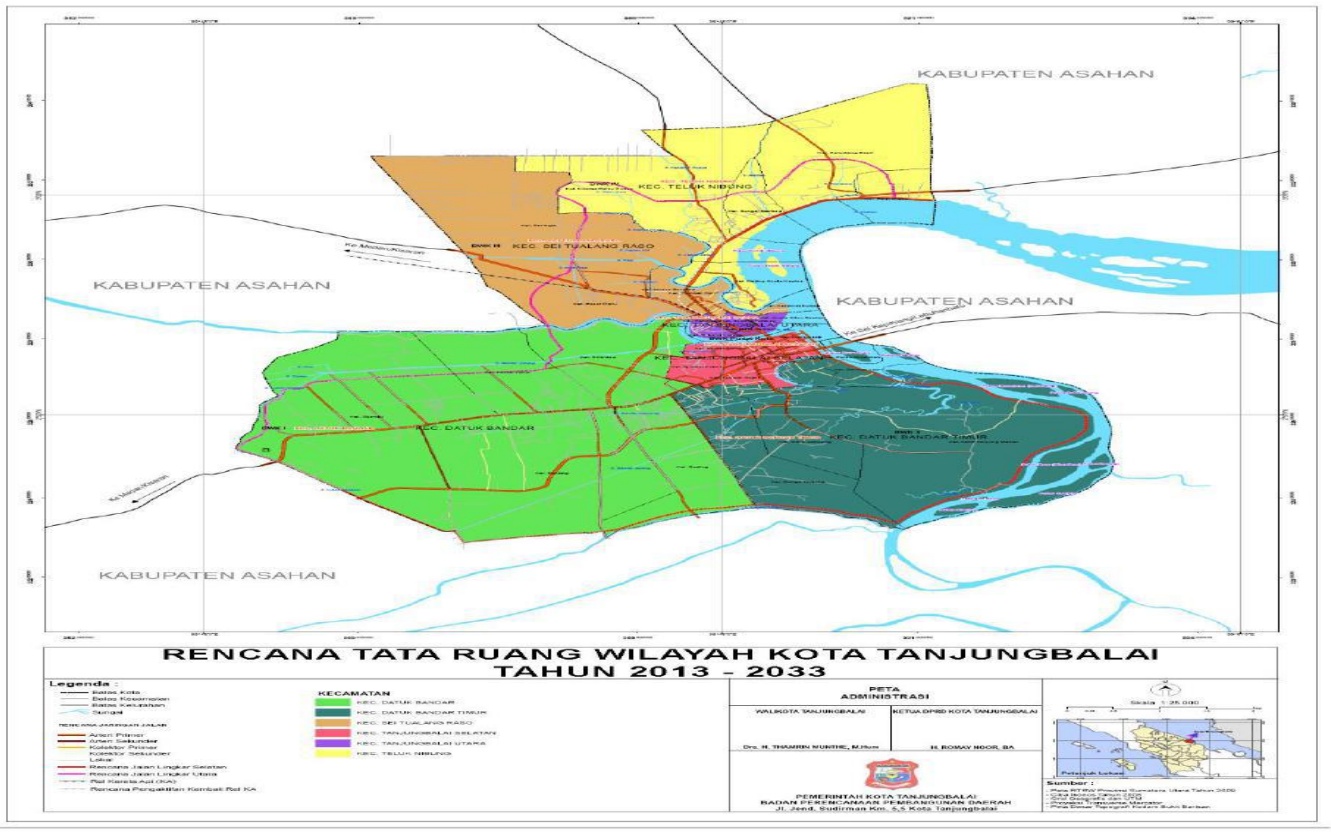

Figure 1. Research location map

2. MATERIALS AND METHODS

2.1 Materials

The researcher used a mixed method approach. Research using this method is a research by combining two forms of research, namely qualitative and quantitative.The research was located in PDAM Tirta Kualo in Tanjungbalai city (see Figure 1). The respondence of the research are head of the family that already costumers for more than 10 years in all 5 coverage services areas of Tirta Kualo. To analyze the potential availability of water source and the increasing needs of drinking water that caused water scarcity by using descriptive analysis. To formulate model for sustainable water governance in PDAM Tirta Kualo refers to the regional spatial plan of Tanjungbalai city year 2013 until 2033.

2.2 Data analysis

The potential water availability must provide by Tirta Kualo by using the following formula [21]:

1. Water Capacity = Area x Rainfall / Discharge [22]. The projection method of water demand for an area
2. Population Water Needs (in year ....) = Total Population x Water Needs liter/capita/day. The total population in 2017 was 169.367 people, while the number of customers or house connections in 2017 was 23.320 customers.

3. RESULT AND DISCUSSION

3.1 Potential water sources analysis

Water capacity = 60.620 km^2 x 95,47 m^3/second
= 5.787.391,4 m^3/second
= 5.787,3914 liter/second

From the equation proposed by Soemarto [22], it was obtained that the total potential water capacity that must be available to meet the needs of all the people of Tanjungbalai city is 5.787 liter/second.

3.2 Increasing water demand analysis

Population growth is an important factor in planning water needs [23]. The total population in 2017 was 169.367 people, while the number of customers or house connections in 2017 was 23.320 customers. The projection of water demand for the last five years.

The standard of eligibility for clean water needs is 49.5 liters/capita/day [24]. For human needs, the required water is 2.5 liters/day. UNESCO world body itself in 2002 has determined the basic human right to water, which is 60 liters/person/day. Population growth is one of the important factors in planning the need for clean water [25]. The population projection is used as a basis for calculating the level of clean water demand in the future. The benefit of this projection technique is for development planning and program assessment for both companies.

Based on Figure 2, the projected demand for clean water continues to increase every year so that PDAMs must continue to maintain the quantity and quality of clean water in terms of productivity. In 2017 the need for clean water for the people of Tanjungbalai city was 13 l/second, the following year, in 2018 there was an increase in the need for clean water by 14%. It is estimated that the need for clean water has increased by 2% per year as the coverage service presented in Table 1.

3.3 Existing condition of drinking water governance at PDAM Tirta Kualo

Continuous changes in the political, legal, economic, social, and technological aspects of water must ensure that efforts to improve water management and services offer the best long-term prospects [26]. The governance of sustainable drinking water supply in PDAM Tirta Kualo using governance principle based on the problems that exist in each working unit as presented in Table 2 and Table 3.

3.4 Sustainable Water Governance Model at PDAM Tirta Kualo

Based on the regional spatial plan of Tanjungbalai city for 2013-2023, the potential for regional development consists of protected areas and cultivation area. Then adjusting the municipal government spatial plan program with the conditions that needed by PDAM Tirta Kualo and its customers. From Figure 3 below, it can be seen that Sustainable water management model at PDAM Tirta Kualo took from the potential for regional development on cultivated areas, which are listed in the Cultivation Area Spatial Pattern Plan 2013-2033.

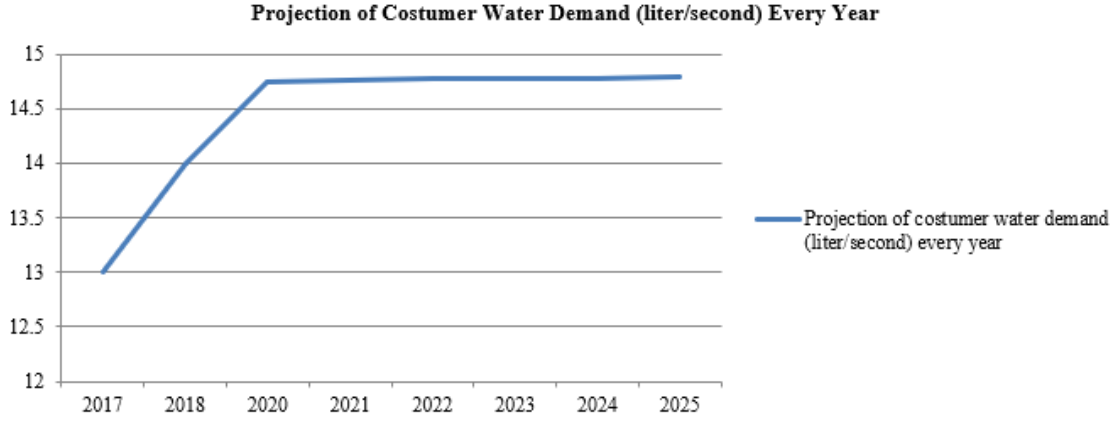

Figure 2. Projection of costumer water demand (liter/second) every year

Table 1. Coverage services area of Tirta Kualo regional water corporate

Coverage services area	Districts	Area (km^2)	Total Inhabitants of Tanjungbalai City (inhabitant)	Total Costumers of Tirta Kualo (costumer)	Total each person as costumers of Tirta Kualo (inhabitant)	Persentage of Services
1	Datuk Bandar	22.59	37.062	4.860	24.300	65.57
	Datuk Bandar Timur	14.57	29.546	5.056	25.278	85.55
2	Tanjung Balai Selatan	1.98	21.198	4.983	21.028	99.20
3	Tanjung Balai Utara	0.84	17.395	2.729	13.645	78.44
4	Sungai Tualang Raso	8.09	24.906	2.496	13.812	55.46
5	Teluk Nibung	12.55	39.260	3.196	18.537	47.22
Total		60.62	169.367	23.320	116.600	68.86

Table 2. Result of interview with all working units

No.	Working Unit	Issues
1	Technical unit	Water production does not meet the health requirements and does not meet quality and quantity requirements because laboratory testing is not carried out. The rate of water losses 36,86 %. The water treatment plant and drilling wells are not in good condition. The transmission and distribution pipes are old and leaking. Employees do not implementing Standard Operational Procedure in carrying out work because of the low quality of human resources.
2	Administration and finance unit	The level of uncollectible customers receivables is still very high. The company is not full cost recovery. The number of employees is 283 employees. The company does not pay employee salaries for up to 4 months. In 2017, based on the audit of the North Sumatra financial audit representative, it was found that the employee ratio was 13.15, which means that 13 employees served 1000 customers. This means that 1 employee serves 77 customers. Based on the BPKP performance evaluation, 1 employee must serve 200 customers. The actual number of active subscribers is not yet known. The level of quality of human resources is still low. The water account payment system has not used Online Banking Payment Point. The administrative system is not in accordance with the quality management system procedures.
3	Customer satisfaction unit	Many illegal connections are not detected. Customers do not have an accurate water meter and even most of costumers doesn't have water meter as a measurement of water usage. Officers do not record water usage correctly. Many customers do not have a water meter.
4	Planning unit	Low quality of human resources. The facilities and infrastructure are not supported.
5	Internal supervisory unit	Never conduct inspections to all work units because of low quality of human resources

Table 3. Water meter condition

Services area	damage	No water meter	Never checked	Total
01	3223	1.923	2.205	7.351
02	827	314	378	1.519
03	1052	157	331	1.741
04	1159	275	569	1.802
05	1954	133	615	2.702
Total				15.115

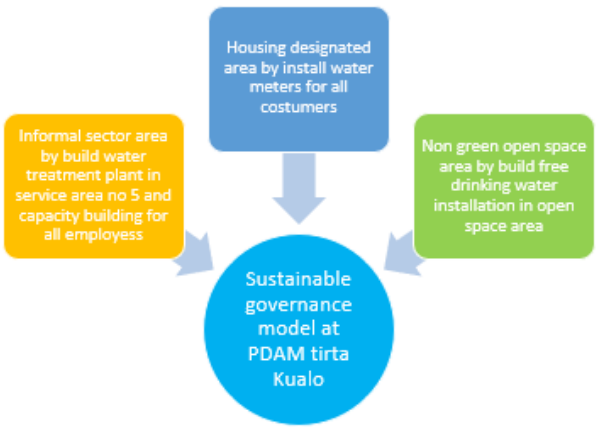

Figure 3. Sustainable water supply governance model in PDAM Tirta Kualo

3.5 Discussion

The results of this study are also relevant to the studies of White et al. [2], where sustainable water governance is a normative framework that is directed towards the goal of regulating these community activities to ensure adequate, fair and safe water to support economic development and social welfare, while not harming the community. life support ecosystem. On the other hand, the results of this study are not in line with the views of Zhou et al. [27] and Mulyana and Prasojo 28] where the most important basis for achieving a sustainable balance between water supply and demand is to effectively identify the factors that affect the security of water resources and evaluate the effectiveness of water resources management measures. which exists.

4. CONCLUSION

Tanjungbalai city must have 5.787,39 liters/second for potential water availability. The projection of water supply demand for each house connection for the next 5 years, assuming an increasing of 2%, is an average of 14.79 liters/second. The condition of water supply governance in

PDAM Tirta Kualo is still low, it is proven that there are still many problems in all work units. The design of the sustainable water supply governance model refers to the Spatial Plan for Tanjungbalai city for 2013-2033. The sustainable water supply governance model designed to build improvement in the quality of infrastructures and human resources such as upgrading human resources, installing water meter to all customers, adding new water treatment plans in services area 5 and build free drinking water installation in open space area. Based on the conclusion, the recommendation is it is necessary to socialize the process of implementing or implementing governance that has been designed by researchers in the scope of PDAM Tirta Kualo. Since this study is limited, so further research is needed related to the implementation of sustainable clean water management in the company's environment.

ACKNOWLEDGEMENT

The authors would like to thank to PDAM Tirta Kualo for the permission to conduct the research.

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