

2022

Developing Sustainable Water Supply Management Strategies in Lagos, Nigeria.

ADEBAYO OYEBANJI
Walden University

Follow this and additional works at: <https://scholarworks.waldenu.edu/dissertations>

This Dissertation is brought to you for free and open access by the Walden Dissertations and Doctoral Studies Collection at ScholarWorks. It has been accepted for inclusion in Walden Dissertations and Doctoral Studies by an authorized administrator of ScholarWorks. For more information, please contact ScholarWorks@waldenu.edu.

Walden University

College of Management and Technology

This is to certify that the doctoral dissertation by

Adebayo Oyebanji

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee

Dr. Maja Zelihic, Committee Chairperson, Management Faculty

Dr. Holly Rick, Committee Member, Management Faculty

Dr. Teresa Lao, University Reviewer, Management Faculty

Chief Academic Officer and Provost

Sue Subocz, Ph.D.

Walden University

2022

Abstract

Developing Sustainable Water Supply Management Strategies in Lagos, Nigeria

by

Adebayo Oyebanji

MS, University of London, 1992

DIC, Imperial College of Science, Technology, and Medicine, 1992

BS, University of Ife, 1985

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Management

Walden University

February 2022

Abstract

The problem of inadequate potable water supply to all Lagos residents persists despite the efforts by Lagos Water Corporation (LWC), whose mandate is to provide adequate potable water to Lagos residents. This problem is important because of the high costs of the adverse effects of inadequate potable water supply to the populace. Some researchers have identified a declining state of Lagos water supply and others attribute the problem to lack of sustainable management and funding strategies by LWC. Using the systems theory lens, the purpose of this qualitative case study was to explore better sustainable management and funding strategies used by LWC, which would allow to provide adequate potable water to all Lagos residents. Data were collected in semistructured interviews of 20 senior staff of LWC, a focus group discussion of six independent water supply management experts in Lagos, and document review of LWC performance for data triangulation. The resulting transcripts were organized into codes and categories to generate the themes. Twenty-eight themes emerged, some of which include improving operational efficiency of existing waterworks, inviting private enterprises to participate in water supply, and using multidisciplinary professionals on water projects. This study could contribute to positive social change, as adequate water supply to residents could improve their socioeconomic statuses, general wellbeing, and reduce unsafe-water-related diseases, and mortalities.

Developing Sustainable Water Supply Management Strategies in Lagos, Nigeria

by

Adebayo Oyebanji

MS, University of London, 1992

DIC, Imperial College of Science, Technology, and Medicine, 1992

BS, University of Ife, 1985

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Management

Walden University

February 2022

Dedication

To God, from whom all blessings flow. I also dedicate my doctoral program to all women and children all over the world who bear the brunt of scouting for alternative water sources for the household when the public water supply is inadequate, intermittent, or completely absent. You labor in a significant way to make life better for the society and this has inspired me to be a better leader and human being who wants to create a future where the burden of searching for alternative water sources is completely removed from our mothers and children.

Acknowledgments

I thank members Walden faculty for their support and encouragement during my doctoral journey. I extend my sincere appreciation to Dr. Maja Zelihic; my Chair for your exceptional coaching and mentoring that galvanized me through the stages of my dissertation. Your efforts extended beyond my final research, it also enhanced my development as a scholar-practitioner. I extend my gratitude to Dr. Daniel Zimmerman, and Dr. Holly Rick who assumed the duties as my final SCM, providing support and feedback to improve my final dissertation. I thank Dr. Teresa Lao, for being my University Research Reviewer, but more significantly, for your timely feedback and comments that have further helped to improve the quality of my dissertation. I appreciate Dr. Samuel Aikhuomogbe, my brother, whose support was priceless for completing this phase of my search for knowledge. I thank my partner organization and the participants of my study and those who facilitated my recruiting drive. I also want to appreciate my extended Walden Ph.D. partners, who were a source of encouragement in my low moments. To my immediate family and friends, thank you for your support, understanding and love over the past years when my availability was intermittent. I use this opportunity to thank my wonderful wife, Olusola and my children, Oluwatosin, Oreoluwa, and Anuoluwa, whose love was the tonic; I needed to forge ahead to realize my goal of contributing to making the world a better place.

Table of Contents

List of Tables	xiii
List of Figures	xiv
Chapter 1: Introduction to the Study	1
Background of the Study	2
Problem Statement	4
Purpose of the Study	7
Research Questions	8
Conceptual Framework	8
Nature of the Study	12
Definitions	14
Assumptions	16
Scope and Delimitations	17
Scope	17
Delimitations	17
Limitations	17
Significance of the Study	19

Significance to Theory and Practice	19
Significance to Social Change	19
Summary and Transition.....	21
Chapter 2: Literature Review	23
Literature Search Strategy.....	24
Conceptual Framework	25
Systems Theory.....	27
Internal Interactions in a System.....	29
External Interactions with Stakeholders and the Environment.....	33
Feedback Mechanisms and Responses	34
Water Supply and Demand Management	38
Urban Water Supply Management.....	39
Overview of Population Growth, Rapid Urbanization, and Water Supply.....	40
The Study Area.	42
Lagos State: Population Growth, Water Supply and Demand Nexus	44
Lagos Water Supply.....	45
Lagos State Population	50

Evolution of Water Supply in Lagos: 1910 to Date.....	52
Bridging Demand-Supply Gap Through Water Supply Master Plan	53
Lagos Water Demand and Supply-Current Realities	58
Climate Change and Water Resources.....	60
Water Infrastructures and Operation of Water Facilities	63
Water Infrastructures	63
Operation of Water Facilities	64
Operational Efficiencies of Lagos Waterworks	66
Institutional and Organizational Capacity	66
Water Governance	67
Forms of Water Governance.....	71
The Role of Governance in Water Supply	72
Water Governance Gaps	73
Water Governance around the World and its Impact on Performance	73
Water Governance in Selected Developing Countries.....	74
Water Governance in Nigeria	76
Nigerian National Water Policy	79

Lagos State Water Institutional Framework	80
Water Supply Management Options or Strategies	82
Public Ownership and Operation	83
Public Ownership and Private Operation	84
Private Ownership and Operation	85
Choice of Water Supply Management Option	87
Health Implications of Inadequate Safe Water Supply	90
Funding for Public Water Supply Utilities	92
The Gap in the Literature	100
Summary and Conclusion	102
Chapter 3: Research Method.....	105
Research Design and Rationale	106
Research Design.....	107
Research Rationale.....	109
Role of the Researcher	110
Methodology	113
Research Participant Selection Logic	113

Instrumentation	117
Procedures for Recruitment, Participation, and Data Collection	125
Document Review	127
Data Analysis Plan	128
Issues of Trustworthiness	130
Credibility	131
Transferability	131
Dependability	132
Confirmability	132
Ethical Procedures	133
Confidentiality	135
Summary and Transition	136
Chapter 4: Results	138
Field Test	138
Research Setting	139
Demographics	141
Data Collection	144

Data Collection Through Document Review	147
Data Analysis	149
Evidence of Trustworthiness.....	152
Credibility	152
Transferability	153
Dependability	154
Confirmability	154
Study Results	155
Results from Semistructured Interviews	162
Theme 1: Improving Operational Efficiency of Existing Waterworks.....	162
Theme 2: Inviting Private Enterprises to Participate in Water Supply	164
Theme 3: Establishing a Succession Planning System in Water Supply Management.....	166
Theme 4: Organizing High Quality Recruitment Process & Educational Background	167
Theme 5: Improving Staff Motivation & Training Among all Staff	168
Theme 6: Organize Regular Customer Orientation and Excellent Customer Service.....	170

Theme 7: Organize Massive Water Conservation Campaign.....	171
Theme 8: Adhere to Water Corporation Ethical Standard and Compliance.....	173
Theme 9: Collaborating with other Governmental Agencies and Non-State Providers: Shared Data	174
Theme 10: Organizing Water Corporation into Area & Zonal Management System.....	176
Theme 11: Ensuring Quality, Quantity & Availability of Water Supply	177
Theme 12: Resolving the Dichotomy about Water as Environment Issues or Health Issues.....	179
Theme 13: Improving collaboration & integration of efforts among LWC staff & departments.....	180
Theme 14: Identifying and mapping all the currently unknown pipe networks into Geographical Information System (GIS) to curtail non-revenue water.....	182
Theme 15: Establish a Customer-Friendly Billing and Payment Options	183
Theme 16: Establishing a Seller/Buyer Relationship with the Customers	185
Theme 17: Provision of Reliable and Safe Water to Customers	186
Theme 18: Develop Implementable Business Plan in which LWC Staff Take Ownership	187

Theme 19: Seek Non-Governmental Organization Aids and Grants.....	188
Theme 20: Digitalization of Billing System & Collection Through e- Payment Platforms	190
Theme 21: Improvement in Products Development in the Water Sector	192
Theme 22: Use of Appropriate and Functional Prepaid Meter	194
Results from Focus Group	196
Theme 23: Using Multidisciplinary Professionals in Water Supply Management.....	201
Theme 24: Unbundling Water Corporation Into Smaller Business Units.	201
Theme 25: Involving Community/Customers in Water Supply Management.....	203
Theme 26: Remove Government Interferences and Run as Commercial Entity According to the act that established LWC.....	205
Theme 27: Partner with private consultants on Revenue Collection	207
Theme 28: Update & Grow Customer Database	208
Document Review	209
Data Triangulation	209
Summary	210

Chapter 5: Discussion, Conclusions, and Recommendations	213
Semistructured Interviews	213
Focus Group Discussion	214
Interpretation of Findings	215
Theme 1: Improving Operational Efficiency of Existing Waterworks.....	215
Theme 2: Inviting Private Enterprises to Participate in Water Supply	217
Theme 3: Establishing a Succession Planning System in Water Supply Management.....	218
Theme 4: Organizing High-Quality Recruitment Process & Educational Background	219
Theme 5: Improving Staff Motivation & Training among all Staff	221
Theme 6: Organize Regular Customer Orientation and Excellent Customer Service.....	222
Theme 7: Organize Massive Water Conservation Campaign	224
Theme 8: Adhere to Water Corporation Ethical Standard and Compliance.....	225
Theme 9: Collaborating with other Governmental Agencies and Other Non-State/Shared Data.....	226

Theme 10: Organizing Water Corporation into Area & Zonal Management System.....	227
Theme 11: Ensuring Quality, Quantity & Availability of Water Supply	227
Theme 12: Resolving the Dichotomy about Water as Environment Issues or Health Issues	228
Theme 13: Improving Collaboration & Integration of Efforts among LWC Staff & Departments	229
Theme 14: Identifying and mapping all the Currently Unknown Pipe Networks into Geographical Information System (GIS) to Curtail Non-Revenue Water.....	230
Theme 15: Establish a Customer-Friendly Billing and Payment Options	231
Theme 16: Establishing a Seller/Buyer Relationship with the Customers	233
Theme 17: Provision of Reliable and Safe Water to Customers	234
Theme 18: Develop Implementable Business Plan in Which LWC Staff Take Ownership	235
Theme 19: Seek Non-Governmental Organization Aids and Grants.....	236
Theme 20: Digitalization of Billing System & Collection Through e- Payment Platforms	237
Theme 21: Improvement in Products Development in the Water Sector	238

Theme 22: Use of Appropriate and Functional Prepaid Meter.....	238
Themes from Focus Group Discussion.....	239
Theme 23: Using multidisciplinary professionals on Water Projects.....	240
Theme 24: Unbundling Water Corporation into Smaller Business Units.....	240
Theme 25: Involvement of Community in Water Supply Management.....	241
Theme 26: Remove Government Interferences and Run as Commercial Entity According to the Act that Established LWC.....	242
Theme 27: Partner with Private Consultants on Revenue Collection.....	243
Theme 28: Update & Grow Customer Database	244
Limitations of the Study.....	244
Recommendations.....	245
Recommendation for Further Research	245
Recommendations for Practice	246
Implications.....	250
Methodological Implications	250
Implications for Practice	251
Social Change Implications	252

Conclusions.....	254
References.....	255
Appendix A: Final Interview Protocol.....	299
Appendix B: Final Focus Group Discussion Protocol.....	301

List of Tables

Table 1. Demographics for Semistructured Interviewees.....	142
Table 2. Demographics for Focus Group.....	144
Table 3. Summary of the Data Collection Elements.....	148
Table 4. Data Analysis: Codes and Emerging Themes from Semistructured Interviews	
156	
Table 5. Data Analysis: Codes and Emerging Themes from Focus Group Discussion	
..198	

List of Figures

Figure 1. The Conceptual Framework & Alignment of the Case/System	12
Figure 2. Lagos State Local Government Areas	44
Figure 3. Lagos State Natural Drainage System	47
Figure 4. Lagos State Population & Water Demand/Supply Gaps	54

Chapter 1: Introduction to the Study

Water sustains life, societies, and the environment. The current evidence of severe water scarcity in many parts of the world (Mekonnen & Hoekstra, 2016) requires a change of long-held beliefs about water from an infinite to a finite resource (Santos et al., 2019). The global freshwater supply may meet the current global water demand, and because of the disparity of freshwater distribution in many areas across the globe, some regions might not meet their water requirements for the domestic, economic, and environmental needs (Cosgrove & Loucks, 2015). Inadequate potable (safe drinking) water is a significant challenge confronting society, at varying degrees, and is more pronounced in developing countries than the developed countries (Rathnayaka et al., 2016). The issue of a sustainable supply of adequate water is vital because a lack of it constrains human well-being, productivity, and economic development (Cosgrove & Loucks, 2015). Guarino (2017) suggested that water scarcity could lead to an economic downturn, starvation, social unrest, and political instability in any country. Water crisis is one of the top global risks (World Economic Forum, 2016).

In this qualitative case study, I sought to identify the better sustainable management and funding strategies by Lagos Water Corporation (LWC), which could provide adequate potable water supply to all Lagos residents. This study has potential implications for social change because improved water supply for the populace improves their socioeconomic statuses and general well-being. In addition, improved water supply reduces poverty levels, pressures on women and children, incidents of water-related diseases, and unsafe-water-related mortalities.

I include in Chapter 1 the background of the study, which itemizes the primary issues that support the need for the study, problem statement, describing both the general and specific water supply problems, the purpose of the study, nature of the study, research questions guiding the study, and the conceptual framework. Chapter 1 also contains the definitions of key terms and concepts, the study assumptions, scope and delimitations of the study, study limitations, the significance of the study to theory, practice, and social change, and summary and transition

Background of the Study

I searched selected articles relating to the research using keywords *water supply management, water supply, water demand, water governance, climate change, sustainable water supply management strategies, water quality, water resources, water scarcity, cost-recovery by water utilities, water pricing, water supply and health, sustainable funding strategies, and water supply in developing countries*. Abubakar (2016) explored the quality dimensions of water supply in Abuja, Nigeria, and found that water scarcity, low infrastructure maintenance, inefficient metering and billing systems, low pressure, and occasional dirty water weakened the primary function of the water delivery system in Abuja. Adams et al. (2018) synthesized relevant literature on historical and evolving institutional arrangements for urban water supply in Sub-Saharan Africa to determine successes, shortcomings, and opportunities for enhancing future access to water. Ameyaw and Chan (2015) identified the risk factors associated with public-private partnerships (PPP) for water infrastructure projects, which could assist in PPP project implementations in Ghana. Ayeni (2017) discussed the increasing population,

urbanization, and climatic factors in Lagos State and their nexus and implications on water demand and supply.

Dighade et al. (2014) suggested that water losses affect water utilities and their consumers worldwide, mainly in developing countries, resulting in high operational costs and reduction in revenues and financial viability of public water utilities. Egbinola (2017) suggested a decline in capital allocation for water supply and access to public water supply and increased people's reliance on groundwater sources for domestic use in urban and rural areas of Nigeria. Ohwo (2016) discussed the challenges of public water provision in Nigerian cities, focusing on the demand-supply gap, infrastructural deficit, and the way forward. Ohwo and Abotutu (2014) suggested that households' access to potable water supply in Nigerian cities is inadequate and stressed the need to position water utilities for efficiency and effectiveness. Savenije et al. (2014) appraised water as society's most valuable resource and one of the most constrained.

Balogun et al. (2017) suggested that the demand and supply gap, among others, and the rate of urbanization, can lead to severe water shortage problems in Lagos. They suggested areas for further study, including exploring sustainable management and funding and cost-recovery strategies for LWC. The current study addressed some of these gaps, and the findings could solve the problem of inadequate potable water supply by LWC to all Lagos residents. The strategies that emerged from the findings of my study could help water utility stakeholders improve water supply to residents, thereby promoting positive social change.

Problem Statement

Water is crucial for the sustenance of life, societies, and the environment, and the availability and sustainability of potable water is a challenge. Despite the importance of water, the problem of inadequate access to potable water is a worldwide phenomenon. Globally, about 2.1 billion people live without access to potable water at home (World Health Organization & United Nations International Children's Emergency Fund, 2017b), and about 4 billion people experience at least 1 month of severe water scarcity in a year (Mekonnen & Hoekstra, 2016). Another 159 million people collect their drinking water from surface water, such as ponds and streams (World Health Organization & United Nations International Children's Emergency Fund, 2017b), and about a half of people drinking water from unprotected sources live in Sub-Saharan Africa (UNESCO World Water Assessment Programme, 2019). The estimated cost of insufficient water supply and sanitation, in terms of poor health, pollution, and other adverse effects, to emerging markets and developing economies (EMDEs) is US \$260 billion per year (Alaerts, 2019).

In Nigeria, with an estimated population of 201 million people (United Nations, 2019), the problem of inadequate potable water supply persists, despite interventions from governments and private sectors (Abubakar, 2016; Ayeni, 2017; Balogun et al., 2017; Ohwo & Abotutu, 2014). About 69 million Nigerians do not have access to water supply (United Nations International Children's Emergency Fund, 2018). Over 70% of rural communities in Nigeria rely on water sources capable of causing water-borne diseases (Ishaku et al., 2011; Ohwo, 2016). More than 70,000 children below the age of 5

years die annually in Nigeria due to unsafe-water-related illnesses (United Nations International Children's Emergency Fund, 2018).

The general management problem is the inadequate potable water for residents of Lagos. The Lagos Water Supply Master Plan (Lagos Water Corporation, 2010) puts the daily water demand for Lagos at 540 million gallons per day (mgd) and the production capacity of LWC at 210 mgd, leaving a gap of 330 mgd. With the current Lagos population of 21 million (Environmental Rights Action, 2016; Okonkwo, 2018), the United Nations estimates that only 10% of the population has access to potable water supplied by the LWC (Heller, 2016). The problem of inadequate water supply is due to LWC's insufficient production capacity and operational inefficiency, which causes water losses within the distribution pipe network (Balogun et al., 2017; Kandissounon et al., 2018; Omole et al., 2016).

The specific management problem is inadequate potable water to all Lagos residents due to inadequate sustainable management and funding strategies by LWC, whose mandate is to provide adequate potable water to Lagos residents (Balogun et al., 2017; Omole et al., 2016). There is a substantial body of evidence that the majority of the inadequate water problems are due to rapid urbanization, population growth, increases in per capita water consumption in some areas, poor maintenance, inefficient cost-recovery, climate change, inadequate funding, and water governance failure (Abubakar, 2016; Ayeni, 2017; Balogun et al., 2017; Dighade et al., 2014). However, further research is needed in other areas, such as exploring sustainable management and funding and cost-recovery strategies for LWC (Balogun et al., 2017).

The current funding sources for public water supply in most developing countries, including Nigeria, are subventions from governments, external aids in terms of loans and grants, and revenue generated through cost recovery; these are, usually, inadequate. Aper and Aku (2018) attributed the lack of adequate water in public water utilities to insufficient government funding. Ohwo (2016) implicated low investment in water supply infrastructure as one of the problems of LWC. Egbinola (2017) suggested a general decline in Nigerian governments' capital allocation for water supply, resulting in reduced access to public water supply and increased people's reliance on unregulated alternative water sources.

Chepyegon and Kamiya (2018) reported that low water supply investments reduced water supply coverage in Kenya. Okeola and Sule (2012) suggested that inadequate funding for water facilities affects the smooth operation and maintenance of the water supply system. Funding shortfall also hampers the ability of water utilities, such as LWC, to grow with the pace of water demand, thereby hindering water utilities' capacity to meet their core mandate of providing adequate water supply to the populace (Egbinola, 2017; Ohwo, 2016). To address this gap, I employed a qualitative exploratory case study to obtain the perspectives, and experiences of senior officials of LWC and other senior water management experts, in Lagos, who are conversant with the workings of LWC, as a way to gain a rich insight on sustainable management and funding strategies for LWC. This research could add new knowledge to help water utility stakeholders develop strategies to improve water supply to residents.

Purpose of the Study

The purpose of this qualitative case study was to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. I purposefully recruited 20 senior staff (Grade Level 13 and above) of LWC, who had more than 10 years of experience in the development of sustainable water supply management strategies, for in-depth interviews. They also possessed a minimum of a bachelor's degree in water supply management-related courses. Senior staff on Grade Level 12 and above in Nigeria civil service is a range of middle-level staff to top management staff. Grade Level 13 and above is a mixture of middle and top management who possesses the competence and experience to provide valuable perspectives on management and funding strategies that might solve the problem of inadequate water supply by LWC.

This range, Grade Level 13 and above, may also minimize possible top management biases. The primary function of top management is to provide direction and resources. The middle-level staff implement and could confirm whether they receive clear guidance and sufficient resources from the top management. Getting the perspectives of the vertical section of this range could show the relationship between LWC policies and performance.

Also, I purposefully recruited six water supply management experts (manager and above) from Lagos, who had more than 15 years of experience in the development of sustainable water supply management strategies for a focus group discussion. They also possessed a minimum of a bachelor's degree in water supply management-related

courses. The three data collection instruments for this study were in-depth interviews, a focus group discussion, and document review. The document review focused on the LWC performance reports in the last 5 years. The interviews and the focus group discussion were by Zoom meetings.

Research Questions

Two research questions were used to guide this study:

Research Question 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

Research Question 2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

Conceptual Framework

Sustainable water supply management is complex and requires appropriate management functions that foster the right internal and external interactions among various actors in an open system to satisfy the social, economic, and environmental dimensions of water supply. The conceptual framework for this study stems from the interactions of the management functions with the components of the water supply system. Water supply management comes with feedback, cascading consequences, and issues that are difficult to envisage or control by the water managers (Rietveld et al., 2016). Managing complex dynamic interactions among stakeholders and the environmental feedbacks requires an adaptive governance approach (Pahl-Wostl, 2017); this will give the organization the resilience to maintain its functions and structure during

internal and external changes (Allenby & Fink, 2005). Resilience requires leaders capable of making organizations agile and adaptive to turbulence (McKenzie & Aitken, 2012) without system breakdown.

The water supply management problem in Lagos is systemic and requires a systemic response. The management functions (planning, organizing, staffing, leading, and controlling) could help managers address common water supply management issues. These issues include (a) water supply and demand management, (b) water infrastructure and operation of water facilities, (c) institutional and organizational capacity, (d) water governance, (e) water supply management options, (f) health implications of inadequate water supply, and (g) the funding for public water utilities. The essential components of a system are the input, process, external variables, output, and reenergizing the system, while the management functions convert the input to output and respond to external prompts to maintain dynamic stability (Chikere & Nwoka, 2015). Therefore, management functions play a prominent role in ensuring that an organization, such as LWC, operating in an open system, achieves its objectives and dynamic stability.

Quality internal interactions among organizational units, and quality interactions between the organization and external stakeholders, are vital to any business's performance in an open system (Chikere & Nwoka, 2015). A lack of quality interactions can lead to integrative and collaborative gaps (Bergsten et al., 2019). Organizations consist of functions (Rossetti et al., 2011) integrated through information sharing (Dorantes et al., 2013). For any organization to achieve its objectives, there must be quality integration of efforts by the various components (Bolman & Deal, 2013). That is

why the manager's primary role is to align people and processes from varied disciplines and multiple stakeholders for the benefit of the organization (Tovmasyan, (2017)).

The management functions (planning, organizing, staffing, leading, and controlling) will create the right balance among input, processes, external variables, output, and reenergizing to achieve the organizational objective (Chikere & Nwoka, 2015). Exploring LWC activities through the lens of the systems theory will provide a holistic view, which the traditional practice of isolating and manipulating variables in controlled environments cannot achieve (Bridgen, 2017). The systems approach to solving water supply problems will minimize unforeseen adverse secondary effects to and from the broader environment (Rietveld et al., 2016). In addition, the systems theory could shed light on the interactions between a process and the environment (Mania-Singer, 2017). Therefore, a holistic approach that considers the management functions, the organization's components, and their internal and external interactions is required to solve the complex problems of water supply by the LWC.

Systems theory was proposed by von Bertalanffy (1950) as a holistic approach to complex issues; von Bertalanffy stated that interactions of components in a system, and not individual parts, determine the properties and functions of that system (Morgeson et al., 2015). The underlying principles of systems theory are (a) a holistic approach, (b) interconnections of parts, and (c) controlling of the system (von Bertalanffy, 1972). The author used "wholeness" concerning the systems theory, aiming at uniting the parts to form a whole, taking cognizance of the influence of the external environment on the

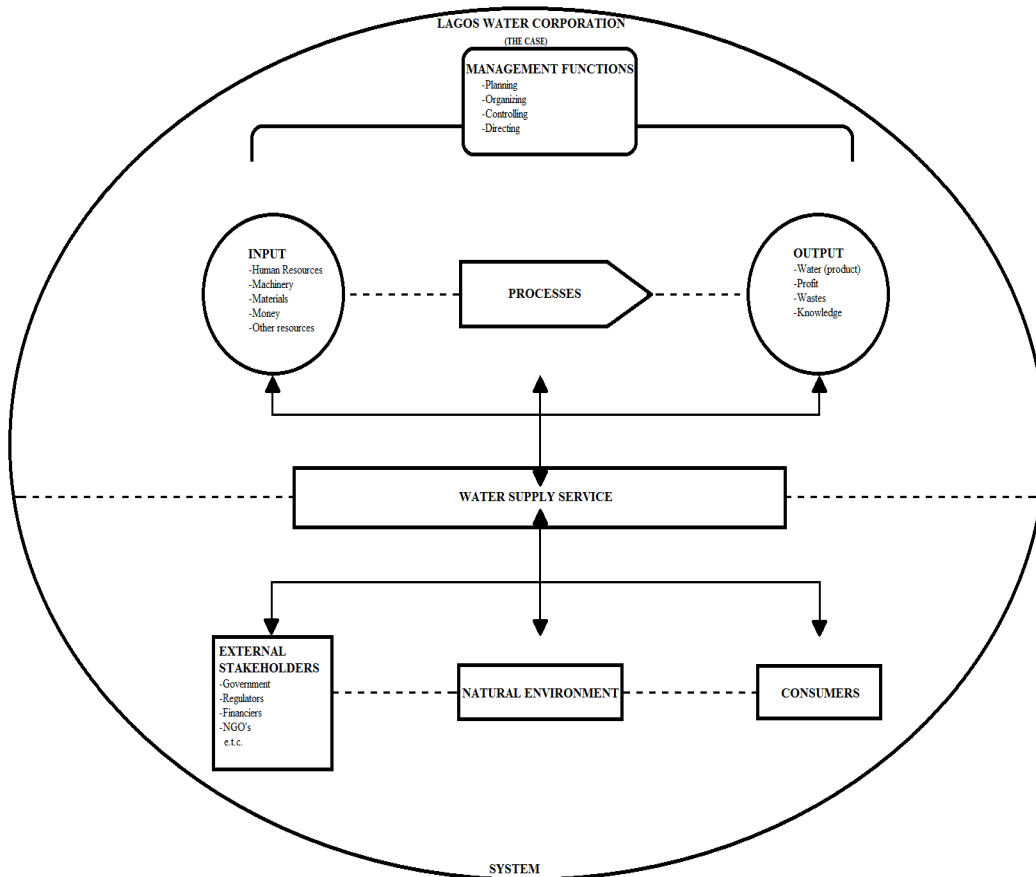
system. Systems theory could assist researchers in exploring how the interactions among entities produce a result (Sayin, 2016).

Systems theorists provide real-world explanations and solutions to everyday practical situations (Adams et al., 2014). They argue that a system reduced to parts will cease to exist, altering one part affects system performance, and the success of enhancing one part depends on interactions between this part and other parts of the same system (Patton, 2015). Sayin (2016) suggested that managers could use systems theory approaches to build the skills and competencies of workers and improve performance. Therefore, leaders require a deep understanding of the interactions among multiple systems within their organizations to sustain performance (Turner & Endres, 2017). In addition, the systems theory could enhance leaders' business data interpretation to support business (Marsan et al., 2016).

First, I chose systems theory as a lens to guide this study because a holistic systems approach is critical for any business's survival. This business includes the multidisciplinary and complex water supply business by LWC, with multiple functions and stakeholders who are in dynamic interactions. Second, the current problem of inadequate water supply by LWC is systemic and requires a systemic response, which may not lend itself to fixing each problem, one after the other, or fixing functional or process pieces. Third, the systems theory can offer practical solutions to real-world problems. I provided a detailed explanation of the conceptual framework in Chapter 2, and Figure 1 shows the conceptual framework and the alignment of the case with the system.

Figure 1

The Conceptual Framework and the Alignment of the Case with the System



Nature of the Study

There are three research methodologies: qualitative, quantitative, and mixed methods. Yin (2018) suggested the use of qualitative methods when investigating phenomena that require further exploration to increase understanding. Qualitative researchers use interviews to obtain insights on the phenomenon under study (Oltmann, 2016) and rich and detailed information to understand people's experiences (Majid et al.,

2017). The qualitative study helps understand how people interpret their experiences and the meaning they make out of them (Merriam & Tisdell, 2016). The qualitative method is appropriate for this study because I aimed to have an in-depth understanding of the multidimensional issue of water supply in Lagos. In contrast, quantitative research methods use statistics to quantify correlations between measurable variables (Burkholder et al., 2016; Moser & Korstjens, 2017). Since I did not identify or measure causal variables, a mixed-methods approach was also inappropriate.

Once I chose the qualitative research method, I considered three research designs for a qualitative study on sustainable water management and funding strategies: phenomenology, ethnography, and case study. Phenomenology is suitable for studies that seek to describe the essence of a lived phenomenon (Landrum & Garza, 2015). However, because water supply inadequacy is an ongoing problem for leaders of LWC, a phenomenological design is not applicable. Ethnography aims to describe and interpret the patterns of behavior of a culturally identical group (Lopez-Dicastillo & Belintxon, 2014), but the identifying of the most effective strategies the leaders of LWC use for water supply management are not necessarily related to culture. A case study design may permit a researcher to investigate processes and contexts as they occur in real life, capturing the complexities within a bounded system (Baskarada, 2014; Stake, 1995; Yin, 2018). The case study will be best suited for studying a contemporary and complex water supply problem for Lagos residents. A case study design also comes with the benefits of exploring the phenomenon within a unit, comparison with other units, organizations, and cases, thereby resulting in a rich description of the phenomenon under study (Baskarada,

2014). The case study is also aligned with the systems theory, as a case study is already a bounded system (Stake, 1995).

For data collection, I purposefully recruited 20 senior staff (Grade Level 13 and above) of LWC, who had more than 10 years of experience in the development of sustainable water supply management strategies for in-depth interviews. They also possessed a minimum of a bachelor's degree in water supply management related courses. Additionally, I purposefully recruited six water supply management experts (manager and above) from Lagos, who had more than 15 years of experience in the development of sustainable water supply management strategies for a focus group discussion. They also possessed a minimum of a bachelor's degree in water supply management related courses.

The data from the focus group discussion complemented the data obtained from the in-depth interviews and document review. The use of multiple sources of data satisfied the methodological requirement for triangulation. I used a case study strategy to analyze the data using an inductive approach and interpreted the data through the systems theory lens.

Definitions

Some of the terms might be unique to this study and may require definitions to help readers (Hancock & Algozzine, 2017). A clear understanding of the terms allows readers to evaluate the research or determine whether there are material deviations from what the researcher proposed in the problem statement (Leedy & Ormrod, 2010). Therefore, the following terms and definitions will provide readers with a shared understanding of the terms used in this study.

Safe drinking (Potable) water: water that does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages (World Health Organization, 2017a).

Water governance: the social function that regulates the development and management of water resources and provisions of water services at different levels of society and guides the resources towards a desirable state and away from an undesirable state (Pahl-Wostl, 2015).

Adaptive water governance: This is water governance with adaptive capacity, which is the ability of a governance system to alter processes and adapt structural elements to respond to current or anticipated changes in the social or natural environment (Pahl-Wostl, 2015).

Management functions: The main functions of management are planning, organizing, leading, and controlling (Schraeder et al., 2014).

Stakeholder: Any individual or group whom an organization's actions may impact (e.g., shareholders, customers, employees, suppliers, and community members). In the context of water governance, stakeholders include public and private actors who compete for the share of voice in decisions concerning the allocation of resources (Harrison et al., 2015).

Sustainable water use: Water use that does not destroy the natural cycle and allows the resource to regenerate itself (Savenije et al., 2014).

Water sustainability: Ensuring a sufficient and equitable water supply in a way that does not threaten future use (Damkjaer & Taylor, 2017).

Assumptions

Assumptions are beliefs that guide the research, yet these beliefs cannot be confirmed (Hancock & Algozzine, 2017). The first assumption was that the study results of my topic, developing sustainable water supply management strategies for Lagos using a case study, could solve the current problem of inadequate potable water in Lagos state. The second assumption was that the sample size 15-20 senior staff of LWC who met the inclusion criteria for participation in the in-depth interviews, and 6 senior water supply management experts in Lagos who met the inclusion criteria for participation in a focus group discussion, and document review would be sufficient to achieve data saturation to address the research questions for the study. Due to this assumption, it was essential to get sampling right in my research design (Patton, 2015).

The third assumption was that the participants would be competent, willing, and available to provide honest and accurate answers to research interview questions; this also applies to the focus group discussion. Correct answers to research interview and the focus group discussion questions are essential to achieve quality study conclusions. The fourth assumption was that I could interpret participants' statements largely without unnecessary assumptions or biases. A correct interpretation of participants' views could lead to quality study conclusions. I used member checking and document review to reduce potential misrepresentations and inaccuracies. Finally, I assumed the choice of the exploratory case study was the most appropriate research design to answer the research questions concerning a complex water supply problem. The exploratory case study is suitable for studying a current, ongoing, and complex problem (Yin, 2018).

Scope and Delimitations

Scope

The scope of the study clearly defines the boundaries of what the researcher intends to achieve based on the study plan (Leedy & Ormrod, 2005). The scope of this study was Lagos State, Nigeria. To address transferability in the study, I provided a full explanation of the study's findings and provided detailed descriptions of the steps. Comprehensive reports of the steps will allow readers and future researchers to make informed decisions about the transferability of the findings to a specific organization, location, or context.

Delimitations

Delimitations define a study's boundaries, incorporating study parameters, research participants, and characteristics (Hancock & Algozzine, 2017). Delimitations are limitations deliberately set by researchers to make study objectives possible to achieve (Theofanidis & Fountouki, 2019). The case I considered was a bounded system, an organization. I chose to focus on water supply management because it is an increasingly critical issue for Lagos state of Nigeria residents. Therefore, the scope of this study did not cover an in-depth study of water resources management as a whole; the study focused on water supply management by LWC, Lagos, Nigeria.

Limitations

Limitations are possible weaknesses in a study outside the researcher's control (Hancock & Algozzine, 2017; Theofanidis & Fountouki, 2019). The choice of a research design comes with assumptions and influences sample selection, data analysis,

interpretation, and trustworthiness issues (Merriam & Tisdell, 2016). The first limitation was that a qualitative exploratory case study has advantages and disadvantages as a research design, and the researcher must note these throughout the research process to minimize biases and wrong assumptions. A limitation of a qualitative study is that it precludes the researcher from making too many claims of generalizability or conclusiveness (Marshall & Rossman, 2014). However, Smith (2018) suggested that qualitative researchers' focus should not be on generalizability, as the lack of it does not diminish the research value. Therefore, qualitative research does not have generalizability as its underlying tenets (Korstjens & Moser, 2017).

The first limitation of this study was the sampling method that I used to recruit participants. All participants for the in-depth interviews were senior officials at LWC and, therefore, might tend to provide supporting rather than contradictory information to project a common position. Also, self-selection bias might exist when the managers at LWC, who were volunteers, might be primarily interested in showcasing their accomplishments.

The second limitation was the possibility of officials aligning their responses with their superiors' from the same department to project a common front. However, this was not significant, as the choice of participants from the vertical section of the corporation cut across multiple departments and removed this limitation. Diefenbach (2009) suggested that subordinates might hesitate to express views different from their superiors', thereby introducing biases. Underscoring the power of biases, Bang and Frith (2017) suggested that if biases have the upper hands in what we do, and everything

follows the usual patterns, we lose the opportunity to change our world for the better. The interviews were conducted one-on-one, by Zoom meetings, and I maintained confidentiality and removed every identifier that could link participants to any information. Additionally, to further reduce biases, I used member checking and multiple sources of data to provide methodological triangulation, which minimized the potential for biases in the findings.

Significance of the Study

Significance to Theory and Practice

The results of the study could benefit scholars and practitioners in many ways. First, by making an original contribution, this study's findings could address an under-researched water supply management area regarding sustainable management and funding strategies for LWC. Second, the study could help LWC and similar water supply utilities enhance their ability to provide adequate potable water supply to residents, eliminating water shortage and extra cost on water supply. Third, the results of the study could reduce the incidents of diseases associated with untreated alternative water sources (Ishaku et al., 2011) and minimize the associated costs of insufficient water supply and sanitation (Alaerts, 2019).

Significance to Social Change

The results of the study could contribute to positive social change in the following ways: (a) increased water supply to residents, as a result of sustainable management and funding strategies, could increase their socioeconomic statuses, and (b) leaders of water utilities could use the results to align water strategies with sustainable water governance.

Water use is increasing globally, and by projection, demand could exceed sustainable supply by 40% by 2030 (World Economic Forum, 2015). In addition, increased travels and accommodation requirements increase pressure on the water supply (World Tourism Organization, 2018). Sustainable water management requires responsible conduct in water use by all stakeholders (Marques et al., 2016). Therefore, findings from this study could help leaders of water utilities be environmentally sensitive and align water management with sustainable water governance. Also, the effects of tourism or migration on infrastructures, such as water supply, will require water management strategies that foster efficient water use by all stakeholders.

Further, an adequate water supply improves the socioeconomic statuses of the citizenry (Ohwo & Abotutu, 2014). The provision of water supply could reduce poverty because it is related to food security and agriculture (Marwah & Marwah, 2014). An adequate water supply could reduce the burden of searching for alternative water sources for household use on women and children (Shrestha et al., 2019). In some situations, women spend up to a quarter of their working hours scouting for water for household use (Gross et al., 2018). Zolnikov and Blodgett-Salafia (2017) reported improved access to water enhances relationships among family members in Kenya, thereby improving their economic growth.

Women and children are more prone to the effect of water shortages, such as illnesses, than men (Khiyara, 2016). For example, the high maternal mortality of about 5 per every 1000 live births in Mexico reported by the World Bank in 2017 might be due to inadequate potable water (Silva & Miguel, 2018). Underscoring the importance of

women's empowerment, Godfrey and Wolf (2016) noted that poverty is one area where women have more than a fair share. Therefore, water plays a critical role in poverty alleviation, and this explains why the global emphasis is to align global water initiatives with the antipoverty program of international bodies, such as the World Bank (Sambu, 2016).

Consequently, water that is more available for women, especially in developing countries, can result in poverty alleviation, as women can then devote more of their time in activities other than searching for alternative water sources, including activities that strengthen their household wealth and health (Silva & Miguel, 2018). Thus, a combination of improved socioeconomic status, poverty alleviation, and the lessening of the burden of searching for water sources on women and children brings about positive social change. Also, the provision of adequate water for residents will reduce water-related diseases, improve the general well-being of the people, and reduce unsafe water-related mortalities, thereby bringing about positive social change.

Summary and Transition

Chapter 1 was an introduction to the study and described the study's background, which listed the primary issues that supported the need for the study. These issues included the call for further research to explore sustainable management and funding and cost-recovery strategies for LWC. Included in Chapter 1 was the problem statement, describing both the general and specific water supply problems in Lagos State, the purpose of the study, nature of the study, research questions, and the conceptual framework.

Other discussions in Chapter 1 included the definitions of key terms and concepts, the study assumptions, scope, delimitations, and limitations of the study, and the significance of the study to theory, practice, and social change. There was alignment among the problem statement, purpose statement, research questions, nature of the study, and the conceptual framework. The units of analysis were (a) 20 senior staff (Grade Level 13 and above) of LWC who met the inclusion criteria for in-depth interviews, and (b) six water supply management experts (manager and above) in Lagos, who met the inclusion criteria for the focus group discussion.

Chapter 2 contains a review of the relevant gap in the literature related to the study. Chapter 2 includes the literature review, analysis, and synthesis of previous studies to evaluate the case discussed. Furthermore, the literature review explores sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. I review the conceptual framework underpinning the study, the literature on water supply and demand management, water infrastructure and operation of water facilities, institutional and organizational capacity, water governance, water supply management options, health implications of inadequate water supply, and the funding for public water utilities in Chapter 2.

Chapter 2: Literature Review

The specific problem that I addressed is inadequate potable water to all Lagos residents due to inadequate sustainable management and funding strategies by LWC, which could provide adequate potable water to Lagos residents (Balogun et al., 2017; Omole et al., 2016). The purpose of this qualitative case study was to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. Balogun et al. (2017) suggested that the current demand and supply gap, among others, and the rate of urbanization, are capable of leading to severe water shortage problems in Lagos; and suggested areas for further study, including identifying sustainable management, cost-recovery, and funding strategies for LWC.

Dighade et al. (2014) suggested that water losses affect water utilities and their consumers worldwide, mainly in developing countries, resulting in high operational costs, revenue losses, and constraining the financial viability of these water utilities. Therefore, the objective of the literature review was to explore relevant literature that may provide an in-depth understanding of the sustainable water supply management and funding strategies by LWC, which could provide adequate water supply for all Lagos residents.

The literature review is foundational to answering the research questions, which addressed what water supply management strategies by LWC could provide adequate water for all Lagos residents and what water supply funding strategies by LWC could provide adequate water for all Lagos residents. To assist in answering the research

questions, I evaluated scholarly peer-reviewed journal articles from databases such as ProQuest Central, Academic Search Complete, Science Direct, Emerald Insight, ABI/Inform, SAGE Journals, Thoreau Multi-Database Search, and Google Scholar.

The literature review contains critical analysis and synthesis of the topics organized into three parts: (a) the conceptual framework, (b) the topical foundation, and (c) the gap in the literature. Part 1 covers the conceptual framework and includes the following subsections: introduction, systems theory, internal interactions in a system, external interactions with stakeholders and the environment, feedback mechanisms and response, and management functions. Part 2 covers the topical foundation: (a) water supply and demand management, (b) water infrastructure and operation of water facilities, (c) institutional and organizational capacity, (d) water governance, (e) water supply management options, (f) health implications of inadequate potable water supply, and (g) funding for public water utilities. Finally, part 3 discusses the gap in the literature. The literature review provides the necessary foundation for the research questions. The research questions address (a) what sustainable water supply management strategies by LWC could provide adequate potable water for all Lagos residents and (b) what sustainable water supply funding strategies by LWC could provide adequate potable water for all Lagos residents. There appear to be gaps in the literature concerning identifying cost-recovery and sustainable management and funding strategies.

Literature Search Strategy

I retrieved peer-reviewed journal articles in the library databases, such as ProQuest Central, Academic Search Complete, Science Direct, Emerald Insight,

ABI/Inform, SAGE Journals, Thoreau Multi-database Search, and Google Scholar. The keywords that I used in searching the databases were *water supply management, water supply, water demand, water governance, climate change, sustainable water supply management strategies, water quality, water resources, water scarcity, cost-recovery by water utilities, water pricing, water supply and health, sustainable funding strategies, and water supply in developing countries.*

I reviewed over 400 peer-reviewed articles and seminal sources, out of which 305 were used in the study. From the sources, 236 (77%) were from the past 5 years (2016-2021), 267 (88%) were peer-reviewed articles, 7 were government reports (2 %), 18 were seminal works (books; 6%), and 13 (4%) were industry websites.

Conceptual Framework

Sustainable water supply management is complex and requires appropriate management functions that foster the right internal and external interactions among various actors in an open system to satisfy the social, economic, and environmental dimensions of water supply. The conceptual framework for this study was derived from the management functions and their interactions with the components of an open system. Water supply management comes with feedback, cascading consequences, and issues that are difficult to envisage or control by the water managers (Rietveld et al., 2016). Dealing with the dynamic interactions among stakeholders and the environmental feedback requires an adaptive governance approach (Pahl-Wostl, 2017), which could provide the organization with the resilience to maintain its functions and structure in the face of internal and external changes (Allenby & Fink, 2005). Agile leaders provide the

necessary resilience that makes organizations adaptive to turbulence (McKenzie & Aitken, 2012) without system breakdown.

The water supply management problem in Lagos is systemic. Therefore, it requires a systemic response, where the management functions (planning, organizing, staffing, leading, and controlling) could help address common issues of water supply management. These issues include water supply and demand management, water infrastructure and operation of water facilities, institutional and organizational capacity, water governance, water supply management options, health implications of inadequate potable water supply, and funding for public water utilities. The essential components of a system are the input, process, external variables, output, and reenergizing the system; while the management functions convert the input to output; and appropriately respond to external prompts to maintain dynamic stability (Chikere & Nwoka, 2015). Therefore, management functions play a prominent role in ensuring that an organization, such as LWC, operating in open systems, achieve its objectives and dynamic stability.

Quality internal interactions among departments and external stakeholders are essential for any business's performance in an open system. A lack of quality interactions can lead to integrative and collaborative gaps (Bergsten et al., 2019). Organizations consist of functions (Rossetti et al., 2011) integrated through information sharing (Dorantes et al., 2013). For an organization to achieve its objectives, the components must be well integrated (Bolman & Deal, 2013). Therefore, the manager's primary role is to align people and processes from varied disciplines and multiple stakeholders to achieve the organizational outcome (Tovmasyan, 2017).

The management functions are essential in maximally aligning input, processes, external variables, output, and reenergizing to achieve the organizational objective (Chikere & Nwoka, 2015). Therefore, exploring LWC activities through the lens of the systems theory will provide a holistic view, which the traditional practice of isolating and manipulating variables in controlled environments cannot achieve (Bridgen, 2017). Furthermore, the systems approach to solving water supply problems will minimize unforeseen adverse secondary effects to and from the broader environment (Rietveld et al., 2016). Therefore, a holistic approach that considers the management functions, organization's components, and their interactions, internally and externally, could solve the complex problems of water supply by the LWC.

Systems Theory

The theorist von Bertalanffy (1950) propounded a systems theory that supports a holistic approach to solving everyday practical problems, such as that of the LWC. von Bertalanffy stated that interactions of components in a system, and not individual components, determine the properties and functions of that system (Morgeson et al., 2015). Thus, the underlying principles of systems theory comprise a holistic approach, interconnections of parts, and the need for controlling the system (von Bertalanffy, 1972). The author used "wholeness" concerning the systems theory, aiming at uniting the parts to form a whole, taking cognizance of the influence of the external environment on the system.

Systems theory could provide researchers with insights into how the interactions among entities in a system produce a result (Sayin, 2016). Systems theorists provide real-

world explanations and solutions to everyday practical situations (Adams et al., 2014). They argue that a system reduced to parts will cease to exist, altering one part affects system performance, and the success of enhancing one part depends on the interactions between this part and other parts of the same system (Patton, 2015).

The application of systems theory is common in qualitative and quantitative studies. The systems theory is suitable for understanding and managing complex adaptive systems (Pype et al., 2018). It has been used, for example, for an integrated approach to managing security and safety in complex systems (Young & Leveson, 2014). Managers could use systems theory approaches to enhance staff skills, competencies, and organizational performance (Sayin, 2016). Systems theory could prepare managers to handle multiple interacting systems in an organization to sustain performance (Turner & Endres, 2017).

Systems theory could throw light on the dynamics of the process and the environment (Mania-Singer, 2017). It could enhance business data interpretation for business sustainability (Marsan et al., 2016). Furthermore, systems thinking could help leaders strike the right balance between market models and the complex and rapidly changing business environment (Vargo et al., 2017). Finally, systems theory could improve the understanding of managers about the functionalities of their businesses.

I chose systems theory as a lens to guide this conceptual framework because a holistic systems approach is critical for any business's survival. The water supply business by LWC is complex, multidisciplinary, with multiple functions and stakeholders in dynamic interactions. Besides, the current problem of inadequate water supply by

LWC is systemic. It requires a systemic response, which could not lend itself to fixing each problem, one after the other, or fixing functional or process pieces. On the other hand, systems theory can offer practical solutions to real-world problems. Therefore, systems theory underpinned the conceptual framework for this study to explore better sustainable water supply management and funding strategies by LWC, which could provide adequate water for all Lagos residents.

Internal Interactions in a System

Understanding the purposes of LWC as a system and how LWC achieves the purposes are foundational to having a holistic view of it, using systems theory. Bridgen (2017) suggested that we understand a system by its purpose and how it achieves the purpose, and the common denominator in terms of purpose is the propensity for survival. The purpose of the LWC is to provide adequate potable water for all Lagos residents in a sustainable manner (Lagos Water Corporation, 2019). The LWC achieves its purpose through dozens of water facilities of varying capacities and functionalities; and aging distribution networks that cut across the Lagos landscape (Ayeni, 2017; Balogun et al., 2017). The primary departments or units in LWC are engineering, production, maintenance, distribution, commercial, and human resources (Lagos Water Corporation, 2019). These departments or units are pursuing the common purpose of providing adequate potable water supply to Lagos residents.

Realizing LWC's purpose requires quality internal interactions among the individuals and departments and quality external interactions with the stakeholders and the environment. Therefore, examining LWC issues through the lens of the systems

theory will provide a holistic view of the water supply system, which the traditional practice of isolating and manipulating variables in controlled environments could not achieve (Bridgen, 2017). Cosgrove and Loucks (2015) suggested that piecemeal reactions and responses to constraining disruptions to vital systems such as water systems are not enough; solutions come through integrated efforts. The quality of internal interactions among the internal units, on the one hand, and the interactions of LWC with the external environment, on the other hand, is a determinant of whether the mandate will be achieved or not.

LWC operates in a complex and multidisciplinary business environment, with multiple stakeholders to manage, and success depends on the quality of the individuals and units, their interactions with one another, and the external environment. Anaf et al. (2007) suggested that a complex organizational system, such as LWC is always prone to rapidly changing relationship dynamics and external pressures. LWC has professionals such as engineers, scientists, laboratory scientists, accountants, lawyers, and administrators, working together for a common purpose. For the roles and goals of diverse teams from different disciplines to be effective, team members must not work in siloes (Anaf et al., 2007). Working in siloes could create integrative or collaborative gaps in water governance (Bergsten et al., 2019), which could prevent organizational goals.

By integrating multi-stakeholders, the systems approach can use expertise, real-world decisions, and local knowledge to solve practical problems in simple ways (Rietveld et al., 2016). The involvement of critical stakeholders in urban policy at all levels ensures that the needs of the communities do not depend purely on scientific and

political considerations (Rietveld et al., 2016). The quality workforce comes through the multidisciplinary nature of the water supply management team. The participation of stakeholders, significantly, local communities in water supply management could enhance the likelihood of the success of the water supply initiative.

Extending the decision-making process to include the local communities will help align policy decisions with needs, enhance the legitimacy of the decisions, and promote the success and sustainability of the water supply system. Ezenwaji et al. (2016) suggested that professional community-based management options could enhance the chance of meeting the Sustainable Development Goal (SDG) of access to water and sanitation for all by the year 2030. Aper and Aku (2018) suggested that the inclusion of community members in operation and maintenance of water equipment enhances the sustainability of water supply facilities. Yeleliere et al. (2018) suggested that the mechanisms for managing Ghana's water resources are ineffective due to the difficulty of combining customary laws and practices, statutory laws, and Integrated Water Resources Management (IWRM) in water resources management. Chukwuma (2018) traced low quality and lack of sustainability of rural water supply in Nigeria to an insufficient policy framework to integrate community-based water services and public water supply efforts.

Further, Sherry et al. (2018) suggested that for any water supply innovation to succeed, the target population's perceptions of acceptability and feasibility must carry weight on deployment. Kasri et al. (2017) suggested that appropriate citizen and government engagement is vital to Indonesia's sustainable rural water service delivery. The involvement of key stakeholders, through quality interactions, in the decision-

making processes on water management will enhance success and sustainability. Some of the decision-making processes that require stakeholders' involvement include the choice of water supply management options, operation and maintenance of water facilities, and acceptability and feasibility of new initiatives.

For any organization, such as LWC, operating in systems to achieve its objectives the various units must work well, work collaboratively, and the various efforts must be well integrated. Chikere and Nwoka (2015) suggested that an organization, as a system, is made up of units, individuals, and groups who must work individually and collaboratively to achieve the organizational goals. Systems theorists argue that a system works well when the parts have quality interactions (Patton, 2015). An organization, such as LWC, comprises functions (Rossetti et al., 2011), which are integrated through information sharing (Dorantes et al., 2013). Therefore, managers must be competent to align people and processes to achieve organizational objectives (Tovmasyan, 2017).

The performances of individual persons or functions without quality interactions among them will not result in organizational performance (Patton, 2015). For example, due to poor leak detection and control, poor water distribution by the distribution department will nullify water production success when the actual volume of water produced does not get to the consumers. There is evidence of poor distribution networks resulting in water leakages, which erode the water quality's success at the production points. Ohwo (2014) reported water quality differentials between production points and the points of use due to progressive water recontamination along the distribution line.

Also, low revenue drive by the commercial department could impact cost recovery and the ability of the Corporation to be self-sustaining and remain in business. For example, Balogun et al. (2017) and Ohwo (2016) reported a low revenue drive by LWC that leads to ineffective cost-recovery. The resultant lack of adequate revenue hinders the Corporation's ability to muster enough funds for its operation. Therefore, a combination of quality individuals or units and quality interactions among them is necessary for achieving the mandate of adequate potable water to all Lagos residents.

External Interactions with Stakeholders and the Environment

LWC operates in an open system, influences and is influenced by its external environment and stakeholders. The quality of interactions between the Corporation and the environment and how fast the Corporation can adapt to environmental reality will determine performance. The theorist von Bertalanffy (1973) argued that real systems are open and interact with the external environment for health and survival and suggested a holistic approach to solving organizational problems. The effect of the external environment or forces on any business is enormous and should be a significant consideration (Chikere & Nwoka, 2015). LWC gets its raw material, and labor input from the environment processes them and sells the output to the environment (Lagos Water Corporation, 2019). The ability of the Corporation to adapt to its changing external environment will determine its success and continued stay in business.

The activities of many critical stakeholders such as staff, governments, regulators, customers, suppliers of goods and services, financiers, and the economic and natural environments have significant impacts on the performance of the LWC. These impacts

depend on the quality of interactions with the stakeholders and the LWC's ease of adaptation to the economic and natural environments. Sayin (2016) suggested that systems theory could help leaders address the influence of external forces on the organization. A leader who sees the organization from the lens of the systems theory will maintain the proper dynamic equilibrium among the input, the process, and the output (Chikere & Nwoka, 2015), using feedback mechanisms.

The feedback mechanisms will help the leader adjust in response to stakeholders' requirements, thereby adapting to the current reality of the changing environments with which it interacts. LWC has internal systems that are in constant interactions with one another and with the environment. Interactions within any organization and the external environment define the organization's function and purpose (Bridgen, 2017). There is, therefore, the need for quality internal interactions within the components of the LWC, on the one hand, and with the critical stakeholders and the environment, on the other hand, taking full advantage of the feedback mechanisms.

Feedback Mechanisms and Responses

Sustainable water supply implies that the LWC must ensure adequate potable water to Lagos residents now and in the future without failure through system maintenance to ensure dynamic stability. Bridgen (2017) suggested that the system's purposes are achieved and maintained by control mechanisms called balancing or reinforcing feedback loops, which maintain system stability or alter the effect of incoming information. For a system like Lagos water supply management to be sustainable, in the long run, in addition to correct internal workings, the Corporation must

have quality interactions with the external environment. Therefore, there must be appropriate environmental feedback mechanisms to help water managers strike the right balance among input, processes, and output. The right balance is necessary to forestall system breakdown and to maintain dynamic stability.

Many actions that affect water supply management are outside water policymakers or managers' control (Rietveld et al., 2016). The feedback mechanisms and appropriate responses will help water policymakers to take proactive measures to manage the side effects of actions not directly under their control (Bridgen (2017)). For example, changes in water resources management at the national level might affect water availability at the supply intakes of water facilities (The Federal Republic of Nigeria, 2004). Also, changes that are beyond the control of water managers (Rietveld et al., 2016), such as in national laws, for example, in taxation, import, and export, water governance, water quality, and tariff, among others, might affect the sustainability of water supply by LWC. Therefore, appropriate feedback mechanisms and adequate responses are necessary to deal with the various risks of operating an open system in a rapidly changing complex environment.

The LWC, as an organization operating in a rapidly changing external environment, faces three major types of risks that could be preventable, strategic, or external; and its survival depends on its ability to manage these risks. The World Economic Forum (2013) suggested three risk types: (a) the preventable, caused by human errors or process breakdowns, (b) the strategic, planned due to their potential benefits, and (c) the external, which are beyond one's capacity to influence or control

Suitable organizational cultures and compliance with relevant directives could address preventable and strategic risks, while sustained resilience could manage external risks.

Organizations, such as LWC, must possess essential resilience to adapt to change and recover quickly from shocks to the desired equilibrium. Allenby and Fink (2005) suggested that resilience helps a system maintain its functions and structure when faced with internal and external change or degrade seamlessly if necessary. Balaei et al. (2019) suggested that the resilience of Vanuatu's local people helped the country quickly overcome the water supply problem caused by a Tropical Cyclone (T.C.), Pam, of category 5 in 2015, without the country experiencing any chaos due to water shortages. Resilience makes an organization stable and gives it a comparative advantage over others in terms of market reach. Therefore, LWC leaders must be adequately skilled and competent; to succeed in a complex, volatile, uncertain, and ambiguous environment (Dunn et al., 2012).

McKenzie and Aitken (2012) suggested that agile leaders could cope with complexity and make their organizations agile and adaptive to any form of turbulence. Leadership plays a prominent role in the performance of an organization, such as LWC, operating in an open system, which is subject to the dictates of the external environment. For any organization to be sufficiently resilient to survive turbulence, its leaders must possess the ability to adapt quickly and direct the organization along the path of the current reality, as dictated by the external environment. Decision-makers in LWC must, therefore, play the role of activating resilience in the organization through appropriate

leadership. For this to happen, leaders must adopt a holistic view of issues through a systems theory approach.

Management Functions

The main management functions are planning, organizing, leading, and controlling (Schraeder et al., 2014). The authors suggested that the four functions do not necessarily operate as stand-alone, there are substantial overlaps and fluidity, and the functions are dynamic. For example, the authors suggested that the planning function dictates organizational directions and goals; the organizing function allocates resources to achieve goals and plans. Further, they suggested that the leading function creates an enabling environment for employees and organizations to perform.

In contrast, the controlling function monitors the organization and employees regarding performance and progress towards the goal. The authors suggested that the inclusion of employees in implementing these functions might increase trust and organizational performance. Therefore, managers of LWC could use the management functions (planning, organizing, leading, and controlling) to create the right balance among input, processes, external variables, output, and reenergizing to achieve the organizational objective (Chikere & Nwoka, 2015).

The LWC operates in systems, and the essential components of a system are the input, process, external variables, output, and reenergizing the system, which are in constant interactions. The management functions transform the input to output; and appropriately respond to external prompts to maintain the dynamic stability of the system (Chikere & Nwoka, 2015). Therefore, LWC will require planning, organizing, leading,

and controlling to align input, process, output, and reenergizing the system. This alignment is necessary to forestall system breakdown and ensure the continued survival of the system. There is, therefore, the need to explore the management functions concerning the dynamic interactions of the water supply system in the LWC.

Water Supply and Demand Management

Water is crucial for the sustenance of life, the environment, and societies. However, its sustainability, both in quantity and quality, is a big problem. The management of water in terms of demand and supply does not follow strict economic laws because it combines public, private, and common good properties (Savenije et al., 2014; Zeneli, 2017). Many authors (e.g., Abubakar, 2016; Balogun et al., 2017) have put forward the importance of water and its scarcity and unsustainability consequences. Guarino (2017) suggested that water scarcity could lead to an economic downturn or starvation in both the developed and developing countries and advised developing countries to prioritize enhancing and maintaining their water infrastructure.

In recognition of the importance of water, in 2010, the United Nations General Assembly (UNGA) and the Human Rights Council recognized the human right to water (Clark, 2017). In 2014, the U.N.'s Sustainable Development Goals (SDG) set a target of universal access to water (Martins et al., 2016). Achieving Sustainable Development Goals (SDGs) will require removing inequality in access to water at all levels (Hutton & Chase, 2016), as this can hinder universal coverage. Various governments could ensure universal coverage by removing disparities in water access through deliberate actions to

address water supply problems in deprived areas and vulnerable population (Gazze & Abubakar, 2018).

Water is a natural resource influenced by societies' cultural and religious values, and the solution to water problems requires understanding and dealing with complex social, economic, and environmental factors. Cosgrove and Loucks (2015) suggested that culture influences people's attitudes towards water use in different societies; therefore, water professionals should incorporate local knowledge to solve water-related problems. In addition, many factors put pressure on water supplies, especially in urban centers, making water supply management problematic in many countries, including Nigeria. Therefore, dealing meaningfully with the issues of water supply management requires a holistic approach.

Urban Water Supply Management

Rapid urbanization, population growth, and several other factors have increased the water demand, mostly in urban centers. Kejsler (2016) suggested that the pressures of economic and population growth and the impact of climate change on water demand might create a gap between available water use and demand. Hurlimann and Wilson (2018) suggested aligning water supply with demand from various sources calls for large-scale urban water supply management. The authors indicated that the massive scale of urban water supply makes governments prefer centralized urban water systems using public water utilities, and in some cases, through a public-private partnership. However, there are divergent views on whether the arrangements are appropriate, and the focus of

developed countries in water supply management is different from that of developing countries.

The water management problems in the developed countries differ from that of the developing countries, and these differences explain the disparity in the focuses of the two worlds. Rathnayaka et al. (2016) suggested that the main problems of water management in most developing countries are inadequate infrastructures and resources, limited access to potable water and sanitation, increased exposure to water-related diseases, and wasteful consumption. The primary concern in developed countries is to reduce wasteful consumption to ensure sustainability (Rathnayaka et al., 2016), which is possible through responsible water use and conservation by all stakeholders (Marques et al., 2016). Water utilities in most developing countries require resources to provide adequate water to bridge water demand-supply gaps in the urban and rural areas, while the focus in the developed world is to reduce waste (Rathnayaka et al., 2016). Thus, responsible behavior concerning the sustainability of water resources and water supply is a common focus by both developed and developing countries.

Overview of Population Growth, Rapid Urbanization, and Water Supply

The rapid urbanization of the rural areas, high population growth rate, and rural-urban migration stretch urban facilities, such as water supply, beyond limits, and this is true for Lagos State. Dos Santos et al. (2017) traced the water scarcity problems in Sub-Saharan Africa, partly to population growth and urbanization. Ayeni (2017) and Balogun et al. (2017) suggested that the current water stress in Lagos is due to rapid urbanization, high population growth, and rural-urban drift. Rugemalila and Gibbs (2015) and Rehman

and Baig (2017) implicated rapid urbanization as one of the factors that put pressure on water supply in Tanzania, and Pakistan, respectively. In contrast, Kandissounon et al. (2018) argued that water losses in the distribution network are a more important factor responsible for inadequate water supply in Lagos than urbanization and population.

Kandissounon et al.'s (2018) assertion might not be correct as researchers such as Ayeni (2017) and Balogun et al. (2017) demonstrated that the maximum current output from LWC waterworks, even without any losses, could not meet the Lagos water demand. Urbanization and population are growing at the rates at which the capacities of the LWC's water facilities cannot cope. The benefits inherent in urbanization do not exist in urban centers in Nigeria, as in many urban centers of most developing countries. Aliyu and Amadu (2017) suggested that urbanization in Nigeria is high, with Lagos having the highest growth rate of about 5.8%. The authors suggested that urbanization in Nigeria does not come with the associated socioeconomic benefits to the urban setting but comes with an urban health crisis of inadequate potable water supply and sanitation, poor settlements, and reduced functionalities of social amenities.

The effect of population growth and rapid urbanization on water supply is aggravated by the changing settlement pattern that favors rural-urban migration without increasing urban social amenities. Dunmade (2017) suggested that massive rural-urban migrations, the high population growth rate in peri-urban municipalities, including that of Lagos, are responsible for overstressing the existing water facilities. Mapfumo and Madesha (2014) linked the challenges of delivering an efficient water supply in Zimbabwe to population growth and climate change. The problem of inadequate access

to water also comes with a disparity in the level of access (Dos Santos et al., 2017). Most peri-urban makeshift settlements, where most of the current urban population lives, experience inadequate water supply (Adams, 2017; Dunmade, 2017). The level of income of the residents also affects the amount of access to improved water sources (Abubakar, 2019; Akoteyon, 2019).

The rates at which water facilities are developed or upgraded in developing countries, such as Nigeria, do not match population growth rates in cities such as Lagos, thereby putting pressure on existing water facilities (Egbinola, 2017). This population and facilities mismatch is one of the problems of LWC that has the mandate to provide adequate potable water for Lagos residents (Balogun et al., 2017). However, LWC's water facilities could not meet up over the years (Ayeni, 2017). Limited capacity and inefficient operation (Balogun et al., 2017) reinforce the failure of the LWC to provide adequate water to all Lagos residents. This lack of adequate delivery forces the populace to patronize alternative water sources with safety concerns (Ahmad, 2017; Akoteyon, 2019).

The Study Area.

The study area is Lagos State, which is also a city (Kandissounon et al., 2018), in the Southwestern part of Nigeria, along the West African coast, within latitude 6°22'N and 6°52'N, and longitude 2°42'E and 3°42'E (Ayeni, 2017). It is Nigeria's smallest state and former capital with an area coverage (land and water bodies) of about 3,577 square kilometers (Ayeni, 2017); and the primary commercial and industrial state in Nigeria (Ohwo, 2016). Lagos State is bounded in the south, by about 200Km coastline with the

Atlantic Ocean, in the North and East, by the Ogun State of Nigeria, and in the West, by the Republic of Benin (Ayeni, 2017; Balogun et al., 2017). Lagos State has two primary climates/vegetation: Freshwater swamp and wet lowland tropical rainforest climates; and two minor climate/vegetation, dry lowland rainforest, and southern guinea savannah (Balogun et al., 2017).

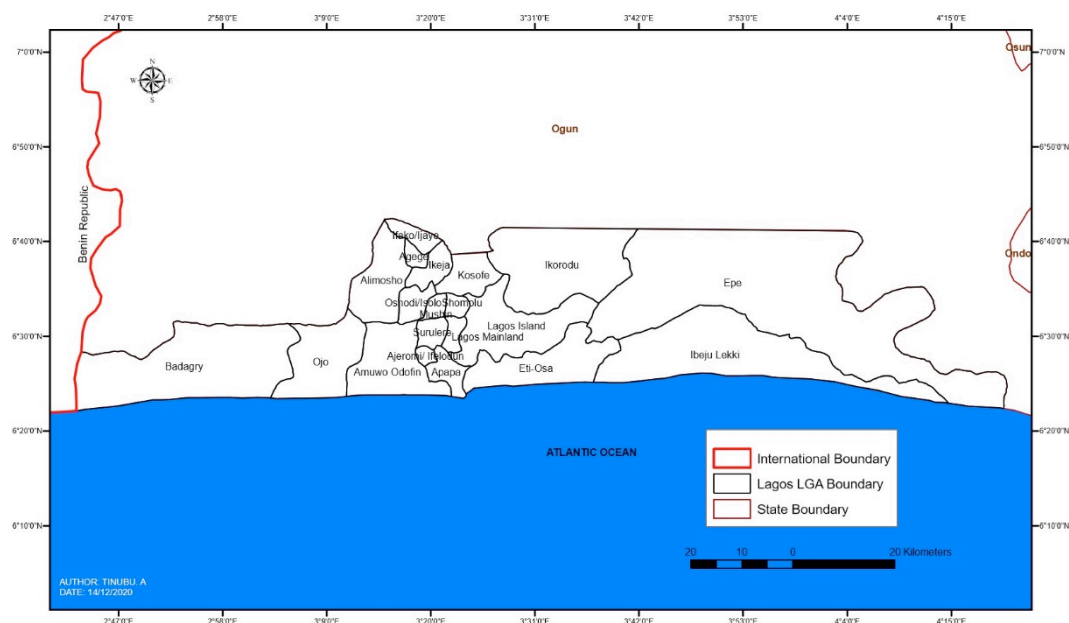
Lagos State has two climatic seasons, dry season (November to March) and wet season (April to October), with an average annual rainfall of between 1400 millimeters and 1800 milliliters, and a short august break (Ayeni, 2017). The maximum and minimum temperatures are 38.3°C and 20.2°C, respectively (Yusuf et al., 2017). The major water bodies are Ogun, Osun, Yewa, Owo, Aye, and Oworu/Solodo rivers. These water bodies flow into Lagos, Lekki, Ologe lagoons, and Badagry Creek (Lagos Water Corporation, 2010).

For administrative purposes, Lagos State consists of 20 local government areas (LGAs); 16 of these local government areas within the Lagos Metropolitan area are urban, while the remaining 4 local government areas are sub-urban (Ayeni, 2017). The 16 urban local government areas (LGAs) that make up the metropolitan areas include Agege, Alimosho, Ifako-Ijaiye, Ikeja, Kosofe, Mushin, Oshodi/Isholo, and Shomolu (Ayeni, 2017). Others include Apapa, Eti-Osa, Lagos Island, Lagos Mainland, Surulere, Ajeromi/Ifelodun, Amuwo/Odofin, and Ojo; the Sub-Urban Areas include Badagry, Ikorodu, Ibeju-Lekki, and Epe local government areas (LGAs) (Ayeni, 2017). However, Balogun et al. (2017) noted that it is a matter of time for all the local government areas (LGAs) in Lagos State to evolve into urban LGAs, making Lagos State a predominantly

urban city-state of Nigeria. Figure 2 shows the map of Lagos State and the 20 Local Government Areas (LGAs).

Figure 2

Lagos State Local Governments Areas



Note. Source: Tinubu (2020)-with permission.

Lagos State: Population Growth, Water Supply and Demand Nexus

Lagos State is one of the most rapidly growing coastal cities in Sub-Saharan Africa (Sojobi et al., 2016). The population annual growth rate could be as high as 5.8% (Aliyu & Amadu, 2017). The high population growth rate in Lagos State puts pressure on the natural resources such as land and water and stretches the functionality of social infrastructures, such as water supply, beyond limits (Aliyu & Amadu, 2017; Ayeni, 2017;

Balogun et al., 2017; Kandissounon et al., 2018). As a result, the Lagos Water supply Master Plan (Lagos Water Corporation, 2010) identified additional new water facilities (See Figure 4) to narrow down the water demand and supply gap over time (Kandissounon et al., 2018).

Lagos Water Supply

The city of Lagos has large water bodies, which could meet the water supply requirements of the Lagos State in the future (Kandissounon et al., 2018). Ayeni (2017) reported a slight rise in temperature, and rainfall in Lagos, over time, which could be due to several factors. However, Kandissounon et al. (2018) suggested uncertainties around the future impacts of climate change in Lagos and that dysfunctional water supply facilities are the central problem of LWC and not rapid urbanization or population growth. Ayeni (2017) also suggested that the Lagos public water supply had consistently fallen short of demand over the previous 55 years, even when the population was not as high.

The inadequate water supply by LWC, and other public water utilities in Nigeria, encourage private water vendors to fill the gap through various means, which are, generally, unregulated, and whose water quality is not assured (Ahmad, 2017; Akoteyon, 2019; Ayeni, 2017; Balogun et al., 2017). Therefore, Lagos residents have adopted different coping strategies for inadequate water supply through alternative sources whose safety cannot be guaranteed over the years.

The impact of industry and agriculture on the potable water supply by LWC is negligible as private consumers are responsible for consuming about 80% of the available

water supply by LWC (Lagos Water Corporation, 2019). Furthermore, though connected to the Lagos Water Supply network, most industries rely on their boreholes for a significant part of their water requirements. In contrast, in the U.K., industry, especially agro-allied, uses a large amount of public water supply (Ajiero & Campbell, 2018). In addition, in the U.S., most cities consume a large amount of potable water for production, watering of gardens, and waste management (Cunningham & Gharipour, 2018).

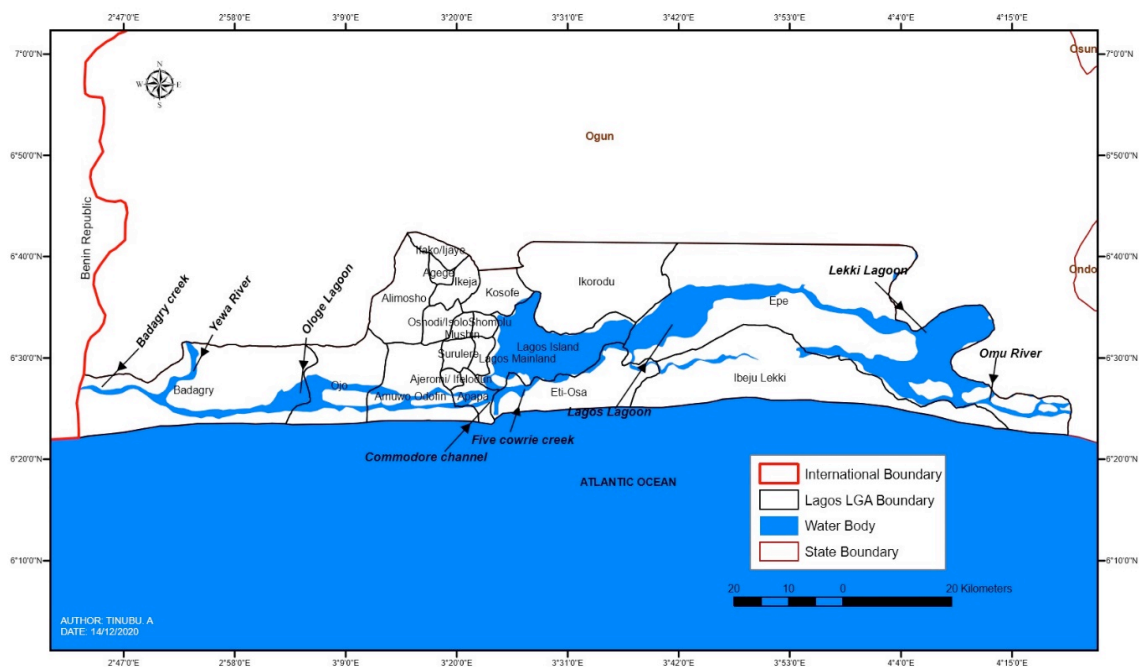
In the U.K., providing sustainable water supply may require a focus on industry, particularly agro-allied industries, which are the most significant water users in their raw, and potable forms (Ajiero & Campbell, 2018). However, the amount of potable water supply available to the industry in Lagos State is small compared to their water requirements for production and waste management. This lack of adequate water supply by LWC forces companies not to depend on the LWC for their water supply.

Urban agriculture is practiced in Lagos, as people, especially the poor, engage in food security and poverty alleviation (Kandissounon et al., 2018). There is a link between agriculture and poverty reduction (Marwah & Marwah, 2014; Sambu, 2016). However, LWC could not support both the agricultural and industrial sectors to provide adequate water for their productions. The agricultural industry takes the lion's share of available water for crop production (Guarino, 2017; Hoekstra, 2017). The agricultural and agro-allied industries use more water than other industries (Manocha & Chuah, 2017). However, in Lagos State, both industry and agriculture minimally depend on public water supply by the LWC because of its lack of capacity to deliver. The industry and agriculture in Lagos State depend on their boreholes for their productions and processes.

In terms of water resources for crop production, which is usually high (Manocha & Chuah, 2017), the Lagos State natural channels, lagoons, creeks, and canals enable urban agriculture to thrive in Lagos (Kandissounon et al., 2018).

Figure 3 shows the Lagos State natural drainage (Tinubu, 2020). The contribution of the LWC water supply to industrial, agricultural, and agro-allied uses is small. While these industries are willing to pay for service delivery, the water utility cannot currently deliver.

Figure 3
Lagos State Natural Drainage System



Note. Source: Tinubu (2020)-with permission.

Lagos Water Supply Master Plan

The Lagos Water Supply Master Plan (Lagos Water Corporation, 2010) stands on the tripod of abundant water resources, willingness to pay, and population. As a result, there are ample water resources in Lagos to meet the water supply requirement of Lagos State into the future.

Water Resources

The water resources in Lagos comprise surface water (both fresh and brackish) and groundwater. Lagos State has water bodies sufficient to supply water for its entire population for many years into the future (Kandissounon et al., 2018). However, these water bodies receive contaminations from various sources (Idu, 2015), which is a common problem in the world (Sharma & Bhattacharya, 2017) and may require special treatment for water supply (Lagos Water Corporation, 2010).

According to the Lagos Water Master Plan (Lagos Water Corporation, 2010), the freshwater sources' total yield is 615.2mgd. This yield comes from Ogun river, with a safe yield of 460.8 mgd, Osun river, with a safe yield 45.6 mgd, Yewa river, with a safe yield of 41.6 mgd, Owo river, with a safe yield of 28 mgd, Aye river, with a safe yield of 18.4 mgd, and Oworu/Solodo river, with a safe yield of 20.8 mgd. The brackish water sources include the Lagos Lagoon, with a surface area of 500 Km², Badagry Creek, with a surface area of 200 Km², which extends to the Republic of Benin, Lekki Lagoon, with a surface area of 300 Km², and Ologe Lagoon, with a surface area of 64 Km².

Lagos state is rich in abundant groundwater resources. The Coastal Plain Sands Aquifer provides Lagos with abundant groundwater resources (Balogun et al., 2017). Since the LWC could not meet the growing water demand, groundwater becomes a feasible alternative for domestic, industrial, and agricultural water needs. However, despite the importance of groundwater resources as an alternative source of water for the people of Lagos, the sector is unregulated, and there is the need to conduct a study to ascertain the groundwater abstraction potentials of Lagos State aquifers (Balogun et al., 2017).

Willingness to pay

Willingness to pay for water service delivery by Lagos residents is a necessary condition for the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), whose primary strategy is public-private participation. Some researchers have reported that customers are willing to pay for improved water service delivery in Nigeria (e.g., Akeju et al., 2018; Coster & Otufale, 2020). There are also reports on the ability to pay, as Lagos customers pay 4-10 times the rates being charged by LWC to private water vendors for alternative water sources (Jideonwo, 2014). In Ijebu-Ode, close to Lagos, Nigeria, customers are willing to pay higher rates for improved public water supply than they pay private vendors (Coster & Otufale, 2020). In addition, Ifabiyi et al. (2019) reported insufficient water supply in Ilorin, one of the major cities in the central part of Nigeria, forcing residents to pay for alternative water sources.

In Owo, Nigeria, the same geopolitical zone as Lagos, Akeju et al. (2018) surveyed customers' satisfaction and willingness to pay and reported that customers are willing to pay for improved public water supply. In Kano, the northern part of Nigeria, customers pay private vendors up to 28 times the rates charged by the Kano State Water Board (KNSWB) during the rainy season and up to 40 times during the dry season; and also, customers are willing to pay lower than monthly flat fixed tariff set by KNSWB (Ahmad, 2017). In contrast, Ohwo and Agusomu (2018) surveyed customer satisfaction in Ojota, Lagos, and reported that only about 12% of the customers are willing to pay for water based on their overall perception of the services of the LWC. This non-willingness to pay (Ohwo & Agusomu, 2018) might be due to the low service delivery level (Ohwo, 2016).

Further, Lagos State is a mix of high, middle, and low-income residential areas. Akoteyon (2019) reported that low-income earners are willing to pay and pay exorbitant rates to private water vendors for their daily water consumption. LWC is yet to take advantage of the customers' readiness to pay for service delivery because of a lack of autonomy (Ohwo, 2016). The lack of autonomy makes the government preclude LWC from charging appropriate tariffs (Ohwo, 2016), which could support operation and maintenance. A combination of abundant water resources, willingness and an ability to pay, and a ready market is a positive driver for public-private participation.

Lagos State Population

The population of Lagos, which has been on the increase for more than 50 years (Ayeni, 2017), is a source of a ready market for water service delivery. Ayeni (2017)

suggested that the Lagos population increased from 1.44 million in 1963 to about 9.2 million in 2006 based on the population census figures of 1963 and 2006. Using an annual growth rate of 3.4 %, the author projected the population to be 12.3 million in 2015, representing an increase of about 754% within 55 years (Ayeni, 2017). In contrast, the United Nations (1999) estimated the population of Lagos for 2015 at 23.2 million and one of the fastest-growing cities in the world. The increasing population of Lagos affects social infrastructures such as water supply (Aliyu & Amadu, 2017).

There is a trend of water demand-supply gap in Lagos for more than five decades. Ayeni (2017) put the Lagos water demand in 1963 at 172, 088 m³/d (45.5 mgd), and water supply at 97, 377 m³/d (25.7 mgd). In 2015, the author put Lagos water demand at 2,392,792 m³/d (632 mgd) and supply at 930, 531 m³/d (245.8 mgd). Ayeni used a 3.4% population growth rate for projection and available water data from Governments to demonstrate that there have been water demand-supply gaps by LWC consistently for about 55 years. The 3.4% growth rate is one of the several rates used by many researchers for Lagos population projections.

There are divergent views on the growth rates for Lagos State population projections, and these views, eventually, affect the projected population figures for Lagos up to and beyond 2020. For example, Balogun et al. (2017) used different growth rate scenarios such as low rate, 2.35%, medium rate, 3.2%, and high rate, 8%, to project Lagos State populations to 2050. Aliyu and Amadu (2017) suggested that the pace of urbanization in Nigeria is high, and Lagos has the highest annual urban growth rate of 5.8%. LWC based the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010)

on a population growth rate of 5%. Researchers used population growth rates of between 2.34% and 8% at various times to project the population of Lagos State up to the year 2050.

Evolution of Water Supply in Lagos: 1910 to Date

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), public water supply in Lagos started in 1910 with Iju Waterworks with a capacity of 2.42 million gallons per day (mgd) and an ND 28” trunk main “A” to serve the old Lagos (Lagos Island). ND 28” trunk main “A” is a pipe of nominal diameter (N.D.) of 28 inches (ND 28”) that carries potable water from the treatment plant to the distribution area, in this case from Iju waterworks to Lagos Island. . The waterworks was called Federal waterworks and was, primarily, to serve the colonial officials residing in Lagos Island, while the government identified the need to increase the capacity to serve adjacent areas. The subsequent upgrade of Iju waterworks increased the capacity to 6mgd with additional trunk main “B,” ND 24,” and the coverage increased to serve old Lagos (Lagos island), Apapa, and Ebutte-Metta (Lagos Water Corporation, 2010)

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), in 1954, there was a further expansion of Iju Waterworks to 11 mgd, and a third trunk main “C” ND 42” was constructed in 1962 and extended the water coverage to the residential /industrial areas of Ikeja, Ikorodu Road through Iddo, and East of the Metropolis. In 1977, LWC commissioned Isashi waterworks, with the capacity of 4 mgd, to serve West of the Lagos metropolis: Ishasi, Satellite Town, and FESTAC Town (Lagos Water Corporation, 2010). In 1982, there was a modernization of the Iju Waterworks,

which increased the capacity from 11mgd to 45 mgd; and LWC added 10 mini waterworks of a combined capacity of 24.6 mgd to boost the pressure in existing mains (Lagos Water Corporation, 2010).

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), in 1992, the LWC commissioned the Adiyen Phase 1 under the Lagos Water expansion project. Adiyen Phase 1 has the capacity of 70 mgd, 80 Km trunk mains (transport water from the treatment plant to distribution areas), 284 km secondary mains (pipes that form the skeleton of the distribution network for effective distribution of bulk water), 1600 Km tertiary mains (carry water from secondary mains towards customers), and 88, 200 house connections (connection of water to the customers). There has been a constant need for water supply expansion since 1910 when the primary focus was to serve the colonial officials residing in Lagos Island and later respond to the increasing population's water demand and cover new areas not served before. The total capacity of all LWC's waterworks, at full capacity utilization, was 210 mgd in 2010 (Lagos Water Corporation, 2010).

Bridging Demand-Supply Gap Through Water Supply Master Plan

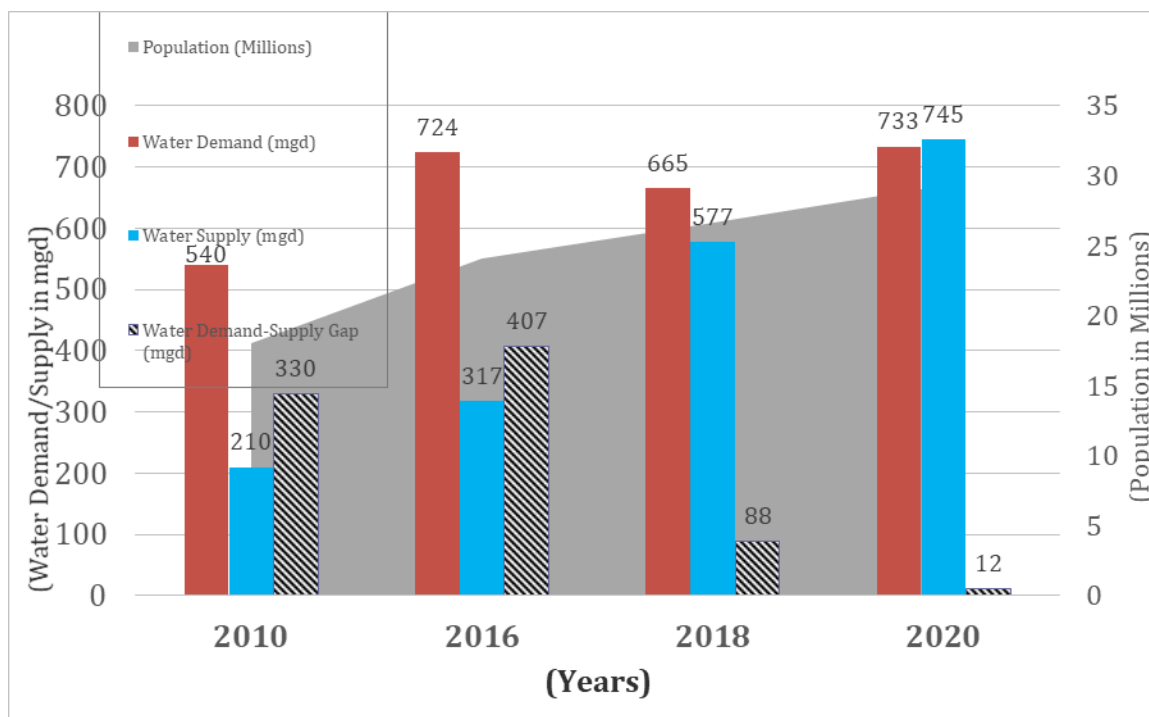
According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), the total water supply by LWC in 2010 under full capacity utilization include water supply from the three major waterworks comprising of (1) Adiyen Phase 1 (70 million gallons per day (mgd)), (2) Iju (45 mgd), and (3) Ishasi (4 mgd), totaling 119 mgd; and 48 Mini/Micro Waterworks with a combined capacity of 91 mgd. The total capacity

for all the waterworks stood at 210 mgd (Lagos Water Corporation, 2010). However, the waterworks are not operating at full capacity as about 60% of the water produced was unaccounted for (Lagos Water Corporation, 2010) or non-revenue water (NRW)(Dighade et al., 2014).

The LWC estimated the population of Lagos at 18 million in 2010, and using a population growth rate of 5%, the projected population for 2016 was about 24.1 million, for 2018 was 26.6million, and for 2020 was 29.3 million (Figure 4). Based on an estimated amount of water consumed by one person in one day (per capita per day in gallons (gcd), and population; waterworks (existing and planned) capacity, and calculated demand, the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), estimated the water demand-supply gaps for the years spanning 2010-2020, and the planned projects to close the gaps in the year 2020 (Figure 4)

Figure 4.

Lagos State Population and Water Demand-Supply Gaps.



Source: Lagos Water Supply Master Plan (Lagos Water Corporation, 2010).

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), in the short term, 2010-2016, LWC estimated the amount of water consumed by one person in one day (per capita water demand) at 30 gallons/capita/day (gcd). For a population of 18 million, the total water demand in 2010 was 540 mgd. With the baseline waterworks at full capacity utilization, the water supply was 210 mgd, leaving a gap of $(540-210)$ 330 mgd. For 2016, with the per capita water demand of 30 gcd, a population of about 24.1 million, the water demand was 724 mgd. The water supply, based on the full capacity utilization of all baseline waterworks in 2010 (210 mgd), and planned short-term projects that would add 107 mgd, was $(210+107)$ 317 mgd, resulting in the demand gap of $(724-317)$ 407 mgd in 2016.

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), the planned short-term (2010-2016) projects are (1) Adiyin Phase II Plant (70 mgd), 95 Km Trunk mains (transport water from the treatment plant to distribution area), and 2,359 Km Distribution Network (secondary mains, tertiary mains & house connections) slated for completion in 2016, (2) Odomola I Plant (25 mgd), 67 Km Trunk main, and 247 Km Distribution Network slated for completion in 2016, (3) Upgrading of Isashi Plant to 12 mgd, 30 Km Trunk main, and 120 Km Distribution Network slated for completion in 2016, and (4) Ota Ikosi Plant (4 mgd), 45 Km Trunk main, and 40 Km Distribution Network slated for completion in 2013. Together, all the short-term (2010-2016) projects were supposed to add 107 mgd to the existing LWC Waterworks capacity in 2016, thereby serving an additional 3.57 million people. The total estimated cost for the short-term projects was US\$ 737.66 million.

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), for the medium-term, 2017-2018, the Lagos Water Supply Master Plan reduced the per capita water demand to 25 gallons/capita/day (gcd) because of the planned effective water demand-side management. Therefore, with a per capita water demand of 25 gallons/capita/day (gcd) and a population of 26.6 million, the total water demand in 2018 was 665 mgd. However, based on the full capacity utilization of all baseline waterworks in 2016 (317 mgd) and planned medium-term projects that would add 260 mgd, the water supply was 577 mgd, resulting in the demand gap of (665-577) 88 mgd in 2018.

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), the planned medium-term (2017-2018) projects are (1) Odomola II Plant (90 mgd) and 500 Km Distribution Network slated for completion in 2018, (2) Adiyin Phase III (70 mgd) slated for completion in 2017, (3) Yewa I (Desalination) Plant (50 mgd), 60 Km Trunk main, and 200 Km Distribution Network, slated for completion in 2018, and (4) Ibeshe (Desalination) Plant (50mgd), 60 Km Trunk main, and 200 Km Distribution Network, slated for completion in 2018. Together, all the medium-term (2017-2018) projects were supposed to add 260 mgd to the existing LWC Waterworks capacity in 2018, thereby serving an additional 10.4 million people. The total estimated cost for the medium-term projects was US\$ 1035.94 million.

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), in the long-term (2019-2020), the Lagos Water Supply Master Plan retained the per capita water demand of 25 gallons/capita/day (gcd) because of the expected sustained effective water demand-side management. With a per capita water demand of 25 gallons/capita/day (gcd) and a population of 29.3 million, the estimated total water demand in 2020 was 733 mgd. The water supply, based on the full capacity utilization of all baseline waterworks in 2018 (577 mgd), and planned long-term projects that would add 168 mgd, was $(577+168)$ 745 mgd, resulting in a surplus of $(745-733)$ 12 mgd in 2020.

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), the planned long-term (2019-2020) projects are (1) Odomola Phase III Plant

(95mgd), 20 Km Trunk main, and 80 Km Distribution Network slated for completion in 2019, (2) Upgrading of Isashi Plant from 12mgd to 35 mgd, 50 Km Trunk main, and 120 Km Distribution Network, slated for completion in 2019, and (3) Yewa II (Desalination) Plant (50 mgd), 20 Km Trunk main, and 50 Km Distribution Network slated for completion in 2020. Together, all the long-term (2019-2020) projects were supposed to add 168 mgd to the existing LWC Waterworks capacity in 2020, thereby serving an additional 6.72 million people. The total estimated cost for the long-term projects was US\$ 712.35 million.

According to the Lagos Water Supply Master Plan (Lagos Water Corporation, 2010), the total estimated cost for the short, medium, and long-term projects was US\$ 2.485.95 million. As a result, the expected total addition to the 2010 baseline water supply in 2020 was 535 mgd. Furthermore, under an effective water demand-side management, the expected population to provide water supply in 2020, at per capita water consumption of 25 gallons per day (gcd), is 29.4 million, which is above the projected population of 29.3 million. As a result, the plan envisaged a 12 mgd water supply surplus for Lagos State by 2020.

Lagos Water Demand and Supply-Current Realities

LWC identified the problem of inadequate potable water supply to Lagos residents and developed a water supply master plan in 2010 (Lagos Water Corporation, 2010) to gradually narrow down the water gap and achieve a surplus of 12 mgd by 2020 (See Figure 4), through a combination of new water projects, and efficient water demand-

side management. However, the LWC has not been able to implement the water supply master plan, so the water problem persists. Based on Lagos Water Corporation's (2010) projection, the current water gap may be as high as 523 mgd due to the inability of LWC to deliver new water projects as planned.

With the current Lagos population of 21 million (Environmental Rights Action, 2016; Okonkwo, 2018), or 29.3 million projections by the LWC in the master plan, United Nations estimates that only 10% of the population have access to potable water supplied by the LWC (Heller, 2016). The lack of access to the water supply is due to LWC's inadequate production capacity and operational inefficiency, which cause water losses within the distribution pipe network (Balogun et al., 2017; Omole et al., 2016). Therefore, solving the water supply problems in Lagos State requires adequate production facilities, operational efficiency, adequate operation, maintenance funding, and new investments in water infrastructure.

In Nigeria, governments provide funds for water capital projects, staff salaries, and major operations and maintenance of the water schemes, while the governments expect water utilities to generate revenue through cost recovery to cater for routine operation and maintenance (Ohwo, 2016). However, LWC, like other water utilities in Nigeria, could not embark on effective operation and maintenance of water facilities due to inadequate government funding and poor cost recovery; and inadequate funding hampers its ability to embark on new capital projects (Balogun et al., 2017; Egbinola, 2017; Ohwo, 2016). The Lagos Water Supply Master Plan (Lagos Water Corporation,

2010) failed to address the problem of Lagos water supply due to lack of implementation, making the water situation in Lagos State today, at least, comparable to the 2010 baseline when LWC developed the water supply master plan, or worse.

Climate Change and Water Resources

Human activities over the years have increased the atmospheric concentration of greenhouse gases (GHGs) with a negative effect of global warming and climate change, which affects water supply. Climate change is a big problem for the world today, and the United Nations (UN) has championed the need for collaborative actions to mitigate or adapt to climate change. Furthermore, the Intergovernmental Panel on Climate Change (IPCC) (2013) stressed the need to adjust to actual or expected climate change and its effects through adaptation, which seeks to moderate or avoid harm or exploit beneficial opportunities. In line with such adaptation, Ayeni (2017) suggested that the Lagos state government should align land use and environmental protection as a proactive step towards mitigating the effects of potential climate change.

Kandissounon et al. (2018) suggested uncertainties around the future impacts of climate change in Lagos. Hurlimann and Wilson (2018) stressed the need to take a broader look at climate change and adaptation in the water sector because a clear understanding of climate change adaptation will foster sustainable water supply management. The climate change phenomenon affects the ability of water utilities to provide a sustainable water supply.

There are many potential impacts of climate change on water resources. Bates et al. (2008) suggested that the effects of climate change on water resources include increased rainfall intensity and variability, floods, and droughts, changes in water quality and quantity. According to the authors, other effects are increased water demand and potential disruption of water facilities by floods, which might impact the economy and threaten food security. Mapfumo and Madesha (2014) suggested that climate change is one of the main challenges of urban water supply in Zimbabwe and urged the government to strengthen climate change coordination and approach climate change from multidimensional perspectives.

Bates et al. (2008) reported that climate change problems are yet to get the necessary focus. They suggested that the current water management practices might be grossly inadequate to address the anticipated impacts of climate change. Through a holistic approach, a thorough consideration of the effects of climate change on the overall water resources will help policymakers in water utilities either mitigate the effect of climate change or adapt to them. Mitigation against and adaptation to climate change are necessary to ensure a sustainable water supply.

Curtailling the effects of climate change on water supply requires a thorough understanding of the whole cycle of water management. Hurlimann and Wilson (2018) suggested that climate change problems concerning the water supply are at both the demand and supply sides of water management. On climate change and the onset of impacts, Shrestha et al. (2019) suggested that since the effect of climate change is not

immediate and sudden, the majority of the people in Melamchi, Nepal, do not consider it a severe problem. On the need for integrating the various components of water supply management, Yeleliere et al. (2018) suggested that the management of Ghana's water resources over the years is not effective due to the difficulty of adequately integrating various components, including climate variability. Climatic change and the world population's growth to over 8.5 billion by 2030 (United Nations, 2015) makes the sustainable management of water resources and water supply by all stakeholders' imperative (Marques et al., 2016).

Climate change increases water demand on the one hand, and on the other hand, decreases the functionalities of water supply facilities to meet the demand (Bates et al., 2008). There is also the problem of getting the populace to accept climate change as a current problem due to the futuristic nature of its adverse effects (Shrestha et al., 2019). Besides, in some instances, there might be no proper integration of climate change with other factors that affect water supply management, and efforts on climate change among various disciplines might lack proper coordination to provide reliable climate change input in water supply planning and management (Yeleliere et al., 2018). Moreover, most of the actions required to mitigate the effects of climate change, such as greenhouse gases (GHG) reduction, and control of land use and development (Ayeni, 2017), might be beyond the control of water supply policymakers (Rietveld et al. (2016).

Rietveld et al. (2016) suggested that water supply management comes with feedbacks, cascading consequences, and issues that might be beyond the purview of

water managers. However, the effect of climate change is an essential consideration for urban water supply management, and policymakers and water managers should create adequate awareness of the impacts on the populace (Shrestha et al., 2019). It is, therefore, necessary to have water supply management strategies that can mitigate or be adaptive to the current and potential effects of climate change to be sustainable (Intergovernmental Panel on Climate Change, 2013).

Water Infrastructures and Operation of Water Facilities

Water Infrastructures

The problems of inadequate water supply in developing countries increase due to poor operation and maintenance culture. Like in most cities in Nigeria, Abubakar (2016) suggested that water supply infrastructure maintenance in Abuja suffers poor maintenance, resulting in low water pressure, water contamination episodes, and loss of reliability. Dunmade (2017) suggested that insufficient attention to maintenance by water agencies in Nigeria leads to the decay of water supply facilities, thereby aggravating inadequate water problems to the populace. Balogun et al. (2017) suggested that part of the problems confronting LWC is the low operational efficiency of the existing water facilities that engenders leakages. Insufficient water infrastructure maintenance is the primary cause of poor water services in most cities and rural areas of the developing countries, including Lagos (e.g., Balogun et al., 2017; Chukwuma, 2017; Dighade et al., 2014; Yaro et al., 2019).

The poor state of water facilities and poor maintenance culture contribute to the low potable water supply in most urban, peri-urban, and rural areas of developing countries, including Lagos. Okeola and Sule (2012) suggested that water supply services require sufficient funding for effective operation and maintenance that have a direct bearing on sustainable water supply. Lack of maintenance also undermines water quality produced as it travels through the dilapidated water distribution networks (Ohwo, 2014). The poor state of water facilities and maintenance results in inefficient operation and inadequate water supply.

Operation of Water Facilities

In most water utilities in developing countries, including Nigeria, poor operation and maintenance culture lead to inefficient operations that manifest in breakdowns, water losses, and water contamination. For example, Abubakar (2016) suggested that the primary function of the water delivery system in Abuja does not work due to poor infrastructure maintenance, and episodes of contaminated water, among others. Balogun et al. (2017) suggested that LWC should improve the existing waterworks' operational efficiency to reduce leakages. Kandissounon et al. (2018) argued that water losses in the distribution networks are a significant factor in inadequate water supply in Lagos. Chukwuma (2017) suggested that the water demand and supply gap in some communities in Enugu, Nigeria is due to the dysfunctionality of water facilities provided by governments and Non-Governmental Organizations (NGOs).

Dighade et al. (2014) suggested that high Non-Revenue Water (NRW) (about 35%) in most water utilities in developing countries is due to poor operation and maintenance, among others. Low water facilities maintenance is a setback for water supply sustainability in developing countries (Yaro et al., 2019). Dunmade (2017) suggested that the water supply problems in peri-urban are due to abandoned water supply projects and poor maintenance culture. Ohwo (2016) suggested that the problems of inadequate water supply in major Nigerian cities are inadequate infrastructure investment, poor maintenance of the existing water facilities, and dysfunctional distribution networks. Ohwo (2014) suggested that leaking pipes in the distribution network reduces water quality along the pipeline from the source, Iju waterworks, to the points of use at Ojota, Lagos, Nigeria.

Inefficient operation reduces the capacity of the facilities to operate at optimal levels. Also, a considerable amount of water produced is unaccounted for, or non-revenue water (NRW), due to losses, illegal connections, and sabotage (Lagos Water Corporation, 2010). The implication of this is that even the available water from these facilities gets lost in the distribution network without reaching the consumers (Lagos Water Corporation, 2010). The water quality is also undermined by leakages, resulting in water-related diseases due to contamination (Ohwo, 2014; Osiemo et al., 2019; Pirsahab et al., 2017; Rehman & Baig, 2017). Inefficient operation compounds the problem of inadequate water supply; this leads to loss of revenue, thereby hindering water utilities,

such as LWC, to recover cost and be self-sustaining (Balogun et al., 2017; Dighade et al., 2014).

Operational Efficiencies of Lagos Waterworks

Balogun et al. (2017) reported poor and declining operational efficiencies for all the LWC waterworks; operational efficiencies ranged between 4.87% (lowest) and 38.05% (highest). For example, some waterworks with considerably high operational efficiencies were Lekki Peninsula, 38.05%, Apapa, 34.66%, Ikoyi, 34.43%, Dolphin, 25.59%, Victoria Island Annex, 22.14%, and Ajegunle, 21.93%. On the other hand, the waterworks with the least operational efficiencies were Epe, 4.87%, Eredo, 7.84%, Shasha, 8.11%, Badagry, 9%, Alausa, 11.76%, Idimu, 12.17%, and Igando, 13.51%. In their study, Balogun et al. (2017) observed a progressive decline in operational efficiencies in all the LWC waterworks, thereby hindering the ability of LWC to provide the populace with adequate potable water supply. In addition to inadequate water facilities, LWC did not fully utilize its existing water supply facilities; therefore, maintaining existing water facilities, especially the distribution networks, might be vital to solving the water demand-supply gap problem in Lagos state.

Institutional and Organizational Capacity

Rural water supply in most developing countries has the problem of capacity. Behailu et al. (2017) suggested that the absence of uniform implementation approaches, and institutional and organizational capacity at the local levels, contribute to the inadequate rural water supply in Ethiopia. Chukwuma (2017) suggested that one of the

problems hindering domestic water supply efforts in rural communities of Enugu, Nigeria, is, lack of institutional and organizational capacities at the community level. Adequate policy and appropriate levels of workforce are necessary for successful water supply outcomes. In the absence of these, the rural water supply will not have the ability to function at an optimum level, and this will have cascading consequences on the urban water supply through increased rural-urban migration.

Water Governance

There is no one-size-fits-all definition for water governance; the definitions are context-specific and depend on researchers' approaches (Ribeiro & Johnson, 2018; Woodhouse & Muller, 2017). Woodhouse and Muller (2017) suggested that various approaches researchers adopted over the years result in various perspectives on the definition of water governance. Ribeiro and Johnson (2018) suggested that water governance definition depends on the contexts, which could be social, environmental, and economic, among others suggested that the design of water governance is tailored towards solving identified water management problems. According to the United Nations' original definition, water governance is a combination of the political, social, economic, and administrative systems to direct the management of water resources and water services at different levels of society.

Improving upon earlier definitions, Pahl-Wostl (2015) defined *water governance* as "the social function that regulates development and management of water resources and provisions of water services at different levels of society and guides the

resources towards a desirable state and away from an undesirable state." Pahl-Wostl (2017) attributed most of the water supply problems to governance failure at different levels. These problems include weaknesses in role and responsibility definitions, resource allocation and financial management, accountability among critical stakeholders, and failure to provide an enabling environment for private-sector participation (Marques et al., 2016). Thus, the performance of the water sector depends on the effectiveness of its water governance.

The water sector is complex, and many factors of water governance influence the sector's performance. Berg (2016) suggested that institutions, interests, information, incentives, ideas, ideals, and leadership are the vital elements that influence the water sector's performance. Hirano (2016) suggested that there would be damage to legitimacy when decision-makers are remote from critical stakeholders and emphasized that the direct engagement of local stakeholders could foster legitimacy. Neto (2016) suggested an "urban age" water governance that will integrate water management, governance, and policies, at multiple levels and frameworks appropriate to different actors.

Leadership is essential to achieve proper integration and interactions of vital influencing elements that foster performance. The organization works well and achieves its objectives when leaders integrate the various efforts effectively (Bolman & Deal, 2013). Furthermore, the direct engagement of critical stakeholders will make the system work and foster legitimacy (Kasri et al., 2017; Rietveld et al., 2016). Finally, the integrated framework will set expectations for various actors at all levels of the water

supply sector and provide an inclusive implementation guide that incorporates everybody and ensures no activities fall through the cracks.

Comprehensive water management that considers all critical stakeholders, roles, interactions, and relationships, will enhance water supply performance. Kasri et al. (2017) ascribed sustainable rural water service delivery to quality citizens and government engagement in Indonesia. Horning et al. (2016) suggested that understanding human-social relationships is critical to ensure the success of sound water governance principles at the level of implementation. Casadevall (2016) suggested that water resource availability and competing interests introduce complexity to water governance. The author suggested that achieving results requires stakeholders' involvement in decision-making and an inclusive approach that encourages all sectors' social learning and full participation.

Dealing with the complexity of interactions among critical stakeholders in the water sector and the environment's feedback requires an adaptive governance approach (Pahl-Wostl (2017). Adaptive governance is the ability of a governance system to make the necessary process and structural adjustments in response to current or expected changes in the social or natural environment (Pahl-Wostl, 2015). Adaptive water governance will provide the flexibility needed by policymakers and implementers to bend forward and backward to accommodate different stakeholders, competing interests, and environmental feedbacks without system breakdown. Thus, the adaptive water

governance approach is inherently supportive of continuous improvement in water governance.

Good water governance will provide the basis for determining appropriate pricing and tariffs that meet social, economic, and environmental sustainability criteria acceptable to all stakeholders. Molinos-Senante and Donoso (2016) suggested that a context-specific water rate that factors water scarcity, affordability, and equity is necessary to set a water tariff structure. Martins et al. (2016) argued that low-income and vulnerable populations are in developing and developed countries; therefore, affordability should not be generalized. Instead, the authors suggested using relevant factors, such as income, to set a social tariff for low-income and vulnerable populations. Using income to set a social tariff would align with the spirit of human rights to water.

Guimarães et al. (2016) suggested inclusive principles in water governance to guarantee the access of the vulnerable in society to water and sanitation. Wang and Ge (2016) suggested stakeholders' participation in water supply management to increase consumers' cooperation and willingness to pay (WTP). Soto Rios et al. (2018) suggested that water pricing as a tool for management and behavioral change could promote efficient water use among stakeholders. Deyà-Tortella et al. (2017) suggested that the effect of an increased tariff on efficient water use among stakeholders is temporary because people revert to their usual water consumption patterns after some time. Sound water governance should set appropriate water tariffs that meet social, economic, and environmental sustainability criteria without jeopardizing human rights to water.

Forms of Water Governance

Water governance comes in different styles or modes; these are hierarchical, network, and market. Pahl-Wostl (2015) suggested that hierarchical, network, and market governance styles differ based on the degree of formality of institutions and the roles played by government and non-government actors in the water sector. Pahl-Wostl (2019) suggested that the governance modes are hierarchical, a form of top-down control, as seen in government, self-governance, without government control over the actors and co-governance, which involves public and private sectors' interactions devoid of any central control. The different governance styles imply that the government can fully control water supply, or partially through public and private partnerships, or the private sector can fully control the water supply through complete privatization or networks governed by informal institutions. The form of water governance determines the focus, ranging from seeing water as purely a social service to seeing it as a maximum profit venture.

A mix of different governance modes, with its associated benefits and flexibility, will produce better results than individual modes in a continually changing environment (Pahl-Wostl, 2019). The author suggested that hybrid governance styles that leverage the benefits of various governance modes could be more effective in addressing the complex challenges of water supply. The urban water supply is complex, with various stakeholders having affinities for different governance styles, working together for a common goal. This complexity may necessitate combining various governance styles that will engender

flexibility and quick adaptation to the changing external environment to achieve the desired result.

The Role of Governance in Water Supply

Water governance is key to the achievement of sustainable rural and urban water supply. Pahl-Wostl (2017) suggested that water governance plays a significant role in achieving sustainable water resources. Marques et al. (2016) suggested that water supply problems can be solved when players address governance and technical issues. Abubakar (2016) suggested that adequate water governance can help solve inadequate potable water issues in Abuja, Nigeria. Magombo and Kosamu (2016) implicated poor water governance as one of the challenges of water accessibility in the urban centers of Malawi.

Water governance provides clear definitions of roles and relationships among critical stakeholders, such as policymakers, operators, customers, regulators, and other companies performing similar functions (Marques et al., 2016). Proper integration of various efforts (Bolman & Deal, 2013) could help achieve a sustainable water supply. Akpabio and Ansa (2013) suggested that good water governance in Nigeria could lead to efficient and improved service delivery. Water governance is a critical consideration in water supply, as it plays a vital role in water supply efforts, with varying results, in countries around the world. Water governance should be robust and adaptive to the changing nature of economic and natural environments.

Water Governance Gaps

There will be gaps in water governance when it fails to put relationships between issues and actors in the right perspectives. Bergsten et al. (2019) suggested that integrative gaps occur when actors manage interdependent issues in isolation without considering their connections, and collaborative gaps occur when the actors are addressing common issues in siloes. Integration of efforts is essential for performance (Bolman & Deal, 2013), especially in a complex system such as water supply that requires multiple perspectives and clarity of roles and relationships. Any gap, whether integrative or collaborative, could impact the ability of water utility to achieve the desired result. Therefore, there is a need for appropriate water governance, especially in Nigeria, to reduce possible conflicts and confusion among the various stakeholders in the water sector.

The relationship between actors in water resources management and water supply delivery must complement each other to achieve the desired result. These complementary efforts could prevent both integrative and collaborative gaps. Therefore, comprehensive water governance, robust enough to ensure integration and collaboration of the various inputs and the environmental feedbacks, is necessary to achieve the set objectives.

Water Governance around the World and its Impact on Performance

Water governance styles vary from hierarchy to market to network, or hybrid form, and differ from one country to another, and may reflect the national governance styles (Pahl-Wostl, 2019). Hierarchical, network and market governance differ based on

the degree of formality of institutions and the government's role versus non-government actors' roles (Pahl-Wostl, 2015). Pahl-Wostl (2019) suggested that the Netherlands practices a hybrid form of water governance that involves an integrated and adaptive approach, making the government role flexible and pragmatic, and reflective of the requirements of the dominant water governance style. In contrast, Germany is more hierarchical in governance than the Netherlands. Legislation drives water governance, and market and network styles dominate the implementation in Germany (Pahl-Wostl, 2019).

In line with its national governance system, China has its water governance as hierarchical; decision-making is shared by the various levels of governments, leaving out other critical stakeholders, while they emphasize market-style in implementation (Pahl-Wostl, 2019). The predominant water governance in Australia is market mechanisms; however, the hierarchical governance style dominates its water legislation while network governance prevails in the implementation (Pahl-Wostl, 2019).

Water Governance in Selected Developing Countries

South Africa

In South Africa, the water policy is to achieve a mix of hierarchical and network governance, with little room for market influence (Pahl-Wostl, 2019). However, the lack of capacity by the government to provide direction hampered the smooth implementation of this mix, resulting in poor water management performance (Pahl-Wostl, 2019). The resultant effect of the government's lack of capacity led to poor water management in

South Africa, which resulted in a severe water crisis, in the recent past, in some regions of the country.

Tanzania

The Tanzanian National Water Policy adopts a multi-stakeholder approach, which recognizes the community's participation, private sector, Non-Governmental Organizations (NGOs), and other actors in water resources and supply management (Kabote & John, 2017). This water policy departs from an earlier approach where the government monopolized water resources management in rural and urban areas (Kabote & John, 2017). The earlier approach is comparable to a hierarchical style of governance, which is a form of top-down control, typical of government (Pahl-Wostl, 2019). Kabote and John (2017) noted that, while the national policy emphasizes water users' community participation in water supply management, there is no clarity on the specific roles for the informal institutions and structures.

Therefore, a policy or regulatory gap limits community participation because of a lack of clear policy about the extent and how informal institutions should work in parallel with formal institutions (Kabote & John, 2017). The authors further noted greater access to safe water in urban areas than in rural areas. The implication is that the impact of water governance problems is more felt in rural areas than urban centers.

Ghana

Ghana Water Company Limited (GWCL), an institution owned by the government, is vested with the power to provide potable water supply to all urban communities in Ghana (Lugaterah & Dwomoh, 2017). This arrangement is a form of top-down control, reminiscent of a hierarchical style of governance (Pahl-Wostl, 2019). As a result, many public water utilities have multiple issues to contend with (Imonikhe & Moodley, 2018). These issues have their underlying causes as, mostly, governance failure at different levels (Pahl-Wostl, 2017). These challenges lead to inadequate water supply (Abubakar, 2016; Ayeni, 2017; Balogun et al., 2017).

Policy and regulatory constraints are the major handicaps to filling water demand and the supply gap in the water supply sector. The informal institutions in the form of self-help, or private vendors, which might fill the gap, have a policy and regulatory constraints (Ahmad, 2017; Chukwuma, 2018; Muhammad & Dansabo, 2018; Ohwo & Agusomu, 2018). The successes or failures of the water supply management in these countries depend on the flexibility and the effectiveness of their water governance styles. It is, therefore, essential to have adequate institutional frameworks to effectively integrate the efforts by both the formal and informal actors in the water supply sector.

Water Governance in Nigeria

Water governance and water policy come to play, depending on the focus of the researcher. Pahl-Wostl (2017) suggested that the term water governance suggests the researcher's strong affinity for social science that allows a broader understanding of the

human dimension of water management; water policy suggests a strong focus on technical and engineering dimensions. Players in the water sector could view water supply issues within the technical and engineering lens and could also view water issues from the broad context of the human dimension of water management. Nigeria's water policy choice indicates a strong affinity for the technical and engineering dimensions of water management without its broad human dimension.

In the Nigerian context, Okeke (2015) defined water governance as identified courses of action that will provide sustainable management of the nation's water resources and ensure adequate, safe, and affordable water to the populace. Adams et al. (2018) suggested that improving urban water supply access in Sub-Saharan Africa will require a non-traditional approach to water governance and institutional frameworks that strike the right balance among the public, private, and community participation.

The Nigerian water policy (The Federal Republic of Nigeria, 2004) and the Tanzanian water policy (Kabote & John, 2017) emphasized community and stakeholders' participation in the water supply management. However, community and stakeholders' participation is not practiced in Nigeria, as most critical stakeholders in the water sector are not aware of the national water policy (Okeke, 2015). Moreover, the participation of the community and other stakeholders in the water sector comes with policy and regulatory constraints (Ahmad, 2017; Chukwuma, 2018; Muhammad & Dansabo, 2018). The same policy and regulatory constraints issue occur in the Tanzanian National Water policy of 2002 (Kabote & John, 2017).

The Nigerian national water policy (The Federal Republic of Nigeria, 2004) vests the control of water resources and water supply management on the three tiers of governments, which makes the water policy comparable to hierarchical styles of governance, which is a form of top-down control, as seen in government (Pahl-Wostl, 2019). The same policy recognizes community and stakeholders' participation; however, this is not the case during implementation. The failure of the government-controlled water sector to provide adequate water to the populace allows the private or for-profit water vendors to fill the gap (Ahmad, 2017; Coster & Otufale, 2020; Muhammad & Dansabo, 2018; Ohwo & Agusomu, 2018;).

The filling of this gap is a form of market-style governance, where the private sector, through complete privatization, or public-private-participation arrangement, manages water issues (Pahl-Wostl, 2019). These private players struggle for space to operate because of policy and regulatory constraints, which preclude them from governments' technical and financial assistance (Ahmad, 2017; Muhammad & Dansabo, 2018). The communities and other informal groups embark on self-help water projects (Ishaku et al., 2011), a form of network governance style where the government does not control the actors in the water sector (Pahl-Wostl, 2019). This network governance style also struggles for space because of policy and regulatory constraints, denying the players technical and financial support (Ahmad, 2017; Chukwuma, 2018).

Most of the previous studies carried out to find solutions to the problems of inadequate water supply by the LWC (e.g., Ayeni, 2017; Balogun et al., 2017;

Kandissounon et al., 2018) emphasized the technical and engineering dimensions of the problems, with limited focus on the broader understanding of the human-social dimension. Most water supply problems are due to governance failure at different levels (Pahl-Wostl, 2017). Horning et al. (2016) suggested that a clear understanding of the human-social relationships is vital to eliminating the failure of sound water governance at the implementation level. The previous emphasis on the technical and engineering dimensions of the problems, with a narrow focus on the human-social dimensions, might explain the problems' persistence. The various efforts by previous researchers to address the issues of inadequate water supply in Nigeria and Lagos have not yielded the desired results.

Nigerian National Water Policy

The three tiers of government in Nigeria, federal, state, and local, are jointly responsible for providing water supply and sanitation services. Nigeria National Water Policy (The Federal Republic of Nigeria, 2004) gives the federal government the statutory responsibility, through the Federal Ministry of Water Resources, for policy formulation, research and development, national funding, technical support, water supply development, and management coordination, and provision of an enabling environment for private sector participation in the water sector. In addition, the national water policy mandates the state governments to establish and operate urban and semi-urban water supply systems. In contrast, in collaboration with the local communities, the local

governments are charged with the responsibility to establish, operate, and maintain rural water supply schemes.

The Federal Ministry of Water Resources also provides regulatory and oversight functions to the various state water agencies. Egbinola (2017) suggested that despite the robustness of the Nigerian water institutional framework, there is a lack of coordination among institutions and other critical stakeholders, resulting in redundancy and inefficiency. This lack of coordination results in what Bergsten et al. (2019) called an integrative gap, which occurs when interdependent issues are managed in isolation as if they are not connected, and a collaborative gap occurs when actors work in siloes on issues that are common. There is evidence of both gaps in the management of the water sector in Nigeria.

Collaboration, integration, and the need to see the water system as a whole are necessary to achieve results. As one of the states in Nigeria, Lagos State has the mandate to establish and operate urban and semi-urban water supply systems in Lagos State. However, LWC carrying out this function is not meeting the mandate of adequate water for the Lagos residents.

Lagos State Water Institutional Framework

According to Lagos Water Corporation (2019), a 1985 edict by the Lagos state government established the Lagos State Water Management Board (LSWMB), which was later elevated to the Lagos State Water Corporation (LWSC) by an edict of 1994. By 2004, the Lagos Water Sector Law established the LWC as an asset holding company

with the mandate to develop, operate, maintain, and own all the water supply and sewerage services assets (Lagos Water Corporation, 2019). The same edict of 2004 also established the Lagos State Water Regulatory Commission (LSWRC), with the mandate to protect the interests of consumers in the areas of quality, price, and reliability of service by the providers (Lagos State Water Regulatory Commission, 2019).

The Lagos State Water Regulatory Commission (LSWRC) facilitates the operation of water and sewage services in Lagos state and ensures actors get commensurable returns on investments to galvanize the implementation of water supply schemes (Lagos State Water Regulatory Commission, 2019). The commission regulates public water suppliers, LWC, private operators, and individual water supply efforts for personal use. Under the ministry of health, the Lagos State Drug Quality Assurance laboratory is saddled with water quality assurance from water supply systems (Lagos State Ministry of Health, 2019). Lagos State Environmental Protection Agency (LASEPA) monitors Lagos water bodies in the areas of wastewater, solid and liquid waste disposal, groundwater, and other environmental issues in the state and set pollution levels and other environmental laws, which it ensures companies, including LWC, comply with (Lagos State Environmental Protection Agency, 2019). The Lagos State Wastewater Management Office (LSWMO) formulates wastewater policy to address wastewater management in urban, semi-urban, and rural areas of Lagos State (Lagos State Waste Water Management Office, 2019).

There are many regulating agencies responsible for the water sector in Lagos state and the regulatory and oversight functions provided by the Federal Ministry of Water Resources. However, Egbinola (2017) noted that one of the weaknesses of the Nigerian water institutional framework is a lack of coordination among institutions, and other critical stakeholders, resulting in redundancy and inefficiency. In addition, the absence of coordination is a potential for integrative gaps, which occur when actors manage interdependent issues as stand-alone, and collaborative gaps, which occur when actors working on common issues work independent of one another (Bergsten et al., 2019).

Bergsten et al. (2019) also suggested that interdependency becomes complex when various governance actors have different roles, interests, beliefs, and capacities. The lack of proper coordination among various actors in the water institutions (Egbinola, 2017) is a precursor for both integrative and collaborative gaps in the management of the water sector in Nigeria. Bolman and Deal (2013) suggested that organizations cannot achieve their objectives when leaders do not define roles and relationships adequately and integrate efforts well. Ohwo (2016) suggested that the problem of inadequate water supply in Lagos is partly due to inadequate water governance in water supply policy and the absence of autonomy for LWC.

Water Supply Management Options or Strategies

The overall increase in water demand, dwindling water resources, and water supply variability due to many factors such as climate change call for sustainable water supply management strategies. Rathnayaka et al. (2016) suggested that assessment of

these strategies are based, at varying degrees, on economic, environmental, social, risk-based, and functional sustainability. Therefore, for sustainable water supply management, potential strategies must satisfy the right combination of the economic, environmental, social, risk-based, and functional sustainability criteria.

There are three main management strategies or options for the urban water supply system, and the choice of any one of them depends on the sustainability criteria of interest in a given context. Okeola and Sule (2012) suggested three main water supply management options based on the prevailing water sector in Nigeria and best practices around the world; and these options or strategies are (a) public ownership and operation, (b) public ownership and private operation, and (c) private ownership and operation.

Public Ownership and Operation

For this strategy or option, the public water supply management is owned and operated by the government or its organ and comes with disadvantages that hinder adequate water supply. First, the option comes with inefficient operation and low-quality service delivery (Abubakar, 2016; Balogun et al., 2017; Okeola & Sule, 2012). Second, the option has inadequate funding for maintenance and operations and new water infrastructure investments (Egbinola, 2017; Ohwo, 2016; Okeola & Sule, 2012). Third, the option results in dysfunctional facilities due to aging and lack of maintenance (Balogun et al., 2017; Chukwuma, 2018; Ohwo, 2016; Okeola & Sule, 2012). Morris (2017) suggested that there is a tendency for politicians, by excessive politics, to neglect investments in water infrastructure because it is mainly underground and concealed from

public view. Politicians, mostly in developing countries, prefer projects that would give them immediate political mileage.

The option has the disadvantage of poor cost recovery due to poor service delivery, ineffective metering and billing systems, and low tariff (Abubakar, 2016; Balogun et al., 2017; Dighade et al., 2014). Furthermore, the option promotes poor water governance that does not leverage the benefits of private-sector efficiency in water supply management (Abubakar, 2016; Magombo & Kosamu, 2016). The limiting factors mentioned above hamper the capacity of public water utilities to deliver on the primary mandate of adequate water supply to the populace (Abubakar, 2016; Ohwo, 2016). LWC is a government-owned and operated outfit established as a commercial entity with the mandate to supply adequate potable water to the populace in a self-sustaining manner (Lagos Water Corporation, 2019). However, the corporation lacks efficiency and effectiveness (Balogun et al., 2017; Chukwuma, 2018; Ohwo, 2016). Lack of efficiency and effectiveness makes the corporation fail to provide adequate potable water to the Lagos residents.

Public Ownership and Private Operation

This strategy involves joint water supply management between the government and the private sector. According to Okeola and Sule (2012), the government owns the asset, while contractors manage the operation and maintenance in a public-private arrangement. Morris (2017) suggested that public-private partnership is not immune to challenges, with inadequate frameworks not protecting all interests. This option requires

certain factors such as strong political will, strong fiscal capacity, public acceptance, adequate policy and legal frameworks, appropriate water pricing, among others, to succeed (Ameyaw et al., 2017). The option also comes with managing certain risks to succeed; these include unstable foreign exchange rates, corruption, water theft, non-payment of bills, and interference from politicians (Ameyaw & Chan, 2015).

Mvulirwenande et al. (2019) suggested that delegated management of water supply to contractors holds promise for developing countries if there are adequate institutional frameworks and policies and the water utilities are ready to learn from such management contracts. This option ensures the government does not neglect its responsibility of providing adequate potable water supply to the populace. However, shifting the burden of technical efficiency and financial viability to the private partner may be a sure way to ensure reliable and sustainable service delivery.

Private Ownership and Operation

This strategy involves handing over ownership and operation of water facilities to the private sector, which provides adequate potable water to citizens. They charge citizens for the services, while the government offers an enabling environment and performs regulatory and oversight functions to ensure quality and compliance with the regulatory frameworks that govern the operations of private water companies. Okeola and Sule (2012) suggested that the private sector takes over the public assets and liabilities and allows market forces and profits to drive the water supply sector; and also noted that this option comes with high risks of monopoly. The belief is that the business approach of

private companies would remove problems with inefficiency and ineffectiveness of public organizations (Pahl-Wostl, 2017). However, this option could only succeed if the government effectively and efficiently performs its regulatory and oversight functions.

Abubakar (2016) suggested that outright privatization may come with huge risks because water, as a natural monopoly, requires regulatory capacity on the part of the government. Government agencies responsible for regulatory and oversight functions of the water sector may lack regulatory capacity (Behailu et al., 2017; Chukwuma, 2017). The primary purpose of private sector ownership was to take advantage of perceived private ownership efficiency compared to the government.

However, Barbosa et al. (2016) found that ownership type, whether private or public, and regulatory agency might not necessarily translate to improved water utility efficiency. The authors analyzed the effect of governance on the dynamic efficiency of water utilities and suggested that privatization of the Brazilian water and sewage sector does not guarantee increase in the efficiency of the water sector. There was no evidence to back up the claim in some quarters that private ownership has greater efficiency than public ownership (Barbosa et al., 2016). Privatization might not be in the public's interest because it could negate the principle of water as a public good (Zeneli, 2017).

It is essential to consider the capacity of government agencies to regulate the private sector for quality service delivery and prevent the risks of monopoly that could lead to increased cost or low-quality service (Abubakar, 2016). Where private vendors fill the gaps created by public water utilities in Nigeria, policy and regulatory constraints,

inhibit such private actors (Ahmad, 2017; Muhammad & Dansabo, 2018). Also, privatization could impact the human rights to water, thereby denying the poor and the vulnerable population access to water as a basic need. Therefore, the complete privatization of urban water supply management will require a robust regulatory capacity to succeed.

Choice of Water Supply Management Option

The evaluation of the management options can assist policymakers in water utilities in their operation and the design of alternative system improvement works. Okeola and Sule (2012) evaluated the three management options, using multicriteria decision analysis (MCDA), and found that the stakeholders in Offa, Nigeria, prefer public ownership and private operation of the public water utility to foster sustainable water service delivery and satisfy environmental, economic, technical, institutional and sociocultural criteria. The authors suggested that ownership, financing, operation, and risk responsibilities are essential in water supply management. The authors further suggested that the government must not produce and regulate water supply at the same time. Furthermore, there must be financial sustainability at operation and maintenance levels (Okeola & Sule, 2012).

The water supply management option must place a high premium on consideration for increasing variability in the climatic conditions (Ayeni, 2017) by putting heavy weight on the environmental sustainability criteria (Rathnayaka et al., 2016). Stressing the importance of inclusive decision-making, Suleiman and Khakee

(2017) suggested that managerial perspectives are inadequate for any reforms in the water sector; institutional and social issues are essential for any reforms' success. Okeola and Sule (2012) key stakeholders' knowledge and experience of water supply delivery system to explore the sustainability factors that determined the water supply management option for the Offa community. The participation of key stakeholders in the decision-making process to choose the water supply management option for Offa, Nigeria, could enhance legitimacy, success, and sustainability.

The water supply management option should also consider cost recovery by weighing heavily, on economic sustainability criteria, by considering affordability and appropriate tariff. Molinos-Senante and Donoso (2016) suggested that the water rate should consider affordability. However, Martins et al. (2016) argued that affordability should not be generalized based on the country's development level, as low-income and vulnerable populations are present in any country. Guimarães et al. (2016) suggested using sound water governance principles that embrace inclusive governance and access to ensure the vulnerable in society have unhindered access to water and sanitation.

Further, adequate legal and regulatory frameworks should protect private investments without jeopardizing the public good (Morris, 2017). Chepyegon and Kamiya (2018) reported the success story of a deliberate policy to protect the poor and the vulnerable in Kenya's water supply area. It is essential to ensure that, no matter the sustainability criteria adopted, the ability and willingness to pay is necessary for any management options for water supply (Coster & Otufale, 2020; Ohwo & Agusomu,

2018). Besides, citizens' human rights to water should not suffer through excessive tariffs and lax government regulatory frameworks (Abubakar, 2016; Zeneli, 2017). Therefore, the protection of private investments and involvement of critical stakeholders by the government by creating an enabling environment is essential for sustainable water supply management (Kasri et al., 2017; Monney & Antwi-Agyei, 2018; Rietveld et al., 2016).

The sustainability of the water supply system could improve through the involvement of critical segments of the society in water supply management decision-making and project implementation. Opeyemi and Bayode (2018) suggested that women's involvement in water projects is low, even though the more women are involved, the greater the sustainability of water projects. Chima and Itabita (2018) suggested that community members' involvement in the rural water supply scheme could ensure sustainability.

Insufficient use of local communities and traditional water management practices are responsible for the unsustainability of most community water projects (Aper & Aku, 2018; Behailu et al., 2017; Chukwuma, 2018; Sherry et al., 2018). The non-inclusion of local communities and traditional water management practices is due to a lack of regulatory frameworks that accommodate all critical stakeholders (Abubakar, 2016; Chukwuma, 2018; Ezenwaji et al., 2016). Mangai and De Vries (2017) suggested that the community's involvement in maintaining public water facilities has increased access to clean water and sustainable water facilities in Ghana compared to Nigeria, where governments have not taken advantage of the partnership with communities.

Water supply is a complex system that thrives well when all the critical stakeholders are involved (Kasri et al., 2017; Rietveld et al., 2016). For example, the water sector players could use a gender perspective to achieve water supply sustainability. Women and children, who bear the brunt of searching for alternative water sources for family use, have a ready incentive to make the water scheme work (Gross et al., 2018; Opeyemi & Bayode, 2018; Shrestha et al., 2019). In addition, women who bear the burden of water shortage (Shrestha et al., 2019) could foster responsible conduct relating to all stakeholders' water use (Marques et al., 2016). Women and children play a significant role in water supply for household use and could be great stewards of responsible water use conduct.

Health Implications of Inadequate Safe Water Supply

The inadequate safe water in urban and rural areas in Nigeria and other developing countries forces people to depend on alternative sources for their water needs, with profound health implications. Over 70% of households in rural communities in Nigeria do not have access to improved water supply (Ishaku et al., 2011; Ohwo, 2016). They rely on sources that can cause water-borne diseases such as typhoid fever, cholera, dysentery, malaria parasites, among others (Ishaku et al., 2011). Aliyu and Amadu (2017) suggested that urban health crises of inadequate safe water supply and sanitation lead to water-related diseases. Rehman and Baig (2017) suggested that lack of adequate water supply forces inhabitants of the Slum of Karachi to rely on the unhygienic water supply that causes water-related diseases such as typhoid, dysentery, and diarrhea.

There is evidence that water-related diseases are not limited to unsafe water sources, as contaminated water might find its way into water supply systems due to lack of maintenance and inefficient operations. Osiemo et al. (2019) reported evidence of microbiological contamination in all drinking water sources, both at the source and point of use, in Marigat, Kenya, with serious health risks for residents. Taonameso et al. (2018) suggested that boreholes functionality, regular maintenance, and monitoring of borehole water are necessary to prevent contamination and water-borne disease epidemic. The authors came to this conclusion from their borehole water assessment of some rural communities in South Africa,

Woke and Umesi (2018) found that bacteriological levels in many boreholes were above maximum limits for potablewater standards. The authors observed these from evaluating borehole water quality from selected communities in Port Harcourt, Nigeria. From the assessment of the water quality variability between the LWC water facilities at Iju, the production source, and the points of use, Ohwo (2014) suggested that pipe distribution network has an impact on the quality of water because the water quality varies from Iju waterworks to the various sampled zones at Ojota, Lagos, Nigeria. In assessing access to potable water in Nigerian cities, Ohwo and Abotutu (2014) suggested that some of the water supply samples analyzed in Yenagoa, Nigeria, do not meet the World Health Organization (WHO) standards for safe drinking water.

Pirsaheb et al. (2017), based on a study in western Iran, linked incidents of diseases such as dysentery and typhoid to the water quality in the water supply system.

Maduka et al. (2018) found lead in potable water sources in Anambra State, Nigeria.

Omole et al. (2015) found that insufficient potable water supply and hygiene account for five of the top seven diseases, malaria, typhoid, vital organ failure, cholera, and skin disease in Ota, Nigeria.

The choice of alternative water sources for household consumption is not necessarily based on cost, as many alternative sources, apart from coming with high costs in terms of health, also attract high financial costs. For example, Olukanni et al. (2014) suggested that the inadequacy of water supplied by LWC forces people to embrace costlier alternatives, such as commercial and private boreholes. However, these commercial alternatives are mostly unregulated, and the quality might be in doubt.

Funding for Public Water Supply Utilities

The current funding for public water supply in most developing countries, including Nigeria, is subvention from the government, external aids in terms of loans and grants, and revenue generated through cost recovery, which many researchers describe as inadequate (e.g., Imonikhe & Moodley, 2018). Aper and Aku (2018) attributed the lack of adequate water in public water utilities to inadequate government funding. Ohwo (2016) suggested that the problem of inadequate water supply in Lagos has a link with inadequate investment in LWC water infrastructures. Egbinola (2017) suggested a general decline in Nigerian governments' capital allocation for water supply and access to public water supply, forcing residents to rely on alternative sources over time. Chepyegon

and Kamiya (2018) reported that low investments in water facilities constrain the Kenya water sector from achieving maximum water supply coverage.

Inadequate funding for water facilities affects the smooth operation of water facilities such as LWC in terms of operating and maintenance costs (e.g., Aper & Aku, 2018; Imonikhe & Moodley, 2018; Ohwo, 2016). Water supply services require sufficient funding for effective operation and maintenance that determine the sustainability of any water supply system (Okeola & Sule, 2012). Funding shortfall will also hamper water utilities, such as LWC, from embarking on new investments in water facilities, in response to increased water demand, based on population growth (Egbinola, 2017). The resultant effect of all these is the inability of the water utility to achieve its core mandate.

Political consideration, visibility of the projects, and the competition for the limited resources determine the availability of funds for water facilities and their state of health in terms of performance. Morris (2017) suggested that there is a tendency for politicians to neglect investments in water infrastructure because it is mainly underground and concealed from public view. Aliyu and Amadu (2017) suggested that since the state of urbanization affects infrastructure, including water supply, the government should integrate the water sector's funding in the public financing of the urban renewal program. Chukwuma (2017) argued that adequate government funding for developing local capacities could solve rural areas' current water supply problem. Ohwo (2016) suggested that the problem of inadequate funding for water supply utilities increases because of the improper use of available funds.

Knieper and Pahl-Wostl (2016) suggested that the lack of adequate financial resources and inefficient use of the available resources might undermine the performance of water supply management. Where water utilities depend on the government for funding, limited resources and competition by other sectors for attention may hinder the government's ability to provide adequate funding as and when required (Egbinola, 2017). This lack of government financing leaves the water utilities stranded, resulting in poor service delivery (Ohwo, 2016). In addition, politicians are not motivated to invest in projects concealed from public view because they are motivated by the political mileage accruing from any projects they embark on (Morris, 2017). Therefore, overcoming the problems of inadequate funding will require the water utilities to look inward and starting aggressive cost recovery efforts to shore up revenue generation (Mela, 2018).

The cost recovery through billing systems has not been effective in most water utilities in developing countries, including Nigeria (e.g., Abubakar, 2016; Balogun et al., 2017). Mela (2018) suggested that public sector financing and cost recovery, which are the current funding strategies for urban water supply in Jos, Nigeria, have not been adequate and recommended increased public-private partnership and effective cost recovery. Abubakar (2016), and Dighade et al. (2014), among others, suggested that the revenue generation position of most public water utilities in developing countries, including LWC, is weak due to poor cost-recovery strategies and inefficient billing systems. Balogun et al. (2017) called for further research to identify cost-recovery and sustainable funding strategies for LWC. In contrast, there is evidence of financing

through effective cost recovery in Cote d'Ivoire, where over 3 million people gained access to piped water within two decades, entirely financed through tariff revenues without any public funding (Marin, 2009).

Since the government cannot provide adequate water utility funding because of many other commitments competing for the same limited resources, water utilities should aim for sustainable self-funding strategies to deliver on its mandate of providing adequate water for the populace. The precarious position of these water utilities, including LWC, in terms of inadequate government funding and weak revenue generation hampers their abilities to muster necessary funding for operation and maintenance and new investments, which are vital to sustainable water supply management. It is, therefore, essential for water utilities like LWC to look for alternative sustainable funding strategies, including the possibility of a public-private partnership (PPP).

Public-private partnership (PPP) is one of the sustainable funding strategies for infrastructural development in developing countries (e.g., Oseni & Oseni, 2018). However, the authors suggested that government funding for projects, especially in Nigeria, is not always enough or provided on time. According to the authors, better alternatives are financing by public-private partnerships (PPPs), debt (bonds), and equity markets. These come with the benefits of adequate funds and expertise, which enhance the timely completion of projects. However, weak cost recovery due to a few users paying their bills (Abubakar, 2016; Balogun et al., 2017; Kandissounon et al., 2018), and

government preventing LWC from charging economic rates (Ohwo, 2016) make it difficult for LWC to achieve its mandate of adequate water supply for the populace.

Ameyaw and Chan (2015) listed the five top risks involved in the public-private partnership (PPP): unstable foreign exchange rate, corruption, water theft, non-payment of bills, and interference from politicians. Ameyaw et al. (2017) suggested that the critical success factors (CSFs) for attracting private investments into the water sector in the developing countries include the political will to implement PPPs for water supply, the establishment of PPP unit in a government establishment, and strong and competent public water authority. Others are strong fiscal capacity, public acceptance of PPP in water services, fair PPP contracts, adequate policy and legal frameworks to support water PPPs, and appropriate water pricing for profitability.

Ndiritu et al. (2018) suggested that an increase in water user fees improves the sustainability of community water projects and stressed the need to manage this revenue stream properly. The authors also suggested that the higher the community's financial commitments towards community projects, the higher the sustainability of such community water projects. Besides, they suggested that an increase in grant financing reduces the sustainability of community water projects. Therefore, there is a need for adequate and robust water governance to manage the risks associated with a public-private partnership and provide an enabling environment that activates the critical success factors for the public-private arrangement. Thus, water governance can remove or reduce the risks and foster the conditions for PPP successes.

Furthermore, water utilities should embrace the concept of appropriate pricing that produces maximum revenue, sustainable supply, and at the same time, not excluding the vulnerable segment of the society (Guimarães et al., 2016; Soto Rios et al., 2018). Ohwo (2016) suggested that lack of autonomy is the major hindrance to LWC charging appropriate pricing. Besides the consideration for public-private partnership (Oseni and Oseni (2018), LWC could consider the desirability of other funding options, including external loans and aids (Saibu & Obioesio, 2017).

The primary aim of external loans and aids is to stimulate economic growth in developing countries, including Nigeria. There are, however, divergent views about the effectiveness of these aids and grants to the intended purpose. For example, Ugwuegbe et al. (2016) suggested that the effect of foreign aid is not maximally felt in Nigeria because governments direct them to service recurrent or consumption expenditure and not the productive sector that stimulates economic growth. In contrast, Saibu and Obioesio (2017) suggested that foreign aid helps growth in Nigeria. However, there is room for optimizing the benefits by creating an enabling environment, such as an adequate policy framework and institutional arrangement.

Fashina et al. (2018) suggested that foreign aids stimulate economic growth in Nigeria to a point beyond which they have adverse effects on economic growth. From experience in Cambodia, Sothan (2018) suggested that foreign aid positively impacts growth in the short run and has adverse effects on investment and growth in the long term. Instead of foreign aid, the author suggested that policymakers should provide an

enabling environment to attract domestic and foreign investments that will foster sustainable growth and industrialization (Sothan, 2018).

In contrast, Ndiritu et al. (2018) suggested that an increase in grant financing of community water projects reduces such projects' sustainability. For external loans and aids to achieve the goal of triggering economic growth, they require an adequate policy framework and institutional arrangement (Saibu & Obioesio, 2017).

Water is used across sectors to advance development (Hurlimann & Wilson, 2018). With adequate governance and resources that foster water supply performance (Pahl-Wostl, 2017), external loans and aids for water supply will engender economic growth if optimally used (Fashina et al., 2018). Furthermore, adequate funding for the operation and maintenance of water facilities is vital for sustainable water supply (Okeola & Sule, 2012), and financing this aspect will stimulate economic growth. However, there should be an adequate institutional framework to guide foreign aids and their optimal level for water supply facilities operation and maintenance, which will foster economic growth.

Researchers have divergent views on the desirability of international donors' financial and technical supports, such as the World Bank and International Monetary Fund (IMF). Also, the withdrawal of supports from foreign donors can reverse the gains recorded in the sector where the government deployed the supports. For example, Muhumed and Gass (2016) suggested that financial and technical supports provided by the World Bank and IMF instill pain and destruction on the countries that accept them because they inhibit growth, promote inequality and global instability. On the other hand,

Monney and Antwi-Agyei (2018) suggested that strong donor support and well-organized institutional and policy frameworks are responsible for Ghana's water sector, and there was a reversal of these successes when there was a decline in donors' support.

Chigonda and Chazireni (2018) suggested that the withdrawal of donor support due to the country's political isolation affects the water supply sector of Zimbabwe. Ansa and Ukpong (2015) linked the clamor for private sector involvement in the water sector to the progression of neoliberal agenda to satisfy international financial organizations such as the World Bank and IMF, rather than practical concerns to solve water supply problems. To avert strategic political backlash, the fate of critical services, such as water supply, should not be tied to dependence on outside funding to guarantee the sector's sustainability (Chigonda & Chazireni, 2018).

It is, therefore, necessary for public utilities, such as LWC, to find alternative funding, which must not solely depend on the whims and caprices of governments (Ohwo, 2016), and foreign supports to avoid the effect of sudden withdrawal (Monney & Antwi-Agyei, 2018). Instead, the funding must come from internally generated revenue through effective cost recovery (Oseni & Oseni (2018)). One way of achieving this is by increasing customers' willingness to pay through improved service delivery.

Water customers in Nigeria are willing to pay for water services, provided there is quality service delivery. Jideonwo (2014) reported the ability and willingness of Lagos water users who pay 4-10 times the rates being charged by LWC to private water vendors for alternative water sources. Akoteyon (2019) showed that customers in low-income

residential areas of Lagos pay exorbitant prices to private water vendors for their daily water consumption. In contrast, Ohwo and Agusomu (2018) reported a different outcome from the customer satisfaction survey in Ojota, Lagos. They reported that only about 12% of the customers are willing to pay for the public water supply. The low level of willingness is due to their overall perception of the level of services by LWC. However, customers are willing to pay for improved service.

In Ijebu-Ode, close to Lagos, Nigeria, customers are willing to pay higher rates for improved public water supply than they pay private vendors (Coster & Otufale, 2020). In Owo, Nigeria, the same geopolitical zone as Lagos, Akeju et al. (2018) reported that customers are willing to pay for water service delivery. In Kano, the northern part of Nigeria, Ahmad (2017) reported that customers pay private vendors up to 28 times that of Kano State Water Board (KNSWB) during the rainy season and up to 40 times in the dry season. The willingness to pay by customers will improve cost-recovery, which will sustain adequate services to customers. There is, therefore, the need for LWC to take a critical look at improved service delivery, appropriate tariff, willingness to pay, and effective revenue generation drive.

The Gap in the Literature

The purpose of this qualitative case study was to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. Many factors are responsible for the problems of inadequate urban water supply. Some researchers (e.g., Abubakar, 2016; Ayeni, 2017; Balogun et al.,

2017; Dighade et al., 2014) suggested that most of the inadequate urban water supply problems are due to rapid urbanization, population growth, increases in per capita water use in some areas, poor maintenance, inefficient cost-recovery, climate change, inadequate funding, inadequate water governance among others. Despite this substantial body of evidence, further research is needed regarding other causes, including identifying cost-recovery and sustainable funding strategies (Balogun et al., 2017). Therefore, this study explored better sustainable water supply management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents.

Further, most of the earlier studies on water supply management sustainability, such as that of LWC, focused on individual components instead of the water supply system as a whole. The earlier focus paid little attention to the fact that improving individual components of any system may not lead to the overall improvement of the system in the absence of improvement in the interactions among the components (Patton, 2015). The current problem of inadequate potable water supply by LWC is systemic. It requires a systemic response, which might not lend itself to fixing each problem one after the other, or fixing functional or process pieces. The broad spectrum of water supply, incorporating the interactions of different systems, functions, processes, input, output, stakeholders, and the external environment, needs to be considered holistic to achieve results.

Further, most of the studies and the Nigerian Water Policy focus on the technical and engineering dimensions of water supply, with limited attention given to the broader

issue of human-social dimensions of water management. Pahl-Wostl (2017) suggested a distinction between water governance and water policy: Water governance indicates the researcher's strong affinity for social science that allows a broader understanding of human dimensions of water management, while the focus of water policy is the technical and engineering considerations. For this study, I used Pahl-Wostl's (2015) definition of water governance because it is broad, and it incorporates both the technical and engineering dimensions and the social relationship dimensions of water supply. The grounding of the conceptual framework by the systems theory considered the broader issue of human aspects of water supply, thereby enriching the study's outcome.

This study addressed the gaps in the Literature by getting the perspectives and experiences of senior officials of LWC and other senior water management experts who are conversant with the workings of LWC to gain a rich insight into sustainable management and funding strategies for LWC. This research could add new knowledge that may help water utility stakeholders develop strategies to improve cost-recovery, funding, and the general management of water supply, thereby improving water supply to residents.

Summary and Conclusion

In summary, water supply management embodies a complex web of many environmental, sociopolitical, and economic dimensions. Researchers identified rapid urbanization, population growth, lack of capacity, poor operation and maintenance, inefficient cost-recovery, climate change, inadequate funding, inadequate water

governance, among others, as the major problems of rural and urban water supply management. Solving these problems one by one will not solve the overarching problem of water supply management because dealing with functional or process pieces is not adequate for complex systemic problems. From the Literature, there is a research gap in identifying cost-recovery and sustainable funding strategies for LWC. This study might close this gap in the literature by providing insights on sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents.

Further, most of the earlier studies on water supply management issues, such as that of LWC, focused on individual components against the system as a whole, emphasizing the technical and engineering dimensions without adequate consideration for the human dimensions, which provides a broader understanding of water supply management. I used the exploratory case study design to explore the sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. In addition, the study could demonstrate the possibility of combining systems theory and a case study to address the complex issues of inadequate water supply.

Chapter 3 contains the research method. I include in this chapter a discussion of the methodology and design of the study, in alignment with the problem statement, purpose statement, and research questions. The chapter includes the research approach, the research design, and rationale and explains the role of the researcher. I also include in

Chapter 3 a discussion of the research participants' selection process, instrumentation, the procedures for recruitment and participation, and data collection and analysis. The chapter concludes with a consideration of trustworthiness and ethics as related to conducting a qualitative study.

Chapter 3: Research Method

The purpose of this qualitative case study was to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. I purposefully recruited 20 senior staff (Grade Level 13 and above) of LWC, who had more than 10 years of experience in the development of sustainable water supply management strategies for in-depth interviews. In addition, they also possessed a minimum of bachelor's degree in water supply management related courses. Senior staff on Grade Level 12 and above in the Nigerian civil service is a range of middle-level staff to top management staff. I chose staff on Grade Level 13 and above because it is a mixture of middle and top management staff who possess the competence and experience to provide valuable perspectives on management and funding strategies that might solve the problem of inadequate water supply by the LWC.

This mixture of senior staff may also minimize possible top management biases because the participants I drew from the vertical section of the corporation cut across multiple departments. Also, I purposefully recruited six water supply management experts (manager and above) from Lagos, who had more than 15 years of experience in the development of sustainable water supply management strategies for the focus group discussion. They also possessed a minimum of bachelor's degree in water supply management related courses. Last, I conducted a document review of LWC documents.

Together, the three sources of data for the study are in-depth interviews, focus group discussion, and document review.

The methodology and design of the study align with the problem statement, purpose statement, and research questions. The chapter discusses the research approach, the research design, and rationale and explains the role of the researcher. I also include in this chapter a discussion of the basis for research participants' selection process, instrumentation, the procedures for recruitment and participation, and data collection and analysis. The chapter concludes with a consideration of trustworthiness and ethics as related to conducting a qualitative study.

Research Design and Rationale

The methodology for this study was qualitative, and the design was an exploratory case study. I selected the exploratory case study design for the study because it is sufficiently robust to provide answers to the research questions, which were: (a) What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents? (b) What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents? The research questions aligned with the problem explored, provided the framework for carrying out the study and galvanized the study in terms of providing direction and ensuring relevance and consistency in the study.

The qualitative research method was appropriate for this study because I aimed to have an in-depth understanding of the multidimensional issue of water supply

management in Lagos State. Yin (2018) suggested the use of qualitative methods when investigating phenomena that require further exploration to increase understanding.

Qualitative research answers the what, why, and how types of research questions

(Korstjens & Moser, 2017; Yin, 2014). In contrast, the quantitative research method uses statistics to quantify correlations between measurable variables (Burkholder et al., 2016).

The data for correlations in the quantitative research method come from structured surveys with predetermined closed-ended questions, which participants may not interpret as intended, limiting the breadth and depth of participants' responses (Koskey, 2016).

Therefore, I ascertained that the quantitative method cannot address the complex issues of water supply dynamics in Lagos State, and, since I did not identify or measure causal variables, a mixed-methods approach was also inappropriate.

Research Design

The qualitative research design comes in various forms including (a) narrative, (b) grounded theory, (c) content analysis, (d) heuristic, (e) phenomenology, (f) ethnography, and (g) case study (Marshall & Rossman, 2014). Each research method and design has benefits and limitations (Yin, 2018). Narrative design for data collection is appropriate when researchers want to obtain qualitative data through participants' stories (George & Selimos, 2018). Researchers use grounded theory to discover or construct theory from observed patterns in participants' experiences (Chun Tie et al., 2019). Content analysis organizes and extracts meaning from collected data and draws accurate conclusions from

them (Bengtsson, 2016) by analyzing written, verbal, or visual communication (Mohajan, 2018).

Researchers use a heuristic design to study the lived experience of participants (Howard & Hirani, 2013); heuristic design focuses on persons, while the phenomenological method focuses on the phenomenon (Mihalache, 2019). In the end, I seriously considered three methodological approaches for this study: phenomenology, ethnography, and a case study. Phenomenology is suitable for studies that aim to describe the essence of a lived phenomenon (Landrum & Garza, 2015). Because water supply inadequacy is a contemporary problem for leaders of LWC, a phenomenological design was not applicable. Ethnography describes and gives meaning to the behavior patterns of a culturally identical group (Lopez-Dicastillo & Belintxon, 2014). The strategies leaders of LWC use for water supply management are not related solely to culture so I determined that ethnography was also not the best choice.

A case study design allows a researcher to investigate processes, cases, and contexts as they occur in real life, capturing the complexities within a bounded system (Baskarada, 2014; Stake, 1995; Yin, 2018). Researchers could use a case study to explore an event, program, and activity about issues or concerns (Yin, 2018). The case study design could allow a researcher to explore the phenomenon within a unit; allows comparison with other organizations and cases; and can provide a rich description of the phenomenon under study (Baskarada, 2014). The case study is also aligned with the systems theory, as, according to Stake (1995), a case study is, already, a bounded system.

Therefore, the case study will be ideal for studying a contemporary and complex problem of water supply to the residents of Lagos State. The other qualitative designs are inappropriate for this study.

I sought to have an in-depth understanding of the water supply management situations in Lagos. A qualitative case study methodology allows researchers to conduct an in-depth exploration of complex phenomena in specific contexts (Rashid et al., 2019). The depth and richness of a case study description help readers understand the case and decide whether the findings might be applicable elsewhere (Alpi, 2019; Korstjens & Moser, 2017). The qualitative exploratory case study design allowed me to explore the perspectives of senior staff of LWC; and senior water experts in Lagos on better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents.

Research Rationale

The methodology for this study was qualitative, and the design was an exploratory case study. A single case study design has the advantages of detailed description and analysis that provide a better understanding of “how” and “why” things happen (Ridder, 2017). The exploratory case studies research questions could include terms such as what in some cases (Korstjens & Moser, 2017; Yin, 2018). A case study research design is suitable when the researcher seeks in-depth analysis in a natural context using multiple sources of data (Hancock & Algozzine, 2017). For an exploratory design to provide breadth and depth of knowledge, Yin (2014) suggested five

components for a case study: case study questions, building propositions (if any, as propositions might not be needed when the topic is the subject of exploration), identifying the unit of analysis, linking data to the propositions, and interpretation of findings.

The exploratory case study provides the benefits of an in-depth description of the themes in the literature review and data collection inquiry approach. Underscoring the importance of readers' understanding of the qualitative study findings, Alpi (2019) suggested that the depth and richness of case study descriptions provide an in-depth understanding to readers of the use and the limitations of the findings.

An exploratory case study involves a systematic series of steps, which could help readers have a full understanding of the findings, and conclusion (Hancock & Algozzine, 2017)

I considered and rejected the explanatory case study because the explanatory case study research design is best suited for causal study. Hancock and Algozzine (2017) suggested that explanatory designs seek to establish associations between cause-and-effect to determine how events occur and the events that may influence particular outcomes. Exploratory case study influenced my conceptual framework, which guided my development of interview questions that could answer the research question.

Role of the Researcher

The researcher is the primary instrument for data collection in a qualitative study and deploys a personal lens for data collection and exploration (Mohajan, 2018). In this study, I was the primary instrument for data collection and analysis; collected data

through semistructured interviews, a focus group discussion, and document review. Having a researcher as the instrument of data collection may introduce personal biases, which may affect the trustworthiness of the study (Korstjens & Moser, 2018). Some of the factors that introduce biases during data collection include personal values, and beliefs, skills, and experiences of participants (Tong & Dew, 2016).

I minimized biases by using methodological rigor such as member checking (Birt et al., 2016; McGrath et al., 2019; Tong & Dew, 2016), use of multiple sources of data (Dehkordi et al., 2016), and use of field notes and reflexive practices (Deggs & Hernandez, 2018; Korstjens, & Moser, 2018). The verbatim transcribing of audio-recorded interviews also reduced biases to the barest minimum. (Hancock & Algozzine, 2017) suggested that case study researchers must recognize and reduce the effects of their biases and preconceptions to reach accurate conclusions. Also, I was self-aware of my positionality as the researcher.

I worked as a project engineer for LWC between 1993 and 1996, and since that time, I had not had personal, academic, or organizational, or power relationships with the population of the study. In addition, this study was separate from the project engineering role I played between 1993 and 1996. However, I drew a clear distinction between my role as a researcher and a water Engineer. This clear distinction requires careful consideration of the issues of positionality, which is the researcher's social identity concerning the context and setting of the study (Ravitch & Carl, 2016). One way to reduce biases is for the researcher to be self-aware and reflexive of his pre-conceived

assumptions (Korstjens, & Moser, 2018). I drew a clear distinction between the study and my ideas.

In addition to the in-depth interviews, I conducted a focus group discussion and used data from document review for a model for an exploratory case study and to satisfy the methodological requirement for data triangulation. I used an interview guide or protocol (Appendices A & B) to guide the semistructured interviews and the focus group discussion to ensure dependability. Yin (2018) suggested that an appropriate interview protocol could provide an accurate and real-world perspective on the research phenomenon. The use of an interview protocol ensured consistency and helped manage unanticipated problems during the interview process. The interviews were automatically recorded by the Zoom automatic cloud recording facilities and transcribed verbatim for coding purposes.

Further, a researcher is an interpreter of the data collected through interviews, documents review, and observations (Mohajan, 2018; Stake, 1995). In this study, I was solely responsible for data collection, analysis, and interpretation, which could come with biases. Stake (1995) advised researchers to strike the right balance between their involvement with the case under investigation and their roles as experts on the knowledge revealed in the case under study. Researchers are responsible for the quality assurance of the study (Korstjens & Moser, 2018; Mohajan, 2018; Ravitch & Carl, 2016). Therefore, I took responsibility for the quality assurance of the study as a whole.

Methodology

The qualitative research methodology is well suited for the present study since the aim is to have an in-depth understanding of the case under exploration. Yin (2018) suggested the use of qualitative methods when investigating phenomena that require further exploration to increase understanding. Case study research is suitable for a topic that seeks in-depth analysis in a natural context using multiple sources of data (Hancock & Algozzine, 2017). Qualitative researchers use interviews to obtain insights on the phenomenon under study (Oltmann, 2016). Interviews provide rich and detailed information in understanding people's experiences (Majid et al., 2017).

The qualitative method is appropriate for this study because the goal was to have an in-depth understanding of the multidimensional issue of water supply in Lagos. In contrast, quantitative research methods use statistics to quantify correlations between measurable variables (Burkholder et al., 2016; Moser & Korstjens, 2017). Therefore, I did not use statistical measures to analyze the collected data; quantitative methods are inappropriate. I conducted semistructured in-depth interviews, focus group discussion, and document review, asking open-ended questions to collect the primary data. Since causal variables were not identified or measured, a mixed-methods approach was also inappropriate.

Research Participant Selection Logic

The target populations for this study were the senior staff of LWC (grade level 13 and above) and independent senior water management experts (manager and above) in

Lagos State, who met the inclusion criteria below. I based the participants' selection on purposeful sampling, a non-random sampling method that allows the selection of participants of a case deliberately based on identified qualities (Sharafizad & Coetzer, 2016). Hancock and Algozzine (2017) suggested that the researcher has to identify critical participants who may provide valuable insights into the research questions. Purposeful sampling is common in qualitative research to select information-rich cases that are conversant with the phenomenon under study (Palinkas et al., 2015). A purposeful sampling strategy allows the researcher to recruit valuable participants in terms of knowledge, experience, and ability to articulate ideas (Moser & Korstjens, 2018). I used explicit inclusion and exclusion criteria to recruit these participants.

Inclusion Criteria for in-depth Interviews

The inclusion criteria were: I included (a) 20 LWC senior staff (Grade Level 13 and above), who had more than 10 years of experience in the development of sustainable water supply management strategies, and (b) a minimum of bachelor's degree in water supply management related courses. I chose staff on Grade Level 13 and above because it is a mixture of middle and top management who possess the competence and experience to provide valuable perspectives on management and funding strategies that might solve the problem of inadequate water supply by LWC.

Exclusion criteria for in-depth interviews

The exclusion criteria were: I excluded (a) LWC senior staff below Grade Level 13, (b) LWC staff who had 10 years and below experience in the development of

sustainable water supply management strategies, and (c) senior staff with less than bachelor's degree in water supply management related courses.

Inclusion criteria for focus group discussion

The inclusion criteria were: I included (a) water supply management experts (manager and above) from Lagos, who had more than 15 years of experience in the development of sustainable water supply management strategies, and (b) a minimum of bachelor's degree in water supply management related courses. I chose water management experts (manager and above) because they possess the competence and experience to provide valuable perspectives on management and funding strategies that might solve the problem of inadequate water supply by LWC.

Exclusion criteria for focus group discussion

The exclusion criteria were: I excluded (a) water supply management experts below the level of manager, and (b) water management experts with 15 years of experience and below in the development of sustainable water supply management strategies, and (c) water management experts with less than a bachelor's degree in water supply management related courses.

The other source of data for the case study was document review. The use of multiple data sources will facilitate data saturation and provide an opportunity for the cross-verification of data or triangulation (Yin, 2014). Triangulation explores the same phenomenon at different levels and perspectives, ensures data saturation, and is vital for

the reliability and validity of the data and results (Fusch et al., 2018). I interviewed 20 LWC senior staff (Grade Level 13 and above). I obtained rich data and data saturation through a combination of semistructured interviews of 20 participants, a focus group discussion consisting of six participants, and document review. Fusch and Ness (2015) suggested that data saturation occurs when there is no new information, coding, or theme from the data, and researchers can replicate it under similar conditions.

With the IRB approval, I emailed LWC management to seek their cooperation to conduct the study in their organization. The responsibility of LWC in the letter of cooperation included: Identifying potential participants who met the inclusion criteria and providing their names, telephone numbers, and email addresses and making available necessary documents/reports and staff handbook to aid the study. Having received the letter of cooperation and the list of potential participants, I sent an expression of interest email to all identified potential participants; and informed consent forms to participants who intended to participate in the research before the commencement of the interviews. For the focus group discussion, I identified the potential participants (water management experts) through relevant professional bodies and journals and recruited six water management experts (Manager and above) that met the inclusion criteria. I sent an expression of interest emails to water management experts (manager and above) who met the inclusion criteria, sent the informed consent forms emails to seven experts, and chose the first six who intended to participate by replying with the words “I consent.”

My data collection plan was broad and open during data collection until data saturation occurred. Moser and Korstjens (2018) suggested that researchers keep a data plan broad and open until no new data comes. The authors suggested that data saturation should determine sample size in a qualitative study, which is different for each study. Patton (2015) suggested that the researcher must get sampling right in a qualitative study. It is vital to get enough sample size that could answer the research questions, which explains my flexible sample size range of 15-20 for in-depth interviews. Korstjens and Moser (2018) suggested that the guiding principle of sampling in qualitative research is to continue to sample until saturation occurs.

Instrumentation

I was the primary instrument for data collection and analysis for this study. The researcher is the primary instrument for data collection and analysis in qualitative research (Mohajan, 2018). The three data collection tools that I used were semistructured in-depth interviews of 20 senior staff of LWC (grade level 13 and above), who met the inclusion criteria, a focus group discussion comprising of six senior water supply management experts (manager and above) in Lagos, who met the inclusion criteria, and document review. Interviewing is a significant source of rich, in-depth qualitative data (Majid et al., 2017; Meho, 2006). In addition, interviewing fosters individual interactions between the researcher and the participants, sharing experiences and opinions. Hancock and Algozzine (2017) suggested that semistructured interviews are well suited for a case study.

I used open-ended questions for data collection from the participants in semistructured in-depth interviews, which allowed participants to provide answers based on their knowledge, education, and experience in water supply management. Open-ended questions have the advantage of allowing the participants to give the researcher in-depth meaning in their interview responses (McGrath et al., 2019). I used Zoom meeting facilities for the interviews and the focus group discussion. I maintained ethics in the interview process. The interest of any study is to understand the case the researcher is exploring and the meaning the participants could make out from the case (Korstjens & Moser, 2018).

I developed the interview protocols or guides for in-depth interviews and the focus group discussion (Appendices A & B) based on the common themes from the literature review and the conceptual framework. I used the format, arrangement, and flow the qualitative researchers recommended. For example, Jacob and Furgerson (2012) suggested that a literature review underpin the interview guide and incorporate open-ended questions. The authors suggested further that the researcher start with friendly conversations, such as asking for the participants' background as a form of confidence building. A helpful interview guide must identify the right open-ended questions for the participants (Hancock & Algozzine, 2017). The interview guide or protocol aligns with the methodological approach (Laksov et al., 2017). It creates an alignment between interview questions and research questions, encourages inquiry-based conversation,

allows updates, uses feedback from experts, and the possibility of pilot/field testing (Castillo-Montoya, 2016).

The interview guide helps to follow through and capture surprises (Myers & Neuman, 2007), maintain consistency, and pursue the same lines of inquiry with each participant (Patton, 2015). However, the guide or protocol was not cast-in-stone; there was no significant review of the interview and the focus group questions during the data collection process. The review, when necessary, helps to incorporate feedback and take care of emerging topics (Tong & Dew, 2016; Yeong et al., 2018). The interview guide or protocol included: (a) opening and welcome note, (b) interview questions, and (c) a closing summary thanking the participants. The guide also provided the needed focus on the interviewing and the focus group discussion processes.

Individual interview

The first data collection instrument I used was the individual interviews, which involve one-on-one interactions between the researcher and the participant; the researcher asks unstructured, semistructured, or structured questions. I used semistructured individual in-depth interviews with open-ended questions for the participants (Appendix A). Qualitative interviews offer rich and detailed information in understanding people's experiences (Majid et al., 2017), and the individual interviews provide the opportunity to obtain independent, in-depth personal data from each participant (McGrath et al., 2019).

The individual semistructured interviews, with open-ended questions for the participants, are best suited for data collection processes. An in-depth interview allows

for obtaining rich and detailed information in understanding people's experiences (Majid et al., 2017). An interview guide or protocol may facilitate the interview process by ensuring consistency and providing the focus for the entire process. I based the interview on well-chosen questions that answered the research questions and aligned with the methodological approach. The research questions are: Research Question 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents? Research Question 2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

I used Zoom meetings that provided a private setting, which encouraged the individual participants to open up during the interview process. I asked the participants about their availability for interviews through telephone conversations that informed participants of the essential nature, the purpose of the research, and the interviews' duration. The interview questions for the participants directly related to the study's research questions, and all the participants' responses formed the data for the study.

The interviews were automatically recorded by the Zoom automatic cloud recording facilities. I transcribed the audio-recorded interviews and carried out member checking by giving all the participants in the interviews the opportunity to confirm that the produced transcripts represent what transpired during the interviews and the discussion. Member checking is used to confirm the participants' position that the

produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016).

Member checking is a validation technique where “data or results are returned to participants to check for accuracy and resonance with their experiences” (Birt et al., 2016). The member checking in this study involved returning the transcripts (data) to all participants to confirm whether or not the transcripts represented what was discussed during the interview and the focus group discussion. All the participants had the opportunity to confirm whether the transcripts reflected what transpired during the interviews and the focus group discussion through member checking.

The data collection and analysis in a qualitative study come with biases from the researcher, who is the main instrument for data collection and analysis. Researchers have pre-conceived ideas, beliefs, values, predispositions, and assumptions, which may introduce biases into the study (Peredaryenko & Krauss, 2013). Therefore, the first strategy to reduce biases is for the researcher to be self-aware and reflexive of his pre-conceived assumptions (Korstjens, & Moser, 2018).

The second strategy is to use reflexive notes, which contain all the researcher’s subjective responses to the participants during data analysis (Korstjens & Moser, 2018). I incorporated all the participants’ responses, and their ideas counted in identifying patterns and the generation of themes that led to the conclusion. To facilitate the emergence of themes, Rubin and Rubin (2012) suggested coding the transcripts to identify patterns or

descriptions of labels, which come with each line of thought, sentence, or phrase of the participants.

I had obtained the consent of all the participants before the interviews began; and excluded all personal information, which could expose the participants from all interview records. In addition, ethical standards during the interview process require that the study's interest is to understand the case under exploration, and the meaning the participants, not the researcher, make from the case study (Korstjens & Moser, 2018). I upheld these standards throughout the entire interview process.

Focus group

The second data collection instrument I used was a focus group discussion, whereby the researcher convenes a small group of people to obtain their collective views to answer research questions (Doria et al., 2018). In a focus group discussion, the researcher is a facilitator and facilitates a group discussion among participants and not between the researcher and the participants (Nyumba et al., 2018). The researcher will throw some questions to collect data from the participants and allow them to respond, share their views, and position individually, thereby consolidating the answers to the research questions. I aligned the focus group discussion questions with the research questions and the themes from the literature review and used experts to validate the focus group discussion questions (Appendix B). My chair and other committee members also validated the questions through multiple reviews.

I recruited six independent water experts from Lagos, who are conversant with the workings of LWC, to form the focus group. The six experts that met the inclusion criteria were identified through relevant professional bodies and journals. The Zoom automatic cloud recording facility automatically recorded the focus group discussion, and I transcribed the audio-recorded discussion verbatim and allowed member checking. Member checking allowed the participants to confirm whether the transcripts are a true reflection of what transpired during the focus group discussion and that the interpretation and meanings of participants' responses are accurate (Birt et al., 2016; Tong & Dew, 2016). I compared the data from the focus group to that of the in-depth interviews and the document review and used the data from these three sources to gain a comprehensive understanding of all issues surrounding LWC's inability to provide adequate potable water to Lagos residents. The use of multiple data sources helped to achieve data triangulation and improve quality.

Document review

I used the document review as the third instrument for data collection. The document review focused on the LWC performance reports in the last 5 years. Documents such as companies' formal reports on the web, among others, are a good source of data for case studies (Yin, 2014); and can help to answer the research questions and to meet the data triangulation requirement of a case study (Patton, 2015). I used the data obtained from the document review to help achieve saturation and satisfy the methodological requirement of triangulation for a case study. I reviewed LWC

performance reports for the last 5 years. The document review could provide insights required to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents.

Field notes

The observation or field note is a data-collecting instrument in a qualitative study. Field notes in this context refer to the notes I took during the interviews and focus group discussion on complementing the audio recording. It provides the opportunity to acquire data from participants in the context of the activities or the interviews' environment (Ravitch & Carl, 2016). Researchers widely recognize it for documenting rich contextual information (Phillippi & Lauderdale, 2018) and aiding reflections during fieldwork (Maharaji, 2016). In addition, field notes and reflexive practices improve the meaning of qualitative data (Deggs & Hernandez, 2018). I took notes of what happened during interviews, initial understandings, procedural notes, and protocols to keep me on track, and a memo to provide a summary to close out each interview session. The notes were primarily to enhance data recording during the three main data collection instruments: In-depth interviews, a focus group discussion, and document reviews.

Expert Validation/Field Testing

I sent invitational emails to qualitative research subject matter experts (SME) at Walden University for their comments and feedback for expert validation or field-testing. The researcher must ensure that the instrument can perform the desired job as required by the research objectives (Dikko, 2016). The expert validation method provides feedback or

comments from qualitative research subject matter experts on the instrument's appropriateness (Yeong et al., 2018). I sent invitational emails to 6 Walden university qualitative research SMEs. The email included a shortened version of the proposal that contained the title page, the problem statement, the purpose statement, the research questions, and the initial interview and focus group discussion questions. Three of the six experts provided feedback on the interview and focus group discussion questions, and the questions were reviewed to reflect the comments and the feedback from the experts in the final interview and focus group questions (Appendices A & B).

Procedures for Recruitment, Participation, and Data Collection

I started recruiting participants for this study after obtaining approval from the Institutional Review Board (IRB). I accessed the expression of interest form and consent form from the Walden IRB website for use in the current study and obtained the approval of the University's IRB (Walden University) to conduct this study. I requested and obtained the letter of cooperation from my partner organization (LWC) and obtained participants' consent for the interviews and the focus group discussion to collect data by audio recordings. I transcribed audio-recorded interviews and discussion verbatim and performed member checking, which allowed the participants to confirm that the produced transcripts represented what transpired during the in-depth interviews and the focus group discussion. My interpretation reflected the meanings of participants' interview and focus group discussion responses.

Letter of cooperation

I sent a draft letter of cooperation to IRB for approval. After that, I sent an email request for a letter of cooperation to LWC management in Lagos, Nigeria. I provided adequate guidance to LWC management on the contents of the letter of cooperation. The letter of cooperation gave the researcher access and permission to participants' offices and sites.

Expression of interest

The Expression of Interest is the email I sent to the potential research participants in LWC in Lagos, Nigeria. In addition, the email was sent to individuals that might intend to participate in the study. The emails contained a short description of the study, while the consent form contained detailed information about the research procedures and participation. I also sent the expression of interest email to the independent water supply management experts who might intend to participate in the focus group discussion.

Consent form

A way to protect the shared experiences by the participants is through the use of informed consent. I sent the informed consent form emails to all participants who intended to participate in the individual interviews and the focus group discussion. Informed consent allows participants to base their voluntary participation in the research on a full understanding of the potential risks involved (Babbie, 2017), and participants

must grant their informed consent to the researcher before data collection. In addition, the informed consent form contained information on the rights of the research participants.

According to Babbie (2017), the information in the informed consent will include the purpose of the research, the duration of the interviews, description of the procedure to follow, a description of identifiable risks or discomfort to participants, benefits, a description of an alternative method. The author suggested further that for research involving more than minimal risks, information on compensation or medical treatment in case of incidents, privacy and confidentiality of the participants, the freedom to discontinue participation in the research process, at any time, without any penalty or need for permission, the voluntary nature of the study, a statement on whom to contact for questions, and data protection.

IRB at Walden requires informed consent to include background information to the study, data collection procedure, sample interview questions, a statement on the voluntary nature of participation in the study, risks, and benefits of being in the study, payment if any, privacy, contacts and questions, signatures of the participants and the researcher, or in case of online study, a reply to e-consent email with the words stating “I consent.” I received informed consent from each participant in the interviews and the focus group discussion before the data collection commenced.

Document Review

I reviewed the documents relating to the performances of the LWC in the last 5 years. In 2010, when LWC developed its Water Supply Master Plan (Lagos Water

Corporation, 2010), the LWC's total design capacity was 210 mgd. The current total design capacity is 208 mgd. The average capacity utilization in 2017 was 22.69%; in 2018 it was, 28.3%; in 2019, it was 15.78%, and in 2020 it was 14.11%. The data for 2016 was not available during the review. The capacity utilization trend from 2017 to 2020 reflected operational inefficiencies of the waterworks on the part of the organization, and it mirrored the data obtained from the interviews and the focus group discussion. A review of the revenue generation from 2015 up to 2020 also followed a downward trend. The explanation for the trend was due to a reduction in service delivery as represented by capacity utilization. The outcome of the document review mirrored the data collected from the interviews and the focus group discussion.

Data Analysis Plan

I performed data analysis on the data collected from the semistructured individual interviews, focus group discussion, and document review. The document review focused mainly on the LWC performance reports in the last 5 years. I compared the data from the focus group to that of the in-depth interviews and the document review and used data from the three sources to gain a comprehensive understanding of water supply management issues by LWC. The use of multiple sources of data will also satisfy the data triangulation requirement and enhance the reliability of the study's results (Fusch et al., 2018). I used Yin's (2014) suggestion for data analysis by undertaking (a) data compilation, (b) data disassembly, (c) data reassembly, (d) data interpretation, and (e) data conclusion and meaning.

After transcribing all the audio-recorded semistructured interviews, and the focus group discussion, I conducted a member checking with each of the 20 participants in the in-depth interviews; and the six participants in the focus group discussion. Member checking gives the participants in the in-depth interviews and the focus group discussion the opportunity to confirm that the produced transcripts represented what transpired during the interviews and the focus group discussion (Houghton et al., 2013; McGrath et al., 2019; Tong & Dew, 2016). The research questions addressed sustainable management and funding strategies by LWC, which could provide an adequate potable water supply to Lagos residents.

I organized the participants' answers into codes, categories, generated themes, and compared the outcomes with the conceptual framework and the literature review. A code is a word or short phrase that captures the spirit of a portion of language-based or visual data (Saldaña, 2016). Coding helps a researcher arrange similar emerging themes and concepts to foster easy access (Rubin & Rubin, 2012).

I used the NVivo for data management. The NVivo software is popular among notable qualitative researchers and useful for data management, coding, and categorizing the codes. NVivo can manage large data (Dollah et al., 2017), and qualitative researchers use it to organize, manage, and shape qualitative data (Richardson et al., 2015). NVivo has become a widely accepted software by many prominent qualitative researchers (e.g., Leech & Onwuegbuzie, 2011). However, the researcher remains the primary data collection and analysis tool, irrespective of computer support (Mohajan, 2018).

Therefore, I was the main instrument for data collection and analysis in this qualitative exploratory case study.

I interpreted the data and developed findings and conclusions that can be traced to the raw data. The final step after the data analysis is to interpret the data and make sense of it (Saldaña, 2016) and develop findings and conclusions that relate directly to the raw data (Tong & Dew, 2016). The data interpretation remains the primary duty of the researcher through his deep involvement throughout the data collection and analysis stages (Mohajan, 2018). The theorist von Bertalanffy's (1950) systems theory, which focuses on the whole system rather than the behaviors of the individual parts, grounded the conceptual framework. I explored the better sustainable management and funding strategies by LWC, which could provide adequate potable water to the populace, and compared the revealed sustainable management and funding strategies to prior literature findings.

Issues of Trustworthiness

Burkholder et al. (2016) suggested that trustworthiness measures the level of confidence every researcher has in their data sources and the methods used to gather them. Thus, it provides confidence and value, which can be attached to the research as a whole. Furthermore, a combination of credibility, confirmability, dependability, and transferability measures research rigor or thoroughness (Lincoln & Guba, 1985), which requires a researcher to consistently reason in a stringent logical manner (Ibiamke & Ajekwe, 2017).

Credibility

Credibility is the process a researcher adopts to ensure the accuracy of the findings and answers whether people can trust the results (Tong & Dew, 2016). A credible qualitative study provides an accurate description or interpretation of human experience that other people with similar experiences can confirm (Thomas & Magilvy, 2011). Credibility is a measure of the value and acceptability of the research outcome that combines the conduct of the research as proposed and the demonstration of the trustworthiness of the processes (Houghton et al., 2013) and to ensure the credibility of the study, I carried out member checking. In member checking, the participants in the in-depth interviews and the focus group discussion have the opportunity to confirm that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016). I achieved triangulation by using multiple sources of data (individual in-depth interviews, focus group discussion, and document review). The use of multiple sources of data maximized the potential for an in-depth understanding of the case under study, facilitated data saturation, and reduced bias. Further, I engaged Walden university qualitative study experts to help review whether the interview questions were sufficient to answer the research questions.

Transferability

Transferability refers to whether the finding of a study can be used in another study and answers whether the findings are relevant to other contexts and settings (Tong & Dew, 2016). It is a measure of whether or not researchers can replicate the research findings or methods elsewhere or the findings for a particular study are applicable in

another setting (Thomas & Magilvy, 2011) and to help the decision on transferability, I adequately explained the findings with detailed descriptions. Detailed descriptions of the study steps could help readers to make informed decisions about the transferability of the findings (Stake, 1995). The decision for transferability is reserved for readers to make (Houghton et al., 2013; Marshall & Rossman, 2014). I presented a complete report with detailed descriptions, findings, and conclusions, which could help future researchers to make informed decisions about the transferability of the study outcome.

Dependability

Dependability describes how well established the data used in a research study are and answers whether the process is transparent, and this occurs when a different researcher can track the decision trail used in another study (Thomas & Magilvy, 2011). Houghton et al. (2013) suggested that the audit trail will help the reader follow the researcher's steps in conducting the study. Therefore, I maintained an audit trail to capture the steps, activities, and research stages that justified the decisions on methodology and design. For the study's dependability, the field-testing of the interview and discussion questions by experts to validate the ability of the questions to answer the research questions and member checking was carried out. In member checking, participants have the opportunity to confirm that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016).

Confirmability

Confirmability measures the objectivity and correctness of data as presented (Houghton et al., 2013). It answers whether the findings and interpretations relate to the

raw data (Tong & Dew, 2016). Confirmability refers to how others view the findings, whether they reflect the meanings from observed participants or the researcher's leanings. Meeting credibility, transferability, and dependability criteria is necessary for confirmability (Thomas & Magilvy, 2011). To ensure confirmability in the study, I maintained qualitative objectivity by entering in a reflexive journal all personal pre-conceived assumptions and presuppositions and maintaining a reflective journal for an audit trail.

I kept a record of all decisions taken and their rationale at every stage of the study. Korstjens and Moser (2018) suggested that it is a good practice to record the justifications for all decisions in research methodology and data management in the reflexive journal and document all reflections based on personal experience, culture, and biases and explanations that would inform and influence the research process. The data analysis section aligned the findings with the conclusions and interpretations to avoid personal biases in the study. In addition, I carried out member checking with all the participants in the interviews and the focus group discussion. Member checking allows research participants to confirm that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016).

Ethical Procedures

To maintain ethical standards, I communicated the aim of the study, the possible benefits, and the research expectations with the research participants before the commencement of the interviews. Communication is necessary to protect the participants from harm and to ensure professional and ethical standards (Babbie, 2017), and the

standard is to inform the participants about the ethical standards and the informed consent process before data collection (DeJonckheere & Vaughn, 2019). Furthermore, researchers' primary duty is to protect participants and personal records (Yin, 2014), and protecting the participants from harm is an ethical issue for the researcher (Varpio & McCarthy, 2018). Therefore, protecting participants' rights is essential, and I maintained ethical standards for using human samples and managed data collection and analysis in a way harmless to the participants.

I selected different participants for the in-depth interviews and the focus group discussion to minimize the negative effect of using only one data collection source. I used LWC senior staff for in-depth interviews and independent water management experts in Lagos for the focus group discussion. I emphasized the participants' inalienable rights to accept or reject the offer to participate in the study. These included the right to participate or stop participating at any time in the interview process, without penalty, in line with the contents of the expression of interest and the informed consent forms. The safety of the data collected was assured by the encryption of the files and putting all the paperwork connected to the research in a safe location with a lockable device. I did this to reduce the risk of data damage and theft, and the data collected is being kept for at least 5 years, as required by the university. After 5 years, I would dispose of the data by shredding the interview notes and transcripts and destroying the flash drive used for storing any data during the data collection process.

The first step to reducing harm to research participants is to obtain their consent. Informed consent, having been given, will remove the possibility of tagging the data the researcher collected from the participants through recordings and notes as unauthorized (Ritchie et al., 2013). The consent was for individuals who took part in the audio-recorded interviews and focus group discussion. I gave information about the interview duration, member checking, and answered other questions about the research. I reiterated that the participants gave me their consent to be interviewed and audio record the interviews before and after the interview. I took every necessary step to maintain ethical standards for the research.

Confidentiality

I assured the participants in the interviews and focus group discussion of their confidentiality. The protection of participants' privacy may be in the form of confidentiality or anonymity (Ritchie et al., 2013). Confidentiality refers to a participant's privacy and how the researcher handles information about the participants (Ravitch & Carl, 2016). I used pseudonyms for all the participants in the interviews and the focus group discussion. Surmiak (2018) suggested that to assure the confidentiality of research participants, it is important to use pseudonyms and remove all identifiers that may link the participants to the data or the report. In addition, I protected the data and records of the research participants by using a hard drive on a secure, password-protected computer that unauthorized persons cannot access.

Protecting the participants from harm

In the study, I provided full information about the purpose of the study, associated risks and benefits, and their right to discontinue their participation in the study if they no longer feel comfortable or secured participating (Babbie, 2017). In addition, I kept communication channels open and cordial before, during, and after the research. Where necessary, I disclosed all activities that may likely become harmful and risky to the participants and gave them the opportunity for questions and answers sessions.

Protecting the researcher from risk

I discussed the mitigating measures for participants to adopt in case risk occurred during the research process. Before the focus group discussion, I assessed the participants' cultural and power dimensions (Nimmon & Stenfors-Hayes, 2016). Information on cultural differences might help participants understand the potential cultural biases and the need to build trust that will foster openness during the sessions (Shenton, 2004).

Summary and Transition

Chapter 3 contained an overview of the research design and described the qualitative method that underpinned the study. The rationalization of the research design employed in the study served as a guide for the interview questions to extract information that could answer the research questions. I justified using an exploratory case study because of its detailed and rich descriptions to guide readers. I also discussed the need for triangulation through multiple data sources and how this could facilitate data saturation

and enhance the quality of the study. I discussed the three data collection methods; semistructured interviews, focus group discussion, and document review, which provided answers to the research questions and satisfied the methodological triangulation of data. I included in Chapter 3 details of the role of the researcher, research participant selection criteria, instrumentation, data collection and analysis plans, and techniques to maximize reliability. The other sections include trustworthiness, which comprises credibility, transferability, dependability, confirmability, and a summary of the main points of Chapter 3. Chapter 4 includes the introduction, field test, the research setting, demographics, data collection, data analysis, evidence of trustworthiness, results, summary, and transition to Chapter 5.

Chapter 4: Results

The purpose of this qualitative case study was to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. Two research questions were used to guide this study: Research Question 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents? Research Question 2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

To address the research questions and the purpose of the study, I conducted a qualitative analysis of the semistructured interviews with the 20 participants from LWC, a focus group discussion with six participants, who were water supply management experts, and a document review of the performance of LWC in the last 5 years. I used the NVivo computer software to organize the data collected during the interview and the focus group discussion. In Chapter 4, I discuss field test, research settings, demographics, data collection, data analysis, evidence of trustworthiness, study results, and summary.

Field Test

The expert validation method provides feedback or comments from qualitative research subject matter experts on the instrument's appropriateness (Yeong et al., 2018). To receive feedback on the research interview and the focus group discussion questions, I sent invitational emails to six qualitative research SMEs. The email included a shortened version of the proposal that contained the title page, the problem statement, the purpose

statement, the research questions, and the initial interview and focus group discussion questions. Three of the six experts provided feedback on the interview and focus group discussion questions, and I reviewed the questions to reflect the experts' comments and feedback that responded to become final interview and focus group questions (Appendices A & B).

Research Setting

The study setting was consistent during the data collection process. I contacted 30 potential participants who met the inclusion criteria for the in-depth individual interviews from the head of Administration and Human resources, LWC, Lagos, Nigeria. I recruited and conducted the semistructured interviews with the first 20 potential participants from LWC, who gave their consent to participate. In addition, there was a focus group discussion with the first six water supply management experts in Lagos who gave their consent to participate and reviewed LWC's performance in the last 5 years. Both the interviews and the focus group discussion were conducted through Zoom, allowing the participants to choose the most convenient dates and times of the interview and the focus group discussion.

The semistructured interviews took place between 8th and 22nd of April 2021. Seventeen of the participants were interviewed on weekdays while the remaining three participants opted for a Saturday (4/10/2021). The participants also preferred and agreed on times between 10 am and 10 pm. For the focus group discussion, I proposed a date and time, May 3, 2021, 7.30 PM through whatsapp individually to all the participants in

the focus group. One of the participants preferred 4.00 PM and after seeking the availability of others at 4PM same day, they all agreed with the new timing and by consensus the focus group discussion took place by 4.00 PM, May 3, 2021, and lasted 140 minutes. I sent Zoom meeting requests to all the participants in the individual interviews and the focus group discussion with constant reminders and follow-up. Before the commencement and close of the semistructured interviews and the focus group discussion, I reiterated the importance of their consent and the confidentiality of the information they provided.

I carried out member checking by giving all the participants in the interviews and the focus group discussion the opportunity to confirm that the produced transcripts represented what transpired during the interviews and the discussion. Member checking is used to confirm the participants' position that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016). Member checking is a validation technique where "data or results are returned to participants to check for accuracy and resonance with their experiences" (Birt et al., 2016). The member checking in this study involved returning the transcripts (data) to all participants to confirm whether or not the transcripts represented what was discussed during the interview and the focus group discussion. All the participants had the opportunity to confirm that the transcripts reflected what transpired during the interviews and the focus group discussion through member checking.

I contacted all the participants in the interviews and the focus group discussion that I would email the transcripts of the audio recorded interviews and the focus group discussion for them to confirm whether the transcripts reflected what transpired during the interviews and the focus group discussion. The email stipulated the expected time to respond, after which it would be deemed they have agreed that the transcripts reflected what transpired. The emails were followed by telephone calls to confirm receipts of the mail and prompted them to respond to the request made. All the participants confirmed that the transcripts reflected what transpired during the interviews and the focus group discussion.

Demographics

For ease of differentiation, I used respondents for semistructured interviews (Table 1) and participants for the focus group (Table 2). Twenty respondents were interviewed with a minimum Grade Level of 13, minimum years of experience of 19 years, and a minimum bachelor's degree. The location and the duration of the interviews in minutes are shown in (Table 1). This recruitment was in line with the inclusion criteria as discussed in Chapter 3.

Table 1*Demographics for Semistructured Interviewees*

Respondents	Location	Duration (Minutes)
Respondent 1	Lagos	64
Respondent 2	Lagos	32
Respondent 3	Lagos	90
Respondent 4	Lagos	76
Respondent 5	Lagos	78
Respondent 6	Lagos	87
Respondent 7	Lagos	68
Respondent 8	Lagos	44
Respondent 9	Lagos	42
Respondent 10	Lagos	60
Respondent 11	Lagos	50
Respondent 12	Lagos	49
Respondent 13	Lagos	61
Respondent 14	Lagos	38
Respondent 15	Lagos	63
Respondent 16	Lagos	45
Respondent 17	Lagos	62
Respondent 18	Lagos	61
Respondent 19	Lagos	72
Respondent 20	Lagos	38

For the participants in the focus group discussion, I recruited six water supply management experts, who conducted business in Lagos state, with a minimum of 16 years of work experience and a minimum bachelor's degree (Table 2). The duration of the focus group discussion was 140 minutes with an average of 20 minutes per participant. The participants, their field, location, and average duration of discussion are shown in Table 2. I purposefully emailed engineering company top executives in Lagos, who are also senior members of the Nigerian Society of Engineers (NSE), to help identify potential participants who met the inclusion criteria. I contacted the potential candidates from the list they gave me and eventually recruited the first six water management experts that gave their consent to participate.

Table 2*Demographics for Focus Group*

Participants	Field	Location	Number of Minutes
PP1	Water Supply Management Expert	Lagos	20
PP2	Water Supply Management Expert	Lagos	20
PP3	Water Supply Management Expert	Lagos	20
PP4	Water Supply Management Expert	Lagos	20
PP5	Water Supply Management Expert	Lagos	20
PP6	Water Supply Management Expert	Lagos	20

Data Collection

Following the Walden University IRB approval (#03-03-21- 0727327), I started the recruitment process with my partner organization, the LWC, Lagos, Nigeria. The

head of administration and human resources gave me two lists comprising of 30 potential participants based on the inclusion criteria in my letter of request for cooperation with the MD of LWC. I contacted the 30 potential participants for the interviews based on their expression of interest emails and emailed consent forms to those who intended to participate. Twenty of those who intended to participate replied to my consent form email with “I consent”.

I conducted the interviews through Zoom, which allowed the participants to choose the most preferred date and time of interview. On average, the duration of the interview was between 45 and 60 minutes. However, because of the technology glitches, such as Internet problems, the interviews extended in a few cases to about 90 minutes. The interviews were automatically audio-recorded by Zoom recording facility, while I transcribed the audio-recorded interviews manually.

I purposefully emailed engineering company top executives in Lagos, who are also senior members of the Nigerian Society of Engineers (NSE), to help identify potential participants who met the inclusion criteria. I contacted 10 potential candidates from the list they gave me and eventually recruited the first six water management experts that gave their consent to participate by replying to my consent email with “I consent”.

I facilitated the focus group among the six participants and informed the participants of the ground rules when the meeting started through Zoom that participation was voluntary. I also advised participants not to discuss the topics they were

uncomfortable with, stated that there were no right or wrong answers, stressed the need to respect the opinions of others even if they disagreed, stressed the need to avoid revealing very detailed information about their health, and emphasized that everything about their personal information was confidential. There shall be no reference to individual names in the report, and that their personal information would remain confidential. The ground rules also included the need to help protect the privacy of others by limiting the details of the discussion to the group and to stay on topic so that we could cover all the material. The focus group discussion protocol served as a guide.

The focus group discussion was conducted through Zoom, which allowed the participants to choose the most preferred time and date for the discussion. On average, the duration of the focus group discussion was expected to last for about 90 minutes. However, because of the technology glitches, such as Internet problems, there were delays, and the focus group lasted 140 minutes. Thus, the timeline for the entire data collection process lasted for 8 weeks. All six experts for the focus group required that I provide the best time since the data collection was an academic purpose.

I suggested a date and time to which all six focus group participants agreed. The focus group discussion took place virtually through Zoom meeting. Part of the ground rules discussed was that all participants would unmute themselves as they introduce themselves and thereafter mute their microphone. The discussion was audio-recorded after obtaining the consensus from all six experts that I should record the discussion. I was the host and I was also the facilitator who asked the question and called each expert

based on the order of the numbers I used to identify participants while the last person in the cycle commenced answering the following question. Each discussant responded based on their knowledge, experience, and training on the question. They also commented on the responses of others by agreeing, suggesting slight modifications or providing completely new perspectives. The final themes were a product of the collective views of the six participants. Part of the ground rule was also to inform the expert that they should re-log in each time they experienced any technological glitches.

All the information given at the beginning of the discussion helped in the smooth coordination. Few participants experienced Zoom meeting timed out time and technological glitches; however, these did not affect the data collection process. The discussion was automatically audio-recorded by Zoom recording facility, while I transcribed the audio-recorded discussion manually.

Data Collection Through Document Review

The documents reviewed were the LWC performance in the last 5 years, from 2016-2020. However, information for 2016 was not made available except for the revenue performance. I reviewed the analysis of LWC performance from 2017-2020, focusing on the major waterworks and mini/microworks activities, the locations, design capacity, managers in charge with years of experience, actual results in 2017-2020. The documents also included the LWC revenue performance from 2015-2020. I requested the human resource manager to allow me gain access to the analysis of LWC performance document. This document was both in hard copy and in soft copies with several pages

that discussed details on each element. For instance, there is a whole detail on locations, design capacity, managers, and years of manager's experience. The document is in English language and accessible to the top management of the LWC.

Table 3 is used to provide a summary of the three data sources, which include semistructured interview, focus group discussion, and document review. The research question one and two are presented on Table 3. The interview questions are shown in their respective appendix, while the data analysis that took place is also mentioned (Table 3).

Table 3

Summary of the Data Collection Elements

Research Questions	Interview Questions	Type of Data	Analysis
Research Question 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?	Refer to Appendix A for Semistructured Protocol	(a) Semistructured interview (b) Focus Group Discussion (c) Documents Review	Yin's 5 data analysis (a) data compilation, (b) data disassembly, (c) data reassembly, (d) data interpretation, and (e) data conclusion and meaning
Research Question 2: What are the sustainable water supply	Refer to Appendix B for Focus Group Protocol		

funding strategies
by LWC, which
could provide
adequate potable
water to all Lagos
residents?

Data Analysis

There were three sources of data that were analyzed in this study. There were semistructured interview data, focus group discussion data, and the document review data. I performed data analysis on the three data collected from the semistructured individual interviews, focus group discussion, and document review.

The semistructured interview data from 20 participants was analyzed using five Yin's data analysis pattern. Yin's (2018) suggestion for data analysis include (a) data compilation, (b) data disassembly, (c) data reassembly, (d) data interpretation, and (e) data conclusion and meaning. After conducting the interview through Zoom, I transcribed the audio-recorded interview manually and ensured its accuracy. I conducted a member checking with each of the 20 respondents in the in-depth interviews.

Member checking is used to confirm the participant's position that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016). Member checking is a validation technique where "data or results are returned to participants to check for accuracy and resonance with their experiences" (Birt et al., 2016). The member checking in this study involved returning the transcripts (data) to all participants to confirm whether or not the transcripts represented what was discussed

during the interview and the focus group discussion. The research questions in this study addressed sustainable water supply management and funding strategies by LWC, which could provide adequate potable water supply to Lagos residents.

The focus group discussion data was analyzed using Yin's five data analysis pattern. Yin's (2018) suggestion for data analysis include (a) data compilation, (b) data disassembly, (c) data reassembly, (d) data interpretation, and (e) data conclusion and meaning. After conducting the focus group interview through Zoom, I transcribed the audio-recorded discussion manually and ensured its accuracy.

The document review focused mainly on the LWC performance reports in the last 5 years. However, while I reviewed the LWC revenue performance from 2015 to 2020, the performance reports for other aspects such as capacity utilization were from 2017-2020. After I have determined the codes, categories, and emerging themes for the three sources of data, I triangulated the three sources of data to gain a comprehensive understanding of water supply management issues by LWC in Lagos State. The use of multiple sources of data will also satisfy the data triangulation requirement and enhance the reliability of the study's results (Fusch et al., 2018).

I organized the participants' answers into codes, categories, generated themes, and compared the outcomes with the conceptual framework and the literature review. A code is a word or short phrase that captures the spirit of a portion of language-based or visual data (Saldaña, 2016). Coding helps a researcher arrange similar emerging themes and concepts to foster easy access (Rubin & Rubin, 2012).

I used the NVivo for data management. The NVivo software is popular among notable qualitative researchers and useful for data management, coding, and categorizing the codes. NVivo can manage large data (Dollah et al., 2017), and qualitative researchers use it to organize, manage, and shape qualitative data (Richardson et al., 2015). NVivo has become a widely accepted software by many prominent qualitative researchers (e.g., Leech & Onwuegbuzie, 2011). However, the researcher remains the primary data collection and analysis tool, irrespective of computer software support (Mohajan, 2018). Thus, the researcher is the main instrument for data collection because they have to analyze the data to provide answers to the research questions.

The final step in qualitative research is to interpret the data and make sense of it (Saldaña, 2016). Therefore, I came up with findings and conclusions that related directly to the raw data. The data interpretation remains the primary duty of the researcher through his deep involvement throughout the data collection and analysis stages (Mohajan, 2018). The theorist von Bertalanffy's (1950) systems theory, which focuses on the whole system rather than the behaviors of the individual parts, grounded the conceptual framework. I explored the better sustainable management and funding strategies by LWC, which could provide adequate potable water to Lagos residents, and compared the revealed sustainable management and funding strategies to prior literature findings.

Evidence of Trustworthiness

Credibility

Credibility is the process a researcher adopts to ensure the accuracy of the findings and answers whether people can trust the results (Tong & Dew, 2016). A credible qualitative study provides an accurate description or interpretation of human experience that other people with similar experiences can confirm (Thomas & Magilvy, 2011). Credibility is a measure of the value and acceptability of the research outcome that combines the conduct of the research as proposed and the demonstration of the trustworthiness of the processes (Houghton et al., 2013). To ensure the study's credibility, I carried out member checking with participants in the in-depth interviews and the focus group discussion by returning the transcripts to all participants to confirm whether or not the transcripts represented what was discussed during the interview and the focus group discussion.

Member checking is used to confirm the participant's position that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016). Member checking is a validation technique where "data or results are returned to participants to check for accuracy and resonance with their experiences" (Birt et al., 2016). The member checking in this study involved returning the transcripts (data) to all participants to confirm whether or not the transcripts represented what was discussed during the interview and the focus group discussion.

I achieved triangulation by using multiple sources of data (individual in-depth interviews, focus group discussion, and document review). Using multiple sources of data will maximize the potential for an in-depth understanding of the case under study, achieve data saturation, and reduce bias. In addition, I engaged qualitative study experts to review whether the interview and focus group questions are sufficient to answer the research questions.

Transferability

Transferability refers to whether the findings of a study can be used in another study and answers whether the findings are relevant to other contexts and settings (Tong & Dew, 2016). It is a measure of whether or not researchers can replicate the research findings or methods elsewhere or the findings for a particular study is applicable in another setting (Thomas & Magilvy, 2011). To help the decision on transferability, I adequately explained the findings with detailed descriptions. A detailed description might help future readers to make informed decisions on whether the findings are transferable to a specific organization, setting, or context (Stake, 1995). The decision for transferability is reserved for readers to make (Houghton et al., 2013; Marshall & Rossman, 2014). I presented a complete report, including full research descriptions, findings, and conclusions, using comprehensive descriptions that could help future researchers to make informed decisions about the extent of the usefulness of the information.

Dependability

Dependability describes how well established the data used in a research study are and answers whether the process is transparent, and this occurs when a different researcher can track the decision trail used in another study (Thomas & Magilvy, 2011). Houghton et al. (2013) suggested that the audit trail would help the reader follow the researcher's study steps. Therefore, I maintained an audit trail to capture the research steps and activities throughout the research stages to justify my decisions on method and design. To enhance the study's dependability, I carried out the field-testing of the interview and focus group discussion questions by experts to validate the ability of the questions to answer the research questions. In addition, I carried out member checking with the participants in the in-depth interviews and the focus group discussion. Member checking allows participants to confirm that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016).

Confirmability

Confirmability measures the objectivity and correctness of data as presented (Houghton et al., 2013). It answers whether the findings and interpretations relate to the raw data (Tong & Dew, 2016). Confirmability refers to how others view the findings, whether they reflect the meanings from observed participants or the researcher's leanings. Meeting credibility, transferability, and dependability criteria is necessary for confirmability (Thomas & Magilvy, 2011). To ensure confirmability in the study, I maintained qualitative objectivity by entering in a reflexive journal all personal pre-

conceived assumptions and presuppositions and maintaining a reflective journal for an audit trail.

I kept notes of all steps, major decisions, responses and reflections during the stages of the study. Korstjens and Moser (2018) suggested researchers keep record of the justifications for all decisions in research methodology and data management in the reflexive journal and documented all reflections based on personal experience, culture, biases, and explanations that would inform and influence the research process. In the data analysis section, I aligned findings with the conclusions and interpretations to not introduce personal biases into the study. In addition, I carried out member checking with the participants in the in-depth interviews and the focus group discussion. Member checking allows participants to confirm that the produced transcripts represented what transpired during the interviews and the discussion (Birt et al., 2016).

Study Results

The results from this study contain the research questions and emergent themes from the data collection process. I used methodological triangulation; semistructured interviews, focus group discussion, and document review to organize the data collection process. The threshold for theme generation was set for 75% and above. Themes below 75% were not included in this study. Themes below 75% were treated as discrepant responses. I transcribed the recorded interviews from the semistructured interviews and focus group discussion to generate codes and themes. I presented the themes generated from the data collection from the semistructured interviews in Table 4.

Table 4*Data Analysis: Codes and Emerging Themes from the Semistructured Interviews*

Codes	Categories	Themes	Number of Occurrences	Percentage of Occurrences
Efficiency dropped. Production level has plummeted. Upgrade the facilities so that they can perform to full capacity. Aged pipes, Aged networks. Bursts. Pumps are not working. Right now we are all clamoring for more waterworks, more waterworks; how have we been able to adequately managed the ones we have.	Inefficiency. Existing waterworks	Improving operational efficiency of existing waterworks	20	100%

Private sector investment Public-private partnership to deliver the services to Lagos.	Open up participation in water supply services. Encourage investments in water supply.	Inviting Private Enterprises to participate in Water Supply	16	80%
Employment embargo Retirement Without replacement Aging Workforce No succession plan	Inadequate workforce and strategies to sustain the system	Establishing a Succession Planning System in Water Supply Management	16	80%
We don't have sufficient manpower. We stopped recruitment in 2008/9. We need manpower at these plants. We rely on contract staff to run these plants.	Insufficient manpower in terms of quality and quantity. Suspension of young graduate recruitments	Organizing High Quality Recruitment Process & Educational Background	15	75%

Training. Tools and materials. Contract staff	Manpower development. Staff Motivation	Improving Staff Motivation & Training among all Staff	20	100%
Customer Orientation, Customer Service	Customer Orientation and Service	Organize Regular Customer Orientation and Excellent Customer Service	20	100%
Enlightenment Campaign, Potable Water Social service Wasting water Alternative sources	Enlighten customers on sustainable water use, payment of bills and costs of alternative sources.	Organize Massive Water Conservation Campaign	20	100%
Quality, Standards We have labs	Maintain the quality of water at the points of production and customers' premises	Adhere to Water Corporation Ethical Standard and Compliance	20	100%
Collaboration Agencies Pipes Destruction of our Mains	Collaborate with other agencies to prevent destructions of underground water	Collaborating with other Governmental & other non-state Agencies/Shared Data	20	100%

	facilities			
Zonal offices. Area offices. In the past Before now	The Zonal/Area arrangement in the past produced results	Organizing Water Corporation into Area & Zonal Management System	20	100%
Quantity, Quality, Consistent	Need for improved service delivery	Ensuring Quality, Quantity & Availability of Water Supply	20	100%
Water policy Environmental issue, Health issue. Alternative water sources.	Water policy to incorporate the health aspects. Focus on health implications of alternative sources.	Resolving the Dichotomy about Water as Environment Issues or Health Issues		
Collaboration Work in Siloes Hoard knowledge Only same set of people	Collaborate Integrate all efforts.	Improving collaboration & integration of efforts among LWC staff & department	15	75%
Unknown water networks, Non-revenue water.	Have a complete view of water flow in the entire water distribution	Identifying and mapping all the currently unknown pipe networks into Geographical Information System (GIS) to curtail non-	20	100%

	networks.	revenue water		
Good and robust billing and collection system	Customer friendly billing. Easy payment platforms	Establish a Customer-Friendly Billing and Payment Options	15	75%
Relationship Seller Buyer	Purely business relationship	Establishing a Seller/Buyer Relationship with the Customers	20	100%
Service Delivery, Customer satisfaction	Improved service delivery Customer Satisfaction Improved Revenue.	Provision of Reliable and Safe Water to Customers	20	100%
Strategies development, Ownership Staff Good hands Engineers	The use of local resources and expertise to foster ownership.	Develop Implementable Business Plan in Which LWC Staff Take Ownership	20	100%
Loans, Grants, Aids	The need to source for grants, loans, and aids to supplement Water Supply	Seek Non-Governmental Organization Aids and Grants	20	100%

	funding.			
Digitalization, Billing system, Collection platforms	Digitalize billing and collection system. Provide easy payment platforms	Digitalization of Billing System & Collection Through e- Payment Platforms	15	75%
Products Availability	Improve water service delivery	Improvement in Products Development in the Water Sector	20	100%
Meters, Conservation, Payments	Use meters to aid payments, transparency, and water conservation.	Use of Appropriate and Functional Prepaid Meter	20	100%

Results from Semistructured Interviews

Research Question 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 1: Improving Operational Efficiency of Existing Waterworks

The first theme that emerged from the analyzed data from the semistructured interviews was improving operational efficiency of existing waterworks. Twenty respondents, representing 100 % of the respondents, responded that improving operational efficiency of existing waterworks was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Respondent 2 (R2) mentioned:

As at today, our service to our customers is less than 5% is less than 5% compared to the past when we served customers up to 78-80 percent but as at today is less than 5%, improving the operational efficiency of the existing waterworks will help provide adequate potable water to all Lagos residents.

R 1, 3, and 4 agreed that “water supply to Lagos residents now is abysmally very poor because service delivery to the people of Lagos now is unpredictable, but could improve if existing waterworks are efficient”. R1 stated, “a commitment that the routine maintenance, must also make adequate fund for routine maintenance as at when due not until plants breakdown”. R3 stated, “Water supply to Lagos and its metropolis is as at present is very poor, due to inefficient existing waterworks”. R 5, 6, and 7 mentioned,

“Water Corporation produce is far less what we produced as at 1994, 96 and what we produce, producing today cannot go round anywhere.” “Well, considering the state of our infrastructure, probably, I wouldn't say it is satisfactory because the feedback we get from most customers is that the, in fact, demand far outweighs the supply we have at present”; and “I can then say low because existing waterworks are not functional”. R 8, 9, 10, and 11 described as follows: “The service presently, we can just say it's fair”; “Lagos State Water Corporation vis-a-vis its service to the populace is grossly inadequate because of old waterworks abandoned”; “We would still say maybe we are still under, but could rejuvenate the existing waterworks”, “About 4 years ago, we were serving about 38% but it has nose-dived to less than 25% about a year ago”. R11 stated:

We are just doing cosmetics maintenance, it's only when it breakdown that we try to repair. For example, if the manufacturer says after 100,000 hours you must change a bearing, we don't do that. We only wait until the bearing worn-out”.

R20 stated: “Water Corporation eh some others eh believes routine services and maintenance is not needed to be taken care of, properly what we are doing here is eh, when there is eh breakdown, we'll go there and do replacement or do services. This issue of when, when equipment's breakdown, we'll now rise up and go and repair it.

Inefficient operation compounds the problem of inadequate water supply; this leads to loss of revenue, thereby hindering water utilities, such as LWC, to recover cost and be self-sustaining (Balogun et al., 2017; Dighade et al., 2014). Balogun et al. (2017)

reported poor and declining operational efficiencies, which ranged from 4.87% (lowest) to 38.05% (highest) for all LWC waterworks and suggested that LWC should improve the operational efficiency of existing waterworks to reduce leakages.

Theme 2: Inviting Private Enterprises to Participate in Water Supply

The second theme that emerged from the analyzed data from the semistructured interviews was inviting private enterprises to participate in water supply. Sixteen respondents, representing 80%, responded that inviting private enterprises to participate in water supply was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: “And then I think the other thing the corporation will need to do is to look at the possibility of partnering with the private sector to invest in water infrastructure”. R9 mentioned: “Lagos state Government can, maybe, source for fund in the stock market, they can do private eh partnership initiatives, or go to international agencies, international donor agencies, World Bank”

R12 stated:

Work is on the high level on that and having resolved that, I want to believe that the management of Water Corporation will source for foreign or eh local partners who will be able to join hands with the Corporation. These are a lot of people; there are a lot of companies who want to join hands with the Corporation on new projects, such as that of Odomola and Yewa.

R17 stated:

So, its, it is a combination of so many factors but the greatest of them all is, there are no ehm how will I call it, there's no ehm, ah, attribute of fresh injection of funds one, government intervention two, government is still playing a major role, they're are not running it as private sector and that is why probably it's a form of ehm private sector intervention might help, which the public will call private public partnership, whereby if we run eh, in a private sector we will be giving the management.

R16 stated:

From what I know, anything that is government, people just do anything they like. from the management to the junior staff, they believe that if this thing is not working well, at least salary will go on, but when it is privatized, people will know that, if they do not meet up with the demand, they will not get their salary. So, people don't have choice than to be responsible for anything that is happening within their vicinity.

Eighty percent of the participants inferred how partnering with private organization can enhance the supply of water to Lagos state, thereby having a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Bobbink et al. (2020) appraised public and private partnership (PPP) to have started since the 1980s, where privatizing and outsourcing the non-core operational activities of and resources for their product services to reduce costs and risks. PPP

usually maximizes the value of their product-services, by spreading the responsibility for delivering these services over various organizations through contracts and/or concessions (Bobbink, et al., 2020). Mvulirwenande et al. (2019) suggested that delegated management of water supply to contractors holds promise for developing countries if there are adequate institutional frameworks and policies and the water utilities are ready to learn from such management contracts.

Theme 3: Establishing a Succession Planning System in Water Supply Management

The third theme that emerged from the analyzed data from the semistructured interviews was establishing succession-planning system in water board management. Sixteen respondents, representing 80%, responded that establishing a succession planning system in water supply management was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The respondents mentioned:

Staff succession plan is zero. Its zero because a lot of people are, have been retiring and ehm, there are no people filling the, the vacant, the vacant space. And ehm, sometimes when a staff is due to, to retire and eh, he needs to bring up some staff, you know, that can take over from him in that aspect. But there is no succession plan at all, there is none.

Succession planning is important for organizational growth and business sustainability in the public sector. However, few organizations have attempted to

introduce the concept and practice (Suwaidi et al., 2020). Succession planning is influenced by five main factors, namely succession planning strategy, knowledge management opportunities, organizational culture, leadership development opportunities and management commitment towards leadership transition (Suwaidi et al., 2020).

Theme 4: Organizing High Quality Recruitment Process & Educational Background

The fourth theme that emerged from the analyzed data from the semistructured interviews was organizing high quality recruitment process and educational background. Fifteen respondents, representing 75% respondents, responded that organizing high quality recruitment process & educational background was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R4 stated:

As at now, both staff and contract staff are a little less than 1000. No new staffs, no recruitment of new staff. So, they want the corporation to be privatized because we have since been on it. Corporation was formally Lagos State Water Corporation, the state was removed, and now Lagos Water Corporation.

R5 stated:

You can't believe for the past 20 years; they are not recruiting any new staff. They are just getting contract staff and when somebody worked for 10 years, 15

years, eight years as a contract staff, and you are not thinking of staffing the person, you cannot get the real dedication from that person.

R8 stated: “We don’t have sufficient manpower, because we stopped recruitment in 2008 or 2009 and so, we need manpower at these plants, so, most times we rely on contract staff to run these plants and it’s not proper”. R15 stated: The manpower level in quantity, we are a bit short staffed in quantity”. R16 mentioned: “Any time a staff is going, uh, they will have to call that staff back as a contract staff”. R19 stated: “From the scenario I painted that there has been embargo on employment, so they have a lot of contract staff”. R20 stated: “What we are having now is depletion of staff because the retirees are going and we don’t have young blood to replace them now”.

Kasri et al. (2017) ascribed sustainable rural water service delivery in Indonesia to the quality citizen and government engagement. Horning et al. (2016) suggested that understanding human-social relationships is critical to ensure the success of sound water governance principles at the level of implementation.

Theme 5: Improving Staff Motivation & Training Among all Staff

The fifth theme that emerged from the analyzed data from the semistructured interviews was improving staff motivation and training among all staff. Twenty representing 100% respondents, responded that improving staff motivation and training among all staff was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Four of the respondents mentioned: “we believe with the right orientation, in Lagos state water corporation, they

have the caliber of staffs to implement any strategy that could eh move the corporation forward. We have good and capable hands”. R1 stated: “If you take a survey within the utility you will find out that in the last 5 years some staff have not gone to a single training in the last 5 years”. R3 stated: “More importantly there is a need for serious capacity building in the system”.

R4 stated: “Gone are the days’ personnel are trained, we are no longer trained”. R5 stated: “Then the, the, the, our staff, these days, we are losing a lot of our staff. They, most of them, they are not going on some further training”. R7 stated: “Have worked for this organization for over 20 years now, I cannot really recall the last time there is any refresher course or any kind of training, so, for my other colleagues like that. The organization seems not too interested in developing anybody in the system”. R11 stated: “The present staff are okay, though by the time we get a new one, there must be training and retraining program for them to meet the challenges ahead”. R18 stated: “There is need for training and retraining. Training, you know, this aspect has been lacking for so long”.

R19 stated:

I think ah presently eh the management is trying but there is need for eh serious eh training at the different levels of management; there is need for serious training. We used to have staff capacity development plan in the past, I mustn’t eh deceive you, but presently eh perhaps because of this eh present eh of paucity of fund, no one is thinking of staff development eh, capacity development plan now.

Developing staff and motivation will go a long way to make the corporation function effectively.

Theme 6: Organize Regular Customer Orientation and Excellent Customer Service

The sixth theme that emerged from the analyzed data from the semistructured interviews was organizing regular customer orientation and excellent customer service. Twenty representing 100% respondents, responded that organizing regular customer orientation and excellent customer service was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: “I explained to you most of the customers don’t want to pay because of intermittent water supply. I believe if service is improved, customers will pay. We have had willingness to pay study where customers were asked about willingness to pay”.

R2 stated: As today, our service to our customers is less than 5%, is less than 5% compared to the past when we served customers up to 75-80%”. R3 stated: “The other constraint is customers not responding well because of the level of service. LWC needs to address the issue of trust of customers. And with the customers, the people must also understand the principle of non-wasting of water”. R4 stated: “A good service is in a situation whereby a customer opens his tap at home, in his restaurant, even at recreation centers 24 hours and water is running”. R5 stated: “The revenue is nose-diving and these days some customers bypass the meter, so they are just using free water”.

R6 stated: A good service to the customer is when you can get the water, the public water to the door of the customer 24 hours with adequate pressure and that is it". R7 stated: "The perception of most of our customers is that water is a social service.... They see water as something that there should not be a price on it at all". R9 mentioned: "But I believe with the right customers' orientation, in Lagos state water corporation, they have the caliber of staffs to implement any strategy that could move the corporation forward. We have good and capable hands". R18 stated: "The customers will be much more willing to pay if they see the service, you know, on a constant basis". All the respondents for the semistructured interviews gave an affirmative response when asked if organizing regular customer orientation forum would make LWC to improve its sustainable service provision.

Theme 7: Organize Massive Water Conservation Campaign

The seventh theme that emerged from the analyzed data from the semistructured interviews was organizing massive water conservation campaign. Twenty representing 100% respondents, responded that organizing massive water conservation campaign was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: "The other thing in the area for the customers, the Corporation will need to create a kind of training for customers or enlightenment campaign for customers". R2 stated: "People of Lagos are willing to pay for the water they use but the fear now is that more than 80% of those we call our customers have found alternatives for their water requirements by making borehole here

and there, but when the quality of service improves we can still get them back”. R3 stated: “Water Corporation itself needs to reach out to people in terms of advocacy and enlightenment on wasting water”.

R5 stated: Government is talking with double mouths; they will say it during campaigns, they will promise free water”. R7 stated: “They see water as social service”.

R9 stated:

for instance, an aspiring councilor, who doesn't even know any office of Lagos state water corporation, when he's on campaign will tell his ehh ward members that he's going to provide them water. And that's why you see most of them, they go and dig small, small holes, bore holes with 500 liters' tanks and say they provided water

R12 stated:

If we are able to address the issue of rehabilitation of the waterworks and we can get water to the people, although we need to do a lot of campaign, enlightenment to the people to ensure they key up with our supply and we need to follow up to collect our money

R13 stated:

for several years we've been maintaining very good relationship with our stakeholders eh through the various ehm projects that have been done in Water Corporation, we've had cases were NGOs are invited and involved in all these projects in fact we've had cases were NGOs are involved in

championing our public enlightenment campaign in eh ehm mediating, protecting the interest of the customers' massive campaign to create awareness on water management.

Theme 8: Adhere to Water Corporation Ethical Standard and Compliance

The eighth theme that emerged from the analyzed data from the semistructured interviews was adhering to Water Corporation ethical standard and compliance. Twenty respondents, representing 100% respondents responded that adhering to Water Corporation ethical standard and compliance was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: "I know majority of the people of the people would rather take away the hardship, the headache of providing water for themselves and have clean water from the utility". R3 stated: "A good service is described in terms of quality of water supply, in terms of quantity of water supply and in terms of and in terms of availability of water supply. Yes, all of these are presently are rated very low in Lagos". R4 stated: "It is expensive maintaining borehole and the quality of the borehole too cannot be compared to the potable water given by the Corporation".

R6 stated: "My role is to ensure that I mean, the right quality of chemical are being dosed at any pump and ensure there is available material".

R10 stated:

I said Lagos Corporation is doing pretty well in maintaining the quality of water from water being produced from waterworks down to the customer

outlet, and basically how we do that is by check, by adhering to the quality standard at the waterworks, and also doing some intervals and injection if need be of chlorine within our network at some intervals, and also we do checking customers stand point.

R12 mentioned, “Okay, a good service to the customer should be 24/7 water provision at high pressure and good quality that will meet WHO standard. And that’s what we do”.

R14 Stated:

We might have some intrusion along the distribution network due to low pressure or due to breakages and so on and so forth, but the quality of water that leaves the waterworks, we have qualified quality assurance officer that ensure that the, the water sample meets with regulation. We have the Nigerian standard for drinking water regulation, we have WHO and so these are the guidelines to ensure that we have good quality water being served to the public.

Theme 9: Collaborating with other Governmental Agencies and Non-State Providers: Shared Data

The ninth theme that emerged from the analyzed data from the semistructured interviews was collaborating with other governmental agencies and non-state providers: shared data. Twenty representing 100% respondents, responded that collaborating with other government agencies and non-state providers and shared data was a sustainable water supply management strategy by LWC, which could provide adequate potable water

to all Lagos residents. R12 mentioned: “There should be a kind of collaboration, where our men will be on ground to guide them, to show them the alignment of our mains and what have you, such that it will reduce the rate of ehm, destruction of our mains. We’ve also written to our supervising ministry”. R5 stated:

The same thing like a federal, the ministry, the eh rail way. When they want to start the project, the minister of, of transportation have to come, involved the Water Corporation and that’s why they are getting a good result in that, in that regard even at all, they are in federal. Then the case of the state too... the ... the more even, the water basin agency. Osun, Ogun Water Basin Development Agency. Even they are, they are doing some projects, like last year they do some project in Epe and they are planning to do some in Badagri. I think they are focusing on the rural areas of the state, which is a, is a good collaboration

R17 stated: “Well, the interaction has not been good enough, to avoid destruction of our facilities because if the, if the interaction is enough, such destruction will not come in the first place”. R18 stated: “Eh, with other companies, or comp, companies eh sometimes there's not been so much eh, I mean eh, what will I call it, a good interaction per se”. R15 stated: “But I know once in a while in the time past, they sent one or two staff to such trainings just to have an idea of what they are doing in other water utilities bur it’s not eh a regular thing”. Water governance provides clear definitions of roles and

relationships among critical stakeholders, such as policymakers, operators, customers, regulators, and other companies performing similar functions (Marques et al., 2016).

Theme 10: Organizing Water Corporation into Area & Zonal Management System

The tenth theme that emerged from the analyzed data from the semistructured interviews was organizing Water Corporation into area and zonal management system. Twenty representing 100% respondents responded that organizing water corporation into area and zonal management system was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R2 stated. “I will prefer we go back to, what will I call it now, go back to the system we were using in the 90s where you have area managers, you have zonal managers working with them, give them something to work with....”.

R5 stated:

But sincerely, if water is regular 50 % of the customers will not want you to knock at their doors before they pay. The willingness to pay dwindles when the water is not forthcoming as expected. So, that is it, considering all, we watch out for ourselves, we have zonal officers, where we have these tripartite departments represented, so we watch out for ourselves

R7 stated:

I close to like attended all education here in Lagos... I work with Lagos Water Corporation. I have worked in many capacities in Lagos Water Corporation ehm from regional head, zonal head, area head. I have worked mainly in the marketing angle of things, commercial angle of things where our major business is selling water.

All respondents agreed that LWC should go back to the past (1990s) era and be structured into area and zonal offices for effective management. Egbinola (2017) suggested that despite the robustness of the Nigerian water institutional framework, there is a lack of coordination among institutions and other critical stakeholders, resulting in redundancy and inefficiency.

Theme 11: Ensuring Quality, Quantity & Availability of Water Supply

The eleventh theme that emerged from the analyzed data from the semistructured interviews was ensuring quantity, quality and availability of water supply. Twenty representing 100% respondents' responded that ensuring quantity, quality and availability of water supply was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R7 stated:

Well, when you talk about goldmine to areas where there are no alternatives readily available and water from Lagos, from the state is the major source of supply there is no doubt about that, it is a goldmine; it is a goldmine there. For instance, if you go to, like I said earlier, all these

Islands, eh all these customers along the Islands, it is difficult for them to say they want to switch over to boreholes

R9 mentioned: if water is available, the question of managing the consumers will just be a smaller persuasion to pay for water, which I know they will be willing to pay. I think you get it. The bottom line of which remains provision of quality and in right quantity to the people as at when they need it". R11 stated: "A good service that eh, a good service must ensure 24-hour nonstop supply to nooks and corners where we have mains and it has to be reliable, of good quantity, sorry good quality and with adequate pressure. As at today we have less than 2 bars in our line". R18 stated: "The, the customers will be much, much willing to pay if they see the service, you know, on a constant basis". R19 stated:

You know, they will know that, they need to give these people their desired eh attention, then the best way to improve eh relationship with customers, is by giving them ahh water at adequate and sufficient eh quantity, so whenever they need us, we are there for them. When you promise them, in fact, it is even good for Water Corporation to under promise and over deliver, so by so doing they say "ah this people are improving oh, they really improve they, are not even promising this but look at what they are doing now".

Water governance provides clear definitions of roles and relationships among critical stakeholders, such as policymakers, operators, customers, regulators, and other companies performing similar functions (Marques et al., 2016).

Theme 12: Resolving the Dichotomy about Water as Environment Issues or Health Issues

The twelfth theme that emerged from the analyzed data from the semistructured interviews was resolving the dichotomy about water as environmental issue or health issue. Twenty representing 100% respondents responded that resolving the dichotomy about water as environmental issue or health issue was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated:

For example, the Lagos Water Corporation actually reports to the ministry of environment and water resources. And the ministry of environment and water resources are actually in charge of ehm, developing the policies, creating enabling environment and so on. We have on the other hand the Lagos state water sector regulatory commission who is in charge of regulating the entire sector, setting of tariff, ensuring the quality of water provided and so on. And also, we have other non-direct actors. We have the ministry of health, we have the local government, we have the ministry of education and so on. So, all of these are all actors within the sector.

R3 stated:

The policy of water spoke about water being an environmental issue but everyone also know that water is also a health issues.” “The health of the people would be improved because they would be taking quality water, which is supplied by Lagos Water Corporation”. “Lagos Water Corporation would have to add to the quality of water supply”. “Government also would not be spending more money in the hospital treating water-borne diseases”.

All respondents spoke about the potential health implications of unregulated alternative water sources. Water Corporation would resolve the two ways fold between health and environment so as to have a clear focus and unity of command. Aliyu and Amadu (2017) suggested that urban health crises of inadequate safe water supply and sanitation lead to water-related diseases. Rehman and Baig (2017) suggested that lack of adequate water supply forces inhabitants of the Slum of Karachi to rely on the unhygienic water supply that causes water-related diseases such as typhoid, dysentery, and diarrhea. Boelee et al. (2019) suggested that systematic and integrated water management could reverse health hazards and reduce, or prevent negative health impacts and enhance the health benefits.

Theme 13: Improving collaboration & integration of efforts among LWC staff & departments

The thirteenth theme that emerged from the analyzed data from the semistructured interviews was improving collaboration and integration of efforts among LWC staff and

departments. Fifteen representing 75% respondents responded that improving collaboration and integration of efforts among LWC staff and departments was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R3 stated:

Take for example, we have commercial department taking charge of billing, we have the account department taking charge of collection, we have the customer service almost attributed to commercial department. We have water production at its own end. The water production could even be on its own end. But when we are coming to the issue of water services, I believe commercial department should be at the lead, the distribution department to support the commercial department when they are having issue. Then the issue of collection should still reside within commercial department even though the account would have an oversight function of it, so that there is an interaction in all of these.

R3 stated further: “Presently, in Lagos Water Corporation all of them work in siloes. What I mean by they are in siloes is that everybody is working almost independently. There is no organized way of putting all of these together”

R4 stated “the leadership of the Corporation is also political, given to us by the politicians, the political goons. So, when they come, you will think they want to work, but unfortunately they make the system worse than they met it.” There should be

collaboration among staff in various departments”. Horning et al. (2016) suggested that a clear understanding of the human-social relationships is vital to eliminating the failure of sound water governance at the implementation level.

Theme 14: Identifying and mapping all the currently unknown pipe networks into Geographical Information System (GIS) to curtail non-revenue water

The Fourteenth theme that emerged from the analyzed data was identifying and mapping all the currently unknown pipe networks into geographical information system (GIS) to curtail non-revenue water. Twenty representing 100% respondents responded that identifying and mapping all the currently unknown pipe networks into geographical information system (GIS) to curtail non-revenue water was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. R3 stated:

The part of the problem of Lagos Water Corporation also has is the lack of the knowledge of the entire networks. There is water going to many places that Water Corporation doesn't know about.... There are a lot of mains that are in the system that are not to the knowledge of the present staff.

There is a need to be able to identify where these networks are. A lot of water is going to places, which the staffs don't even know anything about.

We need to address the issue of the knowledge of the networks and from

there you can be able to have a grasp on non-revenue, unaccounted-for water within the system

Other respondents agreed on the fact that: lot of pipes are taking water that are unknown. Lagos needs to find a way to identify these pipes and every drop of water must be accounted for. And for the issue of commercial losses, the issue of metering is very critical. Kandissounon et al. (2018) argued that water losses in the distribution network are a more important factor responsible for the problem of inadequate water supply in Lagos than urbanization and population. Balogun et al. (2017) suggested that part of the problems confronting LWC is the low operational efficiency of the existing water facilities that engenders leakages and recommended that LWC should improve the existing waterworks' operational efficiency to reduce leakages.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 15: Establish a Customer-Friendly Billing and Payment Options

The fifteenth theme that emerged from the analyzed data from the semistructured interviews was establishing a customer-friendly billing and payment options. Fifteen representing 75% respondents, responded that establishing a customer-friendly billing and payment options was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: “And to effectively bill, it means you have to have a good and robust billing and collection system in place”. R2 mentioned: “The billing and collection system has to be improved. There is

still a lot of leakages in the collection system”. R3 stated: The billing and collection system has to be improved”. R5 stated:

At the present billing, I don't think we can actually recover that cost, but what the government needs to do is what, to support our billing system whereby we can, we can improve the customer base because presently, I think Lagos state, Lagos Water Corporation should be talking about more than a million billing when we have about over 20 million residents in Lagos and we are still talking about far, far less than what, even 100 thousand

R6 stated: People want to pay money; they cannot pay because we cannot collect cash from them”. R7 stated: “There are collection issues”. R10 stated: “So like I said, one of the, those, one of the major indices that we measure in water eh business is billings from billings is your collections. So if you are unable to get an accurate customers database it affects these major indices i.e. billing and collections. So I would say it is important for us to get an accurate database of the customer being served from the utility”.

R11 stated: “We are using flat rate, we are not billing them what they actually consume, so there is ongoing metering program but we are yet to cover up to 30% of the populace”. Public utilities, such as LWC should find alternative funding and billing system, which must not solely depend on the whims and caprices of governments (Ohwo, 2016), and foreign supports to avoid the effect of

sudden withdrawal (Monney & Antwi-Agyei, 2018). The funding must come by way of internally generated revenue through effective cost recovery (Oseni & Oseni (2018). One way of achieving this is by increasing customers' willingness to pay through improved service delivery and customer-friendly billing and payment options.

Theme 16: Establishing a Seller/Buyer Relationship with the Customers

The sixteenth theme that emerged from the analyzed data from the semistructured interviews was establishing a seller and buyer relationship with the customers. Twenty representing 100% respondents, responded that establishing a seller and buyer relationship with the customers was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: "our relationship is basically, is the seller and the buyer relationship. We provide water and they buy and of course in recent times, we have seen increase in dissatisfaction from the customers because they feel they are not adequately served" R2 stated: "Relationship between Lagos Water Corporation and the customers. As at today, as at today, I don't think it is cordial, because we are not giving them what is expected of us. They expect their water from us because we cannot give them, they start looking for water from everywhere". R11 stated: "That is a big question because nowadays they complain. But since we are unable to meet their demand 100 percent, there's a slight mistrust". R12 stated: "Revenue will naturally flow in with adequate public enlightenment, campaign, interaction with customers, reduction of leakages, regular production of bills."

All respondents expressed affirmation to the need to establish a seller/buyer relationship between the Water Corporation and the users of water. Horning et al. (2016) suggested that a clear understanding of the human-social relationships is vital to eliminating the failure of sound water governance at the implementation level.

Theme 17: Provision of Reliable and Safe Water to Customers

The seventeenth theme that emerged from the analyzed data from the semistructured interviews was provision of reliable and safe water to customers. Twenty representing 100% respondents responded that provision of reliable and safe water to customers was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated:

For us to be able to do that, it means we need to improve our capacity utilization from where it is now to ensure we are able to provide 24/7 safe water to the customers. So, if we are able to give reliable safe water to the customers definitely there is going to come customer satisfaction and when you have customer satisfaction, then you look how can I effectively bill

R2 stated: "I have said it earlier. If state government can go on their way to rehabilitate some of these waterworks at least to get to may be, 70-80% design capacity, as the people of Lagos are willing to pay for the water they use". R7 stated: "If these infrastructures are functioning well, and enough product to sell, there would be more

revenue, then the system can sustain itself”. R18 stated: “The, the customers will be much, much willing to pay if they see the service, you know, on a constant basis”.

R16 mentioned:

I believe, ehm people still feel that it is the responsibility of government to provide potable water and government too, feels too that it is their responsibility to provide potable water, because if it is privatized, the tariff that people will be paying on water will be more, and if people do not get this potable water, they can go and be drinking unsafe water, so I think that is what uhm Lagos state is guiding against, they don't want to inflict too much pains on the citizens

Aliyu and Amadu (2017) suggested that urban health crises of inadequate safe water supply and sanitation lead to water-related diseases. Water is used across sectors to advance development (Hurlimann & Wilson, 2018). With adequate governance and resources that foster water supply performance (Pahl-Wostl, 2017), external loans and aids for water supply will engender economic growth if optimally used (Fashina et al., 2018).

Theme 18: Develop Implementable Business Plan in which LWC Staff Take Ownership

The eighteenth theme that emerged from the analyzed data from the semistructured interviews was developing implementable business plan in which LWC staff take ownership. Twenty representing 100% respondents, responded that developing

implementable business plan and utility staff to take ownership was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated:

And for me, what I will say is number one, there is a need for the corporation to develop what I will call a, an implementable strategic business plan. What we see most times is to get consultants from wherever to come to develop a strategy for you, by the time they leave you find out that these strategies are things you cannot implement

R3 stated:

We have said that a lot of reports that are written by multilateral agencies like the World Bank and the consultants from abroad. The reports they have written; how would I describe it? Their reports had been classy. It is always important, even though these classy reports are important but there is need to domesticate these classy reports to ensure that they, reports, to ensure they fit well into the culture and the situations we have locally

Theme 19: Seek Non-Governmental Organization Aids and Grants

The nineteenth theme that emerged from the analyzed data from the semistructured interviews seeking non-governmental organization aids and grants. Twenty representing 100% respondents, responded that seeking non-governmental organization aids and grants was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated

It is through state government grant and then from water tariffs. When you improve your efficiency, automatically you improve your chances of being able to get a loan or grant or whatever. Because now, whoever is giving you, will have the confidence that you know what you are doing and when he gives you, you will utilize it properly

R3 stated: "Personally, I have no objection to taking foreign loan and grants for water services, what I object to is non-domestication of the processes they are advocating to use in the water supply services". R5 mentioned: "So the, the situation is is eh it's as bad as that. Unless we get a grant or we get another loan from World Bank". R8 stated: "Apart from this, on monthly basis, the Lagos state government grant salary subvention for the corporation, to this extent I think the Lagos state government is trying in this direction" R9 mentioned:

It may not necessarily be a loan; it may be a grant. There are some international agencies that are that are ready to give grants not loans like USAIDS now, I know USAIDs can give grants and JICA can do. So all those organizations they should be approached or it may not even be monetary funding. A grant may come in in terms of eh machinery equipment. Just donor. I know the Japanese they do give such eh ehm what do you call it, grants. I think in the early, mid 90's the Corporation benefitted immensely from eh sort of Japanese grants giving them water pumps

R13 mentioned:

But for them, probably we would have closed up, but for the government that usually come to our aid in granting support, they give us various form of eh support. They help us in the purchase of chemicals, payment for power supply eh, they even give us a kind of subvention to augment our salary

Ndiritu et al. (2018) suggested that an increase in grant financing of community water projects results in a reduction in such projects' sustainability. For external loans and aids to achieve the goal of triggering economic growth, they require an adequate policy framework and institutional arrangement (Saibu & Obioesio, 2017).

Theme 20: Digitalization of Billing System & Collection Through e-Payment Platforms

The twentieth theme that emerged from the analyzed data from the semistructured interviews was digitalizing of billing system and collection through e-payment platforms. Fifteen representing 75% respondents, responded that digitalizing of billing system and collection through e-payment platforms was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R1 stated: “And to effectively bill, it means you have to have a good and robust billing and collection system in place”. R2 mentioned: “The billing and collection system has to be improved. There is still a lot of leakages in the collection system”.

R3 stated: "The billing and collection system has to be improved". R6 stated: "People want to pay money; they can't pay because we cannot collect cash from them". R7 stated: "There are collection issues".

R7 stated:

Every other production factor cannot operate on its own if you take away the human factor. I know that these days everything has been digitalized, everything is now propelled by mechanics and what have you, but it takes human beings to even work on those digital systems, automated systems, and what have you. Using a digital billing system will optimize the revenue for the corporation

R10 stated:

Basically, one of our, one of our issues is power, adequacy of power. You will recall that power is quite important in this business; so adequate provision of power is an issue for the agency to be able to meet up with the water demand. So is also in collections, there are collection issues in terms of collecting from the billings for water usage, and if there are collections, collection issues, the agency or the utility are unable to meet up with their own financial obligations internally

R13 stated:

for revenue generation the product just has to be there first, the product should be available, and then if the product is available, those things that would come next would be ehm the collection process, so there has to ehh be a robust and more convenient way of making paying payment that would be attractive to, to the customers, for those that have the facility they should be able to pay their bills using their phone, on their phone I mean, ehm those things will enhance payment and inflow of revenue

Theme 21: Improvement in Products Development in the Water Sector

The twenty-first theme that emerged from the analyzed data from the semistructured interviews was improvement in products development in the water sector. Twenty representing 100% respondents, responded that improvement in products development in the water sector was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents.

R1 stated: “Of course, ehm, right now, like I have said before, I wont say our service is good because right now we are not able to give effective service delivery because the product is not there.”

R3 stated:

Ehm, at the optimum, Lagos could serve 33% of the population. But presently as we are speaking, may be, we are serving less than 5% of the population. Majority are getting by, using alternative supply and those 5% like I said, the service remains very, very low.

R13 stated:

for revenue generation the product just has to be there first, the product should be available, and then if the product is available, those things that would come next would be ehm the collection process

R18 stated:

So, there, that's why I said there is very little the Lagos State Water Regulatory Agency can do presently, because if they said they want to regulate, in most areas, people are not getting water and you know that water is so important that there is no how you can do without it, so people must find alternative, the alternative is in either, drilling borehole or patronizing eh water eh tanker services and even water tanker services where are they getting the water? From borehole

R19 stated:

Borehole drilling is one is one of the most lucrative businesses in Lagos now, as a result of that, so that means people are now seeking for alternative sources of supply if not borehole drilling then, eh if you can, you can drill borehole and be selling water, that's another area that is eh of good business, then all these ehh water tanker, ehh commercial water tanker operation is a good business to, so that is to tell you the relationship between Lagos Water Corporation and customers is that bad

R16 stated:

You know it's very easy, it's very easy to drill borehole in Lagos state and people believe that if they can drill borehole uhm, they would be using Lagos Water Corporation as an alternative source, because their, like, like I said uhm there're so many people entering Lagos that the pipe network is not getting to them

All the respondents gave affirmation to products development as a strategy to get funds for LWC

Ohwo (2016) suggested that the problems of inadequate water supply in major cities in Nigeria are due to inadequate infrastructure investment, poor maintenance of the existing water facilities, and dysfunctional distribution networks.

Theme 22: Use of Appropriate and Functional Prepaid Meter

The twenty-second theme that emerged from the analyzed data from the semistructured interviews was the use of appropriate and functional prepaid meter. Twenty representing 100% respondents, responded that using appropriate and functional prepaid meter was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. R3 stated:

Water Water Corporation, at a point, began delivering on, while trying to address non-revenue water, unaccounted-for water, began to install prepaid meters. People embraced the prepaid meters initially but along the

way, it was costing them higher than anticipated and this was due to the fact that more water is being wasted through customers' staffs rather than being used

R4 stated:

So, now we have meters, we have conventional meters, we have prepaid meters that is used to conserve water and also for payment of eh water bills". R4 added: "But where we have very good meters, the prepaid meters, they are using it, it's just that it's teaching them to conserve water. You don't leave taps carelessly again. Then as soon as possible they make sure that they arrest any leakage if not their water is running". "That is why the use of meter, if all customers are metered as it is in electricity, everybody will be cautioned to stop wastages and arrest leakages immediately

R7 stated:

The people are enlightened. They pay without much effort, without so much effort, without so much eh, you know, arguments here and there. As a matter of fact, most of the properties there are on prepaid metering system prepaid billing structure such that, you know, they charge their token ahead of time and they charge reasonable. But the same cannot be said about suburban areas and even rural areas for that matter, where they see water, firstly, as a social service

R13 stated:

The same thing with procurement of ehm meters, smart meters that, that are, are better than these current mechanical meters that we are using or even prepaid meters you know, funding, the personnel need to be trained as well you know, ehh. Capacity building is centered-on funding and with, with that adequate funding, I'm sure that ehm the management will be able to carry out the various eh strategy that would, that would ensure and enhance ehm this good service to be

R19 stated:

When I mean the trend in the vogue eh you don't need to go and meet your customers that you want to collect the money. For example, now, the issue of this prepaid arrangement. When the water is everywhere for everybody to, to access first to tap, and then you now putting the prepaid issue there, so anybody that is wasting our water will pay for it

R20 stated: "... If we are using what is in vogue in the world today, this issue of prepaid or this Internet banking, all sorts of things, so we won't have much problem in collecting our money".

Results from Focus Group

Table 5 contains the codes, categories and themes that emerged from focus group interview. Six themes emerged which include using multidisciplinary professional in

water supply management, unbundling water corporation into smaller business units, involving community and customers in water supply management, remove government interferences and operate as commercial entity according to the act that establish LWC, partner with private consultants on revenue collection, and update and grow customer database (Table 5).

Table 5*Data Analysis: Codes and Emerging Themes from the Focus Group Discussion*

Codes	Categories	Themes	Number of Occurrences	Percentage of Occurrences
So you have to be professional in handling the water supply, you must know every bit that contributes to the value chain of the water supply. Not necessarily, you have to be an engineer, you have to be multidisciplinary professional to handle the problem of Water Corporation	Water Supply management requires multiple disciplines	Using multidisciplinary professionals on Water Supply management.	6	100%
LWC should be unbundled. They are handling more than they can chew. They need more business units that will know how to go out to collect bill	Restructure LWC to smaller business units for efficiency.	Unbundling LWC for efficient service delivery.	6	100%

for supplied water and even to fix tariff appropriately.

<p>There is a gap. And I believe that this gap can be bridged by, by public enlightenment on the part of the LWC. It's very important that they involve customers. End users having a sense of ownership of water infrastructure.</p>	<p>There is need to involve stakeholders especially community /customers in water supply management for sense of ownership.</p>	<p>Involvement of Community/Customers in Water Supply Management</p>	6	100%
<p>Political interference. Expected to be run as a commercial organization Law and the reality are always two different things.</p>	<p>Government interference prevents LWC from being efficiently run.</p>	<p>Remove Government Interferences and Run as Commercial Entity According to the act that established LWC</p>	6	100%
<p>Get them out of the web and let them either they live or die. There is the need to go to full commercial</p>				

services.

<p>Low revenue collection. In the case of Water Corporation, which is not totally only peculiar to them, tariff are not being adequately collected. I would also want to say and lay more emphasis on the issue of private sector partnership.</p>	<p>Inadequate capacity for effective revenue collection.</p>	<p>Partner with Private Consultants on Revenue Collection</p>	<p>6</p>	<p>100%</p>
<p>You have to develop strategies to improve on your customer database by increasing, coming up with strategies how to grow your customers, how to retain your customers.</p>	<p>Know your customers Grow your customer base</p>	<p>Update & Grow Customer Database</p>	<p>6</p>	<p>100%</p>

RQ 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 23: Using Multidisciplinary Professionals in Water Supply Management.

The first theme that emerged from the analyzed data from the focus group discussion was using multidisciplinary professionals in Water Supply management. The collective view of all the six participants, representing 100% participants responded that using multidisciplinary professionals in Water Supply management was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents.

From the focus group, all participants mentioned the fact no matter how many reforms or donors funding is coming, if the leadership is not fit professionally to manage that utility we still run on the same spot. PP1 stated: “You just have to be professionally trained, you must know, work the job, if the job is is not out for you, you don’t have any business to be there”; so you have to be professional in handling the water supply, you must know every bit that contributes to the value chain of the water supply”. Rietveld et al. (2016) suggested that by integrating multi-stakeholders, the systems approach could use expertise, real-world decisions, and local knowledge to solve practical problems in simple ways.

Theme 24: Unbundling Water Corporation Into Smaller Business Units.

The second theme that emerged from the analyzed data from the focus group discussion was unbundling Water Corporation into smaller business units. The collective view of all the six participants, representing 100% participants responded that unbundling

Water Corporation into smaller business units was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents.

PP2 stated:

Lagos Water Corporation should be unbundled, unbundled in the sense that we know because of the population of Lagos State, they are handling more than they can chew and I believe that the whole water supply process, starting from the source, treatment, distribution network, the transmission network, just like the unbundle of NEPA. I think for Lagos state; Lagos state is actually ripe for unbundling. We have different entities; different private commercial entities to handle and then they can network. Then you can now have a situation whereby we have a formal role of regulator, which will now be now the role of Lagos State Water Corporation or may be the ministry. You unbundle it at different units, so that each unit can perform. They will have a smaller, compact, eh rather than this humongous thing that has become more of a monster in Lagos state.

PP3 stated:

Somebody also mentioned unbundling, if you unbundle and get private sector operators to operate, the only way that international loans and grants can come in will be by injection into capital projects. But, if the corporation unbundle self they should be able to operate from their own funds, and give them the opportunity to charge cost-reflective tariff so that they can make enough money

to, to run their operations. Not the current Water Corporation that is on 1% cost eh, tariff recovery or bill recovery and yet the staff are still there, everybody is still there

PP4 stated: “So the whole of Lagos state, they need more business units, that's when the concerned business units will know how to go out to collect eh bill for supplied water and even to fix tariff appropriately”. All participants agreed that LWC should go be unbundled into smaller business units. Egbinola (2017) suggested that despite the robustness of the Nigerian water institutional framework, there is a lack of coordination among institutions and other critical stakeholders, resulting in redundancy and inefficiency.

Theme 25: Involving Community/Customers in Water Supply Management

The third theme that emerged from the analyzed data from the focus group discussion was involving community/customers in Water Supply management. The collective view of all the six participants, representing 100% participants responded that involving community/customers in Water Supply management was a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents.

PP2 stated:

Yes. I believe it would have a salutary effect to service delivery, it would improve service delivery and customer satisfaction. And also don't forget that whatever you own, you would take care of it, if the customers have a means of ownership

of certain aspects of service, I believe it would improve tremendously service delivery to them.

PP5 stated:

Also, it would be a yardstick to get across to the government in some cases through the consumers because consumers also have some kind of ehm of lending voices even to give and they know how to go back to their constituencies to talk to those that are in political circle that would in turn talk to themselves at that government quarters, and then definitely they would find a way of giving some sorts of assistance to the Water Board.

PP6 stated:

I have said it before that it's very important that they involve customers. That was when I said the issue of end users having a sense of ownership of water infrastructure. That, in a community, they have a sense that ok, this is water line, these are pipelines, this is water getting to us, we are actually benefitting from it and we have a sense of ownership and to pay up and that is why is very important for customers to be brought on board. There should be representatives of each community coming on board and be sensitized and be part of decision-making process of the Lagos Water Corporation. I believe by so doing, it will actually help in the delivery of services as expected

Aper and Aku (2018) suggested that the inclusion of community members in the operation and maintenance of water equipment enhances the sustainability of water supply facilities. Ndiritu et al. (2018) suggested that an increase in grant financing of community water projects results in a reduction in such projects' sustainability.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 26: Remove Government Interferences and Run as Commercial Entity According to the act that established LWC

The fourth theme that emerged from the analyzed data from the focus group discussion was removing government interferences and run as commercial entity according to the act that established LWC. The collective view of all the six participants, representing 100% participants responded that removing government interferences and run as commercial entity according to the act that established LWC was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents.

PP2 stated:

The current situation whereby Lagos Water that is supposed to be a commercial entity, still has a lot of interference from the government, So, even if you bring a performance-base contract there would always be a default, may be not on the part of the operator but on the part of the government. My own position is that government should totally bands off the running of water supply in Lagos. What

they need to do is to have a system whereby it is broken into units and play a role of regulator

PP3 stated:

And we know just like we have said that even though the law allows them to be run as a commercial entity, the people that are in the helm of affairs did not go through a competitive eh recruitment process that will show that we have the right, round peg in the round hole, and that the person that is there can actually manage the organization, they would recruit the person that can run and turn the place around. So my own is that they should still find the management that can be accountable to its own board, that is accountable to the shareholders, that is accountable to people looking to them to make a profit and to make the business work, not somebody that wants to work and is not sure whether they are going to remove him tomorrow.

PP3 stated:

The current relationship is that of government running the system by itself through the Corporation. The law says the Corporation is a legal entity, legal personality, allowed to work; it's a corporate personality. That is not the way it is running, it's got no board, there is no corporate governance. The relationship is not in accordance with what the law provides and that is where the problem is, and the law provides for autonomy, they don't have it.

PP6 stated:

I mean effective delivery, because if people are not getting value, they would feel somehow to actually pay on their own part, and also, on the part of government they should hands off, they should limit their interference to Lagos Water Corporation. Let them carry out their duty as stipulated in the law that birthed it. I believe doing this thing; it would actually help in the effective delivery of adequate and potable water across Lagos state

LWC is yet to take advantage of the customers' readiness to pay for service delivery because of a lack of autonomy (Ohwo, 2016). The lack of autonomy makes the government preclude LWC from charging appropriate tariff (Ohwo, 2016), which could support operation and maintenance.

Theme 27: Partner with private consultants on Revenue Collection

The fifth theme that emerged from the analyzed data from the focus group discussion was partnering with private consultants on revenue collection. The collective view of all the six participants, representing 100% participants responded that partnering with private consultants on revenue collection was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. PP6 stated:

I would also want to say and lay more emphasis on the issue of private sector partnership is very, very important. So I would want to say that the issue of

encouraging private sector partnership would actually help in getting adequate and potable water across down to every nook and cranny of Lagos state.

PP3 stated:

Hand it over to private sector management and let them run it as a business on the understanding that there will be no government interference and people will get value for the money they are going to pay for it

PP6 stated further:

There is the need to actually encourage private enterprises that, so that, they can come on board so that they can meet the enormous demand that we have here in Lagos state. I think they have a huge responsibility and they must be awakened to it especially in terms of bringing in private enterprises to actually come and help them in that regard.

Theme 28: Update & Grow Customer Database

The sixth theme that emerged from the analyzed data from the focus group discussion was to update & grow customer database. The collective view of all the six participants, representing 100% participants responded that updating and growing customer database was a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents.

PP1 stated:

So, the most important thing is once there is water supply of good quality and it's regular, they can access it, you have to develop strategies to improve on your customer database by increasing, coming up with strategies how to grow your customers, how to retain your customers. These are the things that are expected between eh the Water Corporation and the customers at that level.

Document Review

I reviewed the documents relating to the performances of the LWC in the last 5 years. In 2010, when LWC developed its Water Supply Master Plan (Lagos Water Corporation, 2010), the LWC's total design capacity was 210 mgd. The current total design capacity is 208 mgd. The average capacity utilization in 2017 was 22.69%; in 2018 it was, 28.3%; in 2019, it was 15.78%, and in 2020 it was 14.11%. The data for 2016 was not available during the review. The capacity utilization trend from 2017 to 2020 reflected operational inefficiencies of the waterworks and it mirrored the data obtained from the interviews and the focus group discussion. A review of the revenue generation from 2015 up to 2020 also followed a downward trend. The explanation for the trend was due to a reduction in service delivery as represented by capacity utilization. The outcome of the document review mirrored the data collected from the interviews and the focus group discussion.

Data Triangulation

Using methodological triangulation, themes emerged from codes and categories from the collected data from the semistructured interview, focus group discussion, and

the document review. The recurring themes aligned with both RQ1 & RQ2. Using Yin's 5-step data analysis process, member checking, and triangulation, key findings emerged. The use of multiple sources of data also satisfied the data triangulation requirement and enhanced the reliability of the study's results (Fusch et al., 2018). The themes are the same in providing meaning to the same RQ while they are different by data collection source.

Summary

Twenty-two themes emerged from the analysis of the data collected from the semistructured interviews. The themes are categorized into two, as they provided answers to the two research questions.

RQ1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

The following themes provided answers to Research Question 1: The sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents include: improving operational efficiency of existing waterworks, inviting private enterprises to participate in water supply, establishing a succession planning system in water supply management, organizing high quality recruitment process & educational background, improving staff motivation & training among all staff, organizing regular customer orientation and excellent customer service, organizing massive water conservation campaign, adhering to Water Corporation ethical standard and compliance, collaborating with other governmental agencies and non-state

providers: shared data, organizing Water Corporation into area & zonal management system, ensuring quality, quantity & availability of Water Supply, resolving the dichotomy about water as environment issues or health issues, improving collaboration & integration of efforts among LWC staff & departments, and identifying and mapping all the currently unknown pipe networks into Geographical Information System (GIS) to curtail non-revenue water.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

The following themes provided answers to Research Question 2: The sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents include: establishing a customer-friendly billing and payment options, establishing a seller/buyer relationship with the customers, providing reliable and safe water to customers, developing implementable business plan in which LWC staff take ownership, seeking nongovernmental organization aids and grants, digitalizing billing system & collection through e-payment platforms, improving products development in the water sector, and using appropriate and functional prepaid meter.

Six themes emerged from the data collected from the analysis of data from the focus group discussion. The themes are categorized into two, as they provided answers to the two research questions.

RQ 1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

The following themes provided answers to Research Question 1: The sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents include: using multidisciplinary professionals in Water Supply management, unbundling Water Corporation into smaller business units, and involving community and customers in water supply management.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents? The following themes provided answers to Research Question 2: The sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents include: removing government interference and operate as commercial entity according to the act that established LWC, partnering with private consultants on revenue collection, and updating and growing customer database. Chapter 5 includes discussion, conclusions, and recommendations.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative case study was to explore better sustainable management and funding strategies by LWC, which could provide adequate potable water to all Lagos residents. I chose an exploratory qualitative case study because it was best suited to answer the research questions concerning a complex problem such as water supply management. The summary of key findings is categorized into two, as they provided answers to the research questions.

A total of 28 themes emerged from the data collection process. Twenty-two themes emerged from the semistructured interviews, while six themes emerged from the focus group data analysis. The document review validated the demographics and the themes that emerged from both semistructured interview data and focus group discussion data.

Semistructured Interviews

RQ1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

The themes from semistructured interview that answered RQ1 include: improving operational efficiency of existing waterworks, involving private enterprises in water supply, establishing a succession planning system, embarking on high quality recruitment and education, motivating and training staff, embarking on massive water conservative campaign, adhering to ethical standard and compliance, collaborating with stakeholders,

organizing Water Corporation into areas and zones, seeing water as both an environmental and a health issue, ensuring collaboration and integration in LWC, and identifying and mapping all unknown pipe networks into Geographical Information System (GIS),

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

The themes from semistructured interviews that answered RQ 2 include: providing customer orientation and excellent services, establishing a seller and buyer relationship with the customers, making staff own an implementable business plan, seeking nongovernmental organization aids and grants, digitalizing billing system to ease payments, improving products development in the water sector, and using appropriate and functional prepaid meter.

Focus Group Discussion

RQ1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

The themes from focus group discussion that answered RQ 1 include: using multidisciplinary professional in water management, unbundling water corporation into smaller business units, and involving community and customers in water supply management.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

The themes from focus group discussion that answered RQ 2 include: removing government interference and operate as commercial entity according to the act that established LWC, partnering with private consultants on revenue collection, and updating and growing customer database.

The document review focused mainly on the LWC performance reports in the last 5 years. After I determined the codes, categories, and emerging themes for the three sources of data, I triangulated the three sources of data to gain a comprehensive understanding of water supply management issues by LWC in Lagos State. The use of multiple sources of data satisfied the data triangulation requirement and enhanced the reliability of the study's results (Fusch et al., 2018).

Interpretation of Findings

RQ1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 1: Improving Operational Efficiency of Existing Waterworks

The first theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that improving the operational efficiency of existing waterworks is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The first theme supported Ablanedo-Rosas et al. (2020). Ablanedo-Rosas et al. (2020) suggested that

decreasing and controlling leakages across the water supply distribution network is a significant factor that could increase the operational efficiency of water utilities. Dighade et al. (2014) suggested that water utilities in developing countries should focus on optimizing the operational efficiencies of existing waterworks rather than clamoring for new ones.

Doronina et al. (2020) suggested that monitoring water quality at both the inlet and outlet of service reservoirs provides valuable information on asset performance and highlights the exact location and extent of deterioration of water supply along the distribution network, thereby leading to cost-efficient resource provision. Furthermore, Martin-Candilejo et al. (2019) suggested an integrated water assessment approach whereby all costs of the water in relation to energy are integrated. The authors noted that energy costs are a significant fraction of the total cost of water supply installation and should be considered from the initial design to foster efficient operation of the facilities. Fathollahi-Fard et al. (2020) inferred that approximately every person needs two liters or half of a gallon of drinking water every day.

However, on the other hand, making the drinking water available is also very important and involves several complex stages, from production through distributing and consuming (Fathollahi-Fard et al., 2020). Hence, there are many reasons to operate existing waterworks efficiently to prove that water management is crucial in today's community (Fathollahi-Fard et al., 2020). Furthermore, an increase in the population of Nigeria and the economic growth and the industrialization of our world are a signal to

severe problems related to water resources management, hence the need for efficiency of existing and investments in new ones (Fathollahi-Fard et al., 2020).

Theme 2: Inviting Private Enterprises to Participate in Water Supply

The second theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that inviting private enterprises to participate in the water supply is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The second theme supported previous literature on the partnership between public and private enterprises for efficiency (Pahl-Wostl, 2017). The belief is that the business approach of private companies would remove problems with inefficiency and ineffectiveness of public organizations (Pahl-Wostl, 2017).

However, Morris (2017) cautioned that public-private partnership is not immune to challenges, especially when the frameworks are inadequate to protect all interests. In addition, Abubakar (2016) suggested that outright privatization might come with huge risks because water, as a natural monopoly, requires regulatory capacity on the part of the government. Government agencies responsible for regulatory and oversight functions of the water sector may lack regulatory capacity (Behailu et al., 2017; Chukwuma, 2017). The primary purpose of private sector ownership was to take advantage of perceived private ownership efficiency compared to the government.

The authors analyzed the effect of governance of governance on the dynamic efficiency of water utilities and suggested that privatization of the Brazilian water and

sewage sector does not guarantee increase in the efficiency of the water sector. There was no evidence to back up the claim in some quarters that private ownership has greater efficiency than public ownership (Barbosa et al., 2016). In addition, privatization might not be in the public's interest because it could negate the principle of water as a public good (Zeneli, 2017). Kang et al. (2019) appraised how several rationales exist for the increased use of public-private partnerships (PPP). First, there are collaborative PPPs when stakeholders in both sectors perceive its need (Kang et al., 2019). The proliferation of PPPs may also stem from the desire for performance improvement, cost reduction, environmental protection, and increased competition (Kang et al., 2019).

Theme 3: Establishing a Succession Planning System in Water Supply Management

The third theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that establishing a succession planning system in water supply management is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The third theme supported the conceptual framework in respect of management functions of organizing, which allocates resources to achieve goals and plans (Schraeder et al., 2014) and previous literature on succession planning (Ali & Mehreen, 2018). Ali and Mehreen (2018) suggested that succession planning makes bank employees feel secure with a positive attitude about their careers, which reduces the turnover intentions among employees and gives management the latitude to fill any vacant position quickly, thereby

sustaining excellent customer services. Oyewole (2018) found that succession planning is a precursor to the sustainability of any organization, which requires the effective and ongoing deployment of management functions.

Fernandez-Araoz et al. (2021) suggested that poor succession planning could be costly because it might lead to excessive turnover among senior executives, significant value destruction for companies and investment portfolios. The authors advised firms to take proactive steps by planning leadership changes before they are needed, identifying and developing high fliers, exposing them to the board, and throwing their net far and wide for possible suitable internal and external candidates, and use the services of the consultants with caution because of excessive fees. Buckman et al. (2020) suggested that succession is not a one-off event for an organization but a process that takes place over time, requiring the buy-in of all crucial stakeholders, whose support is imperative to the success of the process. Buckman et al. (2020) concluded that a thriving business could be impaired if there are no identified business succession plan (BSP) procedures, while a non-thriving business is likely to be maintained as a going concern if there is a communicated BSP.

Theme 4: Organizing High-Quality Recruitment Process & Educational Background

The fourth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that organizing high quality recruitment process and educational background is a sustainable water supply management strategy

by LWC, which could provide adequate potable water to all Lagos residents. The fourth theme supported the conceptual framework in respect of management functions of organizing, which allocates resources to achieve goals and plans (Schraeder et al., 2014) and previous literature on attracting quality talents and performance (Adeosun & Ohiani, 2020). Adeosun and Ohiani (2020) revealed that firms could leverage salary, brand name, referral, job security as core factors in attracting and recruiting quality talents. Also, digitization is a crucial strategy leveraged in attracting and recruiting quality talents.

Techniques such as social media, traditional media, online interviews, and physical interviews have proven to help select quality talents (Adeosun & Ohiani, 2020). Recruiting a talented workforce is critical to a firm's success and superior performance; however, hiring a talented workforce requires an effective recruitment process with proper planning and the ability to obtain background information about prospective employees (Adeosun & Ohiani, 2020). The authors noted that interviews have, over time, proven helpful in selecting quality talents.

Despite Lagos accounting for 80% of Nigeria's manufacturing sector growth with 65% of Nigeria's value-added tax (VAT), Lagos, Nigeria, has a high unemployment rate (Adeosun & Ohiani, 2020). Moreover, with an average graduate churn out of 600,000 by tertiary institutions in Nigeria, getting quality candidates out of a large pool remains a difficult task because of the quality of candidates and lack of workplace readiness. Therefore, organizing multiple layers of assessment and screening has become a common practice to select a suitable candidate. However, such quality candidates are conscious of

their worth and value, resulting in high mobility in the labor market (Adeosun & Ohiani, 2020).

Theme 5: Improving Staff Motivation & Training among all Staff

The fifth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that improving staff motivation and training among all staff is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The fifth theme supported the conceptual framework in respect of management functions of leading, which creates an enabling environment for employees and organizations to perform (Schraeder et al., 2014) and previous literature on the nexus between employee motivation, training, and performance (Girdwichai & Sriviboon, 2020). Girdwichai and Sriviboon (2020) suggested a significant relationship between employee performance and employee motivation and that training has a positive but moderate relationship to employee performance, and in addition, a healthy and positive working environment enhances performance. George (2018) suggested that the motivation of employees can affect the performance of an organization and a demoralized employee attracts poor performance. In addition, the authors suggested that motivation is the right tonic that keeps employees focused on organizational objectives leading to improved productivity and organizational performance.

The human resource management (HRM) practices could be an apparent cure to motivate the personnel's expertise, attitude, and manner, which affect the performance of

organizations and employees (Manzoor et al., 2019). A positive employee attitude can help them give maximum effort to get promoted (Manzoor et al., 2019). Employees must be included in the organization's structure through training and socialization. After this process, vital elements of HRM are evaluated in the development of staff members and encourages them through compensation and reward systems (Manzoor et al., 2019).

Theme 6: Organize Regular Customer Orientation and Excellent Customer Service

The sixth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that organizing regular customer orientation and excellent customer service is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Therefore, theme six supported Sahhar et al. (2021). Sahhar et al. (2021) evaluated service to customers as service not consumed at a single point in time but are usually engaged in what we currently understand as a customer journey. Customer journeys include the events and phases experienced by customers in their communications and interactions with service providers (Sahhar et al., 2021).

In the context of water supply management, the customer's journey involves an adequate and regular potable water supply at an affordable price, and prompt response to complaints from the customers. Excellent customer service consists of resources, activities, context, interactions, and taking into account different customers' roles, which influence responses throughout the customer journey (Sahhar et al., 2021). Customer

relationship management is a strategic approach that integrates people, processes, and technology to understand its customers and maintain long-term relationships with them (Jhamb et al., 2021). However, there are contributory factors to the failure of customer relationship management in public and private organizations, and these factors include unskilled employees, inadequate research, poor quality and quantity of data, inadequate research, lack of understanding of the business benefits, functional limitations, lack of leadership, and involvement of senior management, inadequate assessment systems, and lack of awareness regarding the complexity of implementing (Jhamb et al., 2021).

Domi et al. (2020) examined the determinants of Albanian tourism small and medium-sized enterprise (SME) performance and found that Customer orientation has a direct positive impact on performance, innovativeness, and innovation behavior. Li et al. (2019) suggested that because most public institutions have a built-in customer base, they do not prioritize employees' customer orientation. However, they found that employees' customer orientation behaviors significantly impact customers' perceived service quality and satisfaction toward public institutions, and customers' perceived service quality influences their satisfaction toward public institutions. Yeo et al. (2019) suggested that customer orientation affects adaptive selling behaviors of salespeople, and such behaviors affect the salespeople's organizational identification and sales performance. Therefore, there is a need for educational programs that allow the salesperson to understand customer-oriented organizational culture and empower salespeople to develop positive corporate identities.

Theme 7: Organize Massive Water Conservation Campaign

The seventh theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that organizing a massive water conservation campaign is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Public water conservation campaigns raise awareness in all levels of society about the importance of saving water to cope with its scarcity and ensure sustainability (He et al., 2019). Preparation and execution of public awareness campaigns require a multidisciplinary team, including water experts, building and construction experts, social marketing, communication and outreach, and education professionals. Water conservation campaigns come with the benefits that include (a) fosters reduction in water use, thereby reducing pressures on water utilities, water resources and the environment, (b) fosters reduction in energy use for abstraction, transport, and treatment, mitigating greenhouse gas emissions, and (c) reduces water costs for utilities and end-users (He et al., 2019).

Maduku (2021) suggested that conservation campaigns affect consumers' planned and typical water conservation behavior and provide understanding that make water conservation social marketing effective. Koop et al. (2019) argued that enhancing domestic water conservation provides a promising alternative or necessary addition to reduce costs and stimulate pro-environmental behavior. Finally, Ehret et al. (2021) suggested that all water conservation interventions use information, motivation, and behavioral skills (IMB), suggesting that water conservation interventions can be

interpreted within the IMB framework, and that interventions with two or more IMB components led to reductions in water usage. The use of IBM suggests that LWC could galvanize water conservation campaigns using the instrumentality of information, motivation, and behavioral skills (IMB).

Theme 8: Adhere to Water Corporation Ethical Standard and Compliance

The eighth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that adhering to Water Corporation ethical standards and compliance is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The eighth theme supported the conceptual framework in respect of management functions of controlling, which monitors the organization and employees regarding performance and progress towards the goal (Schraeder et al., 2014). However, organizations face a conflict between employee and organizational ethical standards in their bid to ensure compliance (Rosenberg & Schwartz, 2019). Socializing new employees is one way of assuring compliance, and it is necessary for old and new employees because it makes those standards visible and then operable in the daily life of an organization.

Rosenberg and Schwartz (2019) inferred that organizations initiate ethical standards and compliance by doing the following: code of conduct and relevant compliance policies and procedures, oversight function and accountability, training, communication, and awareness creating; a delegation of authority, enforcement, discipline, and incentives; monitoring and auditing, internal investigations, risk

assessments, and total quality management. Fotaki et al. (2020) suggested that high ethical standards and synergies between compliance and a focus on organizational values enhance corporate governance. Nejati and Shafaei (2018) suggested that students demonstrated more outstanding anonymous, emotional, and compliant prosocial behavior when they perceive stronger ethical supervision. Therefore, intense ethical supervision could foster compliance behavior of the employees, thereby enhancing corporate governance.

Theme 9: Collaborating with other Governmental Agencies and Other Non-State/Shared Data

The ninth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that collaborating with other governmental agencies and other non-state agencies is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The ninth theme supported the conceptual framework on interdependence management (Bergsten et al., 2019). Bergsten et al. (2019) suggested that governance gaps emerge when responsible actors do not recognize how multiple issues and actors are related. The authors suggested that integrative gaps occur when interdependent issues are managed in isolation ignoring their interdependencies, and collaborative gaps occur when actors working on common issues work in siloes without any collaboration. Hendijani and Saei (2020) suggested that internal and process dimensions of integration positively affect operational and financial performances. Therefore, companies need to integrate and

collaborate with their suppliers and customers. Schot et al. (2020) suggested that developing interprofessional collaboration is not an exclusive function of managers and policymakers; the professionals also have a significant role to play by closing professional, social, physical, and task-related gaps, negotiating overlaps in roles and tasks, and creating an environment conducive to do so.

Theme 10: Organizing Water Corporation into Area & Zonal Management System

The tenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that organizing LWC into area and zonal management system is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The tenth theme supports the literature on decentralization of water and sanitation services (Mwihaki, 2018). Mwihaki (2018) suggested that the decentralization of water and sanitation services particularly in stakeholder participation on water issues, power and role distribution in the Kenyan water sector improves water governance. The decentralization enhances accountability, acceptance of pluralistic trends, and efficient and effective service delivery. From the discussion with the participants, dividing LWC into areas and zones will enhance water supply efficiency and boost revenue for the corporation.

Theme 11: Ensuring Quality, Quantity & Availability of Water Supply

The eleventh theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that ensuring quality, quantity, and water

supply availability is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Thus, eleventh theme aligns with the literature. Balogun et al. (2017) suggested that inefficient operation by LWC compounds the problem of inadequate water supply, thereby hindering cost-recovery and sustainability. Sherry et al. (2018) inferred that inadequate maintenance and management have led to poor water quality, poor access, intermittent supplies, and dissatisfaction with services quality in Tanzania.

Abubakar (2016) suggested that the primary function of the water delivery system in Abuja does not work and characterized by poor infrastructure maintenance, and episodes of contaminated water, among others. Kandissounon et al. (2018) argued that water losses in the distribution networks are a significant factor in inadequate water supply in Lagos. Ohwo (2016) suggested that the problems of inadequate water supply in major Nigerian cities are inadequate infrastructure investment, poor maintenance of the existing water facilities, and dysfunctional distribution networks. Therefore, for LWC to ensure quality, quantity, and availability, it must improve operational efficiency of the existing waterworks while progressing the construction of new ones.

Theme 12: Resolving the Dichotomy about Water as Environment Issues or Health Issues

The twelfth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that resolving the dichotomy about water as an environmental issue or health issue is a sustainable water supply management

strategy by LWC, which could provide adequate potable water to all Lagos residents. The twelfth theme aligns with the literature on collaborative governance (Cain et al., 2020). Cain et al. (2020) found that creating successful collaborative governance regimes is difficult but can be especially hard when collaborations are externally generated by higher levels of government instead of self-generated by local agencies and stakeholders due to the lack of spontaneity. Cain et al. (2020) suggested that beyond the task of solving a particular policy problem, collaborative governance engages multiple government agencies and other stakeholders in consensus-oriented decision-making. Water corporations in Nigeria should collaborate with the ministry of health and the ministry of the environment through a system thinking approach to address all the risks and rewards associated with water management in Nigeria.

Theme 13: Improving Collaboration & Integration of Efforts among LWC Staff & Departments

The thirteenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that improving collaboration and integration of efforts among LWC staff and departments is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The thirteenth theme supported the conceptual framework. Bergsten et al. (2019) suggested that governance gaps emerge when responsible actors do not recognize how multiple issues and actors are related. The authors suggested that integrative gaps occur when interdependent issues are managed in isolation ignoring their

interdependencies, and collaborative gaps occur when actors working on common issues work in siloes without any collaboration.

Hendijani and Saei (2020) suggested that internal and process dimensions of integration positively affect operational and financial performances. Therefore, companies need to integrate and collaborate with their suppliers and customers. Schot et al. (2020) suggested that developing interprofessional collaboration is not an exclusive function of managers and policymakers; the professionals also have a significant role to play by closing professional, social, physical, and task-related gaps, negotiating overlaps in roles and tasks, and by creating an environment conducive to do so. Finally, Obisi et al. (2020) suggested that workforce planning influences organizational performance and recommended that organizations get a business direction right and avoid undesirable costs associated with high staff turnover, poor performance, and dissatisfied workers.

Theme 14: Identifying and mapping all the Currently Unknown Pipe Networks into Geographical Information System (GIS) to Curtail Non-Revenue Water

The fourteenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that identifying and mapping all the current unknown pipe networks into the geographical information system to curtail non-revenue water is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. Qtaishat (2020) demonstrated that Geographic Information System (GIS) technology could manage water

distribution network, pipe network pressure, subscribers' meters, operation, and maintenance system, high failure pipes based on historical repair data, and failures density analysis.

The author suggested that addressing the issues of high pressures variation within the systems, thereby reducing bursts and leakages, replacing outdated water meters with smart systems, eliminating illegal connections, and rehabilitating old water distribution networks, would reduce non-revenue water (NRW), thereby improving the efficiency of the water sector, and fostering financial and water supply management sustainability. AL-Washali et al. (2019) suggested that effective management of non-revenue water (NRW) levels could help water utilities manage water losses and sustain water services. However, the authors added that it is challenging to monitor NRW in an intermittent water supply regime, and the more the water supplied to users, the higher the volume of NRW.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 15: Establish a Customer-Friendly Billing and Payment Options

The fifteenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that establishing customer-friendly billing and payment options is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. The fifteenth theme supported previous literature on e-billing and customer satisfaction (Mayanja, 2020). Mayanja

(2020) suggested that e-bill payment affects customer satisfaction, which included the capacity to treat a high volume of bills and payments within a short time with increased efficiency and accuracy that reduce payment concerns.

Technology has undergone rapid changes over the past few years and retail chains have deployed the use of personal technology development for applications that allow customers to scan products on their smartphone without using an additional device or encountering shop staff (Czyrka & Fraś, 2019). The use of mobile scanning technology, the self-scanning of products by customers has brought great relief and efficiency to shopping process (Czyrka & Fraś, 2019). In addition, the customer can pay from the phone and access their purchase history through the mobile application (Czyrka & Fraś, 2019). Improvements in mobile payment services have resulted in the emergence of new payment and billing models that allow consumers access to the payment services independently and validate the correctness of the information (Venkatraman, 2018).

Oyelami et al. (2020) revealed a significant positive relationship between electronic payment systems determinants (convenience, security and safety, trust, social influence) and e-payment adoption in Nigeria. The authors also indicated that electronic payment influences consumers' purchase decisions and thus increasing consumers' spending growth in Nigeria. Tortajada and Biswas (2020) suggested that most water utilities in the world are unable to price water correctly so that they can have a functional and sustainable business model, giving them the funds for operation and maintenance as

well as capital investments and this is due to politicians the world over who hesitate to put a price on the water for fear of electoral backlash.

Theme 16: Establishing a Seller/Buyer Relationship with the Customers

The sixteenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that establishing a seller and buyer relationship with the customers is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The sixteenth theme supports previous literature on customer relationships (Athaide et al., 2019). Athaide et al. (2019) suggested that sellers can enhance relationship satisfaction by engaging in either unilateral or bilateral relationships, and while information dissemination is more satisfying with less knowledgeable buyers, product co-development enhances satisfaction when targeting more knowledgeable buyers. Herz et al. (2019) suggested that a lack of verifiable information about financial consequences can obstruct the common understanding of what constitutes cooperative behavior between buyer and seller and might introduce mistrust into relationships.

Athaide et al. (2019) revealed that sellers could enhance relationship satisfaction by engaging in either unilateral or bilateral relationships. Sellers enhancing relationship satisfaction is vital because they have to be judicious in spending their relationship resources (Athaide et al., 2019). While information dissemination is more satisfying when targeting less knowledgeable buyers, product co-development enhances satisfaction

when targeting more knowledgeable buyers. LWC should relate with its customers with a clear understanding that it's a seller/buyer relationship.

Theme 17: Provision of Reliable and Safe Water to Customers

The seventeenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that the provision of reliable and safe water to customers is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. Thus, seventeenth theme aligns with Richter et al. (2018). Public water providers such as LWC have many challenges in meeting the needs and expectations of the communities, state, and country they serve. Providing an adequate supply of potable water remains a preeminent goal of all urban water providers, of course. However, the nature of the challenges inherent in continuously meeting that goal has changed dramatically since the first public water supply systems were developed thousands of years ago.

As public concerns over water continue to evolve in the 21st century, so do perspectives on what “sustainability” might mean for urban water supply systems (Richter et al., 2018). Early civilizations and population centers, and ancient water supply systems evolved around abundant and reliable sources, and long before the concept of sustainability emerged, communities knew their sustenance depended on using water within the limits of local water supplies (Richter et al., 2018). Majuru et al. (2018) suggested there are different definitions of what reliability means but the common features are the functionality of the water supply system itself, and the extent to which it

meets the needs of water users. In urban settings the widely used criterion is the duration/continuity of supply in hours per day, while in rural settings, the proportion of functional water systems is commonly used as a measure of reliability. Therefore, for water supply reliability in Lagos state, LWC should ensure the functionality of its water supply system and to adequately meet the water need of Lagos residents

Theme 18: Develop Implementable Business Plan in Which LWC Staff Take Ownership

The eighteenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that developing an implementable business plan and making utility staff take ownership of LWC activities is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. Kopaneva (2019) suggested that when employees perceive mission and vision as the leader's privilege and responsibility and do not see the significance of their contribution to mission and vision, they find it challenging to develop ownership. The author further suggested that the focus should not be on selling mission and vision to employees but bridging the leader-employee gap through consistent dialogue that portrays employee constructions as part and parcel of organization substance. In this case, the employees take ownership of the organization's business plan and make it implementable.

Javed (2018) suggested that if the employees participate in the decision-making process, it will give them a sense of psychological ownership and align their interests

with that of the organization, thereby reducing operating costs and enhancing the overall organizational productivity. Kabeyi (2019) suggested that organizations require strategic planning and management to survive competition in market places and this applies to all organizations in the private sector and nonprofit organizations. The authors advised that the strategy should start with a SWOT analysis to enable the organization to build on its strengths and utilize opportunities while controlling or managing threats and weaknesses.

Theme 19: Seek Non-Governmental Organization Aids and Grants

The nineteenth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that seeking non-governmental organization aids and grants is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. Hushie and Meissner (2018) suggested that Government-civil society partnerships have led to increased access to funding and investment, especially of improved service provision of water and sanitation for disadvantaged communities in the Northern region of Ghana. However, Ndiritu et al. (2018) suggested that an increase in grant financing reduces the sustainability of community water projects and the higher the community's financial commitments towards community projects, the higher the sustainability of such community water projects. Mburung'a (2018) suggested that an increase in grants reduces the levels of sustainability of a community water project in Kenya.

Theme 20: Digitalization of Billing System & Collection Through e-Payment Platforms

The twentieth theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that digitalization of billing system and collection through e-payment platform is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. The twentieth theme supported Ghosh (2021). Ghosh (2021) suggested that the advancement of information and communication technology introduced modern methods of payment. The growth in smartphones and access to the internet made life easier and brought in digitalization, improving trade and commerce and making payment transactions smooth and fast (Ghosh, 2021).

Mayanja (2020) suggested that e-bill payment affects customer satisfaction, which included the capacity to treat a high volume of bills and payments within a short time with increased efficiency and accuracy that reduce payment concerns. Oyelami et al. (2020) revealed a significant positive relationship between electronic payment systems determinants (convenience, security and safety, trust, social influence) and e-payment adoption in Nigeria. The authors also indicated that electronic payment influences consumers' decisions to purchase and thus increasing consumers' spending growth in Nigeria. Shree et al. (2021) suggested that a person's perception of instruments and trust in the overall payments framework and banking system in general influence her usage of digital payment methods.

Theme 21: Improvement in Products Development in the Water Sector

The twenty-first theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that improvement in product development in the water sector is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. The twenty-first theme aligns with the literature by Al-Saidi (2020). Al-Saidi (2020) suggested decentralization of water utilities improve performance when the decentralized utilities possess the capacity and are given the independence required for improved performance. Resolving institutional conflicts during ongoing reform process are a herculean task, particularly when the state is fragile and corruption, and politicization are involved (Al-Saidi, 2020). Al-Saidi (2020) suggested that comparative assessment indicates some improvement in the performance of the decentralized utilities in the urban water sector of Yemen. The respondents in the interviews stated that the product would be available if LWC is decentralized.

Theme 22: Use of Appropriate and Functional Prepaid Meter

The twenty-second theme resulted from analysis and interpretation of the data collection from the semistructured interviews. I found out that using appropriate and functional prepaid meters is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. The twenty-second theme aligns with Hanjahanja and Omuto (2018). Hanjahanja and Omuto (2018) suggested that

prepaid metering is an improvement to conventional metering and communal prepaid meters are now reliable and viable options for serving poor urban communities.

Some customers might resist the deployment of prepaid meters because it could remove payment defaults, as the principle is you drink as you pay. Reniko and Kolawole (2020) suggested that people perceive water as an indispensable commodity in Zimbabwe, a right, and should be enjoyed by every citizen regardless of their socioeconomic status. The people saw the installation of Prepaid Water Meters (PWMs) as inconsistent with Zimbabwe's constitution because it prevents those who cannot pay access to water (Reniko & Kolawole, 2020). Therefore, Sherry et al. (2018) suggested that for any water supply innovation to succeed, the target population's perceptions of acceptability and feasibility must carry weight on deployment.

Kasri et al. (2017) suggested that appropriate citizen and government engagement is vital to Indonesia's sustainable rural water service delivery. The involvement of key stakeholders, through quality interactions, in the decision-making processes on water management will enhance success and sustainability. Some of the decision-making processes that require stakeholders' involvement include the choice of water supply management options, operation and maintenance of water facilities, and acceptability and feasibility of new initiatives.

Themes from Focus Group Discussion

RQ1: What are the sustainable water supply management strategies by LWC, which could provide adequate potable water to all Lagos residents.

Theme 23: Using multidisciplinary professionals on Water Projects

The first theme resulted from analysis and interpretation of the data collection from the focus group discussion. I found out that using multidisciplinary professionals on water projects is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The first theme supported the conceptual framework on the system approach to management (Rietveld et al., 2016). Rietveld et al. (2016) suggested that by integrating multi-stakeholders, the systems approach could use expertise, real-world decisions, and local knowledge to solve practical problems in simple ways. The involvement of critical stakeholders in urban policy at all levels ensures that the needs of the communities do not depend purely on scientific and political considerations (Rietveld et al., 2016).

Tingey-Holyoak and Pisaniello (2019) reported that large water-consuming organizations and water management bodies worldwide had recognized the need to account for water. Beyond responding to regulatory pressure or social concern, water accounting is now taking a crucial position for improving economic performance (Tingey-Holyoak & Pisaniello, 2019). In addition, with greater accountability for water use and accounting, firms have seen the need to embrace effective interdisciplinary teams within other professional firms (Tingey-Holyoak & Pisaniello, 2019).

Theme 24: Unbundling Water Corporation into Smaller Business Units

The second theme resulted from analysis and interpretation of the data collection from the focus group discussion. I found out that unbundling Water Corporation into

smaller business units is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The second theme supports the literature on decentralization of water and sanitation services (Mwihaki, 2018).

Mwihaki (2018) suggested that the decentralization of water and sanitation services particularly in stakeholder participation on water issues, power and role distribution in the Kenyan water sector improves water governance. The decentralization enhances accountability, acceptance of pluralistic trends, and efficient and effective service delivery. Participants in the focus group discussion agreed that unbundling LWC into smaller business units will enhance water supply efficiency and boost revenue for the corporation.

Theme 25: Involvement of Community in Water Supply Management

The third theme resulted from analysis and interpretation of the data collection from the focus group discussion. I found out that involving the community in water supply management is a sustainable water supply management strategy by LWC, which could provide adequate potable water to all Lagos residents. The third theme supported a previous study on professional community-based management (Ezenwaji et al., 2016). Ezenwaji et al. (2016) suggested that professional community-based management options could enhance the chance of meeting the Sustainable Development Goal (SDG) of access to water and sanitation for all by the year 2030. Aper and Aku (2018) suggested that the inclusion of community members in operation and maintenance of water equipment enhances the sustainability of water supply facilities.

Yeleeire et al. (2018) suggested that the mechanisms for managing Ghana's water resources are ineffective due to the difficulty of combining customary laws and practices, statutory laws, and Integrated Water Resources Management (IWRM) in water resources management. Chukwuma (2018) traced low quality and lack of sustainability of rural water supply in Nigeria to an insufficient policy framework to integrate community-based water services and public water supply efforts. Further, Sherry et al. (2018) suggested that the target population's perceptions of acceptability and feasibility must carry weight on deployment for any water supply innovation to succeed. Finally, Kasri et al. (2017) suggested that appropriate citizen and government engagement is vital to Indonesia's sustainable rural water service delivery.

RQ2: What are the sustainable water supply funding strategies by LWC, which could provide adequate potable water to all Lagos residents?

Theme 26: Remove Government Interferences and Run as Commercial Entity According to the Act that Established LWC

The fourth theme resulted from analysis and interpretation of the data collection from the focus group discussion. I found out that removing government interferences and running Water Corporation as a commercial entity according to the act that established LWC is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. Huang (2019) suggested that government interference is a form of friction that prevents companies from making optimal investment decisions, distorts corporate investment behavior, and leads to investment

inefficiency. However, Wang (2018) suggested that government intervention can be vital in specific areas such as supporting Research and Development (R&D) and innovation as the market alone cannot provide adequate incentives for knowledge production. Kourula et al. (2019) suggested that to understand the governance of business conduct, where it fails and where it succeeds, we need a stronger and more nuanced understanding of the role of government therein.

Theme 27: Partner with Private Consultants on Revenue Collection

The fifth theme resulted from analysis and interpretation of the data collection from the focus group discussion. I found out that partnering with private consultants on revenue collection is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. The fifth theme supported Bii and Namsonge (2021). Bii and Namsonge (2021) suggested that outsourcing revenue collection services makes payment of water and sewerage services easier and ultimately improves the revenue collection efficiency of a water and sewerage company in Kenya. The authors noted further that outsourcing revenue collection services come with added benefits of giving the employees the freedom to concentrate on other core functions of the company, thereby reducing the overall cost of production in the organization.

The authors further recommended that the company should sensitize the customers, especially the elderly, on the need to accept and use digital transfers to enhance revenue in the company further. Finally, Mtasigazya (2018) reported cost saving after outsourcing revenue collection of property tax and guesthouse levy in Kinondoni

and Morogoro Municipal Councils, Tanzania. The author noted cost saving because the tendering costs incurred after outsourcing were lower than those incurred on employing revenue collectors and stationeries expenses before outsourcing.

Theme 28: Update & Grow Customer Database

The sixth theme resulted from analysis and interpretation of the data collection from the focus group discussion. I found out that updating and growing the customer database is a sustainable water supply funding strategy by LWC, which could provide adequate potable water to all Lagos residents. The sixth theme aligns with Simanjuntak et al. (2020). Simanjuntak et al. (2020) suggested that customer-perceived value, corporate image, and service quality significantly affect customer satisfaction, while switching barriers affect customer retention. Therefore, LWC could take advantage of the switching barriers such as higher cost of alternative water sources from vendors, costs of running generators for pumping boreholes water, and the cost of unsafe water-related diseases to retain and grow their customers.

Limitations of the Study

In the data collection process, I learned that the information collected was the perspectives of the participants within the inclusion criteria, thereby limiting the study's transferability. Transferability of data could be limited in this study because the 20 respondents for the semistructured interviews were experienced, informed, educated, and had worked in LWC for over 15 years. The participants for the focus group discussion were also in leadership positions in their various outfits. Therefore, the study only used

the leaders' perspectives without getting the perspectives of other relatively junior officials. In addition, the study did not include the perspectives of end-users. All the participants were graduates with a minimum of a bachelor's degree, which was not typical of staff in LWC and other water companies in Nigeria.

In terms of dependability, there were influences, COVID-19 pandemic, the use of Zoom meetings for data collection due to the pandemic, and difficulty predicting a repeat of the pandemic in the future. The COVID-19 pandemic was still very active during the data collection in Nigeria and many parts of the world. Most of the respondents and the participants worked from home most of the days in the week. In addition, most of them required extra efforts to use the technology device (Zoom) used for the interviews and the focus group discussion. Therefore, the study conditions will normalize in the future, making repeating the study under the same conditions difficult.

Recommendations

Recommendation for Further Research

This qualitative exploratory case study design was a well-conceived research tradition for this study. However, future researchers could replicate this tradition or introduce another tradition for exploring sustainable management and funding strategies for adequate potable water in LWC and another setting, expanding the participants to incorporate the perspectives of junior managers and customers. Future research could also adopt a qualitative Delphi approach to assemble experts to brainstorm solutions to

inadequate potable water by LWC. Finally, any other action research approaches could explore the solutions to inadequate potable water by LWC.

Furthermore, the current research used a conceptual framework that combined the systems theory and the concept of management functions. There is a need for further research that could use other theoretical and conceptual frameworks to explore sustainable management and funding strategies, which could provide adequate potable water to all Lagos residents. There is a need for further research to explore the problem of inadequate potable water using a conceptual framework that will combine systems and stakeholder theories. In addition, the current study was limited to water supply management and did not cover the general issues of water resources management. Therefore, there is the need for further research that would expand the scope of the current research to include water resources management.

Recommendations for Practice

Findings from this study revealed how water supply utilities could benefit from this study. Water supply management actors could use the following recommendations for future practice. The recommendations could provide the needed solution to the problem of inadequate potable water supply by water utilities.

Develop a capacity development framework

LWC to develop and commit to implementing a robust capacity development framework that stands on the tripod of individual skills and competencies development, continuing succession planning, and institutional strengthening. An example of such

institutional strengthening is the immediate establishment of a functional Research and Development (R&D) department in the organization. The recommendation on capacity development is grounded on themes 3 and 4 in Chapter 4 where the respondents identified that succession planning and staff motivation and training should be practices in the LWC.

Improve the efficiency of existing waterworks

It is important for LWC to focus on improving the efficiency of existing facilities. The Corporation should raise the current capacity utilization of between 14 and 28% to between 90-95%. Improving the efficiency is possible through rehabilitation and maintenance of existing facilities, reduction of leakages, reduction of non-revenue water through identification of all unknown water distribution networks, and disconnection of all illegal connections. The above could lead to improved service delivery to customers. The recommendation for improving the efficiency of existing waterworks is grounded on theme 1 in Chapter 4. The respondents suggested that improving existing waterworks should be a practice for LWC rather than clamoring for new waterworks.

Identify and map unknown distribution networks

LWC to deploy a non-intrusive technology to identify all unknown distribution pipe networks and map all networks, including the just identified networks using Geographical Information System (GIS). By implementing the above, LWC will have the knowledge of the entire networks, and a situation where water goes to places unknown to the corporation will stop. The knowledge of the entire distribution networks will give the

corporation a clear view of water flow in the entire pipe networks, thereby reducing unaccounted-for water or non-revenue water (NRW). In addition, the reduction in non-revenue water could lead to improved service delivery to customers and improved revenue to LWC. The recommendation to identify and map unknown water distribution networks is grounded on theme 23 in Chapter 4.

Update and grow customer database

LWC to update its customer database and embark on massive campaigns to win them back, leveraging on the switching barriers such as higher costs of alternative water sources and health implications of unsafe water that characterize alternative sources of water. With improved service delivery, LWC should introduce effective billing and collection systems through digitalization and appropriate functional prepaid meters. A combination of improved service delivery, effective billing, and digitalized collection systems with prepaid meters for all customers could shore up the LWC revenue generation. The recommendation on updating and growing the customer database is grounded on theme 28 in Chapter 4.

Operate LWC as a commercial entity

LWC is supposed to operate as a commercial entity with a governing board, but it is not run as such. For about 20 years, there has been no governing board, and LWC takes both subventions and directives from the government. The Lagos state government should allow the corporation to run according to the enabling act that established it. With autonomy as a commercial entity, it could operate as a business concern, guided by

corporate governance, knowing the best business models to adopt and where to source funds and other resources that could make it deliver. The recommendation to operate LWC as a commercial entity is grounded on theme 26 in Chapter 4.

Embark on massive conservation campaigns and enlightenment

LWC, in collaboration with state government and NGOs, should embark on massive campaigns and enlightenment of the public on the importance of adequate potable water to the populace and the deleterious effects of patronizing alternative sources whose safety could not be guaranteed. There should be enlightenment and campaigns on the cost of producing potable water and why water cannot be free like other manufacturing goods. The enlightenment must stress that providing adequate potable water supply is a shared responsibility between the government, LWC, and the public. There should be constant reminders to the public of their roles and responsibilities in water conservation and timely payments of their water bills. The recommendation for LWC to embark on massive campaigns and enlightenment is grounded on theme 7 in Chapter 4.

Promote collaboration and integration of efforts

It is important for LWC to develop a corporate governance framework that fosters collaboration and integration of efforts among its staff. There should be collaboration and integration of efforts between the Corporation and other agencies of governments or private actors whose activities might impact LWC's facilities, such as underground pipes. Quality interactions within the Corporation and with the external stakeholders are critical

to achieving the core mandate of LWC in its water supply system operations. The recommendation for LWC to develop a corporate governance framework that fosters collaboration and integration of efforts is grounded on themes 9 and 13 in Chapter 4.

Implications

The specific management problem addressed by the current study was the inadequate potable water to all Lagos residents due to inadequate sustainable management and funding strategies by LWC, whose mandate is to provide adequate potable water to Lagos residents (Balogun et al., 2017; Omole et al., 2016). There has been substantial evidence that the majority of the inadequate water problems are due to rapid urbanization, population growth, increases in per capita water consumption in some areas, poor maintenance, inefficient cost-recovery, climate change, inadequate funding, and water governance failure (Abubakar, 2016; Ayeni, 2017; Balogun et al., 2017; Dighade et al., 2014). However, further research is needed in other areas, such as exploring sustainable management and funding and cost-recovery strategies for LWC (Balogun et al., 2017). Findings from this qualitative exploratory case study helped to narrow these gaps by making meaningful contributions to scholars and practitioners in three areas: (a) methodological implications, (b) implications for practice, and (c) social change implications at the individual, organizational, and society levels.

Methodological Implications

In this study, I used qualitative methodology to explore how better sustainable management and funding strategies by LWC could provide adequate potable water to all

Lagos residents. Qualitative researchers use interviews to obtain insights on the phenomenon under study (Oltmann, 2016) and rich and detailed information to understand people's experiences (Majid et al., 2017). The qualitative study helps to understand how people interpret their experiences and the meaning they make out of them (Merriam & Tisdell, 2016). The qualitative method is appropriate for this study because I aimed to have an in-depth understanding of the multidimensional issue of water supply in Lagos.

The implication is that this study may not be generalized as it was conducted among 20 participants in the in-depth interviews; and the six participants in the focus group discussion in Lagos state, Nigeria. Participants in other states' water corporations may have a different understanding of the data collection questions. However, Smith (2018) suggested that qualitative researchers' focus should not be on generalizability, as the lack of it does not diminish the research value. Therefore, qualitative research does not have generalizability as its underlying tenets (Korstjens & Moser, 2017).

Implications for Practice

The results of the study could benefit scholars and practitioners in many ways. First, by making an original contribution, this study's findings could address an under-researched water supply management area regarding sustainable management and funding strategies for LWC. Second, the study could help LWC and similar water supply utilities enhance their ability to provide adequate potable water supply to residents, eliminating water shortage and extra cost on water supply. Third, the results of the study

could reduce the incidents of diseases associated with untreated alternative water sources (Ishaku et al., 2011) and minimize the associated costs of insufficient water supply and sanitation (Alaerts, 2019).

Social Change Implications

The results of the study could contribute to positive social change in the following ways: (a) increased water supply to residents, as a result of sustainable management and funding strategies, could increase their socioeconomic statuses, and (b) leaders of water utilities could use the results to align water strategies with sustainable water governance. Water use is increasing globally, and by projection, demand could exceed sustainable supply by 40% by 2030 (World Economic Forum, 2015). In addition, increased travels and accommodation requirements increase pressure on the water supply (World Tourism Organization, 2018).

Sustainable water management requires responsible conduct in water use by all stakeholders (Marques et al., 2016). Therefore, findings from this study could help leaders of water utilities be environmentally sensitive and align water management with sustainable water governance. Also, the effects of tourism or migration on infrastructures, such as water supply, will require water management strategies that foster efficient water use by all stakeholders.

Further, an adequate water supply improves the socioeconomic statuses of the citizenry (Ohwo & Abotutu, 2014). The provision of water supply could reduce poverty because it is related to food security and agriculture (Marwah & Marwah, 2014). An adequate water supply could reduce the burden of searching for alternative water sources

for household use on women and children (Shrestha et al., 2019). In some situations, women spend up to a quarter of their working hours scouting for water for household use (Gross et al., 2018). Zolnikov and Blodgett-Salafia (2017) reported improved access to water enhances relationships among family members in Kenya, thereby improving their economic growth.

Women and children are more prone to the effect of water shortages, such as illnesses, than men (Khiyara, 2016). For example, the high maternal mortality of about 5 per every 1000 live births in Mexico reported by the World Bank in 2017 might be due to inadequate potable water (Silva & Miguel, 2018). Underscoring the importance of women's empowerment, Godfrey and Wolf (2016) noted that poverty is one area where women have more than a fair share. Therefore, water plays a critical role in poverty alleviation, and this explains why the global emphasis is to align global water initiatives with the antipoverty program of international bodies, such as the World Bank (Sambu, 2016).

Consequently, water that is more available for women, especially in developing countries, can result in poverty alleviation, as women can then devote more of their time in activities other than searching for alternative water sources, including activities that strengthen their household wealth and health (Silva & Miguel, 2018). Thus, a combination of improved socioeconomic status, poverty alleviation, and the lessening of the burden of searching for water sources on women and children brings about positive social change. Also, the provision of adequate water for residents will reduce water-

related diseases, improve the general well-being of the people, and reduce unsafe water-related mortalities, thereby bringing about positive social change.

Conclusions

The study was used to explore how better sustainable management and funding strategies by LWC could provide adequate potable water to all Lagos residents among 20 participants in the in-depth interviews; and the six participants in the focus group discussion in Lagos, Nigeria. Participants in other states' water corporations may have a different understanding of the data collection questions. The results of the study could contribute to positive social change in the following ways: (a) increased water supply to residents, as a result of sustainable management and funding strategies, could increase their socioeconomic statuses, and (b) leaders of water utilities could use the results to align water strategies with sustainable water governance.

The study added new insights to existing literature on strategies for sustainable water supply management in Lagos, Nigeria. The study has also added to the body of knowledge on sustainable strategies to improve LWC by making the following recommendations (a) develop a capacity development framework, (b) improve the efficiency of existing waterworks, (c) identify and map unknown distribution networks, (e) update and grow customer database, (f) operate LWC as a commercial entity, (g) embark on massive conservation campaigns and enlightenment, and (h) promote collaboration and integration of efforts among both internal and external actors in the water sector

References

- Ablanedo-Rosas, J. H., Guerrero Campanur, A., Olivares-Benitez, E., Sánchez-García, J. Y., & Nuñez-Ríos, J. E. (2020). Operational efficiency of Mexican water utilities: Results of a double-bootstrap data envelopment analysis. *Water*, *12*(2), 553. <https://doi.org/10.3390/w12020553>
- Abubakar, I. R. (2016). Quality dimensions of public water services in Abuja, Nigeria. *Utilities Policy*, *38*, 43-51. <https://doi.org/10.1016/j.jup.2015.12.003>
- Abubakar, I. R. (2019). Factors influencing household access to drinking water in Nigeria. *Utilities Policy*, *58*, 40-51. <https://doi.org/10.1016/j.jup.2019.03.005>
- Adams, E. A. (2017). Thirsty slums in Africa cities: Household water insecurity in urban informal settlements of Lilongwe, Malawi. *International Journal of Water Resources Development*, *52*(1), 1-19, <https://doi.org/10.1080/07900627.2017.1322941>
- Adams, E. A., Sambu, D., & Smiley, S. L. (2018). Urban water supply in Sub-Saharan Africa: Historical and emerging policies and institutional arrangements. *International Journal of Water Resources Development*, *35*(2), 240–263. <https://doi.org/10.1080/07900627.2017.1423282>
- Adams, K. M., Hester, P. T., Bradley, J. M., Meyers, T. J., & Keating, C. B. (2014). Systems theory as the foundation for understanding systems. *Systems Engineering*, *17*(1), 112-123. <https://doi.org/10.1002/sys.21255>
- Adeosun, O. T., & Ohiani, A. S. (2020). Attracting and recruiting quality talent. Firm perspective. *Rajagiri Management Journal*, *14*(2), 107-120.

<https://doi.org/10.1108/RAMJ-05-2020-0016>

- Ahmad, M. T. (2017). The role of water vendors in water service delivery in developing countries: a case of Dala local government, Kano, Nigeria. *Application Water Science*, 7, 1191–1201. <https://doi.org/10.1007/s13201-016-0507-z>
- Ajiero, I. R., & Campbell, D. (2018). Benchmarking water use in the Uk food and drink sector: Case study of three water-Intensive dairy products. *Water Conservation Science and Engineering*, 3(1), 1-17. <https://doi.org/10.1007/s41101-017-0036-0>
- Akeju, T. J., Adeyinka, S. A., Oladehinde, G. J., & Fatusin, A. F. (2018). Regression analysis of residents' perception on willingness to pay (WTP) for improved water supply: a case from Nigeria. *Agricultural and Resource Economics: International Scientific E-Journal*, 4(2), 5-18. <https://doi.org.10.1177/0002455515021>
- Akoteyon, I. S. (2019). Factors affecting household access to water supply in residential areas of Lagos metropolis, Nigeria. *Bulletin of Geography: Socio- Economic Series*, 43(43), 7-24. <https://doi.org/10.2478/bog-2019-0001>
- Akpabio, E. M., & Ansa, I. E. (2013). Water for cities in Nigeria: The governance dimension. *Mediterranean Journal of Social Sciences*, 4(4), 297-309. <http://www.richtmann.org/journal/index.php/mjss/article/view/37>
- Alaerts, E. J. (2019). Financing for Water-Water for financing: A global review of policy and practice. *Sustainability*, 11(821), 1-25. <https://doi.org/3390/su11030821>
- Ali, Z., & Mehreen, A. (2018). Understanding succession planning as a combating strategy for turnover intentions. *Journal of Advances in Management Research*. 11(20), 12-24. <https://doi.org/10.1108/JAMR-09-2018-0076>

- Aliyu, A. A., & Amadu, L. (2017). Urbanization, cities, and health: The challenges to Nigeria – A review. *Africa Medicine.*, *16*(4), 149–158.
https://doi.org/10.4103/aam.aam_1_17
- Allenby, B., & Fink, J. (2005). Toward inherently secure and resilient societies. *Science*, *309*, 1034–1039. <https://doi.org/10.1126/science.1111534>
- Alpi, K. M. (2019). Distinguishing case study as a research method from case reports as a publication type. *Journal of Medical Library Association.* *107*(1), 1–5.
<https://doi.org/10.5195/jmla.2019.615>
- Al-Saidi, M. (2020). Evaluation of decentralization and commercialization in the urban water sector of Yemen. *International Review of Administrative Sciences*, *86*(3), 513–528. <https://doi.org/10.1177/0020852318780984>
- AL-Washali, T., Sharma, S., AL-Nozaily, F., Haidera, M., & Kennedy, M. (2019). Monitoring nonrevenue water performance in intermittent supply. *Water*, *11*(6), 1220. <https://doi.org/10.3390/w11061220>
- Ameyaw, E. E., & Chan, A. P. C. (2015). Evaluating key risk factors for PPP water projects in Ghana: A Delphi study. *Journal of Facilities Management*, *13*, 133–155. <https://doi.org/10.1108/JFM-10-2013-0051>
- Ameyaw, E. E., Chan, A. P. C., & Owusu-Manu, D. (2017). A survey of critical success factors for attracting private sector participation in water supply projects in developing countries. *Journal of Facilities Management*, *15* (1), 35–61.
<https://doi.org/10.1108/JFM-06-2016-0027>
- Anaf, S., Drummond, C., & Sheppard, L. A. (2007). Combining case study research and

systems theory as a heuristic model. *Qualitative Health Research*, 17(10), 1309-1315. <https://doi.org/10.1177/1049732307308946>

Ansa, I. E., & Ukpong, I. E. (2015). Water management in the private domain: A comparative analysis of urban water management practice in Nigeria's Niger Delta. *Academic Journal of Interdisciplinary Studies*, 4, 196-204.

<https://doi.org/10.5901/ajis.2015.v4n3s1p196>

Aper, J. A., & Aku, E. (2018). The pattern and factors of residential water supply in Ankpa town, Kogi state, Nigeria. *International Journal Advances in Social Science and Humanities*, 6(7), 10-20. www.ijassh.com

Athaide, G. A., Zhang, J. Q., & Klink, R. R. (2019). Buyer relationships when developing new products: a contingency model. *Journal of Business & Industrial Marketing*, 34(2), 426-438. <https://doi.org.10.1108/JBIM-02-2018-0091>

Ayeni, A. O. (2017). Increasing population, urbanization and climatic factors in Lagos State, Nigeria: The nexus and implications on water demand and supply. *Journal of Global Initiatives: Policy, Pedagogy, Perspective*, 11(2), 69-87.

<https://digitalcommons.kennesaw.edu/jgi/vol11/iss2/6>

Babbie, E. (2017). *Basics of social research (7th ed.)*. Boston, MA: Cengage Learning.

Balaei, B., Wilkinson, S., & Potangaroa, R. (2019). Social capacities in fostering water supply resilience in Vanuatu. *Disaster Prevention and Management*, 28, 706-720.

<https://doi.org/10.1108/DPM-08-2018-0279>

Balogun, I. I., Sojobi, A. O., Galkaye, E., & Mannina, G. (2017). Public water supply in Lagos State, Nigeria: Review of importance and challenges, status and concerns

and pragmatic solutions, *Cogent Engineering*, 4, 1-21.

<https://doi.org/10.1080/23311916.2017.1329776>

Bang, D., & Frith, C. D. (2017). Making better decisions in groups. *Royal Society open science*, 4(8), 170193. <https://doi.org/10.1098/rsos.170193>

Barbosa, A., Lima, S. C., & Brusca, I. (2016). Governance and efficiency in the Brazilian water utilities: A dynamic analysis in the process of universal access. *Utilities Policy, Elsevier*, 43(PA), 82-96. <https://doi.org/10.1016/j.jup.2016.06.013>

Baskarada, S. (2014). Qualitative case study guidelines. *The Qualitative Report*, 19(40), 1-18. <https://doi.org/10.46743/2160-3715/2014.1008>

Bates, B. C., Kundzewicz, Z. W., Wu, S., & Palutikof, J. P. (2008). *Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change*; IPCC Secretariat: Geneva, Switzerland.

Behailu, B. M., Hukka, J. J., & Katko, T. S. (2017). Service failures of rural water supply systems in Ethiopia and their policy implications. *Public Works Management & Policy*, 22(2), 179–196.

<https://doi.org/10.1177/1087724X16656190>

Bengtsson, M. (2016). How to perform a qualitative study using content analysis.

NursingPlus Open, 2, 8-14. <http://www.elsevier.com/locate/npls>

Berg, S. (2016). Seven elements affecting governance and performance in the water sector. *Util. Policy*, 43, 4-13. <https://doi.org/10.1016/j.jup.2016.04.013>

Bergsten, A., Jirena, T. S., Leventon, J., Dorresteijn, I., Schultner, J., & Fischer, J. (2019). Identifying governance gaps among interlinked sustainability challenges.

Environmental Science & Policy, 91, 27-38. <https://doi.org/10.1016/j.envsci.2018.10.007>

- Bii, E. C., & Namsonge, M. (2021). Strategic Outsourcing of revenue collection and service delivery in the water service provision: A Case of Kericho Water and Sanitation Company (KEWASCO) In Kenya. *IOSR Journal of Business and Management (IOSR-JBM)*, 23 (5), 1-5. <https://doi.org/10.9790/487X-2305040105>
- Birt, L., Scott, S., Cavers, D., Campbell, C., & Walter, F. (2016). Member checking: A tool to enhance trustworthiness or mere a nod to validation. *Qualitative Health Research*, 26(13), 9. <https://doi.org/10.1177/1049732316654870>
- Bobbink, M. L., Hartmann, A., & Dewulf, G. (2020). Sustaining extended enterproses as a matter of institutional logistics. Insights from the railway sector. *Supply Chain Management. International Journal*, 26(1), 136-150. <https://doi.org/10.1108/SCM-12-2019-0457>
- Boelee, E., Geerling, G., Zaan, B., Blauw, A., & Vethaak, A. (2019). Water and health: From environmental pressures to integrated responses. *Acta Tropica*, 193, <https://doi.org/10.1016/j.actatropica.2019.03.011>
- Bolman, L. G., & Deal, T. E. (2013). *Reframing organizations: Artistry, choice, and leadership (5th ed.)*. San Francisco, CA: Bass.
- Bridgen, S. (2017). Using systems theory to understand the identity of academic advising: A case study. *NACADA Journal*, 37(2), 9-20. <https://doi.org/10.12930/NACADA-15-038>.

- Buckman, J., Jones, P., & Buame, S. (2020). Passing on the baton. A succession planning framework for family-owned business in Ghana. *Journal of Entrepreneurship in Emerging Economics*, 12(2), 259-278.
<https://doi.org/10.1108/IJEEE-11-2018-0124>
- Burkholder, G. J., Cox, K. A., & Crawford, L. M. (2016). *The scholar-practitioner's guide to research design*. Baltimore, MD: Laureate Publishing.
- Cain, B. E., Gerber, E. R., & Hui, I. (2020). The challenge of externally generated collaborative governance. California's attempt at regional water management. *American Review of Public Administration*, 50(4), 428-437.
<https://doi.org.10.1177/0275074020908278>
- Casadevall, S. R. (2016). Improving the management of water multi-functionality through stakeholder involvement in decision-making processes. *Util. Policy* 43, 71-81. <https://doi.org/10.1016/j.jup.2016.04.015>
- Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report*, 21(5), 811-831.
<https://doi.org/10.46743/2160-3715/2016.2337>
- Chepyegon, C., & Kamiya, D. (2018). Challenges faced by the Kenya water sector management in improving water supply coverage. *Journal of Water Resource and Protection*, 10, 85-105. <https://doi.org/10.4236/jwarp.2018.101006>
- Chigonda, T., & Chazireni, E. (2018). Water supply and sanitation in Zimbabwe resettlement areas: A case study. *European Journal of Social Sciences Studies*, 2, 139-151. <https://doi.org/10.5281/zenodo.1217644>

- Chikere, C. I., & Nwoka, J. (2015). The systems theory of management in modern day organizations - A study of Aldgate congress resort limited Port Harcourt. *International Journal of Scientific and Research Publications*, 5 (9), 1-7. <http://www.ijsrp.org>
- Chima, G. N., & Itabita, J. O. (2018). Community participation as strategy to ensure sustainability of rural water supply projects. *FUPRE Journal of Scientific and Industrial Research*, 2 (1), 109-118. <https://www.fupre.edu.ng/journal/index.php/fjsir/article/view/25>
- Chukwuma, O. M. (2017). Patterns and problems of domestic water supply to rural communities in Enugu State, Nigeria. *Journal of Agricultural Extension and Rural Development*, 9, 172-184. <https://doi.org/10.5897/JAERD2016.0802>
- Chukwuma, O. M. (2018). Rural water supply in Nigeria: Policy gaps and future directions. *Water Policy*, 20, <https://doi.org/10.2166/wp.2018.129>.
- Chun Tie, Y., Birks, M., & Francis, K. (2019). Grounded theory research: A design framework for novice researchers. *SAGE Open Medicine*, 7 (1), 1-8. <https://doi.org/10.1177/205031211882292>
- Clark, C. (2017). Of what use is a deradicalized human right to water? *Human Rights Law Review*, 17(2), 231–260. <https://doi.org/10.1093/hrlr/ngx006>
- Cosgrove, W. J., & Loucks, D. P. (2015). Water management: Current and future challenges and research directions. *Water Resources Research*, 51(6), 4823-4839. <https://doi.org/10.1002/2014wr016869>
- Coster, A. S., & Otufale, G. A. (2020). Households' water-use demand and willingness to

pay for improved water services in Ijebu Ode local government area, Ogun state, Nigeria. *Ethiopian Journal of Applied Science and Technology*, 7(2), 33-42.

<http://journals.ju.edu.et/index.php/ejast/article/view/975>

Cunningham, C., & Gharipour, M. (2018). Pipe dreams: Urban wastewater treatment for biodiversity protection. *Urban Science*, 2(1), 1-18.

<https://doi.org/10.3390/urbansci2010010>

Czyrka, K., & Fraś, J. (2019). Automation in purchasing processes and customer reflection. *Zeszyty Naukowe. Organizacja i Zarządzanie/Politechnika Śląska*.

4(2), 85-101. <https://doi.org/10.29119/1641-3466.2019.138.3>

Damkjaer, S., & Taylor, R. (2017). The measurement of water scarcity: Defining a meaningful indicator. *Ambio*, 46(5), 513–531. <https://doi.org/10.1007/s13280-017-0912-z>

Deggs, D. M., & Hernandez, F. (2018). Enhancing the value of qualitative field notes through purposeful reflection. *The Qualitative Report*, 23(10), 2552-2560.

<https://nsuworks.nova.edu/tqr/vol23/iss10/1>

Dehkordi, L. M., Babashahi, M., & Irajpour, A. (2016). Nonprofessional care in chronic critically ill patient: A qualitative study. *International Journal of Preventive*

Medicine, 7(1), 125. <https://doi.org/10.4103/2008-7802.195209>

DeJonckheere, M., & Vaughn, L. M. (2019). Semi-structured interviewing in primary care research: a balance of relationship and rigour. *Family Medicine and*

Community Health, 7(2), e000057. <https://doi.org/10.1136/fmch-2018-000057>

Deyà-Tortella, B., Garcia, C., Nilsson, W., & Tirado, D. (2017). Analysis of water tariff

- reform on water consumption in different housing typologies in Calvià (Mallorca). *Water*, 9, 425. <https://doi.org/10.3390/w9060425>
- Diefenbach, T. (2009). Are case studies more than sophisticated storytelling? Methodological problems of qualitative empirical research mainly based on semi-structured interviews. *Quality & Quantity*, 43(6), 875-894. <https://doi.org/10.1007/s11135-008-9164-0>
- Dighade, R. R., Kadu, M. S., & Pande, A. M. (2014). Challenges in water loss management of water management of water distribution systems in developing countries. *Int. Journal of Innovative Research in Science, Engineering and Technology*, 3(6), 13838-13846. <http://www.ijirset.com>
- Dikko, M. (2016). Establishing construct validity and reliability: Pilot testing of a qualitative interview for research in takaful (Islamic Insurance). *The Qualitative Report*, 21(3), 521-528. <https://nsuworks.nova.edu/tqr/vol21/iss3/6>
- Dollah, S., & Abduh, A., & Rosmaladewi, M. (2017). Benefits and drawbacks of NVivo QSR application. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, 149, 60-63. <https://doi.org/10.2991/icest-17.2017.21>
- Domi, S., Capelleras, J. L., & Musabelliu, B. (2020). Customer orientation and SME performance in Albania: A case study of the mediating role of innovativeness and innovation behavior. *Journal of Vacation Marketing*, 26(1), 130–146. <https://doi.org/10.1177/1356766719867374>
- Dorantes, C. A., Li, C., Peters, G. F., & Richardson, V. J. (2013). The effect of enterprise systems implementation on the firm information environment. *Contemporary*

- Accounting Research*, 30, 1427-1461. <https://doi.org/10.1111/1911-3846.12001>
- Doria, N., Condran, B., Boulos, L., Curtis Maillet, D. G., Dowling, L., & Levy, A. (2018). Sharpening the focus: differentiating between focus groups for patient engagement vs. qualitative research. *Research involvement and engagement*, 4, 19-26. <https://doi.org/10.1186/s40900-018-0102-6>
- Doronina, A. V., Husband, S. P., Boxall, J. B., & Speight, V. L. (2020). The operational value of inlet monitoring at service reservoirs. *Urban Water Journal*, 17(8), 735-744. <https://doi.org/10.1080/1573062X.2020.1787471>
- Dos Santos, S., Adams, E. A., Neville, G., Wada, Y., de Sherbinin, A., Bernhardt, E. M., & Adamo, S. B. (2017). Urban growth and water access in sub-Saharan Africa: Progress, challenges, and emerging research directions. *Sci. Total Environ.*, 607, 497-508. <https://doi.org/10.1016/j.scitotenv.2017.06.157>.
- Dunmade, I. (2017). Sustainable water supply: An overview of water supply systems in some Nigerian peri-urban communities. *Journal of Economics and Sustainable Development*, 8(10), 57-63. <https://www.iiste.org/Journals/index.php/JEDS/article/view/37083/38369>
- Dunn, T. E., Lafferty, C. L., & Alford, K. L. (2012). Global leadership: A new framework for a changing world. *S.A.M. Advanced Management Journal*, 77(2), 4-14. Retrieved from Walden University library database.
- Egbinola, C. N. (2017). Trend in Access to Safe Water Supply in Nigeria. *Journal of Environment and Earth Science*, 7(8), 89-96. <https://www.iiste.org/Journals/index.php/JEES/article/view/38298/39372>

- Ehret, P. J., Hodges, H. E., Kuehl, C., Brick, C., Mueller, S., & Anderson, S. E. (2021). Systematic review of household water conservation interventions using the information–motivation–behavioral skills model. *Environment and Behavior*, 53(5), 485–519. <https://doi.org/10.1177/0013916519896868>
- Environmental Rights Action (ERA). (2016). *Lagos water crisis: Alternative road map for water sector*. <http://www.erafoen.org>
- Ezenwaji, E. E., Eduputa, B. M., & Okoye, C. O. (2016). Investigations into the residential water demand and supply in Enugu metropolitan area, Nigeria. *American Journal of Water Resources*, 4(1), 22-29. <https://doi.org/10.12691/ajwr-4-1-3>
- Fashina, O. A., Asaleye, A. J., Ogunjobi, J. O., & Lawal, A. I. (2018). Foreign aid, human capital and economic growth nexus: Evidence from Nigeria. *Journal of International Studies*, 11(2), 104-117. <https://doi.org/10.14254/2071-8330.2018/11-2/8>
- Fathollahi-Fard, A. M., Hajiaghaei-Keshteli, M., Tian, G., & Li, Z. (2020). An adaptive Lagrangian relaxation-based algorithm for a coordinated water supply and wastewater collection network design problem. *Information Sciences*, 512, 1335-1359. <https://doi.org/10.1016/j.ins.2019.10.062>
- Federal Republic of Nigeria. (2004). *National water policy*. Abuja. Federal Government Printer.
- Fernandez-Araoz, C., Nagel, G., & Green, C. (2021). The high cost of poor succession

planning. *Harvard Business Review*, 99(3), 98–107.

<https://hbsp.harvard.edu/product/R2103F-PDF-ENG>

Fotaki, M., Lioukas, S., & Voudouris, I. (2020). Ethos is destiny: Organizational values and compliance in corporate governance. *Journal of Business Ethics*, 166(1), 19–37. <https://doi-org.ezp.waldenulibrary.org/10.1007/s10551-019-04126-7>

Fusch, P., Fusch, G. E., & Ness, L. R. (2018). Denzin’s paradigm shift: Revisiting triangulation in qualitative research. *Journal of Social Change*, 10 (1), 19–32. <https://doi.org/10.5590/josc.2018.10.1.02>

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, 20, 1408–1416. <http://nsuworks.nova.edu/tqr/>

Gazzeah, K., & Abubakar, I. R. (2018). Regional disparity in access to basic public services in Saudi Arabia: a sustainable challenge. *Utilities Policy*, 52, 70-80. <https://doi.org/10.1016/j.jup.2018.04.008>

George, G., & Selimos, E. D. (2018). Using narrative research to explore the welcoming of newcomer immigrants: A methodological reflection on a community-based research project [45 paragraphs]. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, 19(2), Art. 9, <http://dx.doi.org/10.17169/fqs-19.2.2907>.

George, O. O. (2018). Employee motivation, an organizational performance improvement strategy (A review on influence of employee motivation on organizational performance). *JOJ scin.* 1(5), <https://doi.org/10.19080/JOJS.2018.01.555575>

Ghosh, G. (2021). Adoption of digital payment system by consumer: A review of

literature. *International Journal of Creative Research Thoughts (IJCRT)*, 9 (2), 411-418. www.ijcrt.org

Girdwichai, L., & Sriviboon, C. (2020). Employee motivation and performance: do the work environment and the training matter? *Journal of Security and Sustainability Issues*, 9, 42-54. [http://doi.org/10.9770/jssi.2020.9.J\(4\)](http://doi.org/10.9770/jssi.2020.9.J(4))

Godfrey, E., & Wolf, S. (2016). Developing critical consciousness or justifying the system? A qualitative analysis of attributions for poverty and wealth among low-income racial/ethnic minority and immigrant women. *Cultural Diversity & Ethnic Minority Psychology*, 22 (1), 93-103. <https://doi.org/10.1037/cdp0000048>

Gross, E., Gunther, I., & Schipper, Y. (2018). Women are walking and waiting for water: The time value of public water supply. *Economic Development and Cultural Change*, 66 (6), 489-517. <https://doi.org/10.1086/696531>

Guarino, A. S. (2017). The economic implications of global water scarcity. *Research in Economics and Management*, 2 (1), 51-63. <https://doi.org/10.22158/rem.v2n1p51>

Guimarães, E. F., Malheiros, T. F., & Marques, R. C. (2016). Inclusive governance: New concept of water supply and sanitation services in social vulnerability areas.

Utilities Policy, Elsevier, 43(PA), 124-129.

<https://doi.org/10.1016/j.jup.2016.06.003>

Hancock, D. R., & Algozzine, B. (2017). *Doing case study research: A practical guide for beginning researchers. (3rd ed.)*. New York, NY: Teachers College Press.

Hanjahanja, R., & Omuto, C. (2018). Do prepaid water meters improve the quality of water service delivery? The case of Nakuru, Kenya. *Smart Water* 3 (4)

<https://doi.org/10.1186/s40713-018-0010-9>

Harrison, J. S., Freeman, R. E., & de Abreu, M. C. S. (2015). Stakeholder theory as an ethical approach to effective management: Applying the theory to multiple contexts. *Revista Brasileira de Gestão de Negócios*, 17, 858-869.

<https://doi.org/10.7819/rbgn.v17i55.2647>

He, X., Wu, J., & He, S. (2019). Hydrochemical characteristics and quality evaluation of groundwater in terms of health risks in Luohe aquifer in Wuqi County of the Chinese Loess Plateau, northwest China. *Human and Ecological Risk Assessment: An International Journal*, 25(1-2), 32-51.

<https://doi.org/10.1080/10807039.2018.1531693>

Heller, L. (2016, December 22). U.N. warns of water crisis in Nigeria's megacity Lagos.

GENEVA (Reuters). <https://www.reuters.com/article/us-un-nigeria-water/un-warns-of-water-crisis-in-nigerias-megacity-lagos-idUSKBN14B1V9>

Hendijani, R., & Saei, R. S. (2020). Supply chain integration and firm performance: the moderating role of demand uncertainty, *Cogent Business & Management*, 7(1),

<https://doi.org/10.1080/23311975.2020.1760477>

Herz, H., Schmutzler, A., & Volk, A. (2019). Cooperation and mistrust in relational contracts. *Journal of Economic Behavior & Organization*, 166, 366-380.

<https://doi-org.ezp.waldenulibrary.org/10.1016/j.jebo.2019.07.007>

Hirano, M. (2016). Public participation in the global regulatory governance of water services: Global administrative law perspective on the inspection panel of the World Bank and Amicus Curiae in investment arbitration. *Util. Policy*, 43, 21-31.

<https://doi.org/10.1016/j.jup.2016.06.016>

Hoekstra, A. Y. (2017). Water footprint assessment in supply chains. In: Y. Bouchery, C. J. Corbett, Fransoo, & T.Tan (Eds.), *Sustainable supply chains: A research-based textbook on operations and strategy* (pp. 64-85). Springer, Cham, Switzerland.

Horning, D., Bauer, B., & Cohen, S. (2016). Missing bridges: social network (dis) connectivity in water governance. *Utilities Policy, Elsevier, 43*(PA), 59-70.

<https://doi.org/10.1016/j.jup.2016.06.006>

Houghton, C., Casey, D., Shaw, D., & Murphy, K. (2013). Rigor in qualitative case study research. *Nurse Researcher, 20*(4), 12-17.

<https://doi.org/10.7748/nr2013.03.20.4.12.e326>

Howard, A., & Hirani, K. (2013). Transformational change and stages of development in the workplace: A heuristic inquiry. *Journal of Integral Theory and Practice, 8*(1/2), 71-86. <https://search-proquest-com.ezp.waldenulibrary.org/docview/1427971253?accountid=14872>

Huang, Y. (2019). Government intervention and corporate investment efficiency: Evidence from China. *Journal of Service Science and Management, 12*, 267-276.

<https://doi.org/10.4236/jssm.2019.123018>

Hurlimann, A., & Wilson, E. (2018). Sustainable urban water management under a changing climate: The role of spatial planning. *Water, 10*, 546-567.

<https://doi.org/10.3390/w10050546>

Hushie, M., & Meissner, R. (2018). State-civil society partnerships for improving safe water and sanitation coverage in the Northern region of Ghana: An exploratory

qualitative study, *Cogent Social Sciences*, 4

(1), <https://doi.org/10.1080/23311886.2018.1508626>

Hutton, G., & Chase, C. (2016). The knowledge base for achieving the sustainable development goal targets on water supply, sanitation and hygiene. *Int. J. Environ. Res. Public Health*, 13(6), 536. <https://doi.org/10.3390/ijerph13060536>.

Ibiamke, A., & Ajekwe, C. C. M. (2017). On ensuring rigor in accounting research. *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 7 (3), 157-170. <https://doi.org/10.6007/IJARAFMS/v7-i313284>

Idu, A. J. (2015). Threats to water resources development in Nigeria. *J Geol Geophys*, 4(3), 205. <https://doi.org/10.4172/2329-6755.1000205>

Ifabiyi, I. P., Geoffrey, E. O., & Salami, A. A. (2019). Assessment of water accessibility and quantity in Ilorin south local government area. *Malaysian Journal of Society and Space*, 15 (3), 104-121. <https://doi.org/10.17576/geo-2019-1503-08>

Imonikhe, O. M., & Moodley, K. (2018). The challenge of effective policy implementation in Nigerian water utilities. *Water Science & Technology: Water Supply*, 18 (5), 1696-1705. <https://doi.org/10.2166/ws.2017.231>

Intergovernmental Panel on Climate Change. (2013). *Climate Change 2013: The physical science basis. Contribution of working group I to the fifth assessment report of the intergovernmental panel on climate change*; Cambridge University Press: Cambridge, UK.

Ishaku, H. T., Majid, M. R., Ajayi, A. P., & Haruna, A. (2011). Water supply dilemma in

Nigerian rural communities: Looking towards the sky for an answer. *Journal of Water Resources and Protection*, 3, 598-606.

<https://doi.org/10.104236/jwarp.2011.38069>.

Jacob, S. A., & Furgerson, S. (2012). Writing interview protocols and conducting interviews: Tips for students new to the field of qualitative research. *The Qualitative Report*, 17, 1-10. <http://www.nova.edu/ssss/QR/>

Javed, T. (2018). Impact of Employee Ownership on an Organizational Productivity: A Mediating Role of Psychological Ownership. *Academy of Accounting and Financial Studies Journal*, 22 (2), 1-12.

<https://www.researchgate.net/publication/331327428>

Jhamb, D., Kampani, N., & Arya, V. (2021). Embracing the employee orientation. Does customer relationship metter in branch building? *Benchmarking. International Journal*, 51(2), 44-71. <https://doi.org.10.1108/BIJ-12-2020-0614>

Jideonwo, J. A. (2014). Ensuring sustainable water supply in Lagos, Nigeria. University of Pennsylvania. ScholarlyCommon.

Kabeyi, M. (2019). Organizational strategic planning, implementation and evaluation with analysis of challenges and benefits for profit and nonprofit organizations. *International Journal of Applied Research and Studies*, 5, 27-32.

<https://doi.org/10.22271/allresearch.2019.v5.i6a.5870>

Kabote, S. J., & John, P. (2017). Water governance in Tanzanian: Performance of governance structures and institutions. *World Journal of Social Sciences and Humanities*, 3 (1), 15-25. <https://doi.org/10.12691/wjssh-3-1-3>

- Kandissounon, G. A., Karla, A., & Ahmad, S. (2018). Integrating system dynamics and remote sensing to estimate future water usage and average surface runoff in Lagos, Nigeria. *Civil Engineering Journal*, 4(2), 378-393.
<http://dx.doi.org/10.28991/cej-030998>
- Kang, S., Mulaphong, D., Hwang, E., & Chang, C. (2019). Public-private partnerships in developing countries. *International Journal of Public Sector Management*, 32(4), 334-351. <https://doi.org.10.1108/IJPSM-01-2018-0001>
- Kasri, R. Y., Wirutoma, P., Kusnopranto, H., & Moersidik, S. S. (2017). Citizen engagement to sustaining community based rural water supply in Indonesia. *International journal Development Issues*, 16 (3), 276-288.
<https://doi.org/10.1108/IJDI-03-2017-0031>
- Kejser, A. (2016). European attitudes to water pricing: Internalizing environmental and resource costs. *J. Environ. Manag.*, 183(pt.3), 453-459.
<https://doi.org/10.1016/j.jenvman.2016.08.074>
- Khiyara, S. (2016). Why is the global water crisis a women's issue and the top global risk over the next decade? http://www.huffingtonpost.com/shail-khiyara/why-the-global-water-cris_b_12450260.html
- Knieper, C., & Pahl-Wostl, C. (2016). A comparative analysis of water governance, water management, and environmental performance in river basins. *Water Resources Management*, 30 (7), 2161-2177. <https://doi.org/10.1007/s11269-016-1276-z>
- Koop, S. H. A., Van Dorssen, A. J., & Brouwer, S. (2019). Enhancing domestic water

conservation behaviour: A review of empirical studies on influencing tactics.

Journal of Environmental Management, 247, 867-876.

<https://doi.org/10.1016/j.jenvman.2019.06.126>.

Kopaneva, I. M. (2019). Left in the dust: Employee constructions of mission and vision ownership. *International Journal of Business Communication*, 56(1), 122–

145. <https://doi.org/10.1177/2329488415604457>

Korstjens, I., & Moser, A. (2017). Series: Practical guidance to qualitative research. Part

2: Context, research questions and designs. *European Journal of General*

Practice, 23 (1), 274-279. <https://doi.org/10.1080/13814788.2017.1375090>

Korstjens, I., & Moser, A. (2018). Series: practical guidance to qualitative research. Part

4: Trustworthiness and publishing. *European Journal of General Practice*, 24 (1),

120-124. <https://doi.org/10.1080/13814788.2017.1375092>

Koskey, K. K. (2016). Using the cognitive pretesting method to gain insight into participants' experiences: An illustration and methodological reflection.

International Journal of Qualitative Methods, 15(1), 1-13.

<https://doi.org/10.1177/1609406915624577>

Kourula, A., Moon, J., Salles-Djelic, M.-L., & Wickert, C. (2019). New Roles of

Government in the Governance of Business Conduct: Implications for

Management and Organizational Research. *Organization Studies*, 40(8), 1101–

1123. <https://doi.org/10.1177/0170840619852142>

Lagos State Environmental Protection Agency. (2019). Lagos State Environmental

Protection Agency (LASEPA). <https://www.lasepa.gov.ng/>

Lagos State Ministry of Health. (2019). Drug quality control laboratory.

<https://health.lagosstate.gov.ng/drug-quality-control-laboratory/>

Lagos State Waste Water Management Office. (2019). Lagos State Waste Water

Management Office (LSWMO). <https://moelagos.gov.ng/agencies/lagos-state-waste-water-management-office/>

Lagos State Water Regulatory Commission. (2019). Lagos State Water Regulatory

Commission (LSWRC). <https://lswrc.lagosstate.gov.ng/>

Lagos Water Corporation. (2010). *Lagos Water Supply Master Plan*. Lagos Water

Corporation, Lagos. LWC

Lagos Water Corporation. (2019). Lagos Water Corporation, Lagos State.

<https://lagoswater.org/>

Laksov, K. B., Dornan, T., & Teunissen, P. W. (2017). Making theory explicit – an analysis of how medical education research (ers) describe how they connect to theory. *BMC Med Educ.* 17, 18. <https://doi.org/10.1186/s12909-016-0848-1>

Landrum, B., & Garza, G. (2015). Mending fences: Defining the domains and approaches of quantitative and qualitative research. *Qualitative Psychology*, 2, 199-209.

<https://doi.org/10.1037/qup0000030>

Leech, N. L., & Onwuegbuzie, A. J. (2011). Beyond constant comparison qualitative data analysis: Using NVivo. *Sch. Psychol. Quarterly*, 26 (1), 70-84.

<https://doi.org/10.1037/a0022711>

Leedy, P. D., & Ormrod, J. E. (2005). *Practical research: Planning and design(8thed.)*.

Upper Saddle River, NJ: Pearson Education, Inc

- Leedy, P. D., & Ormrod, J. E. (2010). *Practical research: Planning and design* (9th ed.). Upper Saddle River, NJ: Merrill.
- Li, W., Pomegbe, W. W. K., Dogbe, C. S. K., & Novixoxo, J. D. (2019). Employees' customer orientation and customer satisfaction in the public utility sector: The mediating role of service quality", *African Journal of Economic and Management Studies*, 10 (4), 408-423. <https://doi.org/10.1108/AJEMS-10-2018-0314>
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverley Hills, CA: Sage Publications
- Lopez-Dicastillo, O., & Belintxon, M. (2014). The challenges of participant observations of cultural encounters within an ethnographic study. *Procedia Social and Behavioral Sciences*, 132, 522-526. <https://doi.org/10.1016/j.sbspro.2014.04.347>
- Lugaterah, A. W., & Dwomoh, G. (2017). Service delivery in Ghana water company limited: Lessons for governance in the public sector Ghana. *International Journal of Research in Business and Management*, 4 (8), 30-40. <https://www.ijrbsm.org/papers/v4-i8/5.pdf>
- Maduka, I. C., Anakwuo, A. I., & Ogueche, N. P. (2018). Lead in potable water sources in Anambra state, South East, Nigeria. *Afr J Med Health Sci.*, 17, 26-30. https://doi.org/10.4103/ajmhs.ajmhs_32_17
- Maduku, D. K. (2021). Water conservation campaigns in an emerging economy: how effective are they? *International Journal of Advertising*, 40 (3), 452-472. <https://doi.org/10.1080/02650487.2020.1780060>
- Magombo, P. U., & Kosamu, I. B. M. (2016). Challenges of water accessibility in the

urban centres of Malawi: A case study of Blantyre City. *African Journal of Environmental Science and Technology*, 10, 380-385.

<https://doi.org/10.5897/AJEST2015.2126>

Maharaji, N. (2016). Using field notes to facilitate critical reflection. *Reflective Practice*, 17(2), 114-124. <https://doi.org/10.1080/14623943.2015.1134472>

Majid, M. A., Othman, M., Mohamad, S. F., Lim, S. A. H., & Yusof, A. (2017). Piloting for interviews in qualitative research: Operationalization and lessons learnt. *International Journal of Academic Research in Business and Social sciences*, 7(4), 1073-1080. <https://doi.org/10.6007/IJARBS/v7-i4/2916>

Majuru, B., Suhrcke, M., & Hunter, P. R. (2018). Reliability of water supplies in low and middle-income countries: a structured review of definitions and assessment criteria. *Journal of Water, Sanitation and Hygiene for Development*, 8(2): 142–164. <https://doi.org/10.2166/washdev.2018.174>

Mangai, M., & De Vries, M. (2017). Co-production as deep engagement: Improving and sustaining access to clean water in Ghana and Nigeria. *International Journal of Public Sector Management*, 31(1), 81-96. <https://doi.org.ezp.waldenulibrary.org/10.1108/IJPSM-03-2017-0084>.

Mania-Singer, J. (2017). A systems theory approach to the district central office's role in school-level improvement. *Administrative Issues Journal: Education, Practice & Research*, 7(1), 70-83. <https://doi.org/10.5929/2017.7.1.6>

Manocha, N., & Chuah, J. C. (2017). Water leaders' summit 2016: Future of world's water beyond 2030 – A retrospective analysis. *International Journal of Water*

Resources Development, 33, 170-178.

<https://doi.org/10.1080/07900627.2016.1244643>

Manzoor, F., Wei, L., Bányai, T., Nurunnabi, M., & Subhan, Q. A. (2019). An examination of sustainable HRM practices on job performance: An application of training as a moderator. *Sustainability*, 11(8), 2263-2299.

<https://doi.org/10.3390/su11082263>

Mapfumo, A., & Madesha, W. M. (2014). Challenges for urban water supply: The case of Masvingo municipality in Zimbabwe. *Int. J. Eco. Res.*, 5 (3), 1-5.

<http://www.ijeronline.com>

Marin, P. (2009). *Public-private partnerships for urban water utilities: A review of experiences in developing countries, Volume 8*, World Bank Publications.

Marques, R. C., Pinto, F. S., & Miranda, J. (2016). Redrafting water governance: Guiding the way to improve the status quo. *Utilities Policy*, 43, 1-3.

<https://doi.org/10.1016/j.jup.2016.11.002>

Marsan, G. A., Bellomo, N., & Gibelli, L. (2016). Stochastic evolutionary differential games toward a systems theory of behavioral social dynamics. *Math Models Methods in Applied Science* 26, 1051-1093.

<https://doi.org/10.1142/S0218202516500251>

Marshall, C., & Rossman, G. B. (2014). *Designing qualitative research*. Thousand Oaks, CA: Sage Publications.

Martin-Candilejo, A., Santillán, D., & Garrote, L. (2019). Pump efficiency analysis for proper energy assessment in optimization of water supply systems. *Water*, 12(1),

132. <https://doi.org/10.3390/w12010132>

Martins, R., Quintal, C., Cruz, L., & Barata, E. (2016). Water affordability issues in developed countries. The relevance of micro approaches. *Util. Policy*, 43, 117-123. <https://doi.org/10.1016/j.jup.2016.04.012>

Marwah, R., & Marwah, M. (2014). Water: Issues in planning for poverty alleviation. *Journal of Land and Rural Studies*, 1, 113–129. <https://doi.org/10.1177/2321024913513517>

Mayanja, C. S. (2020). Participatory monitoring and evaluation for quality programs in higher education: What is the way for Uganda? *International Journal of Educational Administration and Policy Studies*, 12(1), 52-59. <https://doi.org/10.5897/IJEAPS2020.0637>

Mayanja, S. N. (2020). Impact of E-bills payment on customer satisfaction in Uganda: Stanbic Bank Uganda Limited as the Case Study. *Science Journal of Business and Management*. Special Issue: Business Policy & Strategic Management, 8(3), 112-118. <https://doi.org/10.11648/j.sjbm.20200803.12>

Mburung'a, S. M. (2018). Influence of capital structure on sustainability of community water projects. *European Journal of Sustainable Development*, 7(4), 323-332. <https://doi.org/10.14207/ejsd.2018.v7n4p323>

McGrath, C., Palmgren, P. J., & Liljedahl, M. (2019). Twelve tips for conducting qualitative research interviews, *Medical Teacher*, 41(9), 1002-1006. <https://doi.org/10.1080/0142159X.2018.1497149>

McKenzie, J., & Aitken, P. (2012). Learning to lead the knowledgeable organization:

- developing leadership agility. *Strategic HR Review*, 11(6), 329-334.
<https://doi.org/10.1108/14754391211264794>.
- Meho, L. I. (2006). E-mail interviewing in qualitative research: A methodological discussion. *Journal of the American Society for Information Science and Technology*, 57, 1284–1295. <https://doi.org/10.1002/asi.20416>
- Mekonnen, M. M., & Hoekstra, A. Y. (2016). Four billion people facing severe water scarcity. *Science Advanced*, 2, 1-6. <https://doi.org/10.1126/sciadv.1500323>
- Mela, S. L. (2018). Evaluation of the strategies for financing urban water supply in Jos metropolis, Nigeria. *International Journal of Innovative Environmental Studies Research*, 6(4), 26-36. <http://www.seahipaj.org>
- Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation*. San Francisco, CA: John Wiley & Sons
- Mihalache, G. (2019). Heuristic inquiry: Differentiated from descriptive phenomenology and aligned with transpersonal research methods. *The Humanistic Psychologist*, 47(2), 136–157. <https://doi.org/10.1037/hum0000125>
- Mohajan, H. K. (2018). Qualitative research methodology in social sciences and related subjects. *Journal of Economic Development, Environment and People*, 7(1), 23-48. https://mpva-ub-uni-muenchen.de/85654/MPRA_PAPER_NO.85654
- Molinos-Senante, M., & Donoso, G. (2016). Water scarcity and affordability in urban water pricing: a case study of Chile. *Utilities Policy, Elsevier*, 43(PA), 107-116.
<https://doi.org/10.1016/j.jup.2016.04.014>
- Monney, I., & Antwi-Agyei, P. (2018). Beyond the MDG water target to universal water

coverage in Ghana: The key transformative shifts required. *Journal of Water, Sanitation and Hygiene for Development*, 8 (2), 127-141.

<https://doi.org/10.2166/washdev.2018.176>

Morgeson, F. P., Mitchell, T. R., & Dong, L. (2015). Event system theory: An event oriented approach to the organizational sciences. *Academy of Management Review*, 40, 515-537. <https://doi.org/10.5465/amr.2012.009>

Morris, J. C. (2017). Planning for water infrastructure: Challenges and opportunities. *Public Works Management & Policy*, 22 (1), 24-30.

<https://doi.org/10.1177/1087724X16668182>

Moser, A., & Korstjens, I. (2017). Series: Practical guidance to qualitative research. Part 1: Introduction. *European Journal of General Practice*, 23(1), 271-273.

<https://doi.org/10.1080/13814788.2017.1375093>

Moser, A., & Korstjens, I. (2018). Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis, *European Journal of General Practice*, 24 (1), 9-18. <https://doi.org/10.1080/13814788.2017.1375091>

Mtasigazya, P. (2018). Cost-effectiveness of outsourcing local government revenue collection in Tanzania: The case of Kinondoni and Morogoro Municipal Councils. *PEOPLE: International Journal of Social Sciences*, 4 (2), 1554-1571.

<https://de.doi.org/10.20319/pijss.2018.42.15541571>.

Muhammad, M. B., & Dansabo, M. T. (2018). Pure water, sale and its socio-economic implications in Nigeria. *Journal of Environmental Sustainability*, 6 (1),

<https://scholarworks.rit.edu/jes/vol6/iss1/3>

- Muhumed, M. M., & Gass, S. A. (2016). The World Bank and IMF in developing countries: Helping or hindering? *International Journal of African and Asian Studies*, 28, 39-49. <https://iiste.org/Journals/index.php/JAAS/article/view/34532>
- Mvulirwenande, S., Wehn, U., & Alaerts, G. (2019). Policy factors explaining the failure of delegated management in water supply: Evidence from Ghana. *Water International*, 44(1), 14-30. <https://doi.org/10.1080/02508060.2018.1539697>
- Mwihaki, N. J. (2018). Decentralisation as a tool in improving water governance in Kenya. *Water Policy*, 20 (2), 252–265. <https://doi.org/10.2166/wp.2018.102>
- Myers, D. M., & Neuman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization*, 17, 2–26. <https://doi.org/10.1016/j.infoandorg.2006.11.001>
- Ndiritu, A. W., Mburung'a, S. M., & Ndiritu, C. N. (2018). Pay as you drink for sustainability of community water projects. *European Scientific Journal*, 14, 137-151. <https://doi.org/10.19044/esj.2018.v14n11p137>
- Nejati, M., & Shafaei, A. (2018). Leading by example: The influence of ethical supervision on students' prosocial behavior. *Higher Education: The International Journal of Higher Education Research*, 75(1), 75–89. <https://doi.org/10.1007/s10734-017-0130-4>
- Neto, S. (2016). Water governance in an urban age. *Util. Policy*, 43(PA), 32-41. <https://doi.org/10.1016/j.jup.2016.05.004>.
- Nimmon, L., & Stenfors-Hayes, T. (2016). The handling of power in the physician-patient encounter: Perceptions from experienced physicians. *BMC Med Educ.* 16,

114. <https://doi.org/10.1186/s12909-016-0634-0>
- Nyumba, T. O., Wilson, K., Derrick, C. J., & Mukherjee, N. (2018). The use of focus group discussion methodology: Insights from two decades of application in conservation. *Methods Ecol Evol.*, 9, 20–32. <https://doi.org/10.1111/2041-210X.12860>
- Obisi, C., Samuel, R., & Ilesanmi, A. (2020). Influence of workforce planning on organizational performance in the manufacturing industry of Lagos, Nigeria. *Global Business Review*, 21(2), 404–417. <https://doi.org/10.1177/0972150918778980>
- Ohwo, O. (2014). The impact of pipe distribution network on the quality of tap water in Ojota, Lagos state, Nigeria. *American Journal of Water Resources*, 2(5), 110-117. <https://doi.org/10.12691/ajwr-2-5-2>
- Ohwo, O. (2016). Challenges of public water provision in Nigerian cities: A review. *Journal of Water, Sanitation and Hygiene for Development* 6 (1), 1-12. <https://doi.org/10.2166/washdev.2016.071>
- Ohwo, O., & Abotutu, A. (2014). Access to potable water supply in Nigerian cities evidence from Yenagoa metropolis. *American Journal of Water Resources*, 2, 31-36. <https://doi.org/10.12691/ajwr-2-2-1>
- Ohwo, O., & Agusomu, T. D. (2018). Residential customers' satisfaction with public water provision in Ojota, Nigeria. *European Scientific Journal*, 14(23), 117-137. <https://doi.org/10.19044/esj.2018.v14n23p117>.
- Okeke, R. C. (2015). Fundamentals of sustainable development in sub-Saharan Africa: A

- focus on water policy in Nigeria. *International Letters of Social and Humanistic*, 65, 143-151. <https://doi.org/10.18052/www.scipress.com/ILSHS.65.143>
- Okeola, O. G., & Sule, B. F. (2012). Evaluation of management alternatives for urban water supply system using multicriteria decision analysis. *Journal of King Saud University – Engineering Sciences*, 24, 19–24. <https://doi.org/10.1016/j.jksues.2011.07.004>
- Okonkwo, C. (2018, March 22). Can Governor Ambode end the water crisis in Lagos? Sahara Reporters. <http://saharareporters.com>.
- Oltmann, S. M. (2016). Qualitative interviews: A methodological discussion of the interviewer and respondent contexts. *Qualitative Social Research*, 17(2), Art. 15. <http://dx.doi.org/10.17169/fqs-17.2.2551>
- Olukanni, D. O., Ajetomobi, M. O., Tebowei, S. O., Ologun, O. O., & Kayode, O. M. (2014). Water supply and sanitation challenges in an urban setting: A case study. *International Journal of Engineering and Applied Sciences (IJEAS)* 1(3), 34-38. <https://www.ijeas.org/>
- Omole, D. O., Emenike, C. P., Tenebe, I. T., Akinde, A. O., & Badejo, A. A. (2015). An assessment of water related diseases in a Nigerian community. *Research Journal of Applied Sciences, Engineering and Technology* 10(7), 776-781. <https://doi.org/10.19026/rjaset.10.2430>
- Omole, D. O., Ndambuki, J. M., Badejo, A. A., Oyewo, O. O., & Soyemi, T. O. (2016). Public feedback on state of domestic water supply in Lagos: Implications for public health. *Indian Journal of Traditional Knowledge*, 15(2), 245-253.

<http://nopr.niscair.res.in/bitstream/123456789/339>.

Opeyemi, O. A., & Bayode, O. J. (2018). Impact of gender involvement in sustainable water development projects in Ibadan, Nigeria. *International Journal of World Policy and Development Studies*, 7(4), 30-34.

http://arpgweb.com/?ic=journal&Journal=13*info=aims

Oseni, E., & Oseni, F. (2018). Identifying appropriate funding model for public infrastructures in Nigeria: A non-empirical analysis. *European Journal of Business and Management*, 10(17), 55-64. <https://www.iiste.org/Journals/index.php/EJBM/article/viewFile/42777/44071>

Osiemo, M. M., Ogendi, G. M., & M'Erimba, C. (2019). Microbial quality of drinking water and prevalence of water-related diseases in Marigat urban center, Kenya. *Environmental Health Insights*, 13, 1-7.

<https://doi.org/10.1177/1178630219836988>

Oyelami, L. O., Adebisi, S. O., & Adekunle, B. S. (2020). Electronic payment adoption and consumers' spending growth: empirical evidence from Nigeria. *Futur Bus J*, 6, 14. <https://doi.org/10.1186/s43093-020-00022-z>

Oyewole, O. O. (2018). Succession planning as a Key to effective managerial transition process in corporate organizations. *American Journal of Management Science and Engineering*, 3 (1),1-6. <https://doi.org/10.11648/j.ajmse.20180301.11>

Pahl-Wostl, C. (2015). *Water governance in the face of global change: from understanding to transformation*. Springer International Publishing.

<http://dx.doi.org/10.1007/978-3-319-21855-7>

- Pahl-Wostl, C. (2017). An evolutionary perspective on water governance: from understanding to transformation. *Water Resources Management* 31(10), 2917-2932. <http://dx.doi.org/10.1007/s11269-017-1727-1>
- Pahl-Wostl, C. (2019). The role of governance modes and meta-governance in the transformation towards sustainable water governance. *Environmental Science and Policy*, 91, 6–16. <https://doi.org/10.1016/j.envsci.2018.10.008>
- Palinkas, L., Horwitz, S., Green, C., Wisdom, J., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration & Policy in Mental Health & Mental Health Services Research*, 42(5), 533-544. <https://doi.org/10.1007/s10488-013-0528-y>
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice (4th ed.)*. Thousand Oaks, CA: SAGE.
- Peredaryenko, M. S., & Krauss, S. E. (2013). Calibrating the human instrument: Understanding the interviewing experience of novice qualitative researchers. *The Qualitative Report*, 18, 1-17. <http://www.nova.edu/ssss/QR>
- Phillippi, J., & Lauderdale, J. (2018). A guide to field notes for qualitative research context and conversation. *Qualitative Health Research*, 28 (3), 381-388. <https://doi.org/10.1177/1049732317697102>
- Pirsaheb, M., Sharafi, K., Ahmadi, E., & Moradi, M. (2017). Prevalence of the waterborne diseases (diarrhea, dysentery, typhoid, and hepatitis A) in West of Iran during 5 years (2006–2010). *Ann Trop Med Public Health*, 10(6), 1524-1528.

<http://www.atmph.org/text.asp?2017/10/6/1524/222662>

- Pype, P., Mertens, F., Helewaut, F., & Krystallion, D. (2018). Healthcare teams as complex adaptive systems: Understanding team behavior through team members' perception of interpersonal interaction. *BMC Health Serv Res.*, *18*, 570-582. <https://doi.org/10.1186/s12913-018-3392-3>
- Qtaishat, K. S. (2020). Reducing non-revenue water in Jordan using GIS. *Proc. SPIE 11524, Eighth International Conference on Remote Sensing and Geoinformation of the Environment*, <https://doi.org/10.1117/12.2570784>
- Rashid, Y., Rashid, A., Warraich, M. A., Sabir, S. S., & Waseem, A. (2019). Case study method: A step-by-step guide for business researchers. *International Journal of Qualitative Methods*, *18*, 1–13. <https://doi.org/10.1177/1609406919862424>
- Rathnayaka, K., Malano, H., & Arora, M. (2016). Assessment of sustainability of urban water supply and demand management options. *Water*, *8*, 595-608, <https://doi.org/10.3390/w8120595>
- Ravitch, S. M., & Carl, N. M. (2016). *Qualitative research: Bridging the conceptual, theoretical, and methodological*. Thousand Oaks, CA: Sage Publications.
- Rehman, S. U., & Baig, S. (2017). Water Consumption Patterns and Waterborne Diseases in Slums of Karachi. *Academic Journal of Interdisciplinary Studies*, *6* (1), 37-43. <https://doi.org/10.5901/ajis.2017.v6n1p37>
- Reniko, G., & Kolawole, O. D. (2020). They don't read meters, they only bring bills: Issues surrounding the installation of prepaid water meters in Karoi town, Zimbabwe. *South African Geographical Journal*, *102*(3), 356–371. <https://doi->

org.ezp.waldenulibrary.org/10.1080/03736245.2019.1691046

- Ribeiro, N. B., & Johnson, R. M. F. (2018). Discussion on water governance: Patterns and common paths. *Ambient. Soc.* 21, [Http://de.doi.org/10.1590/1809-4422asoc0125r2vu18/1ao](http://de.doi.org/10.1590/1809-4422asoc0125r2vu18/1ao)
- Richardson, T. M., Earnhardt, M. P., & Marion, J. W. (2015). Is project management still an accidental profession? A qualitative study of career trajectory. *Sage Open*, 1-10. <https://doi.org/10.1177/2158244015572098>
- Richter, B. D., Blount, M. E., Bottorff, C., Brooks, H. E., Demmerle, A., Gardner, B. L., Herrmann, H., Kremer, M., Kuehn, T. J., Kulow, E., Lewis, L., Lloyd, H. K., Madray, C., Mauney, C. I., Mobley, B., Stenseth, S., & Strick, A. W. (2018). Assessing the sustainability of urban water supply systems. *Journal-American Water Works Association*, 110(2), 40-47. <https://doi.org.10.1108/JAWWA-01-2017-0015>
- Ridder, H. G. (2017). The theory contribution of case study research designs. *Bus Res.*, 10 (2), 281–305. <https://doi.org/10.1007/s40685-017-0045-z>
- Rietveld, L. C., Siri, J. G., Chakravarty, I., Arsenio, A. M., Biswas, R., & Chatterjee, A. (2016). Improving health in cities through systems approaches for urban water management. *Environmental Health*, 15 (31), <https://doi.org/10.1186/s12940-016-0107-2>
- Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*. Thousand Oaks, CA: Sage

- Rosenberg, N. E., & Schwartz, I. S. (2019). Guidance or compliance: What makes an ethical behavior analyst? *Behavior Analysis in Practice*, *12*(2), 473-482.
<https://doi.org/10.1007/s40617-018-00287-5>
- Rossetti, C. L., Handfield, R., & Dooley, K. J. (2011). Forces, trends, and decisions in pharmaceutical supply chain management. *International Journal of Physical Distribution & Logistics Management*, *41*, 601-622.
<https://doi.org/10.1108/09600031111147835>
- Rubin, H. J., & Rubin, I. S. (2012). *Qualitative interviewing: The art of hearing data* (3rd ed). Los Angeles, CA: Sage Publications
- Rugemalila, R., & Gibbs, L. (2015). Urban water governance failure and local strategies for overcoming water shortages in Dar es Salaam, Tanzania. *Environment and Planning C: Government and Policy*, *33*, 412 – 427. <https://doi.org/10.1068/c1324>
- Sahhar, Y., Lowhuis, R., & Henseler, J. (2021). Towards a circumplex typology of customer service experience management practices. A dyadic perspective. *Journal of Service Theory and Practices*, *31*(3), 366-395. <https://doi.org/10.1108/STP-06-2020-0118>
- Saibu, O., & Obioesio, F. (2017). Foreign aid, fiscal optimality and economic growth in Nigeria. *SPOUDAI Journal of Economics and Business*, *67*(4), 85-99.
https://www.researchgate.net/.../323113735_Foreign_Aid_Fiscal_Optimality_and_Econ.
- Saldaña, J. (2016). *The coding manual for qualitative researchers* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Sambu, A. (2016). Impact of global initiatives on drinking water access in Africa.

African Geographical Review, 35 (2), 151-167.

<https://doi.org/10.1080/19376812.2015.1133312>.

Santos, J., Franco, E., Carballo, H., Armenia, S., Pompei, A., & Medaglia, C. (2019).

Water used to be infinite: a Brazilian tale of climate change. *Kybernetes*, 48 (1),

143-162. <https://doi.org/10.1108/K-11-2017-0438>

Savenije, H. H. G., Hoekstra, A. Y., & Van der Zaag, P. (2014). Evolving water science

in the Anthropocene. *Hydrology and Earth System Sciences*, 18, 319-332.

<https://doi.org/10.5194/hess-18-319-2014>.

Sayin, S. U. (2016). A short introduction to system theory: Indispensable postulate

systems and basic structures of the systems in quantum physics, biology and neuroscience. *NeuroQuantology*, 14 (1), 126-142.

<https://doi.org/10.14704/nq.2016.14.1.855>

Schot, E., Tummers, L., & Noordegraaf, M. (2020). Working on working together. A

systematic review on how healthcare professionals contribute to interprofessional collaboration, *Journal of Interprofessional Care*, 34 (3), 332-

342. <https://doi.org/10.1080/13561820.2019.1636007>

Schraeder, M., Self, D. R., Jordan, M. H., & Portis, R. (2014). The functions of

management as mechanisms for fostering interpersonal trust. *Advances in*

Business Research, 5, 50-62. <http://journals.sfu.ca/abr>

Sharafizad, J., & Coetzer, A. (2016). Women business owners' start-up motivations and

network content. *Journal of Small Business and Enterprise Development*, 23(2),

590-610. <https://doi.org/10.1108/JSBED-07-2015-0085>

- Sharma, S., & Bhattacharya, A. (2017). Drinking water contamination and treatment techniques. *Appl Water Sci*, 7, 1043–1067. <https://doi.org/10.1007/s13201-016-0455-7>
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. *Education for Information*, 22, 63-75. <https://doi.org/10.3233/EFI-2004-22201>
- Sherry, J., Juran, L., Kolivras, K. N., Krometis, L. H., & Ling, E. J. (2018). Perceptions of water services and innovations to improve water services in Tanzania. *Public Works Management & Policy*, 1–24. <https://doi.org/10.1177/1087724X18815486>
- Shree, S., Pratap, B., Saroy, R., & Dhal, S. (2021). Digital payments and consumer experience in India: a survey based empirical study. *J Bank Financ Technol*, 5, 1–20. <https://doi.org/10.1007/s42786-020-00024-z>
- Shrestha, S., Chapagain, P. S., & Ghimire, M. (2019). Gender perspective on water use and management in the context of climate change: A case study of Melamchi watershed area, Nepal. *Climate Change - Original Research*, 1-9. <https://doi.org/10.1177/2158244018823078>
- Silva, J. A., & Miguel, R. D. (2018). Gender and water management in Mexico. *Management of Environmental Quality International Journal*, 29, 842-858. <https://doi.org/10.1108/MEQ-10-2017-0112>
- Simanjuntak, M., Putri, N. E., Yuliati, L. N., & Sabri, M. F. (2020). Enhancing customer retention using customer relationship management approach in car loan business.

Cogent Business & Management, 7(1),

<https://doi.org/10.1080/23311975.2020.1738200>

Smith, B. (2018). Generalizability in qualitative research: misunderstandings, opportunities and recommendations for the sport and exercise sciences.

Qualitative Research in Sport, Exercise and Health, 10(1), 137-149.

<https://doi.org/10.1080/2159676X.2017.1393221>

Sojobi, A. O., Balogun, I. I., & Salami, A. W. (2016). Climate change in Lagos state, Nigeria: What really changed. *Environmental Monitoring and Assessment*, 188(556), 1-42. <https://doi.org/10.1007/s10661-016-5549-z>

Sothan, S. (2018). Foreign aid and economic growth: evidence from Cambodia. *The Journal of International Trade & Economic Development, An International and Comparative Review*, 27(2), 168-183.

<https://doi.org/10.1080/09638199.2017.1349167>

Soto Rios, P. C., Dean, T. A., Nagabhatla, N., & Ayala, G. (2018). Explaining water pricing through a water security lens. *Water*, 10(9), 1173, 1-20.

<https://doi.org/10.3390/w10091173>

Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage.

Suleiman, L., & Khakee, A. (2017). Rethinking water reform policies as a 'wicked problem' the case of urban water supply in Ghana. *International Planning Studies*, 22(4), 320-332. <https://doi.org/10.1080/13563475.2017.1291333>

Surmiak, A. (2018). Confidentiality in qualitative research involving vulnerable participants: Researchers' perspectives. *Forum Qualitative Sozialforschung /*

Forum: Qualitative Social Research, 19(3), Art. 12,

<http://dx.doi.org/10.17169/fqs-19.3.3099>.

Suwaidi, M. A., Jabeen, F., Stachowicz-Stanusch, A., & Webb, M. (2020). Determinant linked to executive succession planning in public sector organization. *Vision*, 24(3), 284-299. <https://doi.org.10.1177/0972262920932405>

Taonameso, S., Mudau, L. S., Traoré, A. N., & Potgieter, N. (2018). Borehole water: A potential health risk to rural communities in South Africa. *Water Supply*, 19(1), 128-136. <https://doi.org/10.2166/ws.2018.030>

Theofanidis, D., & Fountouki, A. (2019). Limitations and delimitations In the research process. *Perioperative nursing (GORNA)*, 7(3), 155–162. <https://doi.org/10.5281/zenodo.2552022>

Thomas, E., & Magilvy, J. K. (2011). Qualitative rigor or research validity in qualitative research. *Journal for Specialists in Pediatric Nursing* 16(2), 151-155. <https://doi.org/10.1111/j.1744-6155.2011.00283.x>

Tingey-Holyoak, J., & Pisaniello, J. D. (2019). Water accounting knowledge pathways. *Pacific Accounting Review*, 31(2), 258-274. <https://doi.10.1108/PAR-01-2018-0004>

Tinubu, A. (2020). Lagos State Local Government Administrative Boundary and Natural Drainage Maps.

Tong, A., & Dew, M. A. (2016). Qualitative research in transplantation. Ensuring relevance and rigor. *Transplantation*, 100(4), 710-712. <https://doi.org/10.1097/TP.0000000000001117>

- Tortajada, C., & Biswas, A. K. (2020). Water management in post-2020 world, *International Journal of Water Resources Development*, 36:6, 874-878. <https://doi.org/10.1080/07900627.2020.1837451>
- Tovmasyan, G. (2017). The role of managers in organizations: Psychological aspects. *Business Ethics and Leadership*, 1(3), 20-26. [https://doi.org/10.21272/bel.1\(3\).20-26.2017](https://doi.org/10.21272/bel.1(3).20-26.2017)
- Turner, S., & Endres, A. (2017). Strategies for enhancing small-business owners' success rates. *International Journal of Applied Management & Technology*, 16(1), 34-49. <https://doi.org/10.5590/IJAMT.2017.16.1.03>
- Ugwuegbe, S. U., Okafor, I. G., & Akarogbe, C. A. (2016). Effect of external borrowing and foreign aid on economic growth in Nigeria. *International Journal of Academic Research in Business and Social Sciences*, 6 (4), 155-175. <https://doi.org/10.6007/IJARBSS/v6-i4/2087>
- UNESCO World Water Assessment Programme. (2019). The United Nations World Water Development Report 2019: Leaving no one behind.
- United Nations. (1999). *Human development reports 1999 (Published for the United Nations Development Program)*. New York, NY: Oxford University Press.
- United Nations. (2015). Department of economic and social affairs, population division (2015). Population 2030: Demographic challenges and opportunities for sustainable development planning (ST/ESA/SER.A/389).
- United Nations. (2019). United Nations Department of Economic and Social Affairs, Population Division. (2019). World Population Prospects 2019: Highlights

(ST/ESA/SER.A/423).

United Nations International Children's Emergency Fund. (2018). Water, sanitation, and hygiene. <https://www.unicef.org/nigeria/wes.html>

Vargo, S. L., Koskela-Huotari, K., Baron, S., Edvardsson, B., Reynoso, J., & Colurcio, M. (2017). A systems perspective on markets—Toward a research agenda. *Journal of Business Research*, 79, 260-268. <http://dx.doi.org/10.1016/j.jbusres.2017.03.011>

Varpio, L., & McCarthy, A. (2018). How a needs assessment study taught us a lesson about the ethics of educational research. *Perspect Med Educ* 7, 34–36. <https://doi.org/10.1007/s40037-017-0356-y>

Venkatraman, S. (2018). Analysis of mobile payment influencing factors. In *Proceedings of 8th International Conference on Computer Science, Engineering and Applications (ICCSEA 2018), Melbourne*. 41(2), 114-122. <https://doi.org/10.5121/csit.2018.80315>

von Bertalanffy, L. (1950). An outline of general system theory. *The British Journal for the Philosophy of Science*, 1, 134-165. <https://doi.org/10.1093/bjps/i.2.134>

von Bertalanffy, L. (1972). The history and status of general systems theory. *Academy of Management Journal*, 15, 407-426. <https://doi.org/10.2307/255139>.

von Bertalanffy, L. (1973). *General systems theory (Revised Edition)*. George Braziller, New York.

Wang, J. (2018). Innovation and government intervention: A comparison of Singapore and Hong Kong. *Research Policy*, 47(2), 399-412.

<https://doi.org/10.1016/j.respol.2017.12.008>.

- Wang, J., & Ge, J. (2016). Alternative approaches to treat respondent uncertainty in contingent willingness to pay estimation. *China Agricultural Economic Review*, 8, 412-429. <https://doi.org/10.1108/CAER-11-2015-0153>
- Woke, G. N., & Umesi, N. (2018). Evaluation of water quality in selected communities in Obio/Akpor L.G.A, Rivers State. *International Journal of Research in Agriculture and Forestry*, 5 (4), 13-16. <http://www.ijraf.org/papers/v5-i4/3.pdf>
- Woodhouse, P., & Muller, M. (2017). Water governance-an historical perspective on current debates. *World Development, Elsevier*, 92(C), 225-241. <https://doi.org/10.1016/j.worlddev.2016.11.014>
- World Economic Forum. (2013). *Global risks 2013: Eighth edition*. http://www3.weforum.org/docs/WEF_GlobalRisks_Report_2013.pdf
- World Economic Forum. (2015). *Global risks 2015 (10th ed.)*. https://www3.weforum.org/docs/WEF_Global_Risks_2015_Report15.pdf
- World Economic Forum. (2016). *The global risks report 2016 (11th Edition)*. Cologny: World Economic Forum.
- World Health Organization. (2017a). *Guidelines for drinking-water quality: Fourth edition incorporating the first addendum*. Geneva.
- World Health Organization & United Nations International Children's Emergency Fund. (2017b). *Progress on drinking water, sanitation and hygiene*: https://www.who.int/water_sanitation_health/publications/jmp-2017/en/uploads/2017/03/safely-managed-drinking-water-JMP-2017-1.pdf

- World Tourism Organization. (2018). <http://www2.unwto.org/press-release/2018-08-27/unwto-highlights-confirm-another-record-year-2017>
- Yaro, C. A., Kogi, E., Onoja, A. E., Attah, T. C., & Zubairu, B. O. (2019). Challenges and spatial distribution of water infrastructures (boreholes) in Okenne town, Kogi state, Nigeria. *J. Applied Sci.*, *19* (1), 25-30.
<https://doi.org/10.3923/jas.2019.25.30>
- Yeleliere, E., Cobbina, S. J., & Duwiejuah, A. B. (2018). Review of Ghana's water resources: The quality and management with particular focus on freshwater resources. *Applied Water Science*, *8*(93), 1-12. <https://doi.org/10.1007/s13201-018-0736-4>
- Yeo, C., Hur, C., & Ji, S. (2019). The Customer Orientation of Salesperson for Performance in Korean Market Case: A Relationship between Customer Orientation and Adaptive Selling. *Sustainability*, *11*(21), 6115.
<https://doi.org/10.3390/su11216115>
- Yeong, M., Ismail, R., Ismail, N., & Hamzah, M. (2018). Interview protocol refinement: Fine-tuning qualitative research interview questions for multi-racial populations in Malaysia. *The Qualitative Report*, *23* (11), 2700-2713.
<https://nsuworks.nova.edu/tqr/vol23/iss11/7>
- Yin, R. K. (2014). *Case study research: Design and methods*: Thousand Oaks, CA: Sage
- Yin, R. K. (2018). *Case study research and applications: Design and methods (6th Revised ed.)*. Thousand Oaks, CA: Sage.
- Young, W., & Leveson, N. G. (2014). An integrated approach to safety and security

based on systems. *Communication of the ACM*, 57(2), 31- 35.

<https://doi.org/10.1145/2556938>

Yusuf, N., Okoh, D., Musa, I., Adedoja, S., & Said, R. (2017). A study of the surface air temperature variations in Nigeria. *The Open Atmospheric Science Journal*, 11, 54-70. <https://doi.org/10.2174/1874282301711010054>

Zeneli, F. (2017). Water privatization in developing countries: Case of Albania. *European Scientific Journal, ESJ*, 13(10), <https://doi.org/10.19044/esj.2017.v13n10p%p>

Zolnikov, T. R., & Blodgett-Salafia, E. (2017). Access to water provides economic relief through enhanced relationships in Kenya. *Journal of Public Health*, 39(1), 14-19. <https://doi.org/10.1093/pubmed/fdw00>

Appendix A: Final Interview Protocol

Interview Questions

1. Let's begin with, can you tell me about your background?
What are your previous roles? What is your current role?
2. How would you describe Lagos Water Corporation's (LWC)'s service to customers in terms of adequate potable water delivery?
Can you provide examples? How would you describe a good service?
3. How would you describe LWC's responsibility for providing adequate potable water to each Lagos resident?
4. What are the issues that are preventing all Lagos residents from obtaining adequate potable water from LWC?
5. What should LWC do to address these issues?
 - How could you support these actions by personal involvement?
 - How would these actions comprise an LWC management strategy?
6. What is your assessment of LWC's management capability to execute the strategies you have described?
7. What resources would LWC require in order to implement the management strategies you have described?
 - What is the location of these resources?

- Which parties would be responsible for providing these resources?
- Are there any alternatives to the resources you have described?

9. How is LWC currently funding the provision of potable water access to all Lagos residents?

- What could be done to improve these funding methods?

10. What is the relationship between LWC and Lagos state government in the provision of adequate potable water to all Lagos residents?

- How should this relationship be managed for adequate funding, enabling environment, and overall water governance?

11. What is the relationship between LWC and other stakeholders in the provision of adequate potable water to all Lagos residents?

12. What is the relationship between LWC and their customers in the provision of adequate potable water to all Lagos residents?

- How should service delivery, customer satisfaction, willingness to pay, effective billing and cost-recovery be managed?

13. How should LWC manage the government, customer and stakeholder relationships to reflect shared responsibilities for providing adequate potable water to all Lagos residents?

14. Is there anything else you'd like to tell me

Appendix B: Final Focus Group Discussion Protocol

1. How would you describe Lagos Water Corporation's (LWC)'s service to customers in terms of adequate potable water delivery?
2. What does the mandate of supplying adequate potable water to Lagos residents mean to you?
3. How would you describe LWC's responsibility for providing adequate potable water to each Lagos resident?
4. What are the issues that are preventing LWC from providing adequate potable water for all Lagos residents?
5. What should LWC do to address these issues?
6. What should be LWC's management capability requirements to execute the strategies you have described?
7. What resources would LWC require in order to implement the management strategies you have described?
 - Where would these resources come from?
 - What are the alternatives to the resources you have described?
8. How is LWC currently funding the provision of potable water access to all Lagos residents?
 - What could be done to improve these funding methods?
 - What other better strategies would you recommend?

9. What is the relationship between LWC and Lagos state government in the provision of adequate potable water to all Lagos residents?
 - How should this relationship be managed for adequate funding, enabling environment, and overall water governance?
10. What is the relationship between LWC and other stakeholders in the provision of adequate potable water to all Lagos residents?
11. What is the relationship between LWC and their customers in the provision of adequate potable water to all Lagos residents?
 - How should service delivery, customer satisfaction, willingness to pay, effective billing and cost-recovery be managed?
12. How should LWC manage the government, customer and stakeholder relationships to reflect shared responsibilities for providing adequate potable water to all Lagos residents?
13. Is there anything else you'd like to discuss?