Int. j. adv. multidisc. res. stud. 2025; 5(5):998-1005

Received: 24-08-2025
Accepted: 04-10-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

The Effectiveness of Water Resources Management in Zambia: A Case Study of WARMA Lusaka

[1] Patience Chanda, [2] Kabubi M Marvin

[1] School of Humanities and Social Science, Information and Communications University, Lusaka, Zambia

[2] Department of Social Research, Information and Communications University, Research and Development Center, Lusaka, Zambia

Corresponding Author: **Patience Chanda**

Abstract

This study evaluates the Water Resources Management Authority's (WARMA) effectiveness in handling water demand for socio-economic purposes. The findings show WARMA's crucial role in capacity building for local councils and communities, with 68% acknowledging community-focused training initiatives. While respondents express support for WARMA's collaboration with industrial stakeholders, there's room for improvement in training programs. 88% believe WARMA effectively manages water demand, and 72% are satisfied with its ability to ensure a reliable water supply. Most respondents are very satisfied with current water rationing, but 12% are dissatisfied. Quantitative data reveal WARMA's positive impact on water quality, public image, and stakeholder engagement. Respondents trust WARMA's identification of freshwater sources, perceiving it as highly effective in water conservation, regulation, efficient use, management plans, and awareness campaigns. Challenges include insufficient water supply, pollution, inadequate infrastructure, and climate change impacts. Lack of awareness on water conservation is not a major concern. All respondents trust WARMA's active engagement in water resource monitoring. More than half rate WARMA's performance above average or excellent, indicating success in meeting expectations. This study emphasizes WARMA's significant role in socio-economic water resource management, pointing out successes and identifying challenges for improvement.

Keywords: Water Resource Management, Socio Economic, Environmental Sustainability, Sustainable Development, Planning

1. Introduction

1.1 Background

Water scarcity is a pressing issue in many African and Third World countries, with a minimum of 25 percent of African nations already experiencing critical water pressure, a figure projected to rise to nearly 50 percent by 2025. This crisis not only jeopardizes human populations but also poses threats to agriculture, industry, and overall economic stability, creating a domino effect across various sectors (Naik, 2016).

The consequences of water scarcity are severe and diverse. Beyond immediate impacts on well-being, it jeopardizes agricultural production, industrial operations, and economic stability. Contaminated and scarce water sources contribute to reduced crop yields, livestock production, and food insecurity. Industries reliant on water face operational constraints and increased costs, creating a ripple effect throughout society (World Health Organization, 2018).

Contaminated water sources and inadequate sanitation cause over 1.5 million deaths annually globally, highlighting the urgent need for addressing water-related issues (World Health Organization, 2018). Insufficient water availability and food shortages, with agriculture responsible for approximately 70% of global water withdrawals (UN Food and Agriculture Organization, 2018).

Rapid urbanization, coupled with an increasing demand for water in cities, poses a global challenge. As the world's population grows and urbanizes, water demand in cities is expected to surge by 50 percent in the next three decades (UN-Habitat, 2019). This trend, along with economic development and competing water needs, complicates the management of water scarcity, requiring innovative solutions and effective governance (World Bank, 2017).

Urban water scarcity is a multifaceted challenge influenced by factors such as pollution, inefficient water management

practices, and climate change. Pollution from improper waste disposal and industrial activities contaminates water sources, exacerbating scarcity. Inadequate water management, including inefficient distribution systems, further strains urban resources, while climate change alters precipitation patterns, affecting water availability and contributing to extreme weather events (World Bank, 2017).
Zambia, like many regions, grapples with water scarcity driven by urbanization, population growth, and economic development. Access to clean water in Zambia's urban areas is a critical concern, requiring a tailored approach considering local conditions, geography, climate, infrastructure, and socioeconomic dynamics (World Bank, 2017).
To address this challenge, Zambia established the Water Resources Management Authority (WARMA) through Act No. 21 of 2011. The formation of WARMA reflects Zambia's recognition of water's crucial importance across various sectors. Since its establishment, WARMA has played a pivotal role in enforcing water resource management policies, issuing permits for water-related activities, ensuring compliance, and resolving conflicts related to water usage (NWASCO, 2016 [6]; Zambia National Assembly, 2011). This legislative commitment demonstrates Zambia's dedication to sustainable water management, fostering a balance between economic growth and environmental protection (WARMA, 2019) [11].

1.2 Statement of the Problem
Water resources management is a critical aspect of sustainable development, especially in regions facing water scarcity and increasing demand due to population growth and economic activities. Zambia, like many other countries, relies heavily on its water resources for various sectors including agriculture, industry, domestic use, and ecosystems. The Water Resources Management Authority (WARMA) in Lusaka plays a pivotal role in regulating, planning, and implementing policies to ensure the responsible and equitable utilization of water resources. However, despite the establishment of regulatory bodies such as WARMA, challenges persist in the effective management of water resources in Zambia, particularly within the Lusaka region. This study aims to investigate and analyze the effectiveness of water resources management in Zambia, focusing on the case study of WARMA in Lusaka. Addressing these issues is imperative for ensuring the effective management of water resources in Zambia, with a focus on the role of WARMA in Lusaka. By identifying strengths and weaknesses in current practices, this study aims to contribute to policy recommendations that enhance water resource sustainability, promote equitable allocation, and address the challenges faced by regulatory bodies like WARMA.

1.3 Objectives of the Study
Following were the objectives of the research: To assess the effectiveness of WARMA in managing water demand for socio-economic usage, to investigate the effectiveness of WARMA in water resources management (diagnosing water resources, sustainable planning and management) and to assess the effectiveness of WARMA in monitoring water resources for sustainable development.

1.4 Research Questions
The following were the questions guiding the study: How effective is WARMA in managing water demand for socio-economic usage? How effective is WARMA in water resources management (diagnosing water resources, sustainable planning and management), how effective is WARMA in monitoring water resources for sustainable development?

1.5 Theoretical Framework
The research is grounded in Information-gap decision theory, a conceptual framework offering insights into decision-making amid uncertainty. Decision-makers often lack complete information, leading to significant gaps in knowledge. Information-gap decision theory advocates robust decision-making, focusing on resilient options rather than precise predictions. It recognizes the essential consideration of various potential outcomes and associated risks due to uncertainties (Ben-Haim, 2011).
Central to the theory is the "information gap," the mismatch between available and necessary information for well-informed decisions. Decision-makers explore multiple pathways accommodating different uncertainties and variable changes. Research applying this theory spans economics, environmental management, engineering, and public policy. In environmental management, it aids in designing strategies for uncertain climate change impacts, while in economics, it models investment decisions amidst market fluctuations (Rezaei, 2019).
In this study, Information-gap decision theory addresses challenges posed by incomplete information, providing a robust framework for informed decision-making in the face of significant gaps. This aligns with the contemporary emphasis on adaptability and resilience in decision-making within complex and uncertain environments.

2. Literature Review
Harare, facing water scarcity, saw significant disruptions in residents' daily lives, with water shortages impacting fundamental tasks like laundry and bathing. The situation forced residents to travel long distances in search of alternative water sources (Hove and Tirimboi, 2011). In Nigeria, despite the establishment of the federal Ministry of Water Resources and the River Basin Development Authority, challenges persist in developing effective water management plans and generating sufficient data for decision-making. The Ministry, tasked with overseeing sustainable water development, has struggled due to institutional and expertise limitations, resulting in ineffective top-down approaches (Akpor, 2011).
Economic drivers of water demand, particularly pricing, were discussed by Corbella and Pujol (2019), highlighting the need for control actions over demand. Approximately 25% of Africa's population faces water stress, and projections indicate increased stress due to growing water demands by 2025 (Vörösmarty *et al*., 2015). Arnell's (2014) study projects a significant rise in the population at risk of heightened water stress in Africa, emphasizing the urgent need for sustainable water management practices.
Annan (2015) warns that one-third of the global population may face water-stressed conditions by 2025 if consumption trends continue. Cong's research (2017) emphasizes the need

for a robust water management framework in Uganda, focusing on integrated and sustainable approaches. The comprehensive approach aligns with Orindi and Huggins (2015), aiming to reduce vulnerability in rural production systems, ultimately improving food security and economic opportunities.

Guppy and Anderson (2017) [2] project that 40% of the world's population will face severe water stress by 2035, highlighting the global water crisis. Mualla and Salman's study underscores the need to explore water usage across sectors, acknowledging challenges in equitable water access rooted in socio-economic factors (CA, 2017). Uganda's water resource utilization presents concerns, with low rates and growing demand across sectors, posing challenges for sustainable development (NEMA, 2018; Das Gupta, 2016; Mohammed, 2014).

NWASCO (2016) [6] expresses concern about climate change and human activities impacting water supplies in Zambia, leading to shortages in various regions. Lusaka City faces reduced borehole yields, impacting water supply in residential areas (NWASCO, 2016) [6]. Strategies to combat water insecurity include climate change mainstreaming and increased investment (NWASCO, 2016) [6].

In Zambia, groundwater serves as a crucial water supply, with Lusaka relying on it for over 52% of domestic water. However, mismanagement has led to declining groundwater tables, deteriorating water quality, and negative environmental effects (Lusaka Water and Sewerage Company, 2014).

NWASCO (2006) reveals disparities in access to water and sanitation services in Peri-urban areas, emphasizing the pressing challenges faced by these regions. LWSC (2017) addresses these challenges through the Peri-urban Department, focusing on policies and initiatives tailored to the specific needs of communities on the outskirts of urban centers.

Water is a vital resource in Zambia, serving various domestic, agricultural, and industrial purposes. However, access to safe and adequate water supply remains a challenge, with only an estimated 49.1 percent of the population having access, according to the 2000 Census Report. Urban areas fare better, with an 86.1 percent access rate, compared to rural areas at 29.5 percent. The disparity in access is further reflected in the per capita consumption rates, with larger urban areas using 180 litres/capita/day, small urban areas using 150 litres/capita/day, and rural areas using only 45 litres/capita/day (GRZ, 2010).

The Water Resources Management Authority (WARMA) plays a crucial role in managing water demand for socio-economic usage in Zambia. Its effectiveness is evident in balancing the needs of various sectors, considering environmental and social concerns. Chileshe's 2015 study delves into water resource appropriation, highlighting the social-political processes and institutions involved. The research aims to bridge the gap between legal provisions and on-ground practices, essential for effective water resource management.

However, challenges persist, as seen in the 2016 NWASCO report, which emphasizes the impact of climate change and anthropogenic activities on water resources. Instances of partial droughts and decreasing water levels in dams and boreholes underscore the urgency of addressing these issues. The interconnectedness of environmental factors becomes evident in the example of the Blue Williams dam, where reduced storage capacity and compromised water quality pose threats to the town's water supply.

Studies by Nyong and Kanaroglou (2001), Beal *et al*. (2011), and Nyambod and Nazmul (2010) shed light on water usage patterns, household dynamics, and the intricate relationship between water resources and poverty. Flint's (2014) study emphasizes the urgency of sustainable development to manage water resources effectively, balancing present needs with future generations' requirements.

In Zimbabwe, Katsi *et al*. (2017) found that households with upgraded family wells were more likely to engage in gardening activities, highlighting the importance of the self-supply approach. Smits *et al*. (2010) and Van Koppen *et al*. (2016) advocate for a more integrated and holistic approach to address water access challenges.

The 2019 World Bank report underscores the vital role of effective water management, highlighting the Water Resources Management Authority (WARMA) as a key entity responsible for collecting, analyzing, and interpreting crucial water resource data. WARMA's multifaceted functions include comprehensive data gathering on water availability, consumption patterns, and usage trends from diverse sources. This data-driven approach empowers WARMA to make informed decisions, optimizing resource allocation and ensuring equitable distribution among agriculture, industry, households, and the environment.

Moreover, the report emphasizes WARMA's role in monitoring water quality, safeguarding public health and ecosystems. By identifying contamination or deterioration promptly, WARMA can intervene swiftly, preventing potential hazards. The report praises WARMA's proactive stance in identifying emerging challenges through comprehensive data collection, enabling the formulation of strategies responsive to changing circumstances.

The World Bank (2019) report highlights WARMA's engagement with various stakeholders, fostering collaboration among government agencies, local communities, industries, and environmental organizations. This collaborative approach contributes to sustainable water resource management, minimizing conflicts among different users.

In 2020, WARMA adopted Integrated Water Resources Management (IWRM) principles, representing a paradigm shift toward a holistic approach. IWRM recognizes the interconnectedness of water, land, and resources, aiming for synchronized development and judicious management. This approach addresses challenges posed by water scarcity, pollution, population growth, and climate change, providing a robust framework for sustainable decision-making.

The United Nations' 2020 report emphasizes WARMA's pivotal role in climate adaptation, integrating resilience considerations into water management plans. As climate patterns become erratic, WARMA spearheads initiatives to enhance water system capacity, incorporating climate resilience principles. These strategies not only safeguard water availability but also preserve ecosystems, prevent conflicts, and facilitate sustainable economic growth.

The 2019 United Nations Development Programme (UNDP) report lauds WARMA's strength in enforcing regulations, ensuring compliance, and managing water resources effectively. Enforcement efforts prevent unauthorized water extraction, minimize wasteful practices, and control pollution, contributing to the long-term well-being of the

environment and communities.

However, the study acknowledges challenges faced by water systems with multiple uses. Insufficient budget allocation, limited technical capacity, and community unawareness pose threats to their sustainability. The study recommends exploring strategies like community-based financing, public-private partnerships, and government subsidies to promote financial contributions for operation and maintenance.

Additionally, conflicts in communities practicing multiple water uses underscore the need for robust management measures. The study advocates for measures addressing equity, distribution, and long-term viability in regions with diverse user categories.

The study, while focusing on water resource utilization, acknowledges the need to consider challenges related to access and overall management. It aims to fill a gap in the literature by examining water management effectiveness in Zambia, particularly the practices of WARMA in Lusaka. The case study approach provides a localized perspective on water management practices and their impact on conservation, shedding light on the dynamics of domestic water use in Zambia.

Despite the abundance of global research on water management, the study recognizes limited empirical evidence in Zambia, emphasizing the importance of understanding local contexts. The research contributes to existing knowledge, urging scholars to delve deeper into the nuanced dynamics of water management in Zambia, potentially inspiring policy changes for sustainable water use.

3. Research Methodology

3.1 Research Design

Research design serves as a blueprint for resolving investigated problems (Ngechu, 2016). This study utilized a Cross-Sectional non-experimental descriptive research design to assess the effectiveness of water resources management in Zambia, focusing on the Water Resources Management Authority (WARMA). Both qualitative and quantitative approaches were employed to maximize data exploration through triangulation (Onwuegbuzie and Collins, 2007).

Qualitative research, focusing on non-statistical methods, employed interview schedules for in-depth discussions and data collection (Willis, 2007). Quantitative research, operating within the positivism paradigm, utilized questionnaires as data collection tools, including open-ended questions for qualitative analysis (Castellan, 2010). The study explored a bounded system over time, utilizing various data sources such as documentation, interviews, and participant-observation (McMillan, 2010; Yin, 2013).

The target population comprised WARMA and stakeholders involved in water resources management in Zambia. The study aimed to examine the dynamic relationship between WARMA and stakeholders, analyzing strategies, policies, and perspectives for effective water management. The sampling design involved stratified random sampling for comprehensive representation and purposive sampling for in-depth interviews with key informants.

Sample size determination, considering a 20% addition for non-response, used Slovin's formula. A total of 50 respondents from organizations like Lusaka Water and Sewerage Company, WARMA, and National Water and Sanitation Council were recruited (Kulbir, 2016; McMillan, 2010).

The researchers ensure that the chosen sampling interval did not hide a pattern. In order to determine an ideal sample size for each stratum and particularly adolescents, Slovin's formula was used. This formula provides a simplified formula to calculate sample sizes.

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

- n is the desired sample size,
- N is the population size for adolescents in Misisi compound,
- e (being ±10%) as Margin of error, and
- the Confidence Level is 95%

Data collection employed questionnaires for quantitative data and interview schedules for qualitative insights. Both questionnaires and interviews included closed and open-ended questions for a comprehensive approach. Secondary sources, including academic journals and books, enriched the study's foundation.

Data analysis incorporated interpretational and structural analyses. A pre-processing phase ensured data accuracy, with coding for subsequent manipulation. Thematic analysis was used for qualitative data, facilitated by STATA for quantitative data. The study prioritized emergent themes for a deeper understanding.

To enhance reliability and validity, the study adopted triangulation, audit trails, prolonged engagement, debriefing, and member checks. Triangulation utilized multiple data sources, while audit trails documented the research process. Prolonged engagement contributed to context understanding, debriefing sessions addressed biases, and member checks validated findings, collectively ensuring trustworthiness (Cresswell & Garreth, 2008; Creswell & Millers, 2004).

4. Findings

4.1 Demographics

This study is about n = 50 participants involved in water management.

4.1.1 Age of respondents

The survey results indicate a relatively even distribution of respondents among the age groups of 20-30, 31-40, and 61 and above, each comprising approximately 8.0% of the total sample. This suggests a diverse research pool. Notably, the age group of 51-60 had the highest representation, making up 40.0% of the respondents, indicating potential significance in relation to the study's subject. The 41-50 age group also had a notable presence, accounting for 28.0% of the total sample.

Table 4.1: Age of respondent

Variable Age	n	%
20 – 30	4	8.0
31 – 40	4	8.0
41– 50	14	28.0
51 – 60	20	40.0
61 +	8	16.0
Total	**50**	**100**

4.1.2 Sex

In the study, male participants significantly outnumbered female participants, constituting 84.0% (n = 42) of the total sample, while females comprised only 16.0% (n = 8) of the participants.

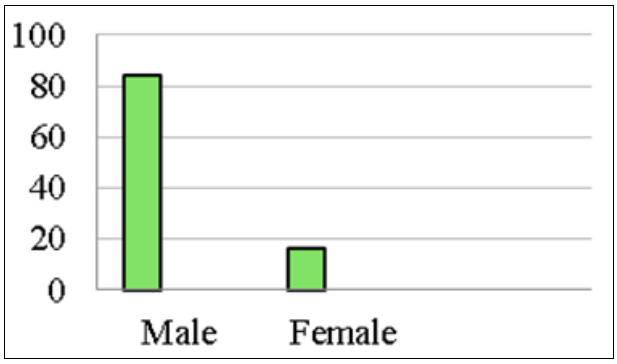


Fig 4.1: Sex distribution

4.2 Level of education

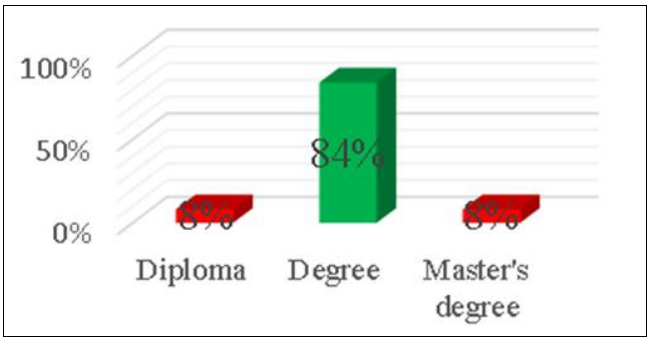


Fig 4.2: Level of education

In the study, 84.0% of the participants (42 individuals) held a degree, while the remaining respondents were evenly split between those with a diploma and those with a master's degree, each accounting for 8.0% of the total sample size (4 individuals in each category).

4.3 Effectiveness of WARMA in managing water demand for socio-economic usage

The study found that 100% of respondents acknowledged that WARMA conducts training programs for local councils in Water Demand Management, indicating active engagement in capacity building. Additionally, 68% of respondents reported that WARMA conducts training sessions for communities, highlighting commendable efforts to empower local communities in water resource management. However, 32% of respondents disagreed, suggesting potential room for improvement in extending community-focused training initiatives.

Table 4.2: Water demand management

Variable	*Yes*	*No*
Does WARMA conduct training for councils in Water Demand Management?	100%	0%
Does WARMA conduct training for Communities in Water Demand Management?	68.%	32%
Does WARMA conduct training for Water Users e.g Hydro Electricity Companies or Sugar companies?	100%	0%

4.4 Effectiveness of WARMA in water resources management

In the study, all respondents (100%) unanimously agreed that WARMA successfully identified potential freshwater sources, as evidenced in table 4.6. This consensus underscores the robustness of WARMA's efforts and highlights the credibility and thoroughness of the study's findings. The complete alignment among participants in acknowledging WARMA's achievements serves as a strong endorsement of the organization's competence in identifying and managing freshwater sources, reflecting high levels of trust and confidence from those surveyed.

Table 4.3: Water resources management

Effectiveness of WARMA in water resources management	*Yes*	*No*
Has WARMA identified potential sources of freshwater supply?	100%	0%
Does WARMA conduct Climate Change activities to manage conserve and protect water resources?	100%	0%

4.4.1 Level performance of WARMA in water resource management

Table 4.4: Level performance

Level of performance	VS	S	N	D	VD
How satisfied are you with the performance of WARMA in water resource management?	28%	60%	12%	0%	0%

The study assessed satisfaction levels with the Water Resources Management Authority's (WARMA) performance in water resource management. Overall, the findings were notably positive, with 88% of respondents expressing satisfaction. Breaking it down, 60% reported being satisfied, 28% were very satisfied, and 12% were neutral. The latter suggests a potential need for further investigation or improvement in WARMA's communication or outreach efforts.

4.4.2 Measures WARMA has taken regarding water resource management

Table 4.5: Measures WARMA has taken regarding water resource management

What measures or actions have you observed or experienced from WARMA regarding water resource management?	*Yes*	*No*
Implementation of water conservation programs	100%	0%
Monitoring and enforcement of water use regulations	100%	0%
Promotion of efficient water use practices	100%	0%
Development of water management plans	100%	0%
Awareness campaigns on water conservation	100%	0%

The findings indicate that 100% of participants expressed confidence in WARMA's implementation of water conservation programs, emphasizing its success in initiatives aligned with sustainable water management. Additionally, all respondents unanimously believed in WARMA's excellence in monitoring and enforcing water use regulations, highlighting the organization's commitment to responsible water consumption practices. The study also revealed unanimous agreement (100%) on WARMA's effectiveness in promoting efficient water use practices,

implementing strategic water management plans, and conducting impactful awareness campaigns on water conservation.

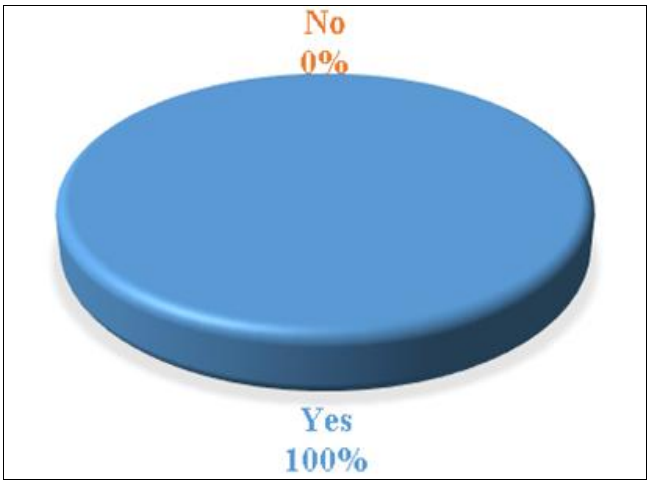
4.4.3 Major water resource management challenges faced

The study sought to establish water resource management challenges faced by WARMA. The table below illustrates a noteworthy trend wherein a significant majority of the respondents expressed their agreement with various aspects related to the Water Resource Management Association (WARMA). The findings reveal that, across multiple factors, more than half of the surveyed individuals shared a consensus regarding the challenges associated with water resources.

Table 4.6: Major water resource management challenges faced

Statements	1	2	3	4	5
Insufficient water supply	31	11	5	3	0
Water pollution	39	8	3	0	0
Inadequate infrastructure for water storage and distribution	31	11	6	2	0
Climate change impacts on water availability	41	8	1	0	0
Lack of awareness and education on water conservation	16	4	12	5	17

4.5 Effectiveness of WARMA in monitoring water resources



Figu 3.3: Effectiveness of WARMA in monitoring water resources

When the researcher inquired with the respondents about whether WARMA conducts water resource monitoring, all 50 respondents (100%) affirmed that they do, and none of them reported otherwise, resulting in a 0% negative response rate

significant number of respondents 97% representing 23.1% females and 73.9% males in this study indicated that their environment plays a significant role in influencing underage drinking because they are a lot of bars and taverns every after few houses and one can buy beer without any restrictions while 3% representing (2% females and 1% males) felt that environmental factors does not contribute to alcohol consumption.

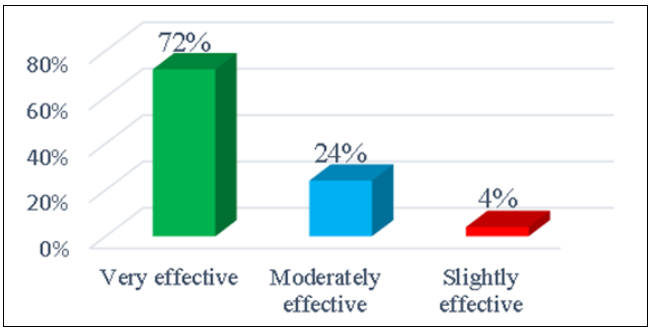


Fig 4.5: Monitoring water resources for sustainable development

The results of the survey indicate that a significant majority of respondents, 72.0%, find the mechanisms for monitoring water resources for sustainable development highly effective. This viewpoint is supported by 36 respondents. In contrast, only a small fraction, 4.0%, perceive the mechanisms as slightly effective, with only 2 individuals endorsing this perspective. Additionally, 24.0% of respondents consider the mechanisms moderately effective, with 16 individuals supporting this assessment.

4.5.1 Performance of WARMA in monitoring water resources

The feedback from respondents regarding the performance of the Water Resources Management Authority (WARMA) is overwhelmingly positive. Participants were asked to rate WARMA on a scale from 1 to 5, with 1 being "Poor" and 5 being "Excellent." The majority of respondents rated WARMA's performance as above average, with some even giving it an excellent rating. This positive feedback highlights WARMA's effectiveness in monitoring water resources. More in-depth analysis of specific praised aspects can offer valuable insights for further improvement. Overall, the results indicate a strong foundation for WARMA in fulfilling its role of responsibly and efficiently managing water resources.

Table 4.9: Performance of WARMA in monitoring water resources

Statements	1	2	3	4	5
Monitoring water quality	0	0	7	33	10
Regulating water abstraction and use	0	8	3	26	13
Enforcing water resource management regulations	0	1	7	31	11
Promoting water conservation and sustainable practices	0	3	9	29	11
Collaborating with stakeholders (communities, industries, etc.) for sustainable water management	4	11	6	12	17

4.6 Discussion

The study's results provide valuable insights into the initially posed research questions. To fully understand and address these findings, it is crucial to compare them with existing literature. This comparative analysis reveals intriguing patterns and notable differences, as discussed in the results section.

4.6.1 Effectiveness of WARMA in Managing Water Demand

The study reveals that 100% of respondents acknowledge WARMA's training programs for local councils,

highlighting active engagement in capacity building crucial for community-level water resource management. While 68% affirm community training, the study suggests room for improvement in extending initiatives. This aligns with the comprehensive approach outlined in the WARMA (2019) [11] annual report, emphasizing collaboration with stakeholders.

WARMA's holistic strategy engages governmental bodies, local communities, industries, and NGOs to balance water demand with environmental preservation. While respondents show strong support for training programs, there's an opportunity for WARMA to enhance community engagement. These findings serve as a foundation for strengthening initiatives and promoting sustainable water resource management.

4.6.2 Level of Agreement

88% express strong confidence in WARMA's capability to manage water demand for socio-economic purposes, indicating substantial community support. Despite a 12% moderate viewpoint, the study lacks opposing literature, emphasizing the need for further public perception research. Initiatives like the Peri-urban Department demonstrate positive steps, urging continued public engagement for improvements aligned with community needs.

72% of respondents admire WARMA's performance in ensuring a consistent water supply for socio-economic activities. This positive perception aligns with the USAID observations in 2015, highlighting WARMA's impact on Zambia's socio-economic development. Additionally, 72% express satisfaction with current water rationing methods, while 16% suggest opportunities for improvement. These insights emphasize the importance of optimizing water resource management in the region.

4.6.3 Effectiveness of WARMA in Water Resources Management

Respondents unanimously agree (100%) on WARMA's success in identifying potential freshwater sources, reinforcing the organization's competence. An overwhelming 88% express satisfaction with WARMA's overall performance in water resource management, with 28% indicating exceptional satisfaction. These positive sentiments align with the WARMA (2020) report, emphasizing the organization's high standard of service delivery.

4.6.4 Measures WARMA has Taken Regarding Water Resource Management

100% of respondents endorse WARMA's proficiency in water conservation programs, emphasizing its dedicated efforts in preserving and sustainably managing water resources. Similarly, unanimous agreement (100%) highlights WARMA's effectiveness in monitoring and enforcing water use regulations. These findings align with the 2019 report, reinforcing WARMA's commitment to vigilantly upholding established water usage regulations.

Additionally, unanimous agreement (100%) affirms WARMA's efficacy in fostering efficient water utilization practices, showcasing its proactive role in promoting responsible water management. A unanimous consensus (100%) on WARMA's effectiveness in developing water management plans underlines its commitment to strategic frameworks for equitable water resource allocation.

Furthermore, 100% of respondents acknowledge WARMA's exceptional proficiency in executing awareness campaigns on water conservation. This unanimous endorsement reflects the agency's success in actively involving the public and stakeholders in promoting responsible water usage practices.

4.6.5 Major Water Resource Management Challenges Faced

The study identifies inadequate water supply, water pollution, insufficiency of water storage and distribution infrastructure, and the impact of climate change as major challenges. These findings align with existing literature and highlight the urgency of addressing these issues. Initiatives like the Peri-urban Department and proactive measures by the Lusaka Water and Sewerage Company indicate steps toward tailored solutions and improved water infrastructure.

4.6.6 Effectiveness of WARMA in Monitoring Water Resources

Respondents unanimously confirm (100%) that WARMA actively monitors water resources, showcasing a high level of trust in the organization's commitment to this crucial task. Over half of the respondents express highly favorable views on WARMA's performance in monitoring water resources, emphasizing its effectiveness. These positive perceptions align with the 2021 annual report, reinforcing the organization's essential role in sustaining and enhancing water resource management.

4.7 Conclusion

Overall, the findings suggest that WARMA has made significant strides in managing water resources, addressing challenges, and monitoring water quality. However, there is always room for improvement, and the insights from this study can serve as a foundation for further enhancing WARMA's initiatives and promoting sustainable water resource management in Zambia. The collaboration between WARMA, stakeholders, and the community, as well as the implementation of innovative tools and mechanisms, are key to achieving sustainable water management and ensuring access to clean water for all.

4.8 Recommendations

The study on the effectiveness of the Water Resources Management Authority (WARMA) in managing water demand for socio-economic usage provides several key recommendations:

1. **Enhance Community Engagement:** WARMA should expand outreach efforts, focusing on a more inclusive approach to water management education, particularly at the community level. Tailored training programs addressing specific community needs and challenges are recommended.
2. **Continuous Improvement in Water Rationing:** Conduct a detailed assessment of water rationing methods, seeking feedback from dissatisfied respondents to refine the process for more equitable and effective water resource allocation.
3. **Addressing Major Challenges:** Prioritize the resolution of major challenges through comprehensive strategies and action plans. This may involve investing in infrastructure development, implementing pollution control measures, and exploring innovative solutions to increase water supply.
4. **Climate Change Adaptation:** Develop and implement strategies to mitigate the effects of climate change, such as promoting water conservation practices, enhancing resilience in water supply systems, and conducting

regular assessments of climate-related risks to water resources.

5. **Monitoring and Evaluation:** Invest in monitoring mechanisms and technologies to ensure the sustainable management of water resources. Regular evaluations of monitoring processes can identify areas for improvement and adaptation to changing conditions.
6. **Legislative Framework:** Continuously review and update relevant legislation to ensure alignment with evolving water management needs and challenges.

5. Acknowledgments

I would want to convey my appreciation to a number of people who have helped me tremendously throughout this research. I also want to express my thanks to Jehovah, my Creator, for maintaining my life and giving me the strength to get this far. Mr Kabubi my thesis supervisor, whose direction and support have been essential, and without whom my dissertation would not have progressed this far with my proposal, I would like to express my deepest gratitude and appreciation.

6. References

1. Global Water Partnership Technical Advisory Committee (GWP-TAC). Integrated Water Resources Management. TAC Background Papers, No. 4. GWP-TAC, 2000.
2. Guppy L, Anderson B. Drought and Humanitarian Crises: Evidence and Implications for Integrated Policy. UNU-WIDER, Working Paper No. 2017/73, 2017.
3. Kummu M, De Moel H, Salvucci G, Viviroli D, Ward PJ. Distribution of global freshwater resources and river discharge. In the Global Water System in the Anthropocene. Springer. Cham. Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (2005), 2016, 43-60.
4. Mikhail M. Opportunities revealed by the Nepal multipleuse water services experience. Waterlines. 2016; 29(1):21-36.
5. Montgomery MA, Elimelech M. Water and sanitation in developing countries: Including health in the equation. Environmental Science & Technology. 2017; 41(1):17-24.
6. NWASCO. National Report on the Joint Monitoring Programme for Water Supply and Sanitation. Lusaka, Zambia: National Water Supply and Sanitation Council, 2016.
7. Johnson KD. Underage Drinking: Problem-Oriented Guides for Police, Problem-Specific Guide Series, No.27. Washington, DC: U.S. Department of Justice, Office of Community Oriented Policing Services, 2004.
8. The Water Resources Management Act, No. 21 of 2011 of the Laws of Zambia.
9. United Nations. Integrated Water Resources Management, 2015. Retrieved from: http://www.un-documents.net/a21-61.htm
10. USAID. United States Agency for International Development (USAID) Making Cities Work, 2012. www.makingcitieswork.org accessed, 03-12-07.
11. Water Resources Management Authority (WARMA). Annual report, 2019. Retrieved from: http://www.warma.org.zm/about-us