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Strategic Approaches to Sustainable Water Resources Management in Ghana: Insights from Senior Management of Ghana Water Company Limited.

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Abstract

Water is a fundamental necessity for human survival and well-being. Globally, the demand for freshwater continues to rise, while the availability of safe, potable water remains limited. Consequently, the sustainable management of water resources is of paramount importance. This study aims to examine strategic approaches to sustainable water resource management in Ghana. A qualitative, descriptive phenomenological approach was utilized to gather insights from the senior management of Ghana Water Company Limited (GWCL) in Sekondi-Takoradi. The participants, each with over two decades of experience in the water utility sector, provided in-depth perspectives. Their responses to the research questions were analyzed and presented thematically, offering a nuanced understanding of sustainable practices in water resource management. The findings reveal that Ghana Water Company Limited (GWCL) faces significant challenges in sustainable water resource management, primarily in operational, financial, resource, customer management, institutional, external, political, and non-revenue water (NRW) areas. These challenges are shown to have a detrimental impact on the long-term sustainability of water resources. Both internal and external environmental factors contribute to these issues, compounding the complexity of achieving sustainable management. Although GWCL has implemented short-term strategies such as performance improvement programs, dry season crisis management plans, institutional strengthening, and customer education, these measures, while beneficial, are deemed insufficient for achieving sustainable water resource management. The study, therefore, recommends the adoption of long-term strategies to ensure sustainable water resource management. Key recommendations include the implementation of comprehensive strategic planning, active protection and conservation of water bodies, the establishment of new treatment facilities, expansion of the distribution network, and investment in high-quality human resources. Additionally, fostering a positive organizational culture is essential to reinforce these initiatives, ultimately supporting GWCL in achieving a resilient and sustainable approach to water management in Ghana.

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1. Introduction

In an increasingly dynamic business environment, organizations must adopt adaptive measures to remain competitive and sustainable. Globalization and rapid technological advancement are reshaping business landscapes, presenting both challenges and opportunities for organizations. Bryson (2018) argues that, on a global scale, firms are under pressure to survive, with technology fundamentally altering workplaces, social interactions, and globalization processes. For water utilities, specific challenges include pollution of water sources, population growth, urbanization, and rising demand for potable water, all of which strain sustainable water resource management efforts. Mekonnen and Hoekstra (2016) note that global demand for freshwater continues to increase due to factors like population growth, improved living standards, and expanded irrigation. This situation highlights the need for effective strategic responses to ensure organizational sustainability.

Effective strategic planning has been recognized as a critical tool for organizational success, guiding decision-making and aligning resources with long-term goals. According to Kenny (2016), a strategic plan enables organizations to clearly define their vision and effectively manage their operations, while Bryson (2018)

emphasizes that strategic planning provides a disciplined framework for guiding an organization's purpose, objectives, and strategies. Ansoff et al. (2019) add that companies employing strategic management practices often achieve better alignment and financial outcomes than those that do not. For water utilities and other organizations seeking resilience and sustainability, comprehensive, systematic, and adaptable strategic planning is essential to thrive in a competitive and evolving global business environment.

1.1 Ghana Water Company Limited

The provision of potable water is essential for both social and economic development. In Ghana, the Ghana Water Company Limited (GWCL) is the state-mandated entity responsible for producing, distributing, and managing potable water across urban areas. Ghana's public water supply infrastructure dates back to the early 20th century, with initial systems developed in Accra before World War I and in other cities like Cape Coast, Winneba, Kumasi, and Sekondi-Takoradi by the 1920s. These systems were initially managed by the Hydraulic Division of the Public Works Department. In 1965, the Ghana Water and Sewerage Corporation (GWSC) was formally established by Act 310 to oversee water supply and sewerage operations nationwide. Later, in 1999, GWSC transitioned into the Ghana Water Company Limited, a fully state-owned limited liability entity.

Currently, GWCL operates 88 urban water supply systems across Ghana, producing an average of 871,496 cubic meters (approximately 192 million gallons) of water per day. However, the current demand for potable water in urban areas is estimated at 1,131,818 cubic meters per day (around 249 million gallons per day), with urban water supply coverage reaching about 77%. This gap between production and demand underscores the pressing need for sustainable water resource management, as GWCL seeks to meet the increasing demand for safe drinking water in Ghana's urban centres.

1.2 Scope of the Study

This study focuses on Sekondi-Takoradi, a twin city serving as the capital of Ghana's Western Region. Located 223 kilometres west of Accra along the coast, Sekondi-Takoradi spans an area of approximately 192 square kilometres and has a population of around 559,548. Known for its harbour and industries such as cocoa, timber, flour, and cement, the city's economy is further boosted by its traditional fishing occupation and diverse educational, hospitality, and entertainment establishments. Since the discovery of oil in commercial quantities in the Western Region in 2010, the demand for potable water in Sekondi-Takoradi has significantly increased, as the oil industry has attracted numerous businesses, investors, and residents to the area. This rapid growth has heightened the need for the Ghana Water Company Limited (GWCL) to establish a strategic plan to enhance service delivery, expand service coverage, and ensure sustainable water resource management in the region.

The study, therefore, investigates sustainable water resource management in Sekondi-Takoradi, considering the city's growing urban population and industrial activities. It specifically examines the strategies employed by GWCL to address the city's rising demand for potable water amidst environmental and infrastructural challenges. By engaging with GWCL staff and management, the research aims to gather comprehensive insights into the practices, challenges, and opportunities for improvement in water resource management in the Sekondi-Takoradi Metropolitan Area, contributing to broader sustainable water solutions for Ghana.

1.3 Problem Statement

Water's irreplaceable role as a fundamental human necessity underscores the critical need for sustainable management in water utilities. The Ghana Water Company Limited (GWCL) has struggled with financial and operational inefficiencies that threaten its sustainability. Financial deficits surged from $19.05 million in 2014 to $44.98 million in 2015 and have remained a concern, with the State Interests and Governance Authority (SIGA) reporting average annual losses of GH₵845.6 million between 2019 and 2023. These deficits reflect structural inefficiencies, high operational costs, and the broader economic impact of Ghana's Domestic Debt Exchange Program and currency depreciation. GWCL's reliance on external factors for financial stability, combined with insufficient revenue streams, underscores the urgency of addressing these systemic challenges for long-term viability

Operationally, GWCL faces significant challenges, including a high non-revenue water (NRW) rate, which currently stands at approximately 40%, frequent pipeline failures, and limited service coverage, with about 27% of urban residents lacking access to potable water. These issues are compounded by increasing operational costs driven by ageing infrastructure, mining-related water pollution, and energy expenses, which make up 35% of its budget. Moreover, a declining collection ratio, falling from 94% in 2013 to 78% in 2018, exacerbates cash flow constraints. Addressing these issues requires targeted interventions, such as upgrading infrastructure, adopting advanced leak detection technologies, and strengthening revenue collection mechanisms to ensure financial and

operational sustainability.

A primary concern is NRW, which rose from 47% in 2013 to 56% in 2018, a significant issue for water utilities in developing countries (Gungor-Demirci et al., 2018). High NRW indicates that water losses surpass sales, undermining GWCL's financial stability and costing the company an estimated $200 million annually (GWCL, 2018). The most recent data indicates (GWCL, 2024) reveal a national non-revenue water (NRW) rate of approximately 42% as of 2023. This figure marks a reduction from prior years, such as the 56% rate reported in 2018. However, it remains significantly higher than the international benchmark of 20-25%. NRW issues are particularly acute in urban centres like Accra and Kumasi, which account for a substantial proportion of water losses. Factors contributing to this high NRW rate include ageing infrastructure, frequent pipeline bursts, illegal connections, and inefficiencies in metering and billing systems.

GWCL has faced rising operational costs from 2019 to 2024 due to various factors including deteriorating raw water quality, increasing chemical treatment needs, and surging energy costs, which constitute about 35% of operational expenses. Between 2014 and 2016, operational costs rose sharply from $84.64 million to $150.52 million. More recent figures from 2019 indicate a 120.5% increase in total expenditures compared to 2018, rising from GH₵1.58 billion to GH₵3.48 billion. This trend reflects continued cost pressures through the subsequent years, influenced by inflation, currency depreciation, and infrastructure challenges.

Additionally, mining-related pollution has significantly degraded raw water quality, necessitating higher expenditures on treatment chemicals. The financial burden is exacerbated by aging infrastructure leading to frequent pipeline failures and water losses. As of 2022, GWCL's treated water production met only 60% of urban demand, with non-revenue water (NRW) losses remaining at critical levels, approximately 46%, according to recent estimates. Efforts to address these issues include revising tariff structures and seeking government and donor funding to improve infrastructure and reduce operational deficits. However, the financial sustainability of GWCL remains a major concern due to its high operational costs and limited revenue growth.

GWCL continues to face significant challenges in its financial and operational efficiency. The collection ratio, which reflects the proportion of revenue collected from billed customers, has declined substantially from 94% in 2013 to 78% in 2018, with minimal improvement through 2024. This reduction is largely attributed to widespread non-payment by customers, including significant arrears from government entities. These inefficiencies have constrained GWCL's cash flow, complicating efforts to maintain and expand service delivery. Additionally, service coverage remains inadequate, with 27% of the urban population lacking access to potable water. Although initiatives like the Greater Accra Metropolitan Area (GAMA) project have improved access for vulnerable communities, they fall short of addressing the broader gap necessary to achieve universal water coverage in alignment with Sustainable Development Goal 6 (SDG 6).

Compounding these challenges are infrastructure issues, including frequent pipeline bursts and significant non-revenue water (NRW) losses, currently estimated at 40%. This reflects improvements from earlier NRW rates of over 50% but still far exceeds international benchmarks of 20-25%. Ageing infrastructure, theft, and system inefficiencies contribute to these losses, elevating operational costs and diminishing water availability. To address these issues, GWCL has engaged in international collaborations, such as agreements with Denmark's Aarhus Municipality, to adopt advanced leak detection technologies. However, achieving financial sustainability and operational efficiency will require comprehensive strategies, including stricter enforcement of payment systems, targeted investments in infrastructure, and enhanced governance mechanisms.

These issues collectively hinder GWCL's growth, performance, and long-term viability. Consequently, this study investigates sustainable water resource management strategies to address these challenges effectively, aiming to prevent a potential collapse in the water supply for Sekondi-Takoradi. As noted by Thompson, Haigh, and Smith (2018), organizations lacking proactive strategic planning are inherently positioned for failure. Effective strategic interventions are therefore critical for GWCL's sustainability and resilience in a changing operational landscape.

Fig. 1. Polluted Rivers

2. Theoretical Framework

Scholars have proposed various theoretical perspectives on sustainable water resource management (Karpouzoglou, Dewulf & Clark, 2016; Biggs et al., 2015). This study specifically draws on two key frameworks: the adaptive governance theory and the sustainable livelihood approach. The adaptive governance theory emphasizes flexible, decentralized management systems that can respond effectively to environmental changes and uncertainties, promoting resilience in water resource management. In contrast, the sustainable livelihood approach focuses on enhancing the capacities and assets of communities, ensuring that water management strategies support long-term socio-economic well-being and environmental sustainability. Together, these frameworks provide a comprehensive foundation for understanding and advancing sustainable water management practices.

2.1. The Adaptive Governance Theory

The adaptive governance theory, advanced by Karpouzoglou, Dewulf, and Clark (2016), integrates principles from governance and environmental theories to address sustainability challenges, particularly in areas like water resource management. This theory emphasizes several core characteristics—adaptive capacity, networks and partnerships, collaboration, shared responsibility, and a focus on knowledge and learning (Munaretto, Siciliano & Turvani, 2014; Bruckmeier, 2014; Green et al., 2016). Adaptive governance advocates for gaining a comprehensive understanding of sustainability issues, fostering partnerships, and creating collaborative networks to address these challenges effectively. It also underscores the importance of distributing responsibility across involved stakeholders.

The adaptive governance framework offers several advantages. Primarily, it enhances the understanding of sustainability and provides valuable insights into sustainable water management. For instance, Rijke et al. (2013) applied adaptive governance analysis to understand governance reforms that promote adaptive and resilient urban water management in Australia. Furthermore, the theory stimulates ongoing discourse on sustainability and addresses specific questions, such as how socio-ecological systems can adapt to climate change and the role of water management in this process (Munaretto, Siciliano & Turvani, 2014).

However, adaptive governance has faced some critiques. Schmidt et al. (2013) argue that the theory suffers from a lack of policy clarity, insufficient political will, and challenges in coordinating across various institutions. These limitations highlight areas where adaptive governance could benefit from further refinement and practical application.

2.2 Sustainable Livelihood Theory

The sustainable livelihood theory focus on the principle of environmental sustainability, emphasizing the relationship between livelihood activities and their impact on natural resources (Biggs et al., 2015). This theory posits that livelihood practices can either enhance or deplete the environmental resource base, contributing to issues such as desertification, deforestation, soil erosion, and water scarcity. Despite Africa's rich endowment of water resources, including lakes, rivers, and aquifers, many of these are threatened by pollution stemming from human activities (Mugagga & Nabaasa, 2016).

The sustainable livelihood theory seeks to evaluate whether global livelihood activities yield a net positive or negative impact on long-term environmental sustainability. It highlights the potential of certain interventions,

such as biotechnological applications, to mitigate environmental challenges (Arora et al., 2018).

However, the sustainable livelihood theory has faced criticism for its limitations. Critics argue that it inadequately links livelihood and governance issues to development and lacks the rigour necessary to account for long-term, large-scale environmental changes (Horsley et al., 2015; Biggs et al., 2015). Furthermore, it struggles to address significant shifts in global market dynamics and political contexts. In the context of Africa, strategic planning is suggested as a crucial approach for managing water resources effectively and achieving the Sustainable Development Goals (Mugagga & Nabaasa, 2018).

2.3. Non-Revenue Water

Non-revenue water (NRW) represents a significant challenge for water utilities in developing countries (Xin et al., 2015; Sharma et al., 2018). According to the International Water Association (IWA, 2016), NRW encompasses the water lost between the volume entering the system and the authorized consumption that is billed. Al-Washali, Sharma, and Kennedy (2016) note that while water loss is a universal issue across distribution systems, the extent of loss varies substantially by country and region. NRW comprises both physical (real) losses—such as leakages and overflows resulting from inadequate maintenance and poor-quality infrastructure—and commercial (apparent) losses, which arise from meter inaccuracies, billing errors, and water theft (IWA, 2016).

Globally, NRW averages around 35%, but in developing countries, this figure can reach 50-60% (Al-Washali et al., 2016). For instance, Nigeria reports NRW levels exceeding 60% (World Bank, 2016), while Ghana's average stands at approximately 50% (GWCL, 2019). Data from South Africa indicates an NRW of 36.8% across 132 municipalities, while other countries report varying levels, with Mexico at 51% and Korea at 16.3%. In contrast, developed nations like Singapore, Denmark, and the Netherlands maintain remarkably low NRW levels of about 5-6% (Muller, 2018; Jang & Choi, 2017). High levels of NRW are indicative of inefficiencies within water management systems, threatening both water resource security and the financial sustainability of water service provision (Khalid, 2018; Abu-Mahfouz et al., 2016).

The causes of NRW are multifaceted, encompassing physical, technical, managerial, and environmental factors (Gungor-Demirci et al., 2018). Effective reduction of NRW necessitates a comprehensive understanding and address of technical, operational, institutional, financial, and administrative issues. Tabesh et al. (2018) emphasize the importance of identifying and addressing the components contributing to NRW, including apparent losses, real losses, and unauthorized consumption. While Abu-Mahfouz et al. (2016) propose a Dynamic Hydraulic Model to tackle physical losses, this approach does not comprehensively address the broader issue of NRW, particularly the substantial commercial losses stemming from illegal connections and metering inaccuracies (Sharma et al., 2018). The diagnostic approach suggested by Farley (2003) has been recognized as a practical framework for addressing NRW challenges (Tsitsifli et al., 2017).

2.4 Strategic Marketing Management

Strategic Marketing Management (SMM) is crucial for organizations in monopolistic or regulated sectors like the Ghana Water Company Limited (GWCL), where it offers a structured approach to meeting public demands despite minimal competition. Kotler and Keller (2016) underscore SMM's role in helping organizations define their value proposition, communicate effectively with stakeholders, and enhance customer satisfaction. For GWCL, SMM enables a focused approach to promoting quality water supply and environmental sustainability, reinforcing its mandate within the public sector and building trust with consumers. By aligning with public expectations, SMM assists GWCL in addressing stakeholder needs, promoting transparency, and managing public perception particularly, crucial during service disruptions or water scarcity (Day & Moorman, 2010).

Moreover, SMM facilitates operational efficiency and resource optimization for GWCL, promoting sustainable practices and enhancing customer loyalty. Through a market-oriented approach, GWCL can integrate customer feedback to improve service quality, align with environmental priorities, and foster public trust (Narver & Slater, 1990). Strategic positioning and brand management (Aaker, 2008) strengthen GWCL's reputation as a reliable water provider while emphasizing competitive advantage through operational responsiveness (Porter, 1985). Academic research supports SMM's impact on organizational growth, as it aligns market needs with internal capabilities, essential for public enterprises constrained by resources (Varadarajan, 2010). SMM further improves GWCL's operational efficiency and fosters community partnerships, leading to resilience and adaptability in a dynamic environment, as noted by Day (2014). This strategic alignment bolsters GWCL's mission, ensuring consistent performance and long-term public support.

2.5 Strategic Planning

Strategic planning is a systematic and disciplined process for making critical decisions and guiding actions that shape an organization's direction and goals. This process encompasses setting clear objectives, formulating actions, implementing strategies, and regularly evaluating progress. Core aspects of strategic planning include establishing a long-term perspective, defining the business scope, and balancing strategic alignment between the organization and its external environment. Effective implementation requires coordinated efforts and a careful balance of resources, including time, human capital, financial assets, and technology. Strategic planning enables organizations to harness opportunities and mitigate risks, particularly within volatile market environments.

Since gaining prominence in the mid-1960s, strategic planning has been recognized as a foundational practice in organizational management. Key components involve assessing the organization's current position, defining future objectives, and analyzing internal and external environmental changes. Strategic planning is essential to organizational success as it facilitates problem identification and resolution, clarifies purpose, and reinforces core values and resource alignment. Studies indicate that the high failure rate among small firms, especially startups, often results from inadequate formal planning. Strategic planning thus remains crucial for both large and small organizations, providing a structured focus, clear direction, and actionable strategies to achieve stated objectives. This approach, which considers an organization's historical performance and future goals, has shown positive correlations with growth, profitability, goal attainment, and sustained competitiveness, emphasizing the indispensable role of strategic planning in achieving long-term organizational success.

2.5.1 Strategic Planning Process and Dimensions

The strategic planning process encompasses multiple dimensions including formality, planning tools, employee participation, implementation, time horizon, and control; all essential to achieving organizational goals. Formality in planning refers to the structured approach using systematic procedures, documentation, and schedules to define mission, objectives, and resource allocation. Formal strategic plans guide organizations in efficiently addressing challenges, although the direct impact on performance remains debated in the literature. Studies, such as those by Kraus and Rigtering (2017), suggest that dimensions including strategy, environment, structure, and resource allocation shape the planning process and influence organizational outcomes. Comprehensive planning, while potentially enhancing performance by reducing biases and increasing motivation, shows mixed evidence on its impact, with some research indicating effectiveness varies based on organizational size and complexity.

Empirical research generally supports a link between strategic planning and improved organizational performance, although findings vary across contexts. For instance, studies have shown that strategic planning positively influences sales and profitability among SMEs (Gomera et al., 2016; Omsa et al., 2018), enhances bank performance in Kenya (Nyarano & Bett, 2018), and supports growth in different sectors globally. Employee participation in planning also appears essential, fostering ownership and aligning organizational objectives with employee engagement. Despite these benefits, barriers such as lack of time, skills, or trust deter small businesses from adopting formal planning processes. Further research is needed to clarify the role of strategic planning in organizational success across different contexts, as factors like industry and company size influence its efficacy.

2.5.2 Strategic Planning and Management

Strategic planning is a fundamental aspect of strategic management, which encompasses the stages of formulation, implementation, and evaluation of policies to achieve organizational objectives. Strategic management, as described by Ansoff (2019), is an ongoing process through which a firm aligns itself with its external environment by integrating strategic planning, capability planning, and change management. As a core element of strategic management, strategic planning focuses on establishing an organization's long-term direction and goals, making it a primary concern for senior leadership. The effectiveness of strategic management hinges on linking planning with decision-making and subsequent actions, creating a cohesive pathway from goal-setting to measurable outcomes.

Strategic theories have long been examined from multiple perspectives, evolving from military origins to encompass frameworks applicable to business organizations. Strategy can be analyzed through the classical, processual, evolutionary, and systematic approaches, each offering distinct views on factors like profitability, competition, and decision-making context. Additionally, industry-based, institution-based, and resource-based perspectives highlight different aspects of strategic planning, from assessing organizational strengths to leveraging unique resources and human capabilities. Strategic planning can be dissected further into dimensions of content, process, context, and outcomes, with each dimension shaping an organization's approach to achieving sustained performance. Studies by Thietart (2015) and Ansoff et al. (2019) emphasize strategy as both a

directional tool and a set of guidelines that enable firms to optimize performance, adapt to external environments, and establish coherent internal processes.

2.5.3 Strategic Planning and Marketing

Strategic marketing centres on identifying, anticipating, and fulfilling customer needs profitably, concentrating resources on activities that enhance sales and market share (Grant, 2016). This discipline encompasses varied frameworks and models, including the 4Ps (product, price, promotion, place), 7Ps (adding process, physical evidence, participants), 4Es (expertise, evaluation, education, experience), and 4Cs (customer solution, cost to the customer, convenience, communication) (Ikechi, Chinenye & Chiyem, 2017). Each framework provides unique insights for meeting market demands and ensuring value alignment with customer expectations. Effective financial management complements these efforts by facilitating resource allocation towards organizational goals. Financial stability, accountability, and stakeholder trust are essential for maintaining operational success and innovation, yet organizations often encounter challenges, including liquidity shortages and insufficient funds for growth. Cultivating a financial strategy that aligns with a broader organizational culture can enhance both financial health and strategic adaptability (Gomera, Chinyamurindi, & Mishi, 2018).

Organizational culture, embodying ideologies, symbols, and core values, is fundamental to a firm's performance and operational effectiveness. Crider (2020) posits that culture surpasses strategy in significance, fostering an environment where motivated and well-informed employees contribute to higher performance and financial resilience. A positive organizational culture, shaped through alignment with strategic goals, drives employee commitment, honesty, and mutual respect. The four primary cultural types, adhocracy, clan, market, and hierarchy; each influence firm dynamics differently. Leaders who cultivate a culture aligned with strategic objectives enhance not only employee engagement but also the firm's capacity to adapt and thrive in competitive environments.

In a nutshell, SMM and SP are pivotal frameworks that guide organizations in achieving long-term objectives by aligning with both customer demands and market dynamics. SMM, especially in monopolistic or regulated environments like the GWCL, enables the establishment of clear value propositions, communicates effectively with stakeholders, and meets public expectations, thereby enhancing trust and customer satisfaction. Through frameworks like the 4Ps, 7Ps, and 4Cs, strategic marketing centres on identifying and fulfilling customer needs while ensuring organizational profitability. Concurrently, strategic planning provides a structured approach to defining organizational goals, distributing resources, and managing internal and external factors that impact business continuity. Together, these strategies enable organizations to achieve resilience, optimize resources, and meet stakeholder expectations effectively.

3. Research Methodology

3.1. Study Design and Data

This study employed a qualitative research approach, utilizing descriptive and thematic analysis (Creswell, 2017) to capture and interpret the lived experiences of a diverse group of staff and management within the Ghana Water Company Limited. The purposive sampling strategy was selected as it aligns well with the research aims, enabling the targeted collection of in-depth primary data from respondents (see Table 3.1) who have direct knowledge and insights relevant to the study's focus. The research approach facilitated a comprehensive understanding of the perspectives and experiences within the organization, ensuring that the data collected was both rich and relevant to the research objectives.

Table 3.1: Description of Participants

Position/Grade	Gender	Educational Level	Experience	Designation
RCM	Male	Master's Degree	29 years	Engineering/Management
RPM	Male	Master's Degree	27 years	Engineering/Economics
RCCM	Male	Master's Degree	21 years	Economics/Marketing
RFM	Male	Master's Degree	31 years	Accounting/Finance
DM-SEKONDI	Male	Bachelor's Degree	28 years	Engineering
DM-TAKORADI	Male	Master's Degree	21 years	Engineering/Management

Author's construct (2024)

3.2 Purpose and Research Objectives

The purpose of this study is to examine sustainable water resources management in Sekondi-Takoradi, a rapidly growing urban centre in Ghana's Western Region facing rising water demand due to population growth and industrialization. The research focuses on the strategies implemented by the Ghana Water Company Limited

to maintain a reliable and sustainable water supply for the twin city. By engaging with both staff and management, the study aims to gain valuable insights into current practices, identify key challenges, and highlight potential areas for improvement in water resource management across the region.

The objectives of the study sought to first, analyze the existing strategies and operational approaches utilized by Ghana Water Company Limited in managing water resources for Sekondi-Takoradi, with attention to efficiency and reliability in water distribution. Secondly, investigate the primary obstacles faced by the organization in fulfilling the water needs of the twin city, focusing on environmental, operational, and infrastructural constraints. Thirdly, examine the effectiveness of sustainability practices currently in place, including initiatives in conservation, resource optimization, and pollution control, and their impact on long-term water resource stability.

The study also sought to propose evidence-based recommendations aimed at strengthening sustainable water resources management, ensuring both a reliable and eco-friendly water supply for Sekondi-Takoradi and offering suggestions for refining policies and planning frameworks that guide water resource management, to support resilience and environmental stewardship over the long term in Sekondi-Takoradi.

3.3 Data Analysis

Descriptive data analysis expressed in themes forms the basis for presenting the answers of respondents to the three main research questions. These questions were: 1) What are the challenges confronting GWCL in Sekondi-Takoradi? 2) What are the internal and external environmental factors that affect the performance of GWCL? 3) How sustainable is potable water production and distribution in Sekondi-Takoradi? 4). Existing measures and solutions, and 5). Long-term sustainable measures. The responses to the research questions are shown in Table 3.3. The respondents' views were presented under five broad areas accounting for a total of thirty-three (33) themes.

Table 3.3 Summary of Results

Theme	Question 1	Question 2	Question 3	Question 4	Question 5
One	Operational	Political	Environmental	PIP	Strategic Plan
Two	Financial	Economic	Operational	Dry Season	Water Bodies
Three	Resource	Social	Financial	Institutional	Treatment Plant
Four	Customer	Technological	Customer	Education	Distribution
Five	Institutional	Legal	Social		Human Resource
Six	External	Supervision			New KPIs
Seven	Political	Motivation			Organizational Culture
Eight	NRW	Training			
Nine		Swot Summary			

Author's construct (2024)

4. Results and Discussion

This section presents and interprets the findings on sustainable water resources management practices in Sekondi-Takoradi. The analysis is based on insights gathered from the Ghana Water Company Limited's staff and management, highlighting both strengths and challenges in current practices. Key themes include the efficiency of existing water management strategies, the impact of environmental and infrastructural constraints, and the effectiveness of sustainability measures. Additionally, this section discusses potential areas for improvement, examining how strategic adjustments could enhance water resource resilience in response to the city's growing demand and environmental pressures.

4.1. Discussion of Results

The results showed that eight themes sought to answer research question one. A total of eight themes explain the challenges confronting GWCL. These are Theme one - operational, theme two - financial, theme three - resource, theme four - customer management, theme five - institutional, theme six - external, theme seven - political administration and theme eight - NRW. The results revealed that operational challenges refer to issues that adversely affect the abstraction of raw water, production and distribution of potable water to customers. The results showed that the River Pra which served as the raw water source for water production at Daboase is polluted by alluvial mining. Alluvial mining worsens the turbidity and colour of the raw water. The alluvial mining also creates silt at the abstraction point which causes frequent breakdown of pumps and equipment. Furthermore, the Daboase intake is sometimes affected by seawater intrusion. On the other hand, River Anankwari which serves as the source for the Inchaban treatment plant is obstructed by illegal mining and quarry

activities. A study by Aboka, Cobbina and Doke (2018) confirmed that mining activities have polluted many rivers in Ghana. It is estimated that more than 60% of raw water bodies in Ghana are polluted due to degradation and contamination. Pra, Ankobra and Birim are said to contain toxic chemicals like mercury and cyanide used in processing gold from illegal mining (galamsey). The challenge of pollution of the raw water source is also highlighted by George, Revathi, Deepa, Sheregar, Ashwini and Das (2016). The results of their study showed that many industrial water bodies in Bangalore are polluted with organic and inorganic contaminants. Old pipelines in the distribution network frequently experience bursts and leakages. The operational challenge contributes to the low production of potable water and therefore some customers within Sekondi-Takoradi do not have access to potable water. The findings of this study about NRW supported the view of Sharma, Choudhary and Kumar (2018) that high NRW is one of the major challenges affecting water utilities in developing countries. The results of this study also confirmed the study by Abu-Mahfouz, Haman, Page, Djouani and Kurien (2016) which showed that high NRW threatens water resource management and the financial viability of potable water provision.

The results showed that nine themes were used to answer research question two. The nine themes were Theme One - political, Theme Two - economic, Theme Three - social, Theme Four - technological, Theme Five - legal, Theme Six - supervision, Theme Seven - motivation, theme Eight - training and theme Nine - SWOT Summary. The results showed that GWCL has no control over the external environmental factors but has control over the internal factors. The study revealed that GWCL is a state-owned company and therefore the Board of Directors and the Managing Director are appointed by the president of the Republic of Ghana. This has implications for the company because the Board of Directors as well as the Managing Director influence the performance of GWCL. Depending on their competence and professionalism, the performance can be favourable or unfavourable. The results buttressed the study by Thungngern, Wijitkosum, Sriburi & Sukhsri (2015) which revealed that problems concerning social, economic, and environmental are important and applicable in all types of water resources management. The results about the internal factors such as supervision, motivation and training indicated that they are critical factors which influence the performance of GWCL.

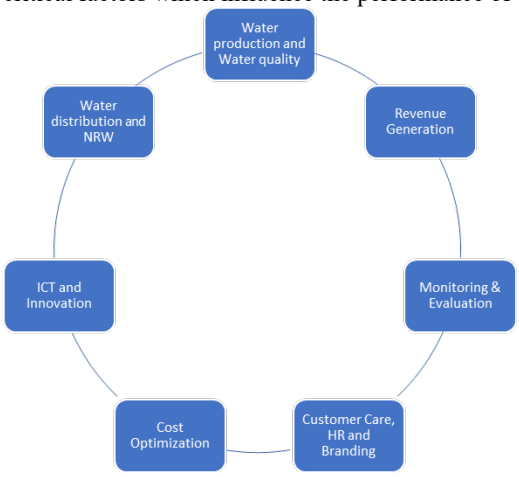

Fig. 2. Seven Priority Areas of the PIP (GWCL, 2015)

The results showed that sixteen themes were used to answer research question three. The sixteen themes were Theme One - environmental, Theme Two - operational, Theme Three - financial, Theme Four - customer management, Theme Five - social, Theme Six - PIP, Theme Seven - dry season crisis management plan, theme eight - institutional strengthening, theme nine - customer education, theme ten - strategic planning, theme eleven - protection of water bodies, theme twelve - new treatment plant, theme thirteen - expansion of distribution network, theme fourteen - human resource, theme fifteen - introduction of new KPIs and theme sixteen - positive organizational culture. The results of this study revealed that one of the fundamental factors affecting water resource management related to the rivers or water bodies is the environment. The results of this study confirmed the results of a similar study conducted by Surendran, Sushanth, Mamman & Joseph (2017). The results revealed that for effective water resource management, there is the need to assess the total water requirements, evaluate the water sources such as rivers, lakes and the rainfall pattern as well as ascertain the water usage trend by various consumers (Surendran, Sushanth, Mamman & Joseph, 2017). Although, issues such as rainfall patterns and other weather conditions affect the water bodies, the results of this study revealed that in the case of Sekondi-Takoradi the water bodies are polluted by human activities such as illegal mining and quarry activities.

Therefore, to ensure sustainable water resource management, there is a need to protect and preserve the water bodies which serve as raw water sources for the production of potable water. The results of this study indicated that the water demand requirement for Sekondi-Takoradi is estimated at 12 million gallons per day but the average supply is estimated at 6.5 million gallons per day.

From the results of the study, another critical area that should be considered to ensure sustainability is operational. Operational issues comprise management of the raw water abstraction point, functioning of the equipment at the treatment plant, distribution of potable water and customer management. To effectively undertake these, requires a sound financial base, competent human resources and logistics. The results of this study confirmed the study conducted in the United States of America (USA) by Koo, Piratla and Matthews (2015) which revealed that the sustainability of water supply is affected by four major challenges; decreasing freshwater sources, increasing pipe bursts, NRW and increasing water demand. The results of this study showed that all these four challenges were considered. However, the results of this study revealed that there were other factors which affect water resource management that were not considered by the study of Koo, Piratla and Matthews (2015). The results indicated that due to the increasing water demand, there is a need to build a new treatment plant with a bigger capacity to ensure sustainability. NRW is a challenge that should be addressed holistically to facilitate sustainability. The results of this study confirmed the study by Poff, Brown, Granthan, Matthews, Palmer, Spence, Wilby, Haasnoot, Mendoza, Dominique and Baeza (2016) that factors affecting sustainable water management include rehabilitation of ageing infrastructure, construction of new dams and expansion of existing water resources.

The results agreed with existing literature that to reduce NRW, both real or physical losses and commercial or apparent losses should be tackled (Tabesh, Roozbahani, Roghani, Faghihi & Heydazadeh, 2018). The challenge of increasing demand for potable water was also considered in this study.

The results indicated that demand for potable water in the Sekondi-Takoradi is increasing due to the influx of many people attracted by the discovery of oil in commercial quantities in the area. Further, the discovery of oil has also generated businesses that require potable water for their operations.

To ensure the sustainability of water resource management, GWCL should adopt a positive organizational culture. The results indicated that the present organizational culture is rooted in all civil service practices where the majority of staff are not high-performance oriented. Management should make conscious efforts to change this trend. Staff should be conscientized through training, coaching, mentoring and implementation of a system that rewards hard work, and innovation and sanctions poor-performing staff.

The study further reveals that customer management is a challenge that should be resolved to ensure the sustainability of water resource management. The results revealed that customers also have responsibilities to perform which would contribute to sustainable water resource management. Therefore, customers should be educated to pay their water bills regularly, use water efficiently, report pipe bursts and leakages, desist from illegal connections, meter bypass and meter theft. Customers should also be encouraged to lodge their complaints.

4.2. Scholarly Contributions

This type of study offers several important contributions. In the first place, the study contributes to theory and practice in the area of sustainable water resource management. In terms of theory, the results showed that sustainability cannot only be viewed from three dimensions or perspectives as prescribed by many scholars. Many scholars stated that sustainability has three main dimensions which as environmental, economic and social (Huang, Wu & Yan, 2015; Gupta, Dangayach & Singh, 2015; Rasmussen, Bierbaum, Oldekop & Agrawal, 2017). The results of this study revealed that in addition to the three main dimensions of sustainability, other dimensions such as institutional and cultural are critical to sustainability.

Concerning practice, the study offers useful recommendations. The results indicated that it is imperative to consider strategic planning to achieve sustainable water resource management. Therefore, the management of GWCL should prepare a strategic plan. There is ample evidence from existing literature that a strategic plan improves the performance of companies and promotes sustainability (Arend, Zhao, Song & Subin, 2017; Elbanna, Andrews & Pollanen, 2018; Sociawani, Ramli, Mustafi & Yusoff, 2015). Arend et al. (2017) asserted that strategic planning contributes to a firm's profitability and growth. Also, Ansoff, Kipley, Lewis, Helm-Stevens and Ansoff (2019) supported the assertion that strategic planning plays a significant role in the performance of companies regardless of the sectors in which they operate.

The results revealed that short-term measures are necessary but they are not sufficient conditions for sustainability of water resource management. Therefore, to achieve sustainable water resource management, GWCL should undertake long-term measures. GWCL should actively assist in the protection of water bodies

which are used as raw water sources for potable water production. Management of GWCL should make a strong and convincing presentation to the three arms of government in Ghana which are the executive, the legislature and the judiciary. GWCL should build a new water treatment plant with a bigger capacity and modern facilities in Sekondi-Takoradi to cover the gap between demand and supply of potable water. Pipelines should be extended to areas within the Metropolis without water connection and old pipelines should be replaced. GWCL should also explore effective ways of reducing costs and increasing revenues. Consequently, GWCL should ensure that major cost components such as chemicals, electricity, fuel and lubricants, overheads and contracts are controlled. Management should renegotiate for tax relief in the cost of chemicals and electricity. Management should also ensure that there is value for money in the award of contracts and procurement of goods. For measures to increase revenue, prepaid meters should be introduced. Management should push convincingly for economic tariffs for water. Management should also run the company with modern strategic management tools such as the use of a balanced scorecard for performance evaluation. Management should reward good performance and innovations that bring improvement and sanction poor performance without fear or favour. All staff of GWCL should be encouraged and prepared to change the present organizational culture and adopt a more positive one that is business-oriented. This will provide the impetus for sustainable water resource management.

Secondly, the detailed description of issues in this study provides a deeper understanding of the challenges confronting GWCL and how these challenges could be addressed. The internal and external environmental factors affecting the performance of GWCL were vividly described. The issues affecting the sustainability of water resource management were also examined. The results indicated that both the internal and external environmental factors that affect the performance of GWCL are crucial and should be effectively tackled.

Thirdly, this study adds to the literature on sustainable water resource management. The available literature on sustainable water resource management covers developed countries and other parts of the world. However, there is little literature on sustainable water resource management in Ghana. Therefore, this study contributes to filling the gap in existing studies on water resource management in Ghana.

4.3. Implications for Theory and Research

This study has the potential to be useful to sustainable water resource management theory in the area of water utilities. The study adds to the literature by providing explanations on challenges confronting water utilities in developing countries, internal and external environmental factors affecting the performance of water utilities and the sustainability of water resource management. The findings of this study showed that although short-term measures such as maintenance of equipment, preservation of fresh water sources and improving the financial viability of water utilities are some of the necessary conditions for sustainability, they are not sufficient. There should be long-term measures such as the preparation of the strategic plan, enactment and implementation of policies or laws to protect freshwater bodies, expansion of water infrastructure, capacity building of staff and effective customer management should be pursued to ensure sustainability.

This study explored sustainable water resource management from the perspective of senior managers of GWCL in Sekondi-Takoradi. The results are useful in serving as a foundation for further research within other areas of sustainable water resource management. For instance, a study could be conducted on sustainable water resource management from the perspective of other stakeholders within the field such as government and policymakers. Furthermore, the study has provided the impetus for additional questions to be addressed in future studies.

This study concentrated on the sustainability of water resource management, and the lived experiences of senior managers of GWCL in Sekondi-Takoradi. This study was limited to a phenomenological approach and would benefit from future empirical study. It may be beneficial to conduct further investigations into other aspects of sustainability.

4.4. Implications for Practice

The results of this study offer several considerations for practice. The results of this study are beneficial to GWCL, the government of Ghana and other water utilities. To the management of GWCL, there are certain measures should be carried out to improve the sustainability of water delivery in Sekondi-Takoradi.

Firstly, GWCL should prepare and implement a strategic plan. In preparing the strategic plan, management should take into consideration the three dimensions of strategic planning which are formality, participation and comprehensiveness (Elbanna, Andrews & Pollanen, 2016; Srinivasan & Swink, 2015; Osman, Beltagi & Hardaker, 2015).

Secondly, GWCL should expand the water infrastructure such as the construction of a new water treatment

plant, booster station and mains extension. The old pipelines in the distribution network should also be changed to reduce the frequency of bursts and leakages. Thirdly, GWCL should collaborate with all stakeholders to launch a fight against illegal mining popularly known as galamsey in Ghana. The protection of the water bodies is of utmost importance to the sustainability of water resource management.

Fourthly, GWCL should modernize its operations by applying technology in all aspects of the work and reducing the manual ways of doing things to improve efficiency. Fifthly, GWCL should adopt effective measures to reduce NRW. In this regard, the NRW should be tackled holistically from the viewpoint of both real and apparent losses. Careful consideration should be given to the diagnostic approach to the solution of NRW prescribed by Farley (2003) and articulated by Tsitsifli, Kanakoudis, Kouziakis, Demetriou and Lappos (2017).

Finally, GWCL endeavours to change the present organizational culture which is rooted in civil service practice. Management should make efforts to change the attitude and mentality of staff to a more positive, modern business-like and efficient organization through orientation, sensitization and training.

The government of Ghana has a crucial role to play in sustainable water resource management. It is the responsibility of the government to provide essential social amenities like potable water to the citizenry. Moreover, the government is the sole shareholder of GWCL which is charged with the responsibility of urban water supply. It is therefore incumbent on the government to ensure that water bodies which serve as raw water sources for potable water production are protected from pollution. The government should institute effective measures to stop illegal mining activities in and around water bodies. Secondly, the government should continue to support GWCL in the provision of water infrastructure.

The results of this study also provide practical lessons for other water utilities, especially others with similar conditions like Ghana. The strategies adopted by GWCL such as the three types of maintenance program namely routine maintenance, preventive maintenance and corrective maintenance as well as the PIP, institutional strengthening, dry season crisis management plan and customer education are worth emulating.

5. Conclusion

This study explored sustainable water resource management. This phenomenological study was conducted with six senior managers of Ghana Water Company Limited in Sekondi-Takoradi. The findings and the results of the study suggest that sustainable water resource management is worthy of consideration. The results showed that River Pra and River Anankwari which serve as raw water sources for the production of potable water supply to Sekondi-Takoradi are polluted by illegal mining and quarry activities. Illegal mining has led to an increase in turbidity and colour of raw water as well as siltation at the intake. Additionally, some equipment at the headworks is old and outmoded which requires regular maintenance and replacement. Consequently, this has reduced water production levels and increased operational costs. The results also showed that transmission and distribution pipelines are old which causes frequent bursts and leakages contributing to high NRW. These challenges threaten the sustainability of water management.

6. Recommendations

Based on the findings, it is recommended that to ensure sustainable water resource management, the challenges discussed in the paper should be effectively addressed. In a nutshell, freshwater bodies should be protected from pollution, water treatment infrastructure should be expanded, distribution networks should be expanded and customer service should be enhanced.

Finally, employees engaged in the provision of potable water should adopt a positive organizational culture in providing efficient and quality customer service.

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