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SMART ENVIRONMENT: ANALYSIS OF WATER MANAGEMENT POLICY IN MAKASSAR

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Abstract

This article aims to analyze the Makassar government's policies on clean water management in Makassar, one of Indonesia's major cities. Utilizing the concept of a smart environment as an analytical framework, this study investigates whether Makassar's clean water management aligns with the principles of a smart environment. The escalating construction of apartments and hotels has notable consequences for water resources in Makassar. Simultaneously, the city experiences rapid population growth each year, indirectly affecting clean water consumption. This qualitative study employs descriptive analysis, aiming to elucidate and depict the current events concerning the research object. Secondary data forms the basis of this study. Research findings indicate that Makassar's clean water management does not conform to the smart environment concept. This discrepancy can be attributed to inconsistent clean water distribution aggravated by the city's swiftly growing population. Furthermore, the implementation of smart environment principles in managing clean water resources, such as the development of Public Green Open Spaces, waste management, river revitalization, and slum settlement management, remains suboptimal. These aspects significantly impact the establishment of a smart environment, particularly concerning the universal provision of clean water for Makassar's residents.

Keywords: *Makassar City, smart environment, policy, water management*

Abstrak

Artikel ini bertujuan untuk menganalisis kebijakan pemerintah Kota Makassar dalam pengelolaan air bersih di Kota Makassar, yang merupakan salah satu kota besar di Indonesia. Dengan menggunakan konsep lingkungan pintar sebagai alat analisis, penelitian ini mengkaji apakah pengelolaan air bersih di Kota Makassar sesuai dengan konsep lingkungan pintar. Pembangunan apartemen dan hotel yang semakin meningkat memiliki dampak terhadap sumber daya air di Kota Makassar. Di sisi lain, faktor pertumbuhan penduduk, yang setiap tahun mengalami peningkatan pesat secara tidak langsung memengaruhi konsumsi air bersih yang ada. Penelitian ini adalah penelitian kualitatif yang menggunakan analisis deskriptif. Penelitian ini menjelaskan atau menggambarkan peristiwa yang terjadi pada objek penelitian saat ini. Data yang dikumpulkan adalah data sekunder. Hasil penelitian menunjukkan bahwa pengelolaan air bersih di Kota Makassar belum sesuai konsep lingkungan pintar. Hal ini disebabkan oleh beberapa hal. Pertama, distribusi air bersih di Kota Makassar tidak konsisten, ditambah jumlah penduduk setiap tahun meningkat dengan cepat. Kedua, pengelolaan sumber daya air bersih melalui konsep lingkungan pintar belum dilakukan, hal ini dapat dilihat dari pengembangan Ruang Terbuka Hijau Publik, pengelolaan limbah. Ketiga, revitalisasi sungai hingga pengelolaan permukiman kumuh yang masih belum optimal. Poin-poin ini sangat memengaruhi dalam membangun lingkungan pintar yang berkaitan dengan persediaan air bersih universal untuk masyarakat Kota Makassar.

Kata Kunci: Kota Makassar, lingkungan pintar, kebijakan, manajemen air

I. INTRODUCTION

In recent years, the concept of smart environments has taken center stage alongside rapid urbanization and the global demand for sustainable development (Vermesan & Friess, 2013). A smart environment encompasses the integration of advanced technologies and sustainable practices to efficiently and effectively manage urban spaces (Bibri, 2021). At the point of this concept lies the idea of smart cities, where cutting-edge information and communication technologies are harnessed to enhance the quality of urban life. This approach not only optimizes resource utilization but also reduces negative environmental impacts (Fawzy et al., 2023).

A key aspect of smart environments is the utilization of information technology to create intelligent urban infrastructures (Lemayian & Al-Turjman, 2019). This involves the use of sensors, sophisticated communication networks, and real-time data analysis to understand and respond to the needs of urban residents (Rathore et al., 2016). For example, sensors monitoring air quality, noise levels, and energy consumption can provide crucial information to city governments. With this data, public policies can be formulated based on tangible evidence, leading to more effective and efficient decision-making.

Additionally, the concept of smart environments encompasses sustainable practices such as efficient waste management, the use of renewable energy, and urban greening (Aletà et al., 2017). Sustainable development lies at the core of smart environments, where the long-term goal is to create a harmonious balance between economic growth, social welfare, and environmental preservation (Carayannis et al., 2022).

As one of the big cities in Indonesia. Makassar continues to experience a fairly drastic population increase. In 2020, the population in Makassar was around 1,423,877 people, however in 2021, there was an increase to 1,427,619 people, and in 2022, it further rose to 1,432,189 people (BPS Kota Makassar, 2021). At least 2 years apart, there has been an increase in the population of around 36 thousand inhabitants. This is a fairly high number for an urban area that is known for its population density. In fact, many criteria are used for a city so the definition of a city is different in each country, but based on previous opinions, it can be seen that the level of population or population growth affects an area called an urban area (Skog & Steinnes, 2016). In Indonesia, there are areas that are categorized as urban areas, such as Jakarta, Surabaya, Semarang to Makassar (Firman, 2016).

Urban regions are greatly impacted by the availability of water, especially clean water, which is strongly tied to the local demographics. As (Bremner et al., 2010;

Fader et al., 2016) argue, the dynamics of population have a significant impact on ecosystems, including those that are related to water availability.. In addition, according to (Ananda, 2019) access to clean water is affected by population density and rapid growth rates.. The relationship between the population and the accessibility of clean water is, however, complicated by a number of intervening factors, such as technology, politics, and culture (Misbahuddin, 2021).

According to (Toding, Arifin, and Sutopo, 2021), in 2018 with a population of approximately 1,508,154 people, the water requirement was about 339,334.65 cubic meters per day. However, the amount of water that could be distributed was only about 244,456.37 cubic meters per day, resulting in a shortfall of 114,878.28 cubic meters per day. Even until 2023, especially during the dry season, the clean water crisis in Makassar has affected up to five districts and around 16 thousand people (CNN Indonesia, 2023). According to the Water Treatment Installations in Makassar, the Makassar Government sources its raw water from rivers and dams such as the Jeneberang River and Bili-bili Dam. However, during drought periods, the dam water source becomes unreliable for supplying clean water to the community, posing another challenge in the realm of clean water supply.

According to (Heathcote, 1998; Muyen et al., 2016), regional development and economic growth in order to see a special economy have an impact on existing water needs, or more precisely raw water, such as increasing society and demand for water, so that a sustainable and integrated water management is needed. The concept of integrated water management starts with developing an understanding of water sources, fostering a commitment to water utilization, raising awareness about conservation, and collectively implementing sustainable management practices to achieve optimal and enduring results (Buytaert et al., 2014).

An issue frequently encountered in urban areas is the emergence of a clean water crisis due to the excessive utilization of groundwater as a primary water source (Madani et al., 2016). This excessive usage results in a decline in groundwater levels, leading to challenges in ensuring water availability (Misra, 2014). The condition of the urban area, which has a large percentage of the population, demands a large consumption of water as well (Parandvash & Chang, 2016). However, in the case of Makassar, the utilization of surface water sources such as rivers and dams is prioritized by the government because the excessive use of groundwater is very challenging. This is due to groundwater pollution, especially in slum areas, and the depletion of groundwater levels caused by excessive well drilling. This makes the city government have to be smarter in managing strategies in managing its water resources. One form of smart city management can be described in the form of a

smart city concept. According to (Komninos et al., 2013), the concept of a smart city is a concept of development, application, and implementation of technology that is applied in an area or region as a complex interaction between the various systems in it. Meanwhile, (Marsal-Llacuna et al., 2015) argue that awareness plays a pivotal role in the concept of a smart city, which is subsequently interconnected with indicators of an intelligent environment.

Currently, Makassar City is pioneering to become one of the smart cities in Indonesia, with various programs, one of which is Sombere and Smart City. Literally, the word "*sombere*" means 'kind and open-hearted', but it also refers to "good service, close brotherhood, and great spirit. However, in its implementation, the Smart City concept has several derivatives on which to base, one of which is the Smart Environment which includes a better process of sustainability and resource management. Especially water management which is one of the sources of human life and other living things. In light of the aforementioned issues, this study will attempt to assess the clean water management policies put in place by the Makassar City government. Through a careful analysis of the implemented programs and the ensuing social repercussions. This study aims to elucidate how the Makassar City government manages clean water through policy implementation and determine whether it aligns with the concept of a smart environment. The findings of this research can serve as a valuable resource for the Makassar City government to manage water resources based on the smart environment concept.

LITERATURE REVIEW

Smart Environment and Urban Sprawl

A smart environment is a concept or part of a smart city that deals with various kinds of natural environmental protection issues requiring strategic policy and planning (Rachmawati & Pertiwi, 2017a). On the other hand, a smart environment is also described as a setting that can offer convenience, resource sustainability, and aesthetic beauty for the community and the general public, whether it be visible or not (Asriadi et al., 2021). According to (Rachmawati & Pertiwi, 2017) that based on the smart city concept in Indonesia, the indicators in the smart environment concept are as follows:

1. Provision of Open Space

   The requirements of its residents must be met by Public Open Public Space. According to Ministry of Public Works No.5 of 2008, it should ideally cover at least 30% of the city's area and take the population into account. Public open space must serve sociocultural, economic, and artistic purposes in addition to its ecological one.

2. Good Waste Management

   Disposal of waste, which comes from household or factory products, may not be dumped directly into the

river, but must be treated and processed first. Furthermore, waste can be used as energy or recycled to become goods of sale value.

3. Slum Management

Urban regions sometimes have what are termed as "slum areas," which typically occupy riverbanks and state-owned property. Slum settlements can harm the city's aesthetics and contribute to an environmental disaster by impeding river water flow during rainstorms, which leads to flooding. In these places, rivers must carry the weight of trash and waste generated by human activity. Therefore, one option to lessen the burden on the river is to relocate those who reside in riverbank slum areas to better settlements and safer accommodations, like flats.

4. Revitalizing the River

Slum area management is related to this endeavor. As was already noted, Indonesian urban rivers frequently serve as trash cans for the people who live along their banks. The very fundamental role of rivers in cities as ecosystems that support urban environments that offer public open space must be restored as part of the smart environment program.

5. Alternative energy

An essential component of the smart environment program is the initiative to look for ecologically friendly and more efficient alternative energy sources. It will be challenging to supply every household's and business's energy needs in highly populated cities. Finding sustainable and renewable energy is crucial for cities to be sustainable, as has long been recommended. similar to wind or solar energy.

6. Reducing CO_2 Production

Looking at almost the whole world, erban regions face the threat of severe pollution, which is a result of human activity in cities and affects practically the entire planet. Humans will quickly experience harmful effects from air pollution, especially that which is distinguished by high carbon dioxide (CO_2) levels. Finding city inhabitants suffering from an illness like ASPA or even lung cancer is entirely normal. Governments in cities must take action to lessen the effects of CO_2 production in order to tackle this issue. These actions can begin with initiatives like tree planting, using bicycles or public transportation to go around the city, and conducting automobile emissions tests.

7. Urban Agriculture

Urban regions have difficulties due to a lack of space for the inhabitants as well as the environment itself as centers of attraction for community mobility. Every city should prioritize initiatives to use space in metropolitan areas efficiently. In order to effectively

employ any unoccupied property as a location for urban agriculture, it should not be kept inactive in any urban context. This will not only improve the aesthetics of metropolitan areas but also help to reduce high CO_2 levels and create green open spaces.

Urban sprawl has long been used in the United States to explain the phenomenon of shifting cities to fringe areas. At first, urban sprawl occurred after the Second World War which became a trend in American society. The reduced services in the city center during the Second World War caused various urban problems including pollution, congestion, and the inability of the sewage system. These changes have caused people in America to prefer to live in rural areas with the characteristics of houses that are increasingly far from the city center. Definition of urban area, for Law No. 24 of 1992, concerning Spatial Planning: Urban areas are areas that have non-agricultural main activities with layers of regional use as urban settlements, concentration and distribution of government services, social services and economic activities. According to (Badan Pusat Statistik, 2000), in the implementation of the survey on the status of the village that was tried, several criteria were used to determine whether a village was categorized as a village or a city. The criteria used are:

1. Centered community per sq km,
2. Number of households whose main occupation is agriculture or non-agriculture
3. Number of households owning a computer
4. Number of households that are electricity customers
5. Universal facilities in the village, such as learning facilities, markets, karaoke, massage parlors, and salons.

Along with the times, the urban sprawl trend is no longer an option. This is due to its large impact on environmental quality. The development of urban sprawl not only reduces forest areas, agricultural areas, green open spaces, but also disrupts ecosystem activities and natural habitats of living things (Matsler et al., 2021). According to (Widiawaty et al., 2019) another impact of urban sprawl is that it causes the rapid growth of urban land use which is characterized by built-up land which has an impact on uncontrolled land conversion on the outskirts of the city. The occurrence of the urban sprawl phenomenon has an impact on the loss of the role of the activity center, dependence on private vehicles, and the loss of area and the function of urban green open spaces that affect the quality and quantity of water (Gunawardena et al., 2017).

This is the cause of the unsustainability of the urban sprawl phenomenon. This is further strengthened by the opinion of (Bueno-Suárez & Coq-Huelva, 2020) which states that urban sprawl is a phenomenon in the aspect of unsustainability. Of course, this

is contrary to the attention of every big city today that has implemented sustainable development in order to save the next generation from the development that is being carried out.

II. METHOD

This qualitative research aims to understand the phenomena experienced by the research subject by describing it through statements using different scientific methods (Achmad & Yulianah, 2022). The data used is secondary data, i.e. data that is already available and collected by other parties. The data collected by the authors were obtained from journals on water management policy and the Smart Environment concept. In addition, other sources of support are printed books, official websites, and articles that have been identified, analyzed, clarified and interpreted to be legitimate works.

This research is a type of descriptive analytic research, namely research that seeks to explain or describe the events currently occurring in the research subject, which are then explained, analyzed, and presented (Achmad & Yulianah, 2022). in a way that becomes a systematic picture. Data processing techniques using descriptive qualitative models. Qualitative description is the process of processing data about certain behaviors, phenomena, events, problems or circumstances that are the subject of an investigation and whose results are meaningful sentence descriptions (Rukin, 2019). explain certain insights.

III. RESULT AND DISCUSSION

Makassar City

The municipality of Makassar City serves as the provincial capital of South Sulawesi. At 5° 8′ S 119° 25′ E, the municipality's major city is located. Location: 5° 8′ S 119° 25′ E, overlooking the Makassar Strait on the southwest coast of the island of Sulawesi. Makassar City, also known as Macassar, Mangkasara, and Ujung Pandang (1971–1999), is the provincial capital of South Sulawesi and one of Indonesia's larger cities. The largest city in Eastern Indonesia and the fourth largest city overall is Makassar City. Makassar City serves as a service hub for Eastern Indonesia (KTI), acting as a hub for trade and services, an industrial hub, a hub for government operations, a hub for land, sea, and air transportation, and a hub for education and research.

This metropolis is divided into 143 villages and 14 districts on an administrative level. The city is situated between 0 and 25 meters above sea level. Location: On the southwest coast of Sulawesi Island, facing the Makassar Strait, at coordinates 5° 8′ S 119° 25′ E. Its borders are the Makassar Strait in the west, the Gowa Regency in the south, the Pangkajene Islands Regency in the north, and the Maros Regency in the east.

Makassar City is divided into 885 RW and 4446 RT, as well as 14 and 143 sub-districts, respectively. geographical circumstances Makassar City is located between 0 and 25 meters above sea level, and its average annual temperature is between 20 and 32 degrees Celsius. Two rivers border Makassar City, including the Tallo River, which drains into the northern part of the city, and the Jeneberang River empties at the south of town. The area of Makassar City is 128.18 km² (Total 175.77 km2).

Clean Water Management Viewed from the Concept of a Smart Environment

According to (Robert and Kodoatie, 2010) In comparison to other resources, water is the most distinctive natural resource due to its dynamic and renewable nature. This indicates that rain, which is the primary supply of water, will always fall according to the appropriate season. Water can, however, run out under certain circumstances. For instance, in some geological settings where groundwater movement takes thousands of years, water will be drained if the groundwater is overburdened.

Water is used in practically every aspect of daily living, including drinking, cooking, bathing, and cleaning. As a result, having access to water is essential, especially clean water. The status of the local population has a direct impact on the availability of water, especially clean water. As according to (Liu & Chen, 2006), population dynamics have a very important influence on ecosystems, including those related to water availability. In addition, according to (Luck, 2007), Access to clean water can undoubtedly be impacted by rapid population growth and congestion. Technology, government policy, and culture are only a few of the many auxiliary factors that span the gap between the population's access to clean water and its availability.

Regarding the policy itself, there are several important things that must be considered according to (Syahputra, 2016) in policy implementation, namely:

1. The way in which the institution or organization in charge of managing the program acts in accordance with its goals and methods of implementation.
2. Various networks of power in political, economic and social dimensions that have direct influence on the parties involved.
3. The intended and unintended consequences for the program that has been put into place.

A policy may take the form of a rule or a program that will ultimately affect society. Therefore, implementation is crucial since it allows for the evaluation of whether or not a policy is successful. According to Article 1 Paragraph 8 of Government Regulation No. 42 of 2008 Concerning Water Resources Management, the water resources management pattern is the fundamental framework for organizing, carrying out,

overseeing, and assessing water resource conservation activities, the use of water resources, and managing the destructive force of water. The management of water resources in accordance with the regulations must be considered. Based on this, the aspects that can be assessed regarding how the clean water management policy in Makassar City can be seen from how the PDAM water distribution is carried out.

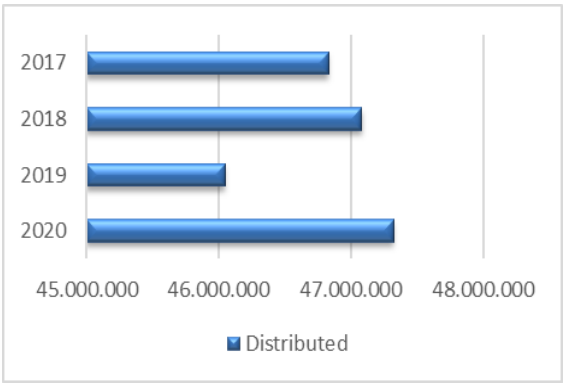

Figure 1. Water Distribution by Local Water Companies (m^3)
(Source: BPS Kota Makassar, 2021)

Looking at the data on the production and distribution of drinking water by the Makassar City regional drinking water company, it can be seen that the distribution of water has fluctuated, although in the end in 2020, there was a significant increase in water distribution in Makassar City. This shows that the government's consistency in distributing water in the last 4 years is still not optimal. In addition, the use of surface water sources has not really been implemented, even though in Makassar City there are several large rivers such as the Jeneberang River, Tallo River, and Pampang River which can be used as surface water sources for distribution to the wider community.

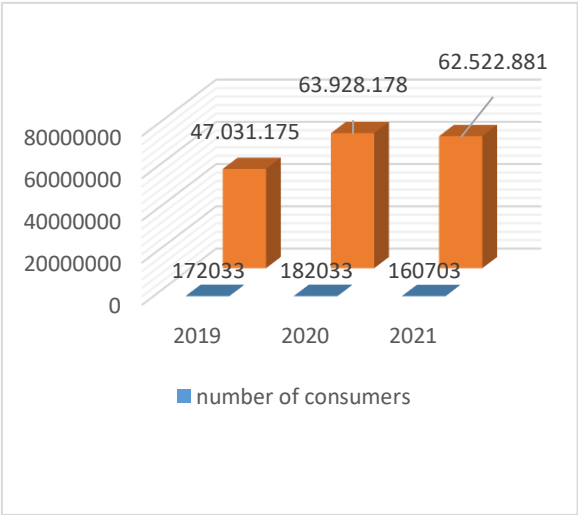

Figure 2. The Number of Customers and the Distributed Drinking Water Volume by Makassar Regional Water Company (PDAM)
(Source: BPS Sulawesi Selatan, 2022)

Regarding clean water consumption for drinking purposes, based on the data above, it is observed that the number of water consumers in Makassar City through the Regional Drinking Water Company, commonly known as PDAM, has experienced a significant and drastic decrease, especially in the last year, 2021. This decrease corresponds with the reduction in water distribution. However, a notable discrepancy can be seen: in 2019, the number of consumers was higher compared to 2021, but on the other hand, the volume of water distribution in 2019 was much lower than in 2021. This difference could be attributed to the higher water

consumption by consumers. This issue should be a cause for concern since the distribution of water to the public needs to be equitable and should not disproportionately favor a small group of people. Additionally, this situation inclines people to opt for alternative water sources, such as bottled water sold by private companies, instead of relying on PDAM.

Although the City of Makassar has carried out many development activities in order to create a city that is comfortable for its people. However, it does not show maximum results, especially in terms of water management based on Smart Environment. Therefore, in order to see a policy from Makassar City based on (Rachmawati & Pertiwi, 2017b) there are indicators of how a city has implemented the concept of a Smart Environment which is closely related to good water management, namely as follows:

1. Development of Green Open Space

   The provision of open space is something that must be done by an urban in order to create comfort for its citizens. Public Open Space must meet the needs of its citizens. Ideally, it should cover at least 30% of the size of the city (based on the Ministry of Public Works No.5 of 2008) and take the population into account as well. Public open spaces not only have an ecological function but must also have a socio-cultural, economic, and aesthetic function. In addition, it is very important the existence of open spaces, especially green open spaces, which will have benefits as a container for channeling rainwater to groundwater. As according to (Voskamp & Van de Ven, 2015) Green Open Space can improve groundwater quality, prevent flooding, reduce air pollution, and reduce city temperatures. In Makassar City, the development of Green Open Space is still at 13%, still very far or not even reaching half of the ideal development which must be 30%, even in 2019 the construction carried out seems very slow because it only develops zero point a certain percent. This is due to the construction of buildings and business centers that are located in almost all areas of Makassar City. One solution to increase water supply in Makassar City is through the optimization of Public Green Open Spaces as groundwater infiltration areas. The development of Public Green Open Spaces can be implemented through extensification, which involves expanding the area of Public Green Open Spaces in city areas that are still vacant and underutilized. In Makassar City, potential development areas include the districts of Biringkanaya and Tamalanrea

2. Good Waste Management

   The disposal of waste, whether from households or factories, should not

be directly dumped into rivers but must be processed and treated first. Therefore, the government plays a central role in ensuring proper waste management. Urban areas are particularly vulnerable to improper waste disposal, especially into rivers. Due to high operational costs, most cities in Indonesia can only collect and dispose of about 60% of their total waste production. Of this 60%, a significant portion is managed and disposed of in ways that are unhygienic, wasteful, and polluting.

Figure 3. The Heaps of Waste That The Community Disposes into The River in Timongang Lompoa

(Source: Sindonews.com, 2022)

Makassar City, as a Metropolitan City, has the capacity to handle approximately 200 - 1100 tons of waste per day, but only about half of this amount is effectively managed. According to data from the Makassar City Environmental Agency, the volume of waste in Makassar in 2022 reached 7,374.5 tons per month and 245.8 tons per day, although it is not as high as the waste volume in Makassar in 2021, which was 410,291 tons, equivalent to 34,190 tons per month and 1,139 tons per day (Kabar News Terbit, 2023). Additionally, the habits of the residents significantly contribute to indiscriminate waste disposal in surface water sources like rivers. In fact, many rivers in Makassar are filled with both organic and non-organic waste.

In waste management, Makassar should learn from Banyumas, an area recognized for its exceptional waste management practices not only in Indonesia but also in Southeast Asia. Banyumas has achieved nearly zero landfill waste management. The concept utilized by Banyumas involves building a circular economy through sustainable waste management, active community participation, and private private-sector investment (Effendi, 2023).

3. Slum Management

Slum areas as it is known can be found in urban areas, usually occupying riverbank areas and state-owned land. In general, the existence of slum areas can damage the visual area of the city and can even cause environmental damage, especially rivers which can be a source of surface water. In addition, according to (Mustikasari et al., 2017), the direct impact of the existence of slum settlements in spatial terms is a decrease in the quality of the physical and social environment of the

settlement which results in the lower quality of the environment as a place to live. Seeing this, it is certain that there are almost similar conditions in Makassar City. As with the Decree of the Mayor of Makassar, in 2014, out of 740.10 hectares of slum areas, now only 368 hectares are left, or a decrease of around 372.10 hectares in accordance with the revised Decree of the Mayor of Makassar in 2018 (Sindo News Makassar, 2019). From this it can be seen that there has been a reduction in slum areas in Makassar City for approximately 4 years, but from this there are still many slum areas in Makassar that must be addressed in order to improve the quality of environmental improvement, especially building universal clean water sources.

4. River Revitalization

River revitalization is one of the important points in developing universal clean water resources in cities. This is because rivers are a source of surface water that can be used as a sou.rce of clean water in a city. In Makassar, the river revitalization process has been carried out in large rivers, such as the Jeneberang river, which will be revitalized. However, there are still many pros and cons regarding the concept of revitalization that will be carried out, in order to continue to maintain the quality of the surrounding environment.

IV. CONCLUSION

Based on the results of the explanation above, the management of water in Makassar does not align with the smart environment concept due to several reasons, including, first in terms of water distribution carried out by PDAM Makassar, there are still in distributing water to the people of Makassar City, even though the population growth rate is getting higher every year, which will certainly affect water use by the community. second, regarding the concept of clean water management in Makassar in terms of the Smart Environment concept, there are several points that illustrate that, clean water management in Makassar has not fully directed towards a smart environment, this can be seen from the construction of new public green open spaces around 13%, far from the target that should be 30%, then Makassar waste management can only manage part of it, so it will certainly affect the quality of surface clean water resources, besides that the management of slum areas that are starting to be improved, still leaves hundreds of hectares of land, the slum that still needs to be addressed, coupled with the revitalization of the river which is still lacking, even though the river can become one of the surface clean water resources for the people of Makassar.

Based on the existing research findings, the author identifies several aspects that need further development in future studies. Firstly, the utilization of primary data is necessary to gain deeper insights into the issues and the implementation of the smart environment concept in Makassar. Secondly, a more in-depth explanation regarding the water management condition in Makassar based on updated documentation collected by the researcher is essential. Thirdly, when analyzing the implementation of the smart environment in Makassar, it would be beneficial to apply analytical indicators from different concepts to better understand how the smart environment is applied in water management in Makassar.

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