

# Analysis on Water Sufficiency and its Policy Implications: The Case of a Highly Urbanized City in Southern Philippines

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## I. INTRODUCTION

Proper access to water remains a complicated issue around the world despite the fact that Earth surface is covered with 70% water (Khatri et al., 2014). This is because many countries around the world are facing water stress, hence, water scarcity is considered as one of the greatest global concerns of the twenty-first century (Abu-Zeid and Shiklomanov, 2003). It was estimated that global water demand is expected to outstrip availability by 40% by 2030 (World Economic Forum, 2011), and the possible effects of climate change, deforestation, population expansion, pollution and inadequate funding are exacerbating the problem (Adom and Simatele, 2021; Rosegrant et al., 2009; Rieu-Clarke, 2017). Indeed, it has been anticipated that by 2025, the number of people affected by water scarcity will approach three billion (Hanjra & Qureshi, 2010). Hence, poses a threat to sustainable water resources.

Unsustainable and uncoordinated policies, inadequate or inappropriate water governance, including management practices, institutional frameworks, and socio-political situations, all have an impact on water resource sustainability (Wang et al., 2017; Rola et al., 2015). As a result, businesses, governments, and policymakers around the world are collaborating to go beyond business-as-usual approaches to water management in order to increase water supply and improve the quality of current water resources, thereby addressing future water scarcity (Christ and Burritt, 2017).

Cagayan de Oro City (CDO), the capital of Misamis Oriental Province located in the northern part of Mindanao, is a densely populated city with an area of 488.86 km<sup>2</sup> having a population of 728,402 (2020 Census of Population and Housing). The city's water system is primarily served by Cagayan de Oro City Water District (COWD), a government-owned and regulated business corporation established to provide Level III water services to the city. COWD received Certificate of Conditional Conformance No. 001 from the Local Water Utilities and Administration (LWUA) on January 4, 1974. Currently COWD is serving 72 barangays with a total population area of 525,040 and about 105,008 households. As

of 2020, COWD has 4 different water sources namely: 26 deep/groundwater production wells with a rated capacity of 3,948,120 cu.m/month, 1 surface water/purchased bulk water of about 2,400,000 cu.m/month, 1 spring water source having 2,650 cu.m/month and 27 booster pumps having a rated capacity of 5,813,158 cu.m/month. The combined production capacity of these operational production wells is about 210,892.85 cubic meters per day. With COWD growing rapidly, delivering sufficient, clean and economical water to its increasing number of concessioners, it is also facing greater challenges. In fact, there was a call to address the scarcity of water in the hinterland and the poblacion barangays in Cagayan de Oro City (CDO). Hence, this paper examines the factors contributing to shortcoming of supplied water in CDO.

## II. FRAMEWORK

The current study examines various theories and concepts related to resource stewardship and sustainability in order to address one of the most pressing global concerns of the 21st century which is water scarcity (Abu-Zeid and Shiklomanov, 2003). Some parts of the world are enduring water scarcity. This means that, in general, water demand by sectors, including the environment, cannot be fully met because of the influence of water usage on water supply or quality (Falkenmark, 1989; Alcamo et al., 2000; Vörösmarty et al., 2000). Such scarcity, can be classified into two types namely: shortage and stress (Kummu et al., 2016). Water shortage refers to a lack of water per capita, whereas water stress refers to an increase in water demand per capita due to people's lifestyles, consumption habits, food and energy security policies, and economic development (Kummu et al., 2016; Connor, 2015; Liu et al., 2017; Molinos-Senante, 2016). As a result, comprehending water shortage is critical for developing policy at the global, regional, national, and local levels (Liu et al., 2017).

Multiple dimensions, from material to intangible ones, such as beliefs, values, and emotions, must be considered while dealing with water scarcity (Strang, 2004). The most essential aim and unit of study in this regard, according to Sauri (2013), is the individual consumer as well as the water utility

corporations (Kallis et al., 2010; Maddaus et al., 1996). Considering these two entities is of relevance in the context of theory of sustainability and Institutional Analysis and Development (IAD) Framework.

The theory of sustainability is the first theory that the present study is based on. The social reactions to environmental challenges are prioritized and integrated in this idea. Limbu (2017) found that the compulsion theory of sustainability is required for the long-term viability of any rural drinking water supply system. This theory also takes into account the four key indices of sustainability: physical, economic, environmental, and social. Understanding the relationships between these indicators is essential for developing water resource management plans. As a result, in order to ensure long-term sustainability, it must expand its capability for making continuous improvements in its services while adjusting to current developments. As a result, we must evaluate effective feedbacks in order to discover what is working and what is not, so that we can replicate and extend success while also addressing the issues indicated by failures. Developing and using indicators based on the notion of capital maintenance can help policymakers, managers, and the general public get more information about water resources (Heintz, 2004). The criteria and indicators identified by this method can also be used to organize policy, investment, and management practice evaluations.

### III. OBJECTIVES OF THE STUDY

This study endeavored to: (1) determine Cagayan de Oro’s water sufficiency through the analysis of actual production and consumption; (2) identify the barangays in Cagayan de Oro City that experienced water insufficiency from January to June 2022 and their issues and concerns; and (3) formulate policy recommendations to address the issues and concerns on water sufficiency.

### IV. METHODOLOGY

This study employed both quantitative and qualitative research designs. The quantitative aspect relied on survey and secondary data such as the summary of total actual production and consumption for 2019-2021. These data sets were secured from the Cagayan de Oro Water District while the secondary data were culled from existing literature and documents

published and/or unpublished that are deemed relevant for this study. This includes the number of notices on water service interruptions accessed through the Facebook Page of the Cagayan de Oro Water District (COWD). Meanwhile, the qualitative aspect used key informant interviews (KIIs), document analysis and literature review.

Moreover, this study employed the purposive sampling and participants were selected based on the following criteria: they are residents of the barangays who are experiencing water insufficiency; they give their Free and Prior Informed Consent; they are known to be able to provide the needed data; and they were available for the KII sessions. There were three groups of respondents including key city officials, barangay leaders, and residents. Before providing consent, the participants were given a brief description of the study and its procedures, benefits, and risks. They were also assured that all collected data would be kept secure and confidential and that participation would be purely voluntary without remuneration; at any time while answering online or in-person, they may withdraw from the study without prejudice or judgment. As a precautionary measure, the participants were provided with a contact number just in case they experience discomfort while answering the research instrument. A total of 100 survey data set and 10 key informant narratives were collected from January to June 2022. The data collected were then processed and analyzed both quantitatively and qualitatively.

### V. RESULTS AND DISCUSSION

#### *Cagayan de Oro’s Water Sufficiency Status*

To assess the current situation of water production and water consumption in the city, summary results are presented in Table 1. As depicted in the table, the actual production of COWD within the three-year period ranges from 73-74 million cu.m consisting of COWD total deep wells and spring water sources as well as the bulk water supply from private company. COWD has been purchasing bulk water supply from Cagayan de Oro Bulk Water Inc. (COBI) based on the purchase order in accordance with its contract of 80,000 cu.m/day (2020 Annual Report, COWD Management Services Dept). Greater production can be observed in 2020 totaled to 74 million cu.m. this is 3% higher than water produced in 2019 but was also decreased by 2% in 2021. Increase production can be traced back to the implementation of various programs and projects of COWD in 2020.

TABLE 1. Summary of Actual Water Supply Production and Consumption from 2019-2021.

Year	Actual Production			Total Consumption		
	Production Wells (cu.m)	Bulk Water Supply (cu.m)	Total Production	Total Billed (metered + average)	Others (regular flushing, volume loss due to isolation and leakages, BOF, non-revenue water withdrawal, water delivery)	Total Consumption
2019	44,485,806	28,584,053	73,069,859	30,856,348	2,039,253	32,895,601
2020	45,560,523	29,331,198	74,891,721	31,431,613	1,876,053	33,307,666
2021	44,337,649	29,235,328	73,572,977	30,263,219	2,560,686	32,823,905

Source: COWD Monthly Production and Consumption Summary (2019-2021).

Furthermore, the data revealed the scope of water loss and wastage from the production to the consumer. For three years data, it can be observed that the total water production ranges from 73-74 million cu.m compared with the total consumption that ranges from 33-32 million cu.m accounting to 40 million

cu.m or about 45% water loss and greater than 50% of non-revenue water (NRW).

According to the Northern Mindanao Regional Development Plan 2017-2022 Midterm Update, the 28 operational water districts are providing sufficient supply of

safe and potable water to seven cities and 28 municipalities in the region. However, it is noted in the report that many water utilities operating in the region continue to face problems on non-revenue water (NRW) where a large proportion of treated water (40% to 50%) are lost in the distribution networks or unaccounted for in the water systems.

Moreover, in 2016 Cagayan de Oro Water District (COWD) launched its Non-Revenue Water (NRW) Reduction Program. The program was developed with the primary objective to reduce water losses and control leaks, and improve and extend water supply and services to more people. USAID through its Be Secure Project supported the program while the Coca-Cola Foundation funded the GIS support. Meanwhile, the COWD implemented the program through a grant from the Philippine Government. The program is expected to help increase COWD’s water supply service to 24 hours per day and benefit 400,000 people.

*Barangays in Cagayan de Oro City with Water Insufficiency.*

To document relative water insufficiency experiences of several individual in Cagayan de Oro City, the researchers collected information from various media outlets as well as key informant interviews from the residents of Cagayan de Oro City. Eight barangays were identified to have water sufficiency issues and concerns during the study period and these include: Lapasan, Gusa, Camaman-an, Indahag, Macasandig, Carmen, Lumbia, and Balubal. From the notice of water service

interruptions from January to June 2022 issued by the Cagayan de Oro Water District (COWD), it was found out that water interruptions were characterized as from low pressure to no water due to installation of pipelines, repairs of pump set of production well, among others.

Moreover, Table 2 presents the issues and concerns relative to water insufficiency in Cagayan de Oro City obtained from the key informants. Data show that there were four themes that emerged hovering on water insufficiency, water quality, public info/advisory, and poor maintenance of water infrastructure. As regards water sufficiency, 52% of survey participants said that they are experiencing water shortage while about 2% said they have no water supply at all. One out of four (25%) survey participants reported low water in their area. Meanwhile, according to the residents interviewed, water insufficiency started to be felt when the victims of typhoon were relocated in the area. This was confirmed by the barangay officials interviewed with a note that they are trying their best to lobby to the city government for the installation of water system in the area. In fact, during the site visit in Barangay Balubal, pipes were stored within the vicinity of the local government unit awaiting installation. The barangay chief executives of the barangay also had the initiatives to tap other water service providers just to ease the burden of the residents of the on-going water insufficiency.

TABLE 2. Issues and concerns relative to Water Insufficiency in Cagayan de Oro City

Theme	Significant Statements
Water Insufficiency	<p><i>Having lived in the area for almost seven years, Macasandig certainly has water supply issues. The apparent shortcomings of the water service provider in the area have sort of made it a norm that supply may be insufficient due to pressure issues or entirely there won't be water coming out in your faucet at some periods in the morning. Though this may not be on a daily basis but the frequency is undeniably annoying.</i>—male resident of Barangay Macasandig</p> <p><i>Here at Upper Carmen, we don't have water supply early in the morning. We can only access water during night time. Where is justice here? We are paying so much yet water supply is insufficient.</i>---female resident of Barangay Carmen</p> <p><i>Even if there are no water interruption advisories, supply of water here in Camaman-an is very low.</i>---male resident of Barangay Camaman-an</p> <p><i>This May we experienced no water supply for one week here at Zone 3 Barangay Lumbia</i>—female resident of Barangay Lumbia</p> <p><i>Many times we experienced water shortage during droughts and even when flooding occurs</i>---female resident of Barangay Lumbia</p> <p><i>Our water supply here is only available every other day and only for 3 to 6 hours. It is not really enough for our family's needs. That's why we always harvest rain water during rainy days and it really helps a lot. If not, we buy water from our neighbors and it is an additional expense for the family.</i>---female resident of Barangay Indahag</p> <p><i>Water supply is not a problem before the relocation sites were constructed. The water system managed by the barangay were enough for the households living in the area. However, when the victims of Typhoon Sendong were relocated in the area, the demand for water increased and allocation of water for the households are now scheduled. Our schedule is every other day and if the schedule is set when we are working, we pay five pesos to our neighbors who can fetch water for us.</i> ---female resident of Barangay Balubal.</p>
Water Quality	<p><i>The quality of the water is not reliable that's why we need to spend for purified water. We cannot afford to get sick with typhoid or bloody diarrhea because it is more costly.</i>—male resident of Barangay Macasandig</p> <p><i>I can say our water quality is worst during rainy days because its murky and sometimes there are presence of leeches in the water. We harvest rainwater because it is clearer than the water supplied to us by the water service provider. We cannot take chances for our family's health so we set aside budget for drinking water.</i>—a female resident of Barangay Indahag.</p>
Public Info/Advisory	<p><i>Many times water interruption just happens without an advisory.</i>--- shared by several key informants in various barangays included in the study.</p> <p><i>There is really an issue on no clear advisories. In a very technologically-driven society where social media dominates information (fake or legit) dissemination, the service provider must have been stuck in a time continuum for failing to take the advantage of various multi-media platforms/social media to expand its PR and what nots.</i> --- male resident of Barangay Macasandig</p> <p><i>I think public advisory is an issue because many times water interruption is longer than what has been advised.</i>---shared by several key informants in various barangays included in the study.</p>
Poor Water Infrastructure	<p><i>We always experience interrupted water supply due to repair and maintenance.</i> ---shared by participants from various barangays included in the study.</p> <p><i>I think water infrastructure is poor because according to the advisories, there is water interruption due to repair and maintenance.</i> ---shared by participants from various barangays included in the study.</p>

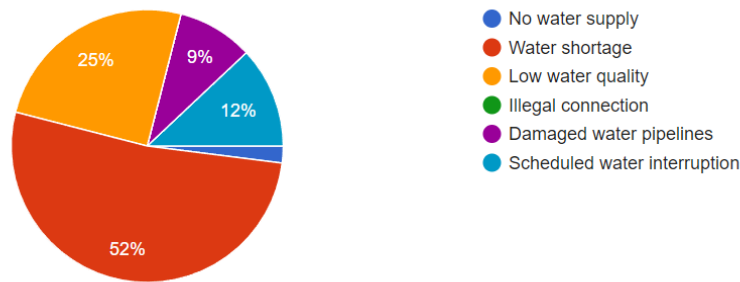


Fig. 1. Issues and Concerns Regarding Water Sufficiency

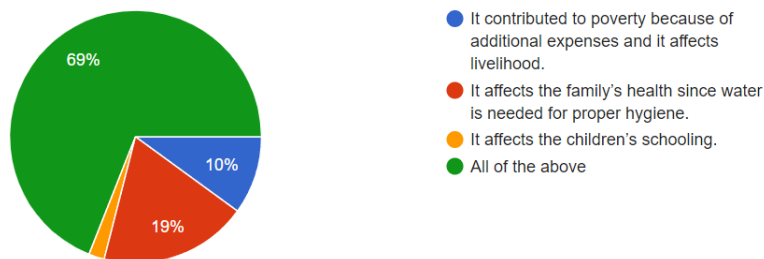


Fig. 2. Perceived Effects of Water Insufficiency to the Family

Moreover, the other theme noted is on water quality where 25% of the survey participants said that the water quality supplied in their barangay is of low quality. One key informant in Barangay Indahag said that during rainy days, water coming out from the faucet is murky and with the presence of leeches. Akin to this, one key informant captured the issues and concerns on water quality in their barangay in the following narrative:

*Water sufficiency could encompass drinkability and general utility, which are pressing concerns that must be addressed. The flourishing water refilling stations mushrooming as a business in almost every couple of blocks is an indicator that people don't have faith in consuming tap water. In fact, the number of water refilling stations could be an indicator that (apart from the demand) there is a clear conscious agreement that water is an issue in the area, but addressing it with establishing and patronizing these water refilling stations is a very passive and counter to development approach in solving the problem. A band aid solution if you will, a near surrendering to the problem. Water conservation and supply education has been sidelined for decades I guess.*

*Moreover, the periodic discharge of murky and sometimes with dust particles in the water makes it unhealthy for drinking. I am genuinely concerned about those who could not afford water from commercial establishments, if not maintain a supply of clean water for drinking and cooking. I am most certain though that this has built a culture of "bahala na" (a culture of laxness due to inability of not having the power/capacity to change the situation) as not every household has or*

*patronize filtered water. So this goes without further exploring that water for cooking, bathing, and drinking is straight of their faucets, which is quite unsanitary and therefore unhealthy.... An unfortunate social injustice existing in a highly urbanized Metro Cagayan de Oro.*

The third theme is the public advisory. According to the participants, public advisory of water interruptions is very important because water is a basic necessity and the households need to store water before supply is cut. However, as experienced there were times when they just experience water shortage without advanced notice. More than the discomforts it can bring, it entails additional expenses since they have to buy water in another area at a higher price. Many times they buy mineral water not only for drinking but also for taking a bath which is really very costly. There was also an incidence noted when the water shortage was extended beyond what was indicated in the advisory. In addition, there is also the fourth theme on poor water infrastructure. According to the key informants, most of the advisories indicated that water interruptions were due to maintenance and repair.

Furthermore, the survey participants were asked about the effects of water sufficiency to their respective families. The results (please see Figure 2) revealed that 69% of the participants said that it contributed to poverty because it entails additional expenses and affects livelihood. Also, it affects the family's health since water is needed for proper hygiene.

*Policy Recommendations.*

The major findings of the study are grouped into four policy issues namely: water insufficiency, water quality, climate resilient water system, and efficiency of water programs. These are presented in Table 3 below with corresponding policy



recommendations. Data show that one policy issue in Cagayan de Oro City is the eminent water insufficiency. There is then a

need for the local government unit to ensure that residents have access to a sustainable and safe water supply.

TABLE 3. Policy Issues and Recommendations

Policy Issues	Findings	Policy Recommendations
Water Insufficiency	The barangays covered in the study experienced water insufficiency.	There is a need for the LGU to add more water service providers (WSPs) to the barangays who are experiencing water insufficiency. It must be ensured that the approved providers are technically and financially capable of delivering the required services. The national standards set for water availability and pressure must be met.
Water Quality	The surveyed residents expressed concerns over the water quality that's why most of them set aside budget for purified water.	The City Council should pass legislation that would ensure water quality in the city. The national standards for water quality must also be met.
Climate Resilient Water System	A considerable number of key informants revealed that they experienced water shortage during droughts and even during flooding. Rainy days also made water dirty in the two barangays included in the study.	The LGU should consider providing a climate resilient water system.
Efficiency of Water Programs	There are several water programs but their efficiency is not properly monitored and evaluated.	It is imperative that the City Council create an oversight committee to monitor and evaluate the effectiveness and efficiency of water programs.

Still on water insufficiency, there is a need for the LGU to add more water service providers (WSPs) to the barangays who are experiencing water insufficiency. It must be ensured that the approved providers are technically and financially capable of delivering the required services. The national standards set for water availability and pressure must be met. Meanwhile, the concerns on water quality, climate resilient water system, and efficiency of water programs necessitates that the City Council should pass legislation that would ensure water quality in the city and a water system that is not only sustainable, but also climate resilient. An oversight committee may be created to monitor and evaluate the efficiency and effectiveness of the city's water security programs.

VI. CONCLUSION

This study concludes that several barangays of Cagayan de Oro City are experiencing water insufficiency. This is an issue on the lack of water service providers rather than an issue of water source. Financing is apparently needed for both local government officials and water service providers to install the required water infrastructures that are climate resilient and to facilitate the distribution of sufficient water supply to every household. It is then imperative for the City Council to pass legislations that would end the suffering of the community brought by water insufficiency. Cagayan de Oro City's plan for metropolization will surely be challenged since most investors will wait for the sustainable water system to be in place before making the decision to invest. Thus, the city government must make water security their utmost priority.

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