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ANALYSIS OF PUBLIC POLICIES AND PROGRAMMES TO WATER SECURITY IN POST-APARTHEID SOUTH AFRICA

BY

RICHARD ADOM

A THESIS submitted to the FACULTY OF SCIENCE, at the UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG, in fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY.

SUPERVISOR: PROF. MULALA DANNY SIMATELE

OCTOBER 2020

DECLARATION

I **Richard Adom** declare that this thesis, including data, tables, diagrams, graphs, and any other information, is my own investigation.

The thesis is being submitted for the Degree of Doctor of Philosophy to the Faculty of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any examination to any other University.



.....

Name: Richard Adom **Date:** 12th October 2020



Supervisor: Prof. Mulala Danny Simatele **Date:** 12th October 2020

ABSTRACT

South Africa is a water stressed country with increasing pressure on water resources due to population growth, increasing levels of urbanisation, inadequate funding in water infrastructure, and the impacts of climate change, resulting in growing demand for water resources. The post-government in 1994 initiated many policies and programmes with the aim of promoting water security. While these policies and strategies achieved much in terms of water provision to communities and households, they failed to establish a water-conscious country with sufficient knowledge and expertise in water management. Furthermore, these policies and programmes are outdated, compartmentalised, complex, and lack robust water governance with resilient stakeholder partnerships that advance the more explicit second phase of the NDP to achieve water security under the threat of climate change. A total of 20 respondents were selected purposely from the Department of water and sanitation and other private institutions in the water sector to participate in semi-structured and in-depth interviews. Additionally, 89 questionnaires were distributed to respondents in four provinces in South Africa. The questions sought to analyse the structural and systematic factors hindering the implementation of policies to achieve water security in South Africa. The results revealed that in the context of policy formulation the country has enacted numerous policies and programmes aimed at promoting water security. However, the policies and programmes do not go far enough to address the challenges of municipalities as the major polluters, nor solving the funding gaps and creating a smart water economy. The study, therefore, recommends an independent water regulator to be established to coordinate different government departments, including the National Treasury to strengthen weak governance capacity and to make it independent to attract private equity into the sector, and to recover fiscal deficits in the water sector.

Keywords: Climate change, management, municipalities, policies, South Africa, Security, water

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LIST OF ABBREVIATIONS AND ACRONYMS

AASA	Aquatic Association of South Africa
ADB	African Development Bank
ANC	African National Congress
AWARD	Association for Water and Rural Development
AWP	America Water Planning
BAC	Bulk Attraction Conveyance
BECSA	Billiton Energy Coal South Africa
CFO	Chief Financial Officer
CMA	Catchment Management Agency
CONEPP	Consultative National Environmental Policy Process
CRR	Comments and Response Report
CSIR	Centre for Scientific and Industrial Research
CSRM	Centre for Scientific and Resource Management
DA	Democratic Alliance
DEA	Department of Environmental Affairs
DID	Department of International Development
DWS	Department of Water and Sanitation
EEA	European Economic Area
EFF	Economic Freedom Fighters
EIA	Environmental Impact Assessment
ESETA	Energy Sector Education and Training Authority
FAF	Future Africa Forum
FAO	Food and Agriculture Organisation
FET	Further Education and Training
FSE	Federation for Sustainable Environment
GDP	Gross Domestic Products
GEAR	Growth, Employment and Redistribution
GPS	Global Positioning System

GSDR	Global Sustainable Development Report
GWP	Global Water Partnership
GWPSA	Global Water Partnership Southern Africa
HSF	Helen Suzman Foundation
ICT	Information and Communication Technology
IDP	Integrated Development Plan
IEA	International Energy Agency
IGWR	Integrated Governance of Water Resource
ILO	International Labour Organisation
IMF	International Monetary Fund
IPP	Independent Power Producers
IWMP	Integrated Water Management Plan
IWR	Independent Water Regulator
IWRM	Integrated Water Resource Management
IWRP	Integrated Water Resources Plan
LCVR	Lawshe Content Validity Rate
LGSETA	Local Government Service Sector Education and Training
LHWP	Lesotho Highland Water Project
MCDA	Multi-Criteria Decision Analysis
MDGs	Millennium Development Goals
MWT	Mvula Water Trust
NCCRWP	National Climate Change Response White Paper
NDP	National Department Plan
NEMA	National Environment Management Act
NGO	Non-Governmental Organisation
NLP	Natural Language Processing
NW&SMP	National Water and Sanitation Master Plan
NWA	National Water Act
NWA	National Water Agency
ODI	Overseas Development Institute

OECD	Organisation for Economic Co-operation Development
PPP	Public-Private Partnership
RDP	Reconstruction and Development Programme
SAAE	South African Association of Engineers
SADC	Southern Africa Development Community
SAHRC	South African Human Rights Commission
SDG	Sustainable Development Goal
SHRM	Society for Human Resource Management
SPSS	Statistical Package for Social Services
SPVs	Special Purpose Vehicles
SSETA	Service Sector Education and Training
StatsSA	Statistical Service of South Africa
SWM	Sustainable Water Management
TCTA	Trans-Caledon Tunnel Authority
TVA	Tennessee Valley Authority
UFH	University of Fort Hare
UN	United Nations
UNCEF	United Nations Children Emergency Fund
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nation Development Programme
UNECA	United Nations Economic Commission for Africa
UNECA	United Nations Economic Commission for Africa
UNEP	United Nation Environment Programme
UNEPA	United Nations Environment Programme Agency
UNFCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
UNWAP	United Nation World Assessment Programme
UNWWDR	United Nations World Water Development Report
WBG	World Bank Group
WEF	World Economic Forum

WHO	World Health Organisation
WISA	Water Institute of Southern Africa
WITS	University of Witwatersrand
WMA	Water Management Act
WPPCL	Water Pollution Prevention and Control Law
WRMA	Water Resource Management Authority
WSA	Water Service Act
WSDP	Water Service Development Plan
WSP	Water Service Provide
WUA	Water Users Association
WWAP	World Water Assessment Programme
WWF	World Water Forum
WWTW	Wastewater Treatment Work
YWP	Young Water Professional

CHAPTER ONE

FRAMES OF REFERENCE

1.1 Background to the Study

Globally, the world's supply of freshwater is decreasing at an alarming rate. Water demand has already exceeded the supply in various parts of the world and, as the population of the world continues to increase, the situations are projected to get worse (Boretti and Rosa, 2018). Ritchie and Roser (2015) indicate that the world population has tripled over the past seventy years, and water usage had increased over six-fold in the same period. This is due to development in the industrial sector and an intensified use of water for irrigation in the agricultural sector. Roudi-Fahim, Creel and Mark de Souza (2002), further disclosed that globally, today, 54 per cent of the yearly available freshwater is being used for these purposes. According to Rosegrant, Cai and Cline (2002), if the current use in these sectors persists, by 2025, they could be using over 70 per cent of the entire global water resources.

Water scarcity and complexities are the most significant global challenges of the 21st century (Saeijs and van Berkel, 1995). Around the world, businesses, governments and policymakers, are working collectively to change the attitudes and move outside the business as usual approach, not only to enhance the supply and increase the quality of current water resources, but correspondingly to reduce withdrawals by redesigning and restructuring the fundamental economic activities (van Halsema and Vincent, 2012). It is estimated that the world demand for water is on course to overtake the supply by 40 per cent by the next twenty years and the conceivable impact of climate variation, drought, deforestation and pollution are increasing the risks even higher (Bigas, Morris, Sandford and Adeel, 2012 and Rosegrant et al., 2002). This is supported by the World Bank Group (2018) and Morris (2019), who argue that unsustainable and uncoordinated water policies among countries and regions, high-water demand across the globe, fragmented administration to address water challenges nationally, and internationally, and deferring perceptions of water are a significant risk to the sustainability of water resources.

Falkenmark (1990) is of the view that many countries in the world are prone to face increased water shortages in the 2020s and beyond. They include parts of India, China, much of the Middle East, Mexico, United States, Poland, Russia, and a clear majority of African countries. Falkenmark (1990) reveals that by 2025, one point one billion Africans, representing about 75 per cent of countries in Africa, including South Africa, are predicted to be living in severe water stress countries with enormous economic, social, environmental, and political consequences.

South Africa is a water-stressed country; water resources are disproportionately spread throughout the country with an average yearly precipitation of 500mm, being almost 60 per cent of the global mean (Dennis and Dennis, 2012). Merely a small section along the south-eastern shoreline obtains sufficient precipitation, whereas the more significant part of the inland, and the western part in South Africa is dry, or semi-dry and waterless (Schulze 2009). Additionally, more than 65 per cent of the country obtains below 500mm per annum, which is generally considered as the lowest for arid land cultivation of agriculture, while 21 per cent of the country obtains beneath 200mm per annum (Roffe, Fitchett and Curtis, 2019 & Schulze, 2009).

The inherent accessibility and availability of water throughout the country are unpredictable, and precipitation outlines dynamic parade seasons. Streamflow in the country's rivers and streams are comparatively low throughout the year (Mukheibir and Sparks, 2003; Botai and Adeola, 2018). The water shortage is being exacerbated by ever-increasing demand owing to economic development, growth in population, improving living standards, unsustainable practices and extreme degree of depletion and damage, and growing pollution rendering water unfit for purpose (Bigas et al., 2012). Adding to the constraints is the destruction of wetlands, modifications, and alterations in precipitation trends due to climate unpredictability, and prolonged droughts which are also the result of climate variabilities. All these factors are contributing to reduced water supply in South Africa (Jackie and Brown, 2006).

By estimate, it is envisaged that by 2030, household demand for water in the country will account for 3.6 billion cubic meters, with the 10 per cent of wealthiest quintile of the population consuming more than 60 per cent of total withdrawals, while the

demand for water from industries such as mining and power generation will increase significantly (Jacobson, Webster and Vairavammoorthy, 2012). To support this analysis, (Basson, 2011, Boccaletti et al., 2010) disclosed that by 2030, the demand for water in South African households would amount to 3.3 billion cubic meters, power generation will contribute to 12 per cent of over-all the resources, mining will account for 18 per cent, and manufacturing and industries will use about 30 per cent of the entire water reserves in the country.

To avert these constraints and to promote sustainability of water in the country, the National Water Act (NWA) and Water Policies came into operation in 1998, replacing a 1956 Water Act. The core principles and objectives, as observed by Nleya (2008) and Bond (2011: 25), highlight that to address the fundamental human rights of the current and future generation, to encourage for equal access of water, to rectify the fallouts of historical and racial inequality, to encourage the value, efficient, favourable and positive use of water, to inspire social and economic development, to ensure for the increasing demand of water use, to safeguard aquatic and its accompanying ecologies and their genetic diversity, to minimise and avert contamination and pollution of water resources, to adhere to universal principles and standards, to encourage dam security, and control overflows and drought require prevention strategies and innovative technologies that reinforce the existing management strategies, reduce demand, and maximum efficiency use should be among integral components of the reactions to address the current mounting demands on the existing water resources.

Nevertheless, the extent to which the NWA and the associated policies protect, control, conserve, regulate, manage, and sustain the water resources of the country is questionable (Mandigele, Snowball and Fraser, 2008). The NWA and these policies are well articulated; however, the program procedures aimed at executing them are often idealistic and impractical. Osmo (2002) and Tiang (2019: 76) highlight that implementing the South African water policies has not been successful due to the difficulties in changing formal and traditional foundations such as assertiveness, personal and organisational conduct, ethics, and social structures. Abrams (1996: 25) identified some of the barriers to the implementation of water policies to attain water security post-independence as including: technical inadequacy, socially and traditionally conflicting with strategies and policies, financially unsustainable

programmes, reliance on less qualified human resources, contradiction with the constitutional requirement, non-coordinated government departments due to lack of public engagements and, external influences, such as weak and low morale public employees and civil disobedient.

1.2. Research Statement

Water demand and consumption in South Africa are not different from global average demand (van Zyl, Geustyn, IIemobade and Buckle, 2007). Water demand in the country, post-independence, has witnessed a steep increase in three significant areas: agriculture, manufacturing, and households (Kuipers, Iny, Kachaner, Portafaix, Mazahreh, 2017). The agriculture sector is the largest user at about 63 per cent, trailed by households and industries at 26 per cent and 11 per cent correspondingly (Nieuwoudt, Backeberg and du Plessis, 2004). The demand for water in the country is projected to grow additionally at around 5 per cent yearly to a range of 18 billion m^3 in 2030, from 15 billion m^3 in 2025 (Balata and Pegram, 2014 and Zhuwakinya, 2012). Based on the current withdrawal and the demand movements, the country is projected to face a water shortfall of about 17 per cent by 2030. This deficit will be exacerbated by climate variability, population grow and wastage (Kohler, 2016 and Makelane, 2020).

Vollmer, Regan and Andelman (2016) argue that, since water is a shared resource, everyone is at risk; therefore, it is critical to comprehend our influence on the resource and integrate water sustainability into our day-to-day activities. Furthermore, the country has reached its natural water dearth, and its socio-economic progress has been directly hindered by the current drought of 2015 (Makelane, 2020). The 2015 drought that hit South Africa negatively affected the agriculture sector. This industry recorded a trade shortfall due to deficiencies in the exportation of maise (Kalaba, 2019 and Schreiner, Mungatana and Balata, 2018). Colvin and Murruvin (2017) disclose that as a result of the drought, in the last quartile of 2015, the agriculture sector shreds 37,000 jobs, which drove an extra 50,000 of the population into the poverty net and augmented inflation by increasing prices of commodities especially food. This situation cut off 0.2 percentage points from the country's economic growth in 2015. South Africa's water predicament is no longer 'tomorrow' conundrum anymore; it is a burning issue now. The current trend of water challenges in South Africa suggests that an

integrated water resources management plan (IWMP) is urgently required to guarantee that this resource does not become a hindrance to the developmental agenda of the country (Schreiner van Koppen, 2018 and UN-Water, 2008).

The post-independence government of South Africa initiated and adopted various water policies and programmes aimed at creating sustainable water development to enhance both the quantity and quality of water supply to its citizens, especially the previously disadvantaged black population. Coning and Sherwill, (2004) and Pengelly, Seyler, Fordycr, van Vuuren, van der Walt, van Zyl and Kinghorn (2017) reveal the policy was abridged to include the following; "Water Service Policy, (White Paper) 1994 to address the accumulations in South Africa's water provision; the establishments and processes required to resolve the backlog. The Constitution of the Republic of South Africa (Act 108 of 1996) established as a bill of right facet, the accessibility to sufficient and quality water provisions as a fundamental human right; Water Service Act (WSA) of 1997 (Act 108 of 1997) also established and empowered people the basic right to water and hygiene. The Act provided a mandatory structure and the creation institutions within the water sector, for instance, water boards and water services providers (WSP) (DWA, 2013 & Pengelly et al., 2017). This Act created an inclusive statutory structure for the delivery of water and health support services, to maintain and preserve the life of individuals through cleanliness, and to recognise the necessity to function in a way that is coherent with the fundamental objectives and agenda of water governance in South Africa (Folifac, 2007 and Coetzee and Kotze, 2018). It also advances collaborative management with prominence on human resource development at all spheres of governance. It further lays-bare the responsibilities of the Department of Water and Sanitation (DWS) on the occasion of under-performance by regional and local administrations.

The WSA of 1997 (DWAF 1997) overhauled the proprietorship and apportionment of water (Pegram and Mazibuko, 2003 and Haigh, Fox, and Davies-Coleman, 2010). The Water Policy of 1997 stipulated that every water reserves, regardless of where it is located in the hydrological cycle, belong to the state, and that the national administration through its responsible department must be responsible as a public custodian (Hodgson 2006 and van der Schhyff, 2011). The National Water Act (NWA) of 1998 (Act 36 of 1998) was established on two principles: sustainability

and equal access (Folifac, 2007 and Soyapi, 2017). To address these objectives, the policy framework established the National Water Resource Strategy (NWRS) to manage the country's water assets. The NWRS (DWAF, 2004a) stipulates the national implementation plan by splitting the country into 19 water management areas (WMA). The DWS strategy in partnership with global corporation programme sought to improve access to quality and low-cost water provision and hygiene for the underprivileged and the needy while, maintaining the sustainability of the water resources (Folifac, 2007 & Viljoen and van der Walt, 2018).

Nevertheless, while these policies ensured that households with access to safe water soared substantially from 77 per cent in 1993 to 85 per cent in 2015, the DWS data for 2017, and StatsSA, (2015) revealed that more than 6.3 million households in the country have no access to consistent water provision, with 14.1 million of the population still using hygienic services beneath the reconstruction development programmes (RDP) benchmark (Pengelly et al., 2017, Jamieson, Berry and Lake, 2017 and Wilkinson, Maggula, 2018). Furthermore, more than 35 per cent of the national water infrastructure is entirely dysfunctional (Mariette 2018). Besides these challenges, the implementation of the policies and programmes post-independence are fragmented, uncoordinated and unintegrated (Knuppe and Meissner, 2015 & Molobela and Sinha, 2011).

The government institutions and other stakeholders have managed water policies and programmes in silos, while interventions and development of water resources in the upper catchment have taken place without adequate consideration of the impacts on downstream areas; water security and quality problems have repeatedly been either overlooked or disconnected from quantity challenges; groundwater has been recurrently mismanaged without any consideration for its hydrological or ecological connections with surface water; land-water relations have been disregarded, the ecological structure have been impaired, as well as social justice and equity repeatedly ignored (Mwendera, Hazelton, Nkhuwa, 2003, Kenmerink, Ahlers and van der Zaag, 2011; & Cole, Bailey, Cullis and New, 2017). To support this argument, Viljoen et al., (2018), and Nel and Driver (2015) reveal that between of 1999 and 2015, the rate at which the major rivers and streams within the country, identified with severe ecological conditions, escalated by 500 per cent with many rivers pushed beyond the recovery point. The levels of tributaries with poor

environmental conditions swelled by 229 per cent within the same period. It was indicated further that the country lost more than 50 per cent of its wetlands, and of the lingering 3.2 million hectares (ha), 48 per cent are extremely threatened, with quarter currently in the very precarious state (Silberbauer and King, 2010 & van Deventer, Smith-Adao, Petersen Mbona, 2018).

Added to the above constraints, water is severely under-priced as well as under-valued; hence, cost recovery of the resource is far below the expected target (Calfucoy, Cibulka, Davison, Hinds and Parks 2009). A water resource in the country is still considered as a free commodity, with an unlimited supply (Mitchell, 2013). Furthermore, South African water legislation and policies have been inadequate to confront the task of water security (Muller, 2018 and Kohler, 2016). As with all crises, Winter (2019) and NW&SMP, (2017) highlight that to achieve the water security, as suggested by Millennium Development Goal (MDG), projected investment capital of about of R33 billion per year for the next decade ought to be solicited through an amalgamation of enhanced revenue collection, and a massive cutback of expenses. Participatory planning, and an implementation process, based on sound science which brings together relevant stakeholders to ascertain how best to achieve the vision and goal of water security and economic benefits, that comes with water resources in South Africa (Mehta, Movik, Bolding, Derman and Manzungu, 2016).

Given these observations, this study was interested in investigating the structural and systematic constraints that make it challenging to implement and enforce policies and programmes designed to drive water security in the country. Of critical importance, is that this study sought to unearth how fragmentation in institutional setup and policy frameworks affects the governance of sustainable water resource management.

1.3. Rationale

A number of studies and reports, NW&SMP (2017), Muller (2018), Schreiner (2013) Bond (2011), Coning et al., (2004) and (Abrams, 1996), all indicate that the combined effects of climate change, population growth and incessant urbanisation are exerting pressure on the limited water resources in South Africa. Zhuwakinyu (2012) indicates that as of 2012, approximately 50 per cent of the population of the country's population was known to be experiencing a water deficit. This water

predicament is currently having substantial effects on the economic development as well as the wellbeing, security and happiness of all and sundry in the country. According to Donnenfeld, Crookes and Heddens (2016), the 2014 – 2016 drought alone did not cause the water scarcity in South Africa. However, the drought ignited a national discussion and, to a larger extent, brought water management strategies deliberation in the country. This observation reflects the systemic constraints of policies and programmes designed to achieve water security.

In post-independent South Africa, few studies, Coning et al., (2004) and NW&SMP (2017), conducted studies on the assessment of water policies in the country. Coning et al., (2004) assessed the water policy process in South Africa between 1994 to 2003. The study established that if human capacity is improved at the Catchment Management Areas, water sustainability will be achieved. Monitoring and Evaluation would reduce degradation and overexploitation of renewable water resources, thus stimulating water security. Their study, however, did not examine the systematic and structural constraints restricting the implementation of the policies and programmes to achieve long-term water security in South Africa. The National Water and Sanitation Master Plan (NW&SMP, 2017) studied the functionality of the water authorisation and registration management systems to ensure proper management of water resources. Nevertheless, the study did not analyse the strengths and weaknesses of the current policies and programmes, nor their impact on water sustainability in the country.

In line with the aforementioned challenges, this research sought to fill the knowledge-gap and contribute significantly to the debate of water management vis-a-vis with water governance in South Africa. It further contributed to the insight of governance that underlies the supply of quality and sustainable water to the population of South Africa in the context of the IWRM paradigm. Currently, there are gaps between public policy planning and implementation concerning water provision in the country (Claude, Tropp and Palencia 2017 & Cosgrove and Loucks, 2015). The policy statements are well defined theoretically, however, the action plans aiming at implementing these policies and strategies are often unrealistic and impractical. There are causal relationships between water scarcity, water quality, and allocation conflicts. Similar linkages also exist between cost recovery and operational performance of water systems. These linkages are rooted in

institutional arrangements, since they are related to ownership, policy issues such as water pricing, and administrative issues such as investments and cost recovery arrangements (Seppala, 2002: 201). This study aimed to investigate these two positions, formulation and adoption versus implementation and enforcement, and to identify the gap, or gaps that exist in the policies, thereby contributing to the generation of interdisciplinary literature which will add to the body of knowledge on the public administration and decision-making procedures within the water management and governance structures. It also sought to contribute to a deeper insight and awareness of the complexities and technicalities of water sector restructurings and reforms in the country post-independent, a necessary tool geared towards long term enhancement of governance. This study proposes some improvements to future policy development and institutional framework. According to Seppala (2002) it is not possible to present a clear-cut institutional framework that would be best for all regions and countries. Nevertheless, an enabling and empowering policy environment as well as institutional and organisational strengthening, including capacity building and human resource development are requirements for success.

1.4 Research Questions

Given the above observations, these questions guided the research procedure:

1. What are the current policies and programmes designed to address water security in South Africa?
2. What are the roles of grassroots organisations in the designing and execution of policies and strategies that address water security in South Africa?
3. What are the systematic and structural constraints restricting the execution of water policies and programmes formulated to address water security challenges in South Africa?
4. What are the strengths and weaknesses of South Africa's water policies and governance in terms of sustainable water resource management?
5. What are the appropriate sustainable strategies within the institutional framework towards achieving water security in South Africa?

1.5. Research Aims and Objectives

This research aimed to investigate the public policies and programmes towards water security in South Africa post-independence. The objectives of the study are as follows:

1. To identify the current policies and programmes aimed at achieving water security in South Africa,
2. To investigate the roles of grassroots organisations in designing and execution of policies and strategies that seek to address water security in South Africa,
3. To investigate the systematic and structural constraints restricting the execution of sustainable water policies and programmes to achieve water security in South Africa,
4. To analyse the strengths and weaknesses of water policies and strategies towards the attainment of water security in South Africa and,
5. To formulate appropriate sustainable strategies within the institutional framework towards achieving water security in South Africa.

1.6 Theoretical Perspectives on Water Management

Whilst people demand for water upsurges, and struggle among sectors that depend on water deepens, water scarcity becomes apparent in different forms, from human consumption to industrial usage (Hertel and Liu, 2016, Cassardo, Anthony and Jones, 2011 & Mancosu, Snyder, Kyriakakis and Spano, 2014). Additionally, there is a common discernment and believe that the scarcity of water is due to some developments that are, to some extent, inevitable; primarily due to the increase in human population and its corresponding demand for food production, municipal, and industrial uses of water (Panjabi, 2014). This views and assertions have led many scholars and governments to a hasty conclusion that the 'water crisis' is unavoidable (Donnenfeld et al., 2018). Nevertheless, Schleifer (2017) argues that the main reason why the world is facing so much water dearth relates to people's conventional notion of regarding water as a common good with an unlimited supply.

Statistical estimates and literature of water crisis globally vary from one country to another, but the overarching conclusion is broadly consistent; a crisis that is affecting millions of people which will worsen in scope and impact if adequate

resources are not invested in its management (Park, Mclaren, Toumi and Rivett, 2019 & GPS, 2017). The World Water Council (WWC) projected in 2010, that while the world's population trebled in the twentieth century, water consumption swelled six-fold in the 1990s (Kummu, Guillaume, de Moel, 2016). By forecast, the world's, annual freshwater accessibility per capita declined in the period ranging from 1950 and 2000 from 16,800m^3 to 6,800m^3 (Ritchie and Roser, 2018). Slobodan and Fahmy (1999); Hoekstra, (2010) and Panjabi, (2014) all argue that poor agricultural practices, leaking pipes, ageing infrastructure, and inconsistent water policies, both in developed and developing countries, can be blamed for global water scarcity. To support this argument, Ferronato and Torretta (2019) indicate that natural sources of water are no longer existing or not in sufficient quantity for human consumption. Rivers, lakes, aquifers, estuaries, wetlands, streams lakes and even sea have been abused, contaminated, depleted, wasted, and are being used as dumping sites for trash from agriculture, industries, mining, and municipal wastes. Several water sources, once beaming with life, are now lifeless and are in despair. All these elements, individually and collectively, are significant factors contributing to the global water crisis.

Over the past twenty years, an entire range of intuitions and theories have undermined underlying norms on which conventional management of water was grounded (Pahl-Wostl, Sendzimir, Jeffrey, Aerts, 2007). More discussions and debates on model changes in water management, both from prescriptive and explanatory perspectives, have emerged. Water resource management has shifted away from well-expressed theories and concepts that appeal for attention, with the growth of urban populations and escalation of manufacturing, mining and agricultural activities in the 19th and 20th centuries (Pahl-Wostl et al., 2007). In addition, water administration has moved from a paradigm where streams and rivers were regulated to safeguard metropolises and arid lands cultivation from flooding. Technical efficiencies that were designed for short term solutions in urgent environmental problems, such as growing complexity of wastewater treatment plants in tackling sanitary and contamination constraints, have changed (Pahl-Worst et al., 2006 and Siebrits, Winter and Jacobs, 2013). A model alteration that entails significant organisational alterations in infrastructure, legislative frameworks, and participatory approach, has been inculcated into global water resource management (Slobodan et al., 1999).

Kabat, Pahl-Worst and Moltgen (2008: 23) defined water management paradigm as "a set of basic assumptions about the nature of the system to be managed, the goals of management and how these management goals can be achieved". A paradigm is a collective principle acknowledged by the epistemological society of characters interested in managing water resources. The standard is demonstrated in relics such as technological infrastructure, formulating strategies, controlling, engineering exercises and trademarks (Mukhtarow and Gerlark, 2013). del Moral, Pita, Pedregal, Hernandez-Mora (2014) summarise the land and water resource management paradigm theory as: "a classical model of a paradigm which explores changes that are occurring in public lands and water resources management".

The theory suggests that the conventional model, which is characterised by continuous capitulate, is invalid and outdated. Whereas no innovative model has been entirely acknowledged, the emergent model is built on two ideologies: environmental management and collective decision making. The enactment of these two ideologies is expected to necessitate comprehensive modification of conservative management practices and establishments. Refusal to tackle these challenges may lead to the adoption of the speechmaking of addressing challenges without any pragmatic changes in attitude towards water management.

Ecosystem management approach of water resource management is a strategic plan of integrating the administration of terrestrial, aquatic, and other living organisms through upholding, preservation, and sustainable use of the environment (Valavanidis, 2018 and Gill, 2008). This theory encourages water management and other related resources on a watershed basis. Ecosystem approach of water management is an all-inclusive and collaborative management approach that recognises the ecosystem as a water source, as well as the customer, clear conditions such as the quality of water, capacity of the resources, ecological stream, riparian rights, as well as the general health and the function of the environment (Jenkins and Schaep, 2018; Cook and Spray, 2012 and Overton, Smith, Dalton, Barchiesi, 2014). Again, the theory promotes the administration of aquatic, land-dwelling, and the other living organisms at the catchment areas, as a multifaceted, social-ecological structure, and aggressively guards and defends the ecological healthiness of the bionetwork (Odume, 2017). In addition, the application of the ecosystem approach of water management helps to sustain an

equilibrium of the three aims of the convention: preservation; sustainability; and the fair and equitable distribution of the gains accruing out of the operation of ecological resources (UNEP, 2004 & Russi, Farmer and Brink Badura, 2013).

Nevertheless, this study primarily focused on collaborative water governance. This strategy of water governance, concisely speaking, is the principle of participation of the state and other critical stakeholders in the formulation and implementation of policies and strategies in the water governance (Cisneros, 2019; Taylor, de Loe, Bjornlund, 2012 & Brisbois, 2016). In the view of Brisbois (2016), collaborative water governance is built on two fundamental philosophies: participation of stakeholders, and collective decision-making functions, thus in this theory decisions are made collectively not by one stakeholder (government).

Kanjna (2015: 9) also defined collaborative water governance as "direct involvement of the public in the decision-making process". The definition of 'public' embraces all shareholders and participants, thus, residents, community organisations, or institutions, that have a claim or a concern in water issues, either, because they affected, or, because they may have some by its outcomes (Jeffery, 2009 & Craxton, Blaclock and Ivanor, 2014). Collaborative water governance is also referred to as delegated water management partnerships, which cover mainly consultative and delegated governance approach (Nowlan and Bakker, 2007). Water governance partnership occurs in four different categories, but revolving on two main features: duration, which includes short or long-term decision-making, and policymaking authority, which includes advisory or authoritative powers (Nowlan et al., 2007).

Collaborative water governance entails the delegation and decentralisation of decision-making to a lower level of governance, for instance, to catchment management agencies (CMAs), local or provincial sector of the department; involvement of a wider variety of non-state actors; the use of a hydrographic demarcation, for example, the watershed, rather than political demarcation; a collective, decision-making procedures, stressing on consensus, trust-building, believing and pragmatic-based, decision making often requiring a comprehensive investigation (Bakker, 2008 & Norman and Bakker, 2009). Over the past five decades, numerous organisational agreements, treaties theories have been developed worldwide with the aim of enhancing water governance, improve efficiency and effectiveness in the water industry, and to improve poverty reduction

strategies connected with integrated water distribution (DESA, 2008, Handley, Higgins, Sharma, Bird and Cammack, 2009). Some of these agreements include water markets, government institutions and water service providers and some NGOs (Easter, Rosegrant, Dinar, 1999; Ghazouani, Molle and Rap, 2012 & Hodgson, 2003).

Integrated water resource management (IWRM) emerged from the 1992 Dublin Conference for Water Resource Management. The key and fundamental message of this conference was to collaborate decision-making of the water sector and to formulate strategies of distributing of the scarce water resources, and to discourage the top-down order of managing water resources (Muller, 2015, Thomas and Durham, 2003; & Mehta, Movik, 2016). The principle of the decentralised water management system has created incentives for broad, widespread engagement of the residents and grassroots organisations in the participation of water governance through the creation of unique, concrete social asset for followers (Capodaglio, 2017, & Leigh and Lee, 2018). The focus here is that decentralisation generates a sense of collectiveness or belongingness, cohesion, and reverence. These are critical components required for promoting connections, establishing correlations, and enabling collective action (Saravanan, 2009; Hartter and Ryan, 2010 & Geiser and Rist, 2009).

In South Africa, water governance and management comprises several functions, among other things, formulating and implementing of policies and strategies at the catchment areas; scrutinising and evaluating the availability of water resources and its use; water use distribution; quality control; the resource conservation; and, institutional development and the enabling environment for public participation (Pollard and du Toit, 2008). The guidelines of integrated water resource management were also approved and implemented in South Africa in the context of the NWA (Act 36 of 1998). Collaborated water governance is regarded as the critical policies driven IWRM; this is since they are designed to allow stakeholders at the communities to have a voice in the distribution and governance of this essential resource (Leendertse, Mitchell and Harlin, 2008, & Denby et al., 2016).

In South Africa, post-independence, the government established three levels of governance: national, provincial, and local (Konstant and Moshikaro 2016). The management and governance of water resources fall under the responsibilities of

the national government, whilst the responsibilities of supplying water and other related services fall under the jurisdiction of the local government through the municipalities, national government's responsibilities mainly is to formulate policies, monitor and provide guidelines (Memard, Jimenez and Tropp, 2017).

The NWA stipulates for the formation of institutions to execute international treaties for the governance and expansion of the resources that are used together with the neighbouring states; also, this policy recognises international obligations (Tewari, 2009, Kuokkanen, 2017 & CSIR, 2010). Hence, South Africa has agreed to numerous bi- and tri-lateral transboundary water agreements with neighbouring Southern African Development Community (SADC) countries concerning its shared watercourses. It is interesting to note that the SADC Revised Protocol on Shared Rivers, signed in 2000, is an all-embracing agreement that stipulates a legal framework for future water resource development and management in the shared rivers in these countries (Mirumachi and Van Wyk, 2009 & Turton, 2008).

The Department of Water and Sanitation is the guardian of South Africa's water resource, and general proprietor of all water institutions within the country. Nevertheless, the department is not directly involved in any operations or day to day running of water services such as infrastructure development and water provision, but supervises the activities of all water institutions within its control, and regulates water sources and water services (Masindi and Duncker, 2016).

The Department of Water and Sanitation is responsible for water resource planning at national and international levels and decisions related to inter-catchment transfers and global distributions (Jonker, 2014 and Thabethe, 2011). The bulk of the water licensing roles are delegated to the CMAs. Nevertheless, granting of permit and certification of substantial impact on water resource, or interrelated management area implications are retained by the department. The country post-independent has divided the water resources into nineteen water management areas (WMAs) this is in line with the conservation principle of the National Water Resource Strategy (NWRS). Water organisations and institutions under this strategy deal with the strategic governance of water (Pegram and Palmer, 2001 & Mazibuko and Pegram, 2006).

However, collaborative water governance in the county has not been much effective and is presently under review by the national department. Peters and Woodhouse

(2019) and Ncube, (2018), argue that to a larger extent, subsistent black farmers, rural communities and the vulnerable groups in urban centres still do not have sufficient and equal access to water provision, or engage in any constructive decision-making process, and are significantly insecure in water provision and distribution. To support this argument, Sowman and Kapfudzaruwa (2009) indicate that the government goal comprehensive formalised system of water governance and management in the country, and particularly in the rural communities, tends towards plural legal systems. The complexities of an institutional relationship in the water sector comprise of numerous establishments performing different tasks and responsibilities (Gilson, Armstrong, Bello and Spini, 2011). Therefore, the complications and challenges faced in the water industry in the country, is to a larger extent, the result of the numerous organisational strata, and the associated risk of performance failure by any single party. Besides, the policies, strategies, and legislation connected to water are very contrast or contradict one another (Thomson, Stimie and Perret, 2001).

Additionally, Malzbender, Goldin, Turton and Earle (2009), disclosed that the National Water Act in South Africa, post-independence, does not acknowledge the traditional management of water structure. Franky, the conservative or the traditional framework was not mentioned even once in the NWA. However, the Traditional Leadership and Governance Framework Act (Act No. 41 of 2003) recognised and acknowledged traditional leadership in supporting and encouraging sustainability of water resources within their jurisdiction, and oblige the national, provincial and local governments to legitimate their participation through regulation, policies and other recognised instruments (Rugege, 1998 and Tapela, 2015).

The unrecognition of the customary and traditional law by the NWA to provide practical guidelines for the implementation within the catchment management areas proved the point of Kapfudzaruwa et al., (2009) and du Toit and Pollard (2018) that South Africa is yet to implement a comprehensive and approach to stakeholders involvement at the level of water management. Part of the setback can be attributed to the lack of effective and poor channels of communication. Public, participatory processes in water management in South Africa, are poorly formulated, misapplied, and often seen as confusing by the role-players (du Toit et

al., 2008). In some cases, a lack of coordination between projects, targeting the same communities leads to confusion, as each project comes with its stakeholders participating procedure (Jeffery, 2009 and Baggerman and Connolly, 2014). 'Participation fatigue', is the consequences of this accompanied by growing frustration with the implementation of the content of materials. The goal for decentralised democratic water resources resource governance is therefore severely compromised if the grassroots involvement procedures are not accessible in the public realm (du Toit et al., 2008 & Kahinda and Boroto, 2009).

Continuous compartmentation in the national strategy to water resource management presents a significant challenge for the efficient application of IWRM in the country (Anderson, Karar, Farolfi, 2008 & Funke, Oelofse, Hattingh and Turton, 2007). Whilst water and land both fall under the broader concept of natural resources, and are indissolubly linked to one another in terms of the way in which the use in one consequently affect the another, the country environmental, water and land-use policies and management are managed by separate line of function government department (Kahinda et al., 2009). Notwithstanding the wide-ranging restructurings of the country's water, land and environmental legislation and policies, this compartmentation is expected to continue into the potential future (Kotze, 2006 & Wynberg and Sowman,2007).

Achieving water security in South Africa will require significant improvements in water resource management initiatives and, linking these to IWRM may be challenging at the implementation level (Jones, Newborn and Phillips, 2006). As Benson, Rouilard and Gain (2015), and Paul and Buytaert (2018) reflect, collaborative water management is critical toward ensuring effective governance. Based on these interlinked and contrasting views on aspects of governance in water resource management, Letcher and Croke (2007) prescribe a holistic strategy to water resource governance that considers various aspects. Besides, water governance must be reflective of a comprehension of the framework, responsibilities, procedures, flexibility, and adaptability that underlie its natural processes.

Although a lot of literature and studies have been undertaken in water resource governance in the country, the government and other relevant role-players are still missing when it comes to policy implementation which entails planning,

monitoring, appraisal, regulating policies and programmes. Therefore, this research relied on what other literature and studies have tried to accomplish in terms of developing theories and framework that address water management in South Africa. The core of this research examines how the structural and systematic constraints have affected the implementation of policies and programmes geared toward water security in South Africa, and the responsibilities of the South African government in ensuring that all the role-players including the communities are abreast with their roles and responsibilities in ensuring water security in South Africa.

1.7 Brief Summary of Research Methodology

A research methodology is a "systematic and logical study of the principles guiding the investigation and is concerned with the questions of how the researcher establishes social knowledge and how he/she can convince others that his/her knowledge is correct" (Bhattacherjee, 2012: 35). Rajasekar, Philominathan, Chinnathambi (2013: 4) also define methodology as "the science of finding out". Rajasekar et al., (2012: 108), is of the view that methodology is a subfield of epistemology - the science of knowing, therefore, as with all social sciences, each research method has its strengths and weaknesses, and specific concepts are more appropriately studied through some methods than through others.

This research used various research methods and approaches. Both primary and secondary research techniques were used to investigate the systematic and structural constraints restricting the enactment of policies and strategies to achieve water security in South Africa. The secondary research technique embraced a review from different literature and analysis of documents. The document analysis included the study of recorded human communication, such as books, websites, painting, and laws (Babbie, 2010: 333). Other materials assessed, included the National Water and Sanitation Master Plan (NW&SMP, 2017), policy documents on water management, international literature on water policies and governance, textbooks, articles, and reports on water security. Web materials related to the area of research also served as an integral component of the data for this study, since it was appropriate to the research questions (Babbie, 2010). The WITS library in Johannesburg, the UFH library in East London, the British Council

in South Africa, as well as the websites of World Water Council (WWC), the United Nation Environmental Protection Agency (UNEPA), European Economic Area (EEA) and many websites were visited to secured literature and data for this research.

The primary research method included personal interviews and questionnaires. The interviews were conducted using structured and semi-structured guidelines. These techniques were used to solicit data, which assisted in answering the research questions. The respondents were drawn from several organisations and institutions. The study population covered employees and managerial staff at the DWS, both national and provincial offices, water research institutes, water boards, academia from universities, as well as experts in the water industry who are directly involved in analysing and reviewing water policies in South Africa. Political organisations and environmental pressure groups were also engaged in obtaining data. This research focused on the connection between governance arrangements for administering water and functioning of water policies and programmes in terms of water security which entails access, quality, and reliability of service provision, equity, and sustainability post-independence.

Expert and purposive sampling techniques were employed in this research to select suitable participants using a non-random sampling technique. This technique allowed the researcher to choose the respondents based on their knowledge, skills, and experience relevant to the subject matter. This method was selected based on the fact that respondents with vast and in-depth knowledge about the subject matter, and about policies and programmes to achieve water security, could provide credible and pragmatic views. Other respondents were chosen using the snowball approach; this was based on the fact that the sample size for the research was restricted to a limited subset within a larger population. The theoretical and conceptual framework provided the basis on which data was synthesised into a description and explanation, from which suggestions for implementation and enforcing policies and programmes developed. In addition, it was predicted that the data would present intuitions into the accomplishment of strategies that, in many cases, could be applied in the nine provinces in South Africa, as almost all the provinces are faced with similar governance challenges. Details of the research methodology and the factors that motivated the choice of this research method expansively discussed and analysed in chapter three of this study.

1.8 Scope of the Study

This study was carried out in South Africa, specifically in the four cities selected. Johannesburg in the Gauteng Province and Grahamstown in the Eastern Cape were chosen because of their extreme levels of water pollution, over-use of water resources, and the severe constraints on water infrastructure which is affecting the provision of water to the residents (Weaver, O'Keeffe, Hamer, Palmer, 2017). The other two cities, namely, Cape Town in the Western Cape, and Bloemfontein in the Free State, were chosen due to the social and economic status of the population, inadequate planning and increasing urbanisation. Other factors include extreme levels of inequalities in the provision of water, prolonged drought, and the challenges of providing safe water to the population (Viljoen and van der Walt, 2018). The study was expressly limited to the structural and systematic constraints restricting the implementation of the policies and strategies designed to achieve water security in South Africa. Besides, participants of the research were selected strictly based on their expertise and knowledge in systems, water governance and management in the country, and will be restricted to post-independence.

1.9. Ethical Consideration

This study sought ethical consideration in soliciting data. Ethics is a split of thinking and world view, which identifies with the behaviour of people and directs the standards, values, and practises of an individual in obtaining information (Blumberg, Cooper, and Schindler, 2008). Since research entails collaboration, cooperation and solidarity from various individuals, organisations, and disciplines, it is prudent to adhere to ethical standards and values to promote and strengthen the partnership.

The researcher adhered to confidentiality, accountability, mutual respect, and impartiality among the respondents that were engaged in soliciting data for this research. This was carried to ensure that participants fully comprehend what they were being asked to do. Based on these, participants were briefed on the general nature of the research and the objectives thereof. The respondents were formally provided consent forms that stipulated that they were under no obligation or compelled to take part in the research. Furthermore, respondents were guaranteed privacy and confidentiality and that their personality would not be disclosed

anywhere in the study. In all, the researcher was confident that the result of this research was cleared of piracy, academic fraud, and intellectual dishonesty.

1.10. Structure of the Thesis

This research is organised into six main chapters. Chapter one includes the introduction, the study background, problem statement, the primary as well as the secondary objectives. Other elements, such as research questions, rationale, and ethical consideration, were considered in the chapter. Also captured in this chapter is the snap of the research methodology. Chapter two present a review of the literature on which the study is grounded. The rationale of this chapter is to delve into the various debates in the policies, strategies, legislation, and philosophies regulating and governing water management globally, nationally, and locally. The chapter began by exploring the debates on the water-related susceptibility and weaknesses of the poor in cities of the globally, and the effect of climate variability on water provision in general.

The third chapter deals with the research methodology exploited to analysed public policies and programmes towards water security. The chapter deals with the research theories, research design, the study population, as well as sampling techniques. Data analysis techniques and the study reflection are also considered under this chapter. Chapter four examines the empirical findings and discussion on water policies, governance and implementation of policies related to the water industry. Chapter five captures the discussions and analysis of the data obtained from the field of study as well as secondary materials. Chapter six provides a recapped of all the chapters in the research. The chapter also provides recommendations for sustainable water governance in South Africa.

CHAPTER TWO

THEORETICAL CONSIDERATION AND LITERATURE REVIEW

2.1 Introduction

There is a water crisis in the world today, but the crisis has nothing to do with having too little water to satisfy our needs, it is a crisis of managing water resources so poorly that billions of the world's population and the environment suffer (WWCVR, 2015). Water is vital for human sustenance, wellbeing, and self-esteem; it is an essential and irreplaceable asset for development (Monney and Ocloo, 2017, Olalekan, Adedoyin, Ayibatonbira, Anu and Oluwaseum, 2019). The wellbeing and happiness of any community are inseparably connected to the availability and reasonably utilisation of the resources (Basiago, 1999 & UNWWDR, 2019).

Globally, the demand for this critical asset has increased significantly due to rapid economic development and increased population growth, and other factors (Lutz and Toth, 1991, & de Sherbini, Carr, Cassels and Jiang, 2007). With the exponential growth in the human population across the world, comes the necessity to cultivate more food, and thus the demand for more water for agricultural purposes. Water resources can be a matter of life and death, based on how it occurs and administered (Gonzalez-Villarreal and Solanes & FAO, 2011). Whether it occurs in it is too much or too little, it can bring devastation, misery, or death. Nonetheless, no matter how it exists, if managed effectively, it can be a vehicle for economic growth and development (Kirby and Ahmad, 2014).

It can be a channel for poverty alleviation through the creation of jobs in water-related industries, while at the same time bringing prosperity to the people (PEP 2002 & UNDP, 2004). Nevertheless, when inadequate in size and quality, it could lead to poverty, misery, economic stagnation, diseases, low productivity, food insecurity, and weak economic development. Thus, what we get out of water hangs mostly upon what we put into in terms of management and how we consume it (DFID, 2003 & UNECA 2000). Though water shortages are occurring globally, yet mismanagement, waste and abuse are prevalent. Many scholarly have literature highlighted how small communities, towns, and metropolis, agricultural, mining, industries, households in developing countries and industrialised economies, are all culprits of exploiting water resources (UNEP, 1991 & Mancosu, Snyder,

Kyriakakis and Spano, 2015). Water quality is declining in the major basins from inner-city and industrial waste. Groundwater is being contaminated from surface sources and irretrievably impaired by saline intrusion (FAO, 1992, Issaka and Ashraf, 2016 & Mateo-Sagasta, Zadeh and Turral, 2017). Over-exploited acquirers are dropping their ability to store water, and lands are diminishing. Cities are incapable of providing sufficient, safe water and hygienic services (dos Santo, Adams, Neville, Wada, de Sherbinim, 2017). Waterlogging and salinisation are lessening arable lands; declining water drifts are decreasing hydro-electric energy while contamination of rivers and streams is impacting on habitats for fish and other sea creatures. The very ecosystem liable for developing water and sustain the water cycles are not properly managed and poorly understood (Nairizi, 2017).

South Africa is not immune to this water crisis driven by population growth, urbanisation, the massive backlog in water infrastructure maintenance and funding, frequent droughts driven by climatic conditions, conspicuous inequalities access to water, and declining water quality are few of the water challenges facing South Africa's water sector (OECD, 2012 & Mnisi, 2020). This water crisis is currently having substantial impacts on economic development, and wellbeing of everyone in the country, which by all indication will be aggravated if left unattended to. These challenges call for policies and strategies that can revert the situation and facilitate effective and efficient water management strategies (Viljoen et al., 2018 & Donnenfeld et al., 2018).

Given the above, the literature review set the platform for the remaining chapters by setting the scene for governance in water resource management. Chapter two reviews the empirical literature on water sustainability policies nationally as well as globally. In addition, the chapter analyses theories and debates on sustainable water management within the country, and other countries within the SADC, Africa, and the emerging and developed world. This chapter further examines the theoretical framework, legislative framework, and conceptual linkages of policies, the theory of demand and supply of water resources in South Africa, and its impact sustainability.

2.2 Definitions of key concepts and terms

Before reviewing the literature of this study, it is relevant to define the relevant concepts and terminologies which occurred or repeatedly used throughout the

research. Specific ideas, terms and phrases are commonly applied, and are mostly acknowledged as the standard; however, other jargons and terms may require clarification and clarification.

2.2.1 Sustainable Water Management

Sustainable development was widely defined by the Brundtland Report "as meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" (Emas, 2015: 1). These needs entail economic, environmental, and social services. Social needs include identity and personal values (Osborn, Cutter, and Ullah, 2015). Economic needs entail habits that promote long-term economic growth without impacting adversely on the social and environmental needs (Emas, 2015). All the components together are generally termed the sustainability triple bottom line (Hammer and Pivo, 2016). Sustainable development is the amalgamation of the natural environment, resources, social development, and sustaining economic growth (Arowoshegbe, Uniamikogbo and Gina, 2018).

Sustainable water management (SWM) is a significant constituent of the sustainable development concept (Rodic and Wilson, 2017). Many scholars have defined this concept differently based on their ideologies and environmental settings. For instance, Russo, Alfredo, and Fisher (2014) defined SWM as providing water services to current users without infringing on the future supply generation. GWP (2012), Bartram and Balance (1996) and Marino and Simonovic (1997) all defined SWM as making water accessible, or the ability to make water resources available, for consumption in sufficient quantity and quality at the right place, and the right period and time. In a more concise definition, SWM contributes to sustaining the environment and improving hydrologic integrity (Louks, Stakhiv and Martin, 2000). However, the interpretation offered by Alley et al., (2010) could be taken as a more holistic one, because their views encapsulate the vision of Agenda 21 of SWM. Agenda 21, cited by Russo et al., (2014), defined SWM as a principle that ensures an appropriate supply of water at the right quality and quantity are sustained for the entire global population, conserving the hydrological, ecological and natural habitats of the environment, while at the same time adapting human interactions within the carrying capacity of the environment.

Nevertheless, these definitions and explanations of SWM appear to be a challenge for acceptance due of the extensive use of slanted message or information associated with this concept and lack of detail (Darko and Chan, 2016). Martin-Ortega, Ferrier, Gordon, and Khan, (2015), criticised these definitions because they offer only a broad conceptualisation of water management. They are of the view that the language and terms used mostly in defining SWM, is usually normative. Additionally, Fint (2004), Voora and Venema (2008) reveal that the definition of SWM entails the design of human and industrial systems to ensure that humankind's use of natural resources and cycles does not lead to a diminished quality of life due either to losses in future economic opportunities, or to adverse impacts on social conditions, human health, and the environment. These definitions use "diminished quality of", and "adverse impacts on", to describe the capacity of sustainable impacts, is challenging to interpret for managerial purposes. Loucks et al., (2000) confirms this by pointing out that the definitions of SWM are more contradictory under Agenda 21 proposed by the United Nations. Knuppe (2011) asserts that these definitions are not applicable in practice, and problematic for policymakers and managers. SWM must concurrently meet the needs of social, economic, and environmental requirements. This suggests that that SWM planning must be grounded on a conceivable long-term strategic goal, using the right planning standards set up sustainable development and the concept of SWM (Mensah et al., 2019, EU, 1998, ECOSCO, 2008, 2000 & Meissner et al., 2015).

In the long-term strategic goal for SWM, one should specify an acceptable measure of water per capita as a long-term goal (ADB, 2000 & Mitchell, 2005). This goal of measure must be accessible, or capable of being made accessible, under the confines of the definition of SWM. This water per capita may differ from one region to another or one country to another, based on geographic features, natural and capacities available, their supplies, and socio-economic characteristics (Loucks et al., 2017). Once the goal is legislatively confirmed or recognised, the social and economic development of the province, or the state, must be formulated and reconstructed based on the target water quantity (Moigne, Subramanian, Xie and Giltner, 1994).

2.2.2 Water Security

There is no single, generally accepted definition of water security (Mason and Calow, 2012). Water security has multiple definitions. Every interpretation depends on needs (human, environment, and economics). For instance, if the definition of water security primarily relates to food security; thus, do we have enough water to grow the food we need? Additionally, this term has been the issue of numerous intellectual debates (van Beek and Arien, 2014). Therefore, a generally recognised definition is not possible to arise (Mason et al., 2012 & Soyapi, 2017). Nevertheless, there are some mutual attributes that can be found in each definition. First, water security is associated with the availability of water for human consumption and sustenance, in the right quantity and quality. Secondly, striving for water security entails the supplying of adequate water that meets up to the basic specifications and requirements for good health and safety of humans. Thirdly, water security associated with water that is suitable for consumption, and crucial to stimulate dignity and life. Fourthly, water security entails getting water at a reasonable cost (Bradley and Barttram, 2002 & Soyapi, 2017).

Based on these facts, water security can, therefore, be construed as, the ability of the people to safeguard sustainable access to adequate quantities, satisfactory quality for sustaining livelihoods, wellbeing, social and economic development, while at the same time protecting the water resources from pollution and other related ruins, and also preserving ecosystems from destructive human activities (Aboelnga, Ribbe, Frechen, 2019). This interpretation suggests that water resource is administered sustainably every stage of the hydrological cycle, and is done through an inter-disciplinary approach so that it can stimulate the social and economic advancement, and strengthens societal relations with the environment without compromising the present and future health of populations and ecosystems (Mason et al., 2012; Fisher-Jeffes, Carden, Armitage and Winter, 2017).

Therefore, achieving water security suggests the distribution of water resources among users must be fair, efficient, and transparent; that water to meet basic human needs is available to all at a reasonable charge for every user; that water throughout the hydrological cycle is collected and treated to prevent pollution and illnesses; and, that open-minded and applicable strategies are in place to resolve conflicts that may occur (GWS, 2010; Sinclair-Smith and Winter, 2018 & UN-

Water, 2013). The concept functions at all facets, from a personal level to households, communities, countries, regional and globally and take into account inconsistency of water availability over time. (Gulati, Jacob, Jooste, Naidoo, and Fakir, 2012).

Therefore, water security is not merely about be in possession of sufficient water or not. It entails all issues related to water management. Therefore, it is interesting to note that, water security addresses the 'too little', 'too much', and 'too dirty' issues of managing water resources (Hoekstra, van Ginkel and Buurman, 2018). Additionally, it is about moderating water-related risks, for instance, floods and drought, resolving skirmishes and conflicts that occur from disagreements over water boundaries, and resolving hostilities among stakeholders who might be competing for the scarce resources (Levy, MPH and Sidel 2011 & Sivakumar, 2011). It is, therefore, essential to manage water resources sustainably to enhance poverty alleviation, food security, and wellbeing as well as stimulate economic development through agriculture, manufacturing energy sectors (Stafford and Faccer, 2014, GWP, 2012 & UNEP, 2011).

2.2.3 Water Governance and Management

Water governance refers to the political, social, economic, and organisational structures developed to govern water resources (Rogers & Hall, 2003). In other words, water governance is the set of procedural structures established to formulate decisions and strategies about water resource (Batchelor, 2006). Water management, on the other hand, is a whole range of different activities: monitoring, modelling, assessment, design of measures and strategies, implementation of policy operation and maintenance (Cosgrove et al., 2009). It encompasses supportive activities, such as organisational reforms. It incorporates community, state, and global activities, geared towards either short-term or long-term activities. As such, water management is an integrated concept that encapsulates scientific, technological, institutional, managerial, legal, and operational endeavours essential to design, advance, control, and manage the resources (Jacobi, Lopez-Gunn, and Stefano, 2014).

Water resources management entails two discrete levels. The first level denotes the real activities and core objectives of the manager. Locks et al., (2015), identified them to include every action directly geared towards reasonable use of water, the

supply of safe and quality water to all, the distribution of water to various sectors of the economy, and the establishment of safety measures in times of floods. The second level involves the organisations and procedures directly. It is a supportive activity to the core responsibilities of the manager. The first level of management is also referred to as external management. Whereas the second is known as internal management (Bakker, 2003 & Bakker and Nowland, 2007). The essential questions for the internal management are: what exactly are the objectives of management; what institutional structure can best serve the process of attaining these objectives, and, how can this institutional structure be operating efficiently and effectively? (Grigg, 2016). Hence, water governance and management are much more about how decisions are made - this entails; "how, by whom, and under what conditions decisions are made rather than the decisions themselves" (Walker, Loucks, and Carr, 2015). Water governance and management cover how distribution and regulatory politics are enforced in the administration of water and other related assets, and mostly embraces the official and unofficial establishments by which authority is exercised (Batchelor, 2006).

There is a profoundly political component to water governance and, as a result, water governance generally displays the political practicalities at global, regional, national provincial, and local levels (Roggers et al., 2003). Consequently, the more common definition of management (as opposed to water governance) is also contested, as those who promote a different version of the future turn to define governance in terms that are consistent with their ambition, and not others (Castro, 2007). Accordingly, the Neo-Liberals regard poor management very explicitly to insufficient markets and excessive government regulations (Rose and Miller, 1992). Therefore, the governance remedies to Neo-Liberals, are removing the constraints which prevent the operation of a market-based economy, and minimise the role of government (OECD, 2001 & Larsson, 2015).

Plummer and Slaymaker, 2007, ADB (2008) & OECD (2018) conceded that governance and management of water service functions more efficiently within an open social structure, that promote broader engagement by civil organisations, private companies and the media, all networking to support and influence government positively. The ideology of a command and control, or a hierarchical central State system, caring for its population, has failed to address water

governance complications, and been substituted in many nations by free market-led water governance strategies (Batchelor, 2006 & Rogers et al., 2003).

Nevertheless, the 'all-promising' market-led water governance approach has failed to address all the constraints in the water sector, as some experts regard this model as being too basic and not reflective of broader societal principles (Pease and Snyder, 2017 & Rogers et al., 2003). The model nowadays is for distributed water governance systems to supplement formal authority by an increasing resilience of formal authority, for instance, through transparent public-private coordination (WEF, 2013). Rogers et al., (2003) concluded that attaining effective water governance cannot embark on hastily employing models outside any given country or region. Effective governance ought to be formulated to match local circumstances. Step-by-step progress and adaptability are essential management style to attain effective water governance (Ayre and Callway, 2005). Furthermore, new reforms must be executed in an integrated manner. Nevertheless, they must be scrutinised to assess if the programmes are realistic and are possible to attract public and political confidence (Hamdy, 2012; Batchelor, 2006 & Pearce et al., 2017).

2.2.4 Public Policy Analysis

Different scholars and authors have defined public policy analysis in different contexts based on the environment, context and situation prevailing. Roux (2002: 421), defines policy analysis as an endeavour to determine the "cost" and "benefit" of different policy alternatives. Policy analysis is used to "produce" and "transform" data important to specific strategies into a format that could be applied to address the inefficiencies relating to these policies (Hankivsky and Cormier, 2011).

Denhardt, Denhardt J and Blanc (2014: 46) also define public policies as a "statement of goals and intentions" regarding a specific problem, or problems. Chitescu and Lixandru (2015) reveal that government institutions are dealing with social, economic, environmental, and political issues by formulating public policies. Public policy stimulates the fundamental principles to be followed in accomplishing specific goals (Khan, 2016). Cox (2009) indicates that public policies reflect the values and ethics of societies and are usually personified in the managing of essential programmes.

Sutton (1999) and Warne (2008) highlight that the purpose of public policies analysis globally is to promote rationality in public policymaking. Understanding how the policy analysis techniques can bond with political dimensions is generally the most vital contemplation in programme evaluation, cost-effectiveness analysis and rational goal identification for public programmes. In addition, Howlett and Lindquist (2004) highlight that public analysis determines the consequences of public policy on its target groups, which could include individuals, relevant groups, institutions, and society overall. The policy is analysed in terms of the goals the policy is supposed to attain (Hudson, Hunter and Peckhan, 2019).

Policy analysis produces information that can be used to distinguish between relevant and less critical issues (Cerna, 2013 & Simon, 2007). By identifying the societal changes and comparing the predicted performance against the results obtained, policy analysis is valuable in determining whether a selected policy alternative is effective and efficient (Sutcliffe and Court, 2005). If the policy alternative is not functioning adequately, the policy analyst should be able to identify the facet of the policy that is not working appropriately. Policy analysis evaluates the objectives, resources, and programme alternatives, which makes it easy to identify errors by utilising the historical framework (Mokhaba, 2005). Public policy decisions are rarely made on the foundation of sufficient thought, or regarding the appropriate role of the government, or contemplating what social justice needs (Hauser, 2017). Public decisions are generally based upon incomplete, insufficient, and ineffective information. Policy analysis can enhance the quality of public decision-making; make severe problems more understandable and more suitable for socio-economic, political, and environmental impact (Almeida and Bascolo, 2006).

2.2.5 Integrated water resource management (IWRM)

IWRM is a concept that encourages coordinated management and governance of the environment (land, water and atmosphere), and other related natural resources to enhance economic and social wellbeing equitably without compromising the sustainability of a vibrant ecosystem (GWP, 2011 & Kasbohn, Grothe, Steingrube and Lai, 2009). Clausen, (2004), & Grig (2008) also defined IWRM as a holistic strategy that pursues to incorporate the administration of the ecosystem within the wider social, economic, and political context. IWRM is a cross-sectoral strategy,

designed to replace the conventional, compartmentalised policy of water management that has led to unsustainable use of resources and poor service provision. The concept is built on appreciating that water resource is an essential element of the ecosystem, natural resource, and for social and economic good (Smith and Clausen, 2010, GWP, 2011 & Duran-Sanchez, García and Rama, 2018).

The framework of IWRM was designed to enhance the management of water resources, and this was grounded on four fundamental principles approved at the 1992 Dublin Conference on Water, and the Rio de Janeiro Summit on Sustainable Development (White, 2003). These principles, according to World Water Forum (WWF, 2000), cited from Snellen, and Schrevel (2004: 10), include the following: "freshwater is a finite and vulnerable resource essential to sustain life, development, and the environment; water development and management should be based on a participatory approach, involving users, planners, and policymakers at all levels; women play a central part in the provision, management, and safeguarding of water; and water has an economic value in all its competing uses, and should be recognised as an economic good".

IWRM is not a prescriptive description of how water should be controlled, but instead a broader outline in which decision-makers can collaboratively determine the aims and objectives of management, and to co-ordinate the use of different methods to accomplish the goals (Clausen, 2004 & White, 2013). Given that, each country varies in terms of the historical context, social and economic circumstances, environment and political background, and cultural settings, there is no blueprint for IWRM, and how it can be applied to tackle the challenges encountered in each nation or community (Nyandoro, 2019 & GWP, 2009). IWRM framework must, therefore, stress on stakeholder cooperation and the participation of grassroots institutions and residents in decision-making on how to use, protect and conserve their water resources (Thoradeniya and Maheshwari, 2017). Fulazzaky (2014), Pahl-Wostle (2011) & Fulazzaky (2014) identify the main advantages associated with IWRM: these were indicated as follows; IWRM promotes the integration of professional skills; promote more innovative solutions to problems due to greater diversity of viewpoints; improves collaboration and minimises the threat of disagreements over resource; and, devise resolutions which

are more transparent, comprehensive, and autonomous, and thereby creating a robust backing that will lead to more reliable results.

Nevertheless, IWRM is not without criticism. The non-existence of a clear-cut and obvious interpretation, or a well-defined framework of resolving water challenges, has led to denunciation of this theory (Grigg, 2008 & Medema, Mclntosh and Jeffrey, 2008). The absence of a precise and detailed explanation of this concept suggests that it is challenging to implement; participation is a lengthy process and expensive; the amount of coordination needed for massive projects often make this concept too intricate to take on, predominantly in third world nations which are often challenged with inadequate/or lack of these relevant organisational structures and resources to effectively fulfil the IWRM requirements (Margerum and Robinson, 2015 & UNEP, 2016).

2.3 Global water demand and supply

Available international statistics for water gives a misleading impression of security as water is abundance globally, but limited locally (Morrison, Morikana, Murphy and Schulte, 2009 & Bigas et al., 2012). The average quantity of water on the earth is 1,360 million cubic kilometres (km^3), but, out of this figure, 97 per cent of the amount is in the oceans (Muller and Grymes 1998 & Rosegrant, Cai and Cline, 2002). "There are 37 million km^3 of consumable water, three-fourths of which is in glaciers and icebergs. About 8 million km^3 of freshwater is stored in groundwater and lakes, while rivers account for only 200,000 km" (Rosegrant et al., 2002: 168). "Renewable freshwater is provided by the 110,000 km^3 of annual rainfall over the land, of which 70,000 km^3 is evaporated, and 40,000 km^3 is transformed into runoff that replenishes rivers, lakes, and groundwater aquifers. Much of the runoff is immediately lost to floods, leaving an estimated 9,000km^3 of reliable runoff annually" (Rosegrant et al., 2002: 170).

Freshwater is unevenly distributed across the globe (Baker, Aldridge, and Omer, 2016). Statistically, water availability is much higher in South America and North America, while Africa, Asia and Europe have a smaller amount of water per capita (Cadena, Remmes, Grosman and de Oliviera, 2017 & van Wyk Meissner, 2009). However, these statistics hide the considerable disparities in water availability in the regions, and even within countries (Raddad 2005). Rosegrant et al., (2005: 38) confirm this by pointing out that, Canada is blessed with 120,000 cubic meters

(m^3) per capita per year of renewable water resources; Kenya has 600 m^3; and Jordan 300 m^3 across regions within countries. Though India has a satisfactory average water availability of 2,500 m^3 per capita, the state of Rajasthan and Pradesh have average access to only 550 m^3 per capita per year, and across seasons (Dhawan, 2017: 8).

Bangladesh and Sri-Lanka per annum endure monsoon flooding; they are trailed by a relentless dry period with severe water scarcities (Das, Gupta, and Varma & Lacombe, Chinnasamy and Nicol, 2019). Water shortage stands at the forefront when reflecting on water-related constraints impeding growth towards sustainable development in the Middle East, where unsustainable water consumption and over-exploitation of both surface and groundwater resources have contributed to massive shortages and threatening any lasting sustainable development (GSDR, 2019, UNWWDR, 2015 & Aboelnga and Elmahdi, 2019). Rosengrant et al., (2002) and UNWWDR, (2015), reveal that water scarcity is based on region to local, and is season-specific.

Additionally, UNWWDR, (2015) and FAO (2017) projected that universal water demand for the industrial sector is projected to surge by 400 per cent from the years 2000 to 2050, overtaking all other sectors, with the majority of this upsurge happening in developing economies and the fast-emerging middle-income countries. Many of the large-scale companies have made substantial headway in appraising and are minimising their water reliance and much of their supply chains. Small and medium-sized companies are confronted with comparable water constraints similar to then large-scale companies; however, they hampered by limited resources to effectively reduced their water consumption (Markkoba, 2014).

Unsustainable development along pathways and governance breakdowns have created enormous stress on water reserves globally, impacting on its quality and availability, consequently, compromising its capacity to create social and economic gains (Cosgrove et al., 2015; Mosher and Smith, 2015). The earth's ability to withstand the increasing demands for water is being contested, and there can be no sustainable development except the balance between consumption and distribution is re-established (Bigas et al., 2015 & Pittock and Lankford 2010). UNWWAP (2015:1) disclosed, water consumption universally stems from four

primary sources; namely agriculture, production of energy, industrial uses, and human consumption.

Globally, agriculture alone accounts for over 70 per cent of water withdrawals, equal to the combined use of households, industries, and energy sectors (Ritchie and Roser, 2018 & Donnenfeld et al., 2018). The thriving demand for livestock products, predominantly, is driving the acquisition of water worldwide (Thornton, 2010). The global demand for food is projected to rise by 70 per cent by 2050, and its associated increase for water in the sector (Hanjra and Qureshi, 2010 & Thornton, 2010). Nevertheless, SEI (2011) and FAO, (2019) argue that the primary constraint the world today is not growing the 70 per cent additional food in the next 40 years, but producing 70 per cent extra food without compromising water security globally. Wise (2013), estimates that future global agriculture water consumption (comprising of both rainwater and irrigated cultivation), is predicted to rise by approximately 19 per cent by 2050; however, this might be much greater if agricultural production and the efficiency of productivity do not improve considerably. Most of the increase in irrigation will occur territories currently experiencing shortages in water (Tatlock, 2006).

Water consumption and energy provision are intricately connected (Sparks et al., 2014). The supply of energy needs water, while energy is also required to propel, process, or transfer water (Copeland and Carter 2017). The need to safeguard water quality and provide the need to guarantee a steady and increasing energy provision is a universally shared experience (Sparks, Madhopa, Keen 2014). These demands have created competing for interests (Sparks et al., 2014). The unconditional nature of the correlation between energy and water is a term referred to as the "water-energy nexus (Keairns, Darton and Irabien, 2016: 243).

Kalogirou (2010: 234) "states that sources of energy and electricity require water in their production processes: the extraction of raw materials, cooling in thermal processes, cleaning operations, cultivation of crops for biofuels, and powering turbines to generate hydroelectricity." Before now, more than one billion of the world's population have no access to electricity and other safe energy sources (Daly, 2018). Universal energy demand is anticipated to swell by more than 50 per cent between now and 2035 owing to the growing population, improved living standards, and escalating economic schedules, with non-OECD nations responsible for more

than 84 per cent of this growth (OECD, 2014; IEA, 2017 & Dayo, Fisher, Fouquet, Gilau and Rogner, 2011).

Water is an essential component of countless industrial activities, and swelling demand for water for industrial processes will lead to economic growth. Perhaps every factory-made commodity had used water during certain aspect of its creation (UNIDO, 2007 & Hong, Wang, and Cheng, 2019). Industrial water use includes the following: concocting, treating, coating, cleaning, preservation, or transferring goods; mixing water into commodities; or for hygienic purposes within the industrial sites (Grigg, 2011). Most of the manufacturing industries that consume the bulk of this resource generate commodities such as food processing, paper, chemicals, refined petroleum, or primary metals (Hutson, Barber, Kenny, Lumia, and Maupin, 2004: 201). Water consumption in the manufacturing sector differs significantly between industrialised and third world nations (Dave, 2004). The consumption of the resource in the first to fourth advanced nations (United States, France, Germany, and Canada) reflects a significantly higher demand than agricultural and other uses (Dave, 2004). In India, China, and Brazil, water use differs significantly from the industrialised nations. “In India and China respectively, 93 per cent and 87 per cent of the freshwater is used in agriculture, whereas the industrial sector uses 4 per cent and 7 per cent respectively” (Hoekstra et al., 2006: 24).

Nevertheless, the OECD report (2018), argues that these countries are going through rapid industrialisation. The gross domestic product (GDP) of China and India is 9 per cent and 7 per cent per annum, correspondingly. It is, therefore, logical to assume that the fast trend of growth in China and India will have a significant influence on water use in the succeeding years. Based on these breakdowns Maddocks, Otto and Luo (2016), questioned that “if world water demand doubles, where is the freshwater going to come from?” As both the emerging and least developed countries are seeking to be “developed”. The hypothetical question is; by what means will the increased demand for consumable water for manufacturing be met? Water management in the industrial sector will be indispensable if we are to address the issue of sustainable development (Dave, 2004 & Flint, 2004).

Ravindra, Mor and Pinnaka (2019), argue that the primary source of water demand comes from the urban population. Urban households globally consumed water, mainly for drinking, hygienic, and flushing. The metropolitan inhabitants of the globe are estimated to increase to 6.3 billion population in 2050, from 3.4 billion in 2009, this will be as a result of natural growth in the population within the inner cities and the net increase in the rural-urban migration (UN, 2019, Ritchie et al., 2019 & Saghir and Santoro, 2018). Moreover, UNICEF (2015) and WBG (2017), indicate that before now a backlog of unattended and neglected urban residents, and the vast rural residents without access to any water provisions and hygiene, have swelled over 20 per cent since the MDGs goals were instituted. Over one billion of the world's population are yet to have any access to safe drinking water, and there is a large number of the population without access to pipe water in metropolises currently than there were at the end of the 2000s (WHO, 2017; UNICEF, 2006). As disclosed by Armah, Ekumah, Yawson, Odoi (2018: 10), "one point four billion people do not have electricity in their homes, and nearly one billion suffer from malnutrition. Two-point six billion people in the world do not have access to improved sanitation facilities. Of the nearly one point three billion people who have no access to improved sanitation during the period 2000 and 2015, 64 per cent live in urban areas."

As indicated by Cosgrove et al., (2015), that there is the need to formulate a universal censoring data system on water to offer accurate information required for effective management of water, and to measure progress against the objectives. Global monitoring information will provide a comprehensive range of evidence and statistics from the municipal, national regional and international scales, for instance, data monitoring, government records, detailed national strategies, and existing and suitable government machinery (UNESCO, 2016, Cosgrove et al., 2015). Appropriate, inclusive, and progressive materials in reachable set-ups, and steady development of the skills and knowledge to process the data into policymaking, is a means to allow the population and organisations opportunity to understand the visions and resolutions of water management (UN-Water, 2015; Kearney, 2015). According to OECD (2015), this innovation will assist in building a well-connected and informed population that will appreciate and value water resources.

2.4 Water supply and demand in Africa and its socio-economic impacts

Water is a vital resource, precious for life, economic and social development, and the ecology (AASA, 2015 & UNWWDR, 2015). "Water can be a matter of life and death, depending on how it occurs and how it is managed. When too much, or too little, it can bring destruction, misery, or death" (Rosinger and Brewis, 2019: 4). Regardless of how it exists, if correctly maintained, can be a strategy for growth and development. It can be a channel for poverty mitigation, taking people out of the humiliation of having to live with access to safe water and hygiene, whilst at the same time improving the well-being of people (Green Aliance, 2015, Galiani, Duflo and Mobarak, 2012 & Mugambi, 2008). Nevertheless, when insufficient in size and standard, can be a contributor to poverty and economic growth, which often leads to high levels of unemployment and stagnant growth, food insecurity, poor health, conflicts, and migration. (Dube and Sigauke, 2015 & Torero, 2014 & ODI, 2004).

The connectivity between water accessibility and growth is depicted by the link between water and poverty (ODI, 2000: 13). From the social and economic perspectives, Africa is challenged with the predicament of widespread poverty and pervasive of underdeveloped. For very few of the Africa countries, economic growth in post-independent has been positive (ADB, 2008 & Mkandawire, Soludo, 1998). Nevertheless, the vast majority of these countries, specifically in sub-Saharan countries, economic growth has been nothing but negative and deteriorating, ever since the oil tragedy in the mid-1970s (WBG, 2015, Christensen, 2016 & ODI, 1982). For the past two decades, the continent economic performance indicators have been weak. The economic outlooks in the 1990s were extremely bleak. Between 2000 to 2010, the average growth of GDP on the continent was lesser than the rates of population growth (Nolan, Roser and Thewissen, 2016). Nevertheless, current statistical data revealed that between 2010 and 2015, there was improvement and recovery in most of the countries on the continent, and average GDP development indicators surpassed population increases for the first time in twenty years. Nonetheless, this revival is considered to be weak and unstable, and there is a lot to be done in order realise sustainable development (Chen, Zhang, Liu,2014, Gordon, 2012 & ADB, 2018).

"For high levels of abject poverty, access to adequate water and sanitation is poor and inadequate on the continent" (Jammali, 2016: 14). Alemu, (2017) and Chalala

(2014) argue that because of the inadequate access to quality water and hygiene, there is a high-level prevalence of contagious illnesses that minimise potency and economic efficiency Africans. Like a maxim, “half the work of a sick peasantry goes to feed the worms that make them sick” (ADB, 2018). Insufficient accessibility to water and hygiene is thus the origin and an end result of misery (Bosch, Rubio, Hommann and Sadoff, 2000, Noga and Wolbring, 2012). To support this argument, Khapayi and Celliers (2016) indicate that the lack of water supplies has become a limitation to increased agricultural development and food safety. The net effect of reduced reserve availability for water resources development has resulted in a further decrease in the availability of water for cultivation (Blignaut and van Heerden 2009). It is important to note that farming is the biggest consumer of freshwater on the continent, which accounts for approximately 88 per cent of aggregate water consumption. Nevertheless, barely 185 million hectares, or below 6 per cent of the over-all arable land of the continent, is being used for agriculture (Steven and van Koppen, 2015 & van Koppen, Lacombe and Mwendara, 2015). Of these statistics, only 12 million hectares, or 6 per cent, of the entire cultivation depends on irrigation system (Salman and Casarotto, 2018 & Faures, Hoogeveen and Bruinsma, 2010). This is thought to be out of, or partly because of, inadequate capital to afford the technology and lack of skills or know-how to apply this facility (Faurès et al., 2010).

Water and economic development are jointly reliant on each other. They can be pivotal in a malignant sequence that puts communities into a descending curved of feeble economic development, and unreliable access to quality and sufficient water provision and hygiene (UN-Water 2013 & Gomez, Perdiguero and Sanz, 2019). On the other hand, they can be focal points in a right sequence, strengthening one another in an acceleration manner, starring to an ascendant growth in which enhanced social and economic expansion generates the resources required for the progressive evolution of water resources which, in turn, support and instigate additional economic growth (OECD, 2016 & Islam and Karim, 2019).

At first sight, Africa seems to be bequeathed with ample water reserves. It boasts significant waterways, huge lakes, enormous swamps, pervasive underground waters (UNEP, 2010 & Mullen, 2018). A Lot of these resources is situated in the Central African sub-region and the island countries. “It has 17 rivers with

catchments areas higher than 100 000 Km^2, more than 160 lakes within its major water basins, many of which are in the eastern half of the continent. Some of its rivers, including the Congo, the Niger, and the Nile, are among the world's longest and largest" (McClain, 2012: 554). Africa, in addition, has copious precipitation, an average which is about 670 mm per annum, and moderately slight levels of water extraction for its three primary consumption – farming, households and manufacturing, which were projected to be approximately 3.8 per cent of over-all annual extraction. (Faures and Santini, 2008).

Nevertheless, amid this extensive provision on the continent, consumable water resources are disproportionately distributed across the continent, with West and Central Africa is known to have a larger percentage of rainfall more than the North, East, and Southern Africa (UNU-WIDER, 2015 & Maskey, Mussa and Trambauer, 2014). "The rainiest nation, the Democratic Republic of Congo, has almost 25 per cent of average interior renewable water resources on the continent, with Mauritania the driest nation, with barely 0.01 per cent. More than 75 per cent of the population are reliant on underground water as their main source of consumable water, mostly in North African countries, such as Libya and Tunisia, as well as parts of Algeria and Morocco, and, in Southern African countries, Botswana, Namibia, and Zimbabwe" (Akpabio, Udofia and Takara, 2017: 6).

To support this argument, Dovi (2007) Banerjee and Morella (2011), argue that there are unlimited reasons restricting the accessibility of safe quality water to the population on the continent. Surface water sources are consistently and exceedingly contaminated, while the capital and infrastructure to turn these water into fresh, clean, and safe for drinking is too expensive for most countries on the continent. Therefore, groundwater serves as the best sources of clean water to most of the communities on the continent, mainly rural setups. Groundwater has the advantage of being organically protected against bacterial infection, and is a reliable reserve, especially during the dry season (Nutakor, 2015).

Nevertheless, the high cost associated with the drilling for the groundwater, as well as the technological challenges in locating the reserves that are large enough to provide the enormous population in need of water, poses challenges which limit the utilisation these reserves (Igor and Lorne, 2004). Groundwater is not a fail-safe and sound reserve either when it comes down to delivering safe drinking water (Igor

and Lorne, 2004). “There could be pollution of the water with heavy metals, and microbes could be introduced by seeping septic tanks or pollution by mines. For all these details, it is imperative that the water table is checked repeatedly, but this is expensive and requires technical capabilities which are often not available in the rural communities (Egboka, Nwankwor, Orajaka and Ejiofor, 1998). Challenges with freshwater accessibility on the continent are further exacerbated by extremely fluctuation in the amounts of precipitation. There already exist several sub-regions and nations on the continent that are facing ever-increasing water shortages, and, unless appropriate and timely interventions are put in place, the problem will be exacerbated (UNESC, 2007 & Muller et al., 2009).

Further complicating the challenge is Africa’s swelling population figures which are estimated to reach the two-billion within the four decades, and relentless urbanisation will hasten the pressure on townships’ and cities’ water resources (Karuri-Sebina, 2016 & Dobbs, Remes, Manyika, 2012). The United Nations Economic Commission for Africa (UNECA) estimates that, by 2020, Africa will have 11 megacities with five-million or more population, and over 700 cities with a number over 100 000 in each. Some researchers estimate that more than half the Africa’s residents will be dwelling in cities by 2030, and that by 2050, over 70 per cent of the anticipated ‘two-billion-strong people’ will be urban dwellers (Bello-Schunemann, Cilliers, Donnenfeld, Aucoin and Porter, 2017).

Additionally, Misra (2014), UNEP, (2012) & Boudi-Fahim, Creel and De Souza, (2012), concluded that declining of water reserves through human-made activities are the major causes of the freshwater crisis in Africa. Available resources are being exploited via human-made activities that have reduced both their safety and their size. Water pollution is swelling across Africa, from industrial by-products to municipal waste, releases of the unprocessed mess, solid wastes that are deposited into storm drains, and liquid leaked from garbage landfills. A significant problem is pollution from agro-processing wastes, and the decomposing of invasive marine wildflowers (Govender, Barnes, and Clarissa, 2011). Poor land management and agricultural practices are heightening the constraints further. Consequently, accumulation of garbage often outstrips the capability of streams to absorb, and water-borne and water-based illnesses frequently become pervasive (Bhateria and Jain, 2016).

The subsequent weakening of water quality is a substantial form of diminution of accessible water reserves (Srinivasan, Lambin, Gorelick, Thompson and Rozelle, 2012). Srinivasan et al., (2012), draws attention to the fact that the declining water quality raises the expense of expanding water reserves, and, in the worst-case scenario, it adds to the water shortages. In accordance with the Hens and Nath (2005), the implications of the worsening water quality consist of nutrient enrichment and the spread of hostile water plants. Eutrophication is a substance mainly associated with lakes. The water 'bluebell' has already been severely affected large water bodies such as Lake Victoria, the Nile and Lake Chivero (Chamier, Schachtschneider, le Maitre, Ashton and van Wilgen, 2012). Possible threats might include contamination from oil manufacturing and processing plants, from farming waste, for example, stimulants and insecticides, as well as small-scale manufacturing industries scattered in major cities (Mateo-Sagasta, Zadeh and Turral, 2017). These developments suggest future capital spending on water resources in Africa is urgently needed to meet the growing demand.

2.5 Overview of current water demand and supply in South Africa

Mukheibir (2007) and Dennis and Dennis (2012), reveal that "South Africa is a water-stressed country with an average annual rainfall of 500mm (60% of the world average). Only a narrow region along the south-eastern coastline receives good rain. In contrast, a significant part of the interior and western part of the country is arid, or semi-arid" (Mukheibir, 2007: 2). Over 65 per cent of the country's regions receive less than 500m on an annual basis, which is generally considered as the least amount for arid land cultivation; with more than 21 per cent of the country receives even below 200mm on an annual basis (Fauchereau, Rouault, Trzaska and Richard, 2003). The natural availability of precipitation throughout the country is fluctuating, and precipitation exhibits robust seasonal variations. Rivers and streams across the country the is relatively low for the most part of the year owing to low concentrations of humidity. In addition, wet areas of the country receive barely 9 per cent of the rain contrasted to the global average of 31 per cent (Mukheibir, 2003 & du Plessis et al., 2017).

Global warming has the potential to impact substantially on both the availability and the conditions for the water in the country. Some climatic patterns indicate that this might exacerbate the water stress levels in the country (UNU-WIDER,

2016 & Archer and Tadross, 2009). Based on these models, the surface water might decline, perhaps by as far as 10 per cent by 2025 in the most parts of the Western Cape (Kruger and Nxumalo, 2017 & Lakraj-Govender and Grab, 2019). The phenomenon of climate change and fluctuations of rainfall patterns across South Africa has great consequences for water-related constraints, such as floods and droughts (Urama and Ozor, 2010). Moreover, as a result, the demands for the water have already surpassed the natural supply in multiple watershed areas. Hence, large-scale transfers of water throughout the watersheds have been executed, for instance, the Lesotho Highlands Water Project (Snadden, Davis and Wishart, 1999 & Rousselot, 2015).

In this context, Kidd (2011) and Basson, (2011), conclude that South Africa has no real large or running rivers, and the collective flow of the entire streams in the Republic amounts to around 49 000 m^3/a, fewer than half of that of the Zambezi River, the closest large river to South Africa. Additionally, a large number of South Africa's rivers are internationally sourced. Eleven out of the 19 water management areas in the country are faced with water shortages - shortages which are defined as demand is higher than water available (Muller et al., 2009). Add to that; the country has over 500 government-held dams with a combined total capacity above 37 million m^3; the largest being Gariep Dam with a storage capacity of 5.5millions m^3. Numerous of these reservoirs constitute an integral part of a comprehensive system of which, often, the aggregate total output is fewer than the real request (Kahinda et a., 2009).

Groundwater, therefore, has a fundamental role to play in the water provision in South Africa. Thus, in many areas of the country, groundwater distribution and protection has become an essential matter, as groundwater constitutes a key source of consumable water (Knüppe, 2011). It has the opportunity to play an important strategic part in supplying water for drinking and hygiene, providing support for farming irrigation projects and industrial purposes, lowering abject poverty and illness, and preserving valuable water and land-based ecosystems (Cosgrove et al., 2015 & Knüppe, 2011). Nevertheless, groundwater is limited by South Africa's geological conditions (groundwater resources happen in a limited amount in some regions). In the northern areas of the nation, both surface water and groundwater reserves are close to extinction (Pietersen and Beekman, 2018).

It is estimated that approximately 5400 million cubic meters of freshwater a year could be derived from the surface sources (Jackie et al., 2011: 12). The overall amount of surface water available in the country averages 49,200 Mm^3 annually, including approximately 4,800 mm^3 of water derived from Lesotho, and nearly 700 mm^3 is derived from Swaziland. Overall amount presently available equals 13,911 mm^3, which can be raised by 5,600 mm^3 by the development of extra surface water programs (Ollis, Snaddon, Job and Mbona, 2013 & Ewart-Smith, Ollis, Day and Malan, 2006). Substantial increases could also be achieved by improving reclaim and recycle of water, and prospect also exists for the future development of groundwater reserves, though at a relatively small amount.

Within the next two decades, groundwater usage is anticipated to increase by 9 per cent. (Jakeman, Bareteau, Hunt, Rinaudo, 2016). King, Tharne and de Villiers (2008) reveal that part of this groundwater commonly referred to as the "Ecological Reserve", ought to stay in rivers to keep the natural environment along the waterways. The craved amount differs from river to river, liable on the prerequisite to sustain the existing ecological status, or potential craved condition, as established by the interested parties in the river basin.

Additionally, le Maitre, Seyler, Holland (2018), concurred that the surface water reserves are the primary source of water provision in the country, supplying just below 11 000 m^3. Though shallow water offers only just about 10 per cent of this quantity, it is widely used, especially in rural and dry regions. In South Africa, as is the case with most other developing nations in the globally, surface water is commonly used for household, sporting or leisure activities, and farming activities, mainly in the countryside (Edokpayi et al., 2016).

Winter, Harvey, Franke, and Alley (1998) argue that the natural water quality of surface water differs from one area to another, based on seasonal variations, changes in climate, and with the kinds of soils, rocks, and surfaces by which it flows. A wide range of human-made undertakings, for instance, cultivation, municipal and manufacturing endeavours, extraction, and leisure activities, substantially change the quality of surface water in South Africa (du Plessis, 2017 & Verliccchi and Grillini, 2019). Despite the significant contribution of surface water to human population and the economy, the resource is under threat of pollution from numerous segments comprising of; insecticides and soil

nourishment that drains away from the cultivation sites, unprocessed human refuse, and manufacturing (Jouanjean, Tucker and te Velde, 2014).

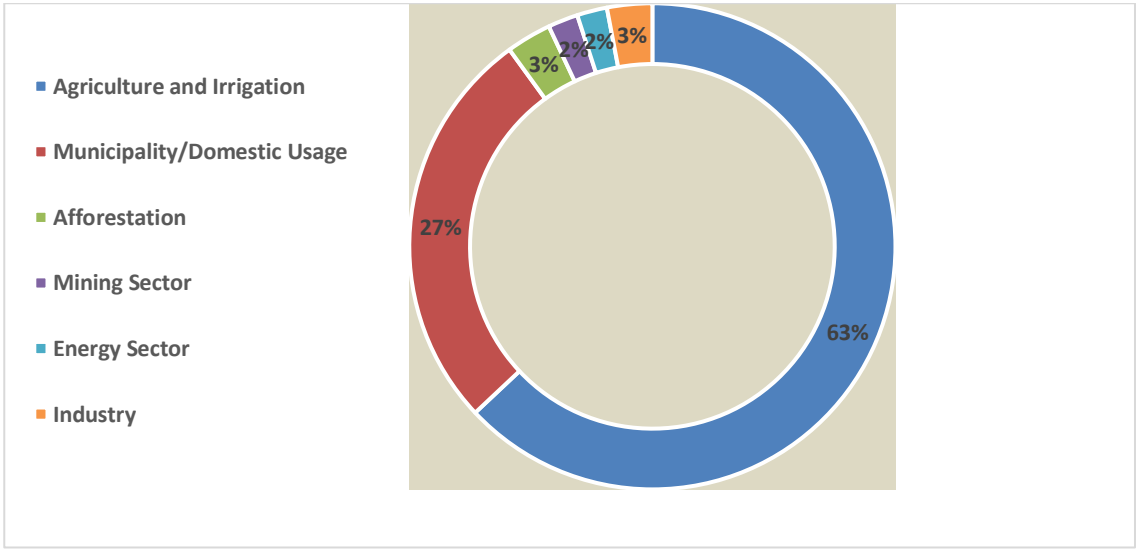
As the economy of South Africa grows, and the population continues to rise, the demand for water increases among agriculture, mining, manufacturing industries, domestic and environmental uses. The supply of water, however, remains inelastic (Blignaut and van Heerden, 2009). The water demand is ever-increasing, and the associated challenges are becoming increasingly significant (Knüppe, 2011). These constraining factors are persistently raising the dearth of water resources within South Africa; hence, the need for effective and efficient use of the resources between the various sectors of the economy. Agriculture and forestry together use about 63 per cent of the available water supplies (Boccaleti, Stuchtey and van Olst, 2010). "Nevertheless, the sector accounts for a mere 4 per cent of the GDP and employs approximately 11 per cent of the total number of employees. Mining and manufacturing sectors respectively contribute about 8 per cent and 23 per cent to the GDP, and employ nearly 7 per cent and 19 per cent of the total number of employees, who use about 5 per cent of the available water resource" (SEDA, 2016: 25 & dti and IPAD, 2018: 56).

The energy sector, though, uses only 2 per cent of available water resource, provides approximately 15 per cent to the GDP to the economy and employs about 250000. In addition, the sector produces more than 95 per cent of the energy in the country and sells some to the neighbouring countries (Balata and Pegra, 2014 & IPAP, 2017). This sector plus Eskom, the country energy producer, depends exclusively on consistent provisions of water for the production of power, and a high-tech interwoven systems transmission of water and storing structures developed precisely to reinforce this sector, ensuring extreme echelons of dependability (Goga and Pegram, 2014 & Madhlopa, Keen, Sparks, Moorlach, 2014).

It is relevant that the administrators of water reserves concentrate on the effectiveness of the delivery processes, while at the same time promoting water efficiency use. Management will be able to minimise wastage and pollution by carefully and periodically assessing water supply structures by conducting "System Water Auditing" (Herbertson and Tate, 2001). Rogers, de Silver and Bhatia, (2002), reveal that the proper and economical pricing of water will provide water security.

"Though the country has decent water resource infrastructure, currently valued at about ZAR 93 billion, it often overlooked the poor and marginalised rural population" (StatsSA 2018: 24 & Bischoff-Mattson, Maree, Vogel, Terblanche, 2020: 13). Therefore, the task of building extra infrastructure to serve the needs of the rural poor, with an understanding that such capital injection is not likely to be retrieved, taking into account the fact that the rural dwellers are impoverished (Duflo et al., 2012). Answer to the problem is essential to integrate infrastructure initiatives with economic requirements together with social and cultural concerns, for instance, supplying water to the neighbouring societies on the trail of the transportation infrastructure (Hermanu and Andrew, 2018). Figure 2.1 below summarises the consumption of water by various sectors within the economy of South Africa.

Figure 2.1 Display water usage by various sectors in South Africa



Source: DWS, 2013, and BUSINESSTECH, 2018.

2.6 Global debates on water policies and sustainable strategies

Globally, water resources are under threat from exhaustion, contamination, maladministration, poor governance and even from being hijacked by multi-national organisations and institutions (Simonson, 2003: 29 & Chan, 2009: 12). Globally, the debate on decentralisation versus centralisation in water management continues to be a thorny issue (Chan, 2009). For the past 20 years, the critical role of multi-sector partnerships of water resources has been highlighted by World Water Fora (Marrakech, 1997); "Participatory Approaches

(The Hague, 2000); Alliances Networks and Dialogues (Kyoto, 2003); Co-ordination Across Levels of Government (Mexico, 2006); the Critical Role of Vulnerable and Marginalised Groups (Istanbul, 2009); and the Need for Multi-Stakeholder Platforms to Support the Effective Management of Water Resources and Services" (Marseille, 2012).

Water shortage and water quality are becoming widespread challenges in nearly all regions across the globe. Several factors are responsible for this phenomenon, notably among them, are: the significant increase in global water extractions propelled by the exponential increase in the world's population and improve standards of living, tied with an incredible malfunctioning of water management and strategies (Abu-Zeid and Shiklomanov, 2003 & Panjabi, 2014). The dilapidation of water supplies represents a threat to human water security and ecological and biological diversity all over the world, which, so far, has been tackled by considerable injections of capital to guarantee public security in the emerging and developed nations. Nevertheless, the threats against ecological frameworks are barely taken into consideration and discussed (Abell, Vigerstol, Higgins Kang, Chapin, 2019).

It is widely acknowledged that regulating water use to meet future demands requires crafting strategies to make water use effective (Bjorklund et al., 2012). Water security is not just about the adequacy of water; however, it is about acknowledging the actual value of water and administering it appropriately (Rogers et al., 2003). To support this assertion, Velis, Conti and Biermann, (2017), point to the fact that there is the need for better management and governance at all levels; international, regional, national, community, and the watershed areas, and the need for cooperation between them. In situations, where a river crosses national borders or shared among nations, trans-border treaties and agreements for water allocation and distributions will have to be enshrined within the international agreements (Schmeier and Vogel 2015). Addressing threats in global water security means that actions adapted from the individual country's political, cultural, fiscal, ecological, business, and social circumstances, must tailor within the context of international environmental regulations (Pereira, 2015).

It is necessary to point out that there are well-established water policies and theoretical frameworks, which have been recognised internationally (World Bank,

2014). World Bank, (1993 and 2003); UNESCO, (2003); Cooley, Ajami, Ha, Srinivasan (2013) & Lein and Tagseth (2009: 12), all acknowledged the three policy alternatives considered globally to address water security. These policies include established strategies grounded on stakeholders collaboration and engagement, a water market or pricing strategy, and a command and control approach policy. The evaluation of the three strategies gives understanding to participation and decision-making regarding the trade-trade-offs among the strategies in the distribution of water between the various sectors.

2.6.1 Stakeholders engagement in water management and governance

Since the 1950s, the critical focus of conventional water resource management methods has been economic development, and the 'top-down' economic diffusion and expansion inclinations (Adams, 1994; Muller, Chikozho and Hollingworth, 2015). Building on this theme, Chifamba (2013), reveals that the gains of water resources management in that era was designed to be a "trickle-down" to the disadvantaged population through a "top-down" strategy, primarily controlled by major global establishments, such as the "International Monetary Fund (IMF) and the World Bank (WB) in collaboration with local Third World Elites".

Megdal, Eden and Shamir (2017), conclude that global and national experts conceived and thought-out that water management approaches brought in from externally, starved engagement with the communities of whom these strategies would impact, is destined to fail. To support this argument, UN-Water (2016) and (WESS, 2016), conclude that by the 1970s, water resources management efforts of many countries, and developmental plans and objectives were not widespread. Studies by Cole, Bailey, Cullis and New, 2018 & Calow and Mason (2014), confirm this by pointing out the disparities, with evidence of the accumulation of massive joblessness and disparities in wealth distribution among role-players in different sectors globally attest to this point. "During the First and Second United Nations Development Decade (1961-71, 71-81), many theorists and practitioners of development argued for focused development, rather than just relying on 'trickle-down' processes to ultimately disseminate the gains of economic development" (WESS, 2017: 19 & Koehler, 2015: 17).

The International Labour Organization (ILO) also espoused a fundamental requirements strategy, which was later officially accepted as the "Declaration of

Principles and Program of Action for a Basic Needs Strategy of Development" by the "World Employment Conference in 1976", stressing on the fundamental needs of the underprivileged (Streeten, Burki, Ul Hag, Hicks and Stewart, 1981). Such demands, according to Ejazul-Huq (1981), incorporated minimum obligations of an individual, must entail "food, protection, clothing, and basic services of shared use such as water, hygiene, health care and education". The need for participatory development concepts was stressed under 1970s conventions (Chifamba, 2013).

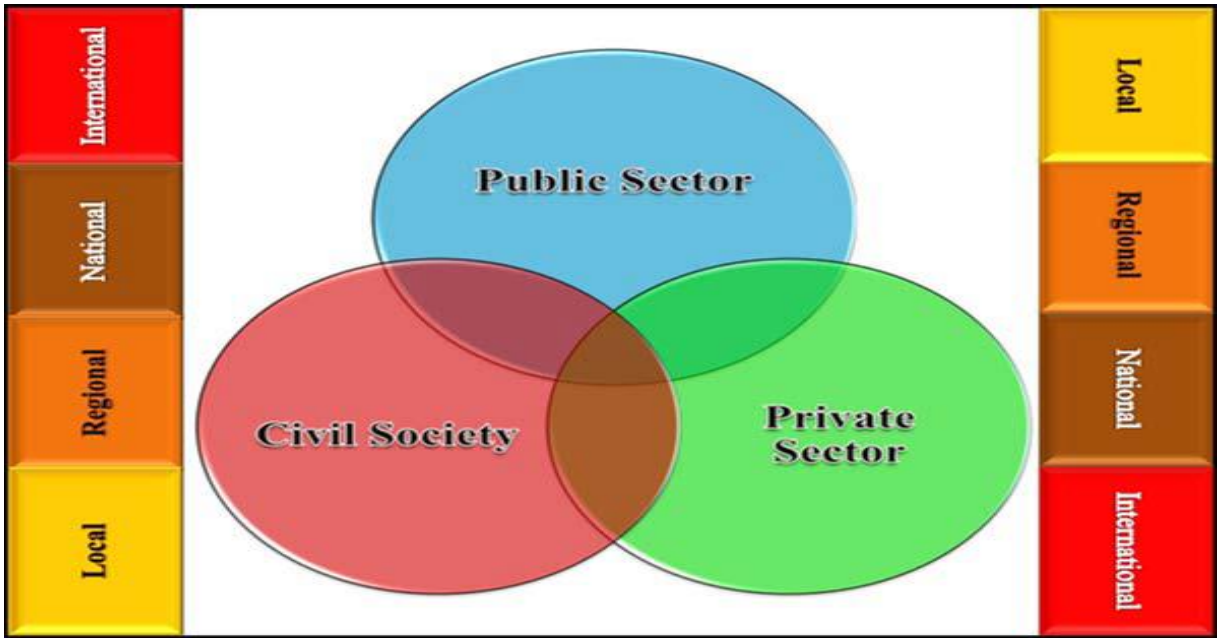
The institutional approach of water management is a philosophy that is based on stakeholders' cooperation integrating with local authorities and other stakeholders in taking decisions in the governance and administration of water reserves at their disposal (Ashton 2013 & Claasse, 2013). Chifamba, (2013: 165) also defined stakeholder involvement in the management of water "as a process through which stakeholder's influence and take control over development initiatives, and the decisions over water resources which affects them".

Tagseth et al., (2009: 12), develop on this principle by disclosing that under this policy, the local communities are engaged in all facets of the decision-making process: "planning, financing, waterworks, implementation, and management of water resources". The administration of the resources is decentralised, with the local government and community leaders responsible of water distribution, and water user associations (WUA) taking control of minor infrastructure projects and water consumption (Rosegrant et al., 2005 & Verzijl and Dominguez, 2015). The primary benefit of this institutional framework is that the interested parties collaborate in the planning and implementing of policies, guidelines, and legislation. Consequently, the application and implementation procedures are conducted efficiently (Maj 2015 & OECD, 2008).

Additionally, a participatory approach policy turns to show in-depth relationships regarding how a community conducts its business dealings regarding this vital asset, and among its inhabitants customarily (Cerna, 2013). A management style that compels authority to acknowledge that though the government representatives carry on with their dominancy in policymaking, progressively it is other role-players, such as private institutions and community organisations, that usually play a critical task in the planning, enforcement and monitoring of these strategies (Armstrong, Bello, Gilson and Spini, 2011 & EEA, 2011).

Subsequently, effective governance of this asset requires robust relations to be developed among and inside institutions and communities involved policymaking; both "horizontally", thus, parallel institutions, and among cities and rural communities, and "vertically", from municipal to international levels (Tropp, 2007). These parallel and straight-up relations that suggest the procedures through which communities enjoy power and responsibilities settle welfares and build personal and collective responses on water provision and allocations (Lebel, Anderies, Cambell, Folke, Hattfield-Dodds, Hughes and Wilson, 2006 & Folke, Halin, Olsson and Norberg, 2005). Consequently, numerous emerging nations, including South Africa, are seeking to develop establishments that create more comprehensibility and fairness in water governance through more active participation of interested parties in accordance with global norms and standards. The figure below summarises the stakeholder approach to water governance.

Figure 2.2 Key stakeholders and role-players in water governance

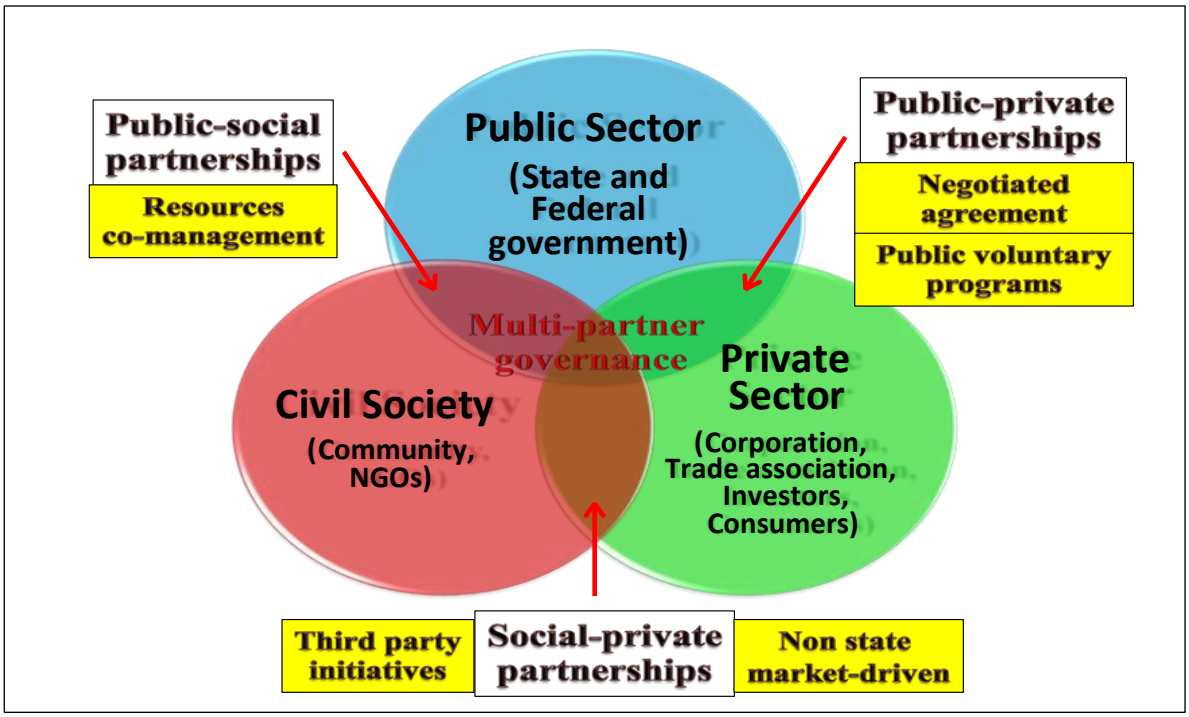


Source: Adapted from Semmahasak, 2013

The contentions for public engagement in water governance could be split into two major groupings: "normative" engagement and "functional" involvement (Tally, Schneider, and Lindquist, 2016). The normative participation involves enhanced democracy and fundamental human rights (Flear and Vakulenko, 2010). On the other hand, functional commitment revolves around practical implementation of

policies, capacity-building, and learning (Viennet and Pont, 2017). The functional involvement of water governance is grounded on the interrelated and interdependence of various stakeholders involved in the water sector (Galvez and Rojas, 2013). Claudine and Selborne (2004) support this by confirming that the functional participatory approach enables the authorities to use a "people-friendly" strategies, by granting the civic institutions, such as NGOs and other grassroots organisations to play a meaningful role in water governance through discussion and involvement in every facet of decision-making.

Figure 2.3 Hybrid functional strategy of water governance



Source: Cited from Semmahasak, 2013

Despite a flourishing picture portrayed towards institutional development in stakeholder participation in water resource governance globally, there are some structural constraints restricting its implementation (Megdal, Eden and Shamir, 2017). Ondieki (2016) points to the lack of empowerment and capacity building as a major significant constraint to the institutional development in stakeholder participation. Land (2004) & Azizi-Khalkheili and Zamani (2009), opine that to achieve the goal of community participation requires individuals and groups within the communities to have sufficient knowledge and expertise to participate meaningfully in the management of water resources. Capacity building addresses issues such as providing the necessary training to stakeholders to enable them to

comprehend the innovative, foreign, technical, political, social, and economic aspect of water governance (Megdal et al., 2017).

2.6.2 Water markets approach towards water management and governance

"Water markets" have been established across the globe as a tool to lessen water shortages, and enhance water distribution amongst consumers (Koopman, Kuik, Tol, and Brouwer, 2017). Different countries around the world have used the principles of water markets to tackle the challenges of water shortages. Some of these countries include USA, Australia, Chile, Spain, China, and South Africa (Tewari, 2009 & Debaere, Richter, Davis, and Duvall, 2014). Ideologically, the water marketing phenomenon occurs when the exchange of water-rights between different consumers arise, and this results in the transfer of water rights from lower to greater-value consumers (Hanemann and Young, 2020, Tewari, 2009 & Pahl-Wostl, 2015). Water markets are believed to enhance the effectiveness of water use and, thereby, the resultant distribution of wealth (Tewari, 2009 & Garrick, Hanemann and Hepburn, 2020).

The assumption of zero transaction cost of transferring water rights would allow the trade until the marginal value of rights is equal across different uses (Garrick et al., 2020). A standard argument that economists in general offer, are that water is under-priced because it is considered to be a public commodity, rather than an economic asset (Der Zaag and Savenije, 2006 & Tewari, 2009). For example, in South Africa, irrigation water in the 1980s was priced at only about 30 per cent of the operating and upkeep expenses (Schur, 1997). Water markets allow the water to be priced at its opportunity costs through interaction between demand and supply forces. The opportunity cost of water reflects the scarcity of water, and hence ensures the best consumption for water. Water users in the society assess the opportunity cost and transactions costs of trade, and, if the expected benefits from acquiring water exceed the costs (opportunity plus transaction charges), then water trading takes place (Tewari, 2009).

As the water markets in various nations operate in accordance with different regulations and procedures, it is hard to draw a conclusion regarding the strengths and weaknesses of water market principles (Mckinney, Cai, Rosegrant and Ringler, 2006). However, Lechman, Resetar, Kalra, Schaefer and Curtright, (2020), summarise the positive components of water markets to include the following: it

ensures the distribution of water to the maximum price consumer, provides encouragements to consumers for water conservation creating the assumption that supplementary water is accessible for the ecology without minimising the general economic performance. Water markets are also seen as an instrument to boost the proficiency of water consumption and the effective distribution of water assets (Bjornlund, 2003).

Another critical issue that Cosgrove et al., (2015) point to is, water markets allow the water to be priced at its opportunity costs through interaction between demand and supply forces. The opportunity cost of water reflects the scarcity of water, hence, ensures the best use of water (Bjornlund, 2003). Water users in the communities assess the opportunity cost and transactional costs of trade and, if the expected benefits from acquiring water exceed the costs (opportunity plus transaction charges), then water trading takes place (Zilberman and Schoengold, 2004). Water markets are a substitute to centralised strategies to water administration and are alternatives to improve the efficiency of water use and improvement in the distribution of its wealth (Cooley and Phurisamban, 2016).

Nevertheless, the water market approach has strong handicapped and cannot address the constraints of water exploitation (Grafton, Libecap, Edwards, O'Brein and Landy, 2012). Water markets are associated with substantial variance in transaction expenses and access to data, due to inconsistencies in revenue levels and the ability to access funding. Other barriers which interfere with the functioning of water markets comprise "third-party" impacts, as well as the fact that water markets and water rights are often not mutually exclusive entities (Grafton et al., 2012).

Many European countries, USA and Australia have implemented the water market policy under the form of pricing of the assets to recuperate the cost of water facilities and, as a strategy to promote sustainability and effective water consumption (Rey, Perez-Blanco, Escriva-Bou, Girard and Veldkamp, 2017). Dai (2012) argues that recuperation of the cost suggests recuperating both the expenditure of administering water and the amount of (non-market) effects on the ecosystem. There are different types of procedures for pricing water.

Nevertheless, hydro-economic modelling of pricing water is generally used in the most advanced nations, and some emerging nations (Kirby and Ahmad, 2014).

Hydro-economic modelling is an instrument of pricing water to achieve water security. Sustainable water management, under hydro-economic modelling of water pricing, depends on scientific archetypes to epitomise the multifaceted connections between the impacts of decisions on water as an asset and water consumption (Heinz, Velazque, Lund and Andreu, 2007). Hanemann (2006) points to the fact that a cost-effective, efficient distribution of the water asset is one that brings maximum outcomes in terms of profit for a specific quantity the resources. According to Hanemann (2006), to achieve efficiency, the worth of water should be equal to the additional cost of providing a marginal unit of water with the scarcity of the assets.

Furthermore, the hydro-economic modelling system combines the economic administration strategies with the traditional techniques in administering the water (Harou, Pulido-Velazquez, Rosenberg, Azuara, 2009). By using this strategy, the worth of water can be determined in terms place and periods, under fluctuating circumstances of water insufficiency and demands, grounded on these in-depth data, how water is administered in a particular catchment area over a period of time can be determined, again, all surface and groundwater reserves, infrastructures development and maintenance, and distribution can be prioritised (Guirria, 2000). This approach can be used to advise determinations regarding the expenses and gains of various distribution and price policy in times of water shortages (Harou et al., 2009). Add to the above; this water policy enjoys the gains of various price-setting procedures to be contrasted to determine the most efficient method. Water price-setting strategies that could be appraised include those founded on administering contentious demands from diverse water consumers on the unstable echelons of water in reserves, and those responsible for mitigating the impacts of drought on water accessibility (Pulido-Velazquez, Alvarez-Mendiola and Andreu, 2012).

2.6.3 Command and control approach of water management policy

"The command and control refers to attributions that cannot be delegated, and are exclusive to the State system, and are traditionally applied by the Public Power by legal disciplining and exercising police power" (Porto and Lobato, 2004: 115). Elazegui (2002) described the command and control water policy as an approach where the government mandate the population, by formulating regulations and

legislation, to bring about behaviour and the use enforcement mechanisms to get residents to comply with water laws and regulations. The methodology requires establishing guidelines to safeguard or enhance water distribution and usage against misuse (Porto et al., 2002). Elazegui (2002) added that this strategy is a traditional regulation that uses a mandatory approach. It is determined through direct (occasionally unilateral basis), what scenario is desirable for the population, and subsequently the law enforcement of the country is brought in to accomplish the tasks (Cole and Grossman, 1999).

This bureaucratic administrative rule is based on the concept that the country, via its organisational and political establishments, can, and must, design and distribute water resources in the best interest of the state (Lein and Tagseth, 2009). This policy is built on a solid idea of experts judgments and the belief that water, cultures, and human beings can be "planned and managed" to get the best solutions (Lein et al., 2009). Proponents of this policy argue that due to the very nature of the water, water administration should be carried out within the context of the watershed management. "Planning, implementation, and conflict resolution must be carried out by individual water management authorities, having superior knowledge and an overview of available resources, with possible ways of using water ideas and tools to decide on the optimal way of allocating resources" (Pahl-Wostl et al., 2015: 52).

Building on this theme, Pegram and Mazibuko (2005) concurred that water management organisations should be managed by committees, often involving various "stakeholders", represented by various interest groups or segments, for instance, civil administration, ministries, economic actors, farmers, women. This water management strategy solicits funds mainly through user-pay principle and charges for water consumed. The main objectives of the charges are to recoup the expenses incurred for supplying water (infrastructure maintenance) and to finance the activities carried out by water administrative experts. The principal professional in this field are hydrologists, and water administrators and, to some degree, agronomists, and irrigation engineers whose responsibilities are to assist dominant players in managing water resources (Field and Collier, 2006).

For instance, in Brazil post-1988, the constitution was ratified, paving the way for water assets to be regarded as commodities in the public territory, under the sole

responsibility of the federal government. Watercourse from the headwaters to the mouth, including the dams, and any water body within the territorial boundaries of that federal entity, are regulated and control by the federal government (Porto et al., 2002). Therefore, there is no water reserve in the private sphere. This statutory fortitude suggests there is absolutely no of 'privatisation' the water regulations, restricted any potential of private intermediaries in the running of infrastructure projects that have anything to do with water, for instance, energy production or potable water supply (Porto et al., 2002;).

Additionally, the command and control policy often referred to as "integrated river basin planning" — influenced by the "Tennessee Valley Authority" (TVA) a policy program linked to the "New Deal Policies" of the economic recession in the United States of America. This strategy which operated like watershed management, was implemented in numerous countries in Africa since the 1960s (Lein et al., 2009). This programme initially became very popular due to the fact that it was attached to the notion of innovation, pragmatism, and formulation. It further bore the principle of a vigorous and dynamic government an instrument of growth and development (Elazegui, 2002 & Porto et al., 2009).

Implicit in Loucks et al., (2017) argument, is that the command and control policy seeks to address several challenges involving water managements for example in hydro energy advancement, irrigation expansion, communities elevation, all in an integrated approach. While prevalent in numerous countries on the continent, the performance of this policy on comprehensive watershed projects within the continent frequently have been extremely depressing (Prasad, Stone, Hughes, and Stewart, 2012). This could be credited to numerous factors associated with planning and execution.

It is important to note that, the methodical use of the environmental borders as administrative and designing components is a contemporary notion with minimal historical precedent, Barham (2001) for example gave this terms as "watershed rule", which often comes into clash with fundamental democratic constitutional rights. Furthermore, and related to the above is the idea that participation in countless democratic characteristics of water management can best be served through "stakeholder participation" in watershed management at different stages.

This sort of participation could range from “nothing more than token interest”, to “severe attempts at initiating real involvement” (Butterworth, 2010).

Nevertheless, the notion of stakeholders involvement presents a number of fundamental questions which is the identification and choice of participants, and how they could be held accountable vis-a`-vis their “constituencies” (Maak, 2007). This technocratic method sits well with Blaikie’s (2000) observation on the conventional, state-controlled, top-down strategy of environmental management. This environmental management strategy was contested in the 1990s by both fundamentalists and modernist theorists.

2.7 Sustainable water management strategies in the South African context

The Brundtland Report (1987), cited from Mensa and Casadevall (2019: 3), described sustainable development as, “economic development which meets the needs of the present generation without compromising the ability of the future generation to meet their needs”. The term comprises two basic elements: economic growth and social upliftment (Mensa et al., 2019). Barkemeyer, Holt, Preuss, and Tsang (2014) concurred that to achieve long-term sustainable development, human beings, and their needs in terms of financial gains, cannot superimpose on the other aspects of development.

Instead, sustainable development should be viewed as the connection between humans and their ecosystem and how development must occur, so that human actions do not negatively affect the environment in the pursuit of economic gains (Basiago, 1999). Sustainable development requires a holistic outlook, and is not aimed at achieving one objective-finance. This means that other factors that impact on the environment and the population, must be considered (Mensa et al., 2019). Kuhlman and John (2010) opined that sustainable development must integrate economic growth and environmental safety to guarantee that nature and its assets are not wrecked. It, therefore, means that sustainable development encompasses the economic, fiscal, trade, energy, agricultural, industrial, natural resources, and other policies aimed at bringing about the growth that is “economically, socially, and environmentally sustainable”.

Emas (2015) revealed that social sustainability points to so-called ‘moral capital’ that can be realised by effective community participation and active civil society. It

includes collective values and equal rights, as well as communal, spiritual, and social collaboration, which are necessary for maintenance and replenishment (Goodland, 2002). In addition to preservation of 'natural capital', economic sustainability adds scale to allocation and efficiency, while ecological sustainability has, as its aim, the improvement of human wellbeing by conserving and promoting natural assets used by human needs and guaranteeing excesses is minimised (Mensa et al., 2019).

"Sustainable development is a critical constituent of the Environmental right Constitution under Section 24 in South Africa, and is the basis of the new integrated environment management system as provided for in the National Environmental Management Act of 1998" (Ridl et al., 2010:12). According to this Section 24 as cited by Ridl et al., (2010), sustainable development is defined as "meeting the basic needs of all and extending to all the opportunity to satisfy their aspiration for a better life". Fundamentally, one of the democratic values of the Constitution is to promote human dignity, equality, and freedom to realise a better and enhance living standards for every person (Humby, 2016).

"Sustainable water management" (SWM) is a significant constituent of sustainable development and stand parallel component as sustainability (Russo et al., 2014). This definition entails meeting the existing water requirements for every water consumer but not impacting negatively on the impending water reserves (Cole et al., 2018). Stated more precisely, SWM contributes to the purposes of societies and preserves natural, ecological, and hydrological values (Loucks, Stakhive, and Martin, 2009). Water is a basic necessity for human sustenance and welfare. Therefore, appropriate, effective, and efficient 'stewardship' of the resource translates into expanding cultivation, reducing abject poverty, and improving public health. SWM includes allocating the resource among competing objectives and consumers (Russo et al., 2014). The allocation of water can be epitomised as a hierarchical structure like depicted and explained by Maslow's hierarchy of human needs (Russo et al., 2014). The structure stresses that the basic biological and physical requirements ought to be addressed before resources are geared towards satisfying upper and complex demands (Yazar and Ali, 2017). The next ranking under Maslow's ladder is "safety", translating into the "security"

households and communities water requirements is a necessity need for human existence.

The next two subsequent rankings are the “social” or “esteem”, correspondingly reflects broader humanity water demands; - care, fairness, and accountability, (Smith, 2003 & Russo et al.,2014). These two rankings share consistencies with levels one and two, and apparently the end of the ladder, the insular “self-fulfilment” divergences from sustainable development goals, which stresses on an “outward-looking” stance, containing the execution of other consumption purposes, currently, and in the future. The utmost constraints facing South Africa is building the culture of SWM among its citizens, which is a significant to attain sustainability in water resources (Yawson, Armah, and Pappoe, 2009).

There is a lack of structures for evaluating the sustainability of water in a broader sense. The existing concept of water sustainability in South Africa does not provide appropriate space for an engineer, a decision-maker, or a cultivator, for example, to bargain with and apply sustainability principles (Carden and Armitage, 2012 and Cosgrove et al., 2015). Therefore, to guarantee sustainability and effective consumption of water, various scholars have been calling for the application of Integrated Water Resource Management (IWRM) (Claassen, 2013, Jonker, 2014 & Setegn and Donoso, 2015). IWRM is defined as a “process that promotes the coordinated development and management of water, land, and related resources, to maximise the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems” (GWP, 2000: 25 & Cardwell, Cole, Cartwright and Martin, 2009: 26).

IWRM aims at reconciling fundamental human requirements, guarantee accessibility and equality with economic growth, but not to overlook of the value of the environment, and emphasises that water assets ought to be administered under the ideologies of collaborative governance and grassroots participation (van der Zaag and Savenije, 2014). In addition, IWRM is multi-dimensional, which integrates the collaboration among natural and social structures; portable water and the coastlines; terrestrial and aquatic; “green and blue water”; surface and groundwater; water quality and quantity; and upper and lower courses management are essential interactions associated to the ecosystem (Cardwell et al., 2009 & GWPSA, 2009). The IWRM recognises the mainstreams, cross-sectoral

integration, macro-economic impacts, cohesive policymaking, economic sector decisions, public participation, and wastewater management are essential components taking into account human system water management practices (Cardwell et al., 2009).

In the context of South Africa, IWRM relates to the biological and physical structures that are supported by a robust legal framework, with the Constitutional Act (Act 108 of 1996) and "National Environmental Management Act" (NEMA Act 107 of 1998). These are vigorous, integrated approach that stimulates the relevant application of the relevant ecological administrative instruments that guarantee the integrated environmental management of initiatives and procedures (Leendertse, Mitchell and Harlin, 2008). The IWRM is also considered as one of the fundamental legislative instrument associated with water resource management in the country (Butterworth et al., 2010). The primary goal of the Act is to guarantee effective use of water in the public interest, with the fundamental values of equity, efficiency, sustainability, and equal representation (Butterworth et al., 2010).

"The Water Services Act (WSA) provides a regulatory framework for the provision of water supply and sanitation services to which people are entitled. It deals with a reticulated water supply and sanitation services" (Algotsson et al., 2009: 13). It explicitly offers for the constitutional rights of right access to basic water provision and the fundamental hygiene, and how local governments through the municipalities should fulfil their obligation to supply water and sanitation facilities to their populations (SAHRC 2014). The WSA is affiliated with the National Water Act (NWA) due to the fact that its translation and interpretation correlates with NWA. The acts provide specific legislation, such as the NWA of (Act 36 of 1998), which identifies the necessity to unify the administration of all the facets of water resources (DWS, 20017).

Despite the relevance and significance of IWRM, and the National Water Act concepts in water management globally and South Africa in particular, the implementation of this concept has drawn more criticism than praise (Butterworth et al., 2010). The World Bank (WB), a powerful campaigner and supporter of IWRM acknowledges that the benefits of the concept have been insignificant, and, for some writers, the major obstacle to the effective execution of IWRM is the absence of theory and intellectual precision. Grigg (2014), contends that the idea is

ambiguous and characterised by overused expressions of a comprehensive and flexible approach, which are just "convenient target of opportunity". To support this argument, Molle (2008: 132) describe IWRM as a "nirvana concept, or an idealistic model that seeks to harmonise and achieve many desires, but is characterised by conflicting goals simultaneously". Add to these arguments, Acheampong, Swirlling and Urama (2016) argue that the agreeable vision of IWRM leans to the vague and inherent partisan landscape of the process. In their views, IWRM is conflict-loaded, and a politically contested process in water administration and distribution which is the core water governance.

In the South African context, Ashton (2013) argues that IWRM and the National Water Act fails to recognise a single critical establishment responsible for land management within the institutional structure of enactment. Conspicuously, the Department of Mineral and Natural Resources and the various Lands Agencies, which are empowered in the administration issues, have been excluded from the IWRM. Nevertheless, these institutions have significant responsibilities for land and minerals matters, while the Lands Commission provides authorisation for the land to be released for developmental purposes (Monney and Ocloo, 2017). Conspicuously, the Department of Minerals and Natural Resources is unforgivably absent from the institutional framework of IWRM. Taking into account the direct impact of mining activities on water assets, these commissions cannot be ignored from policymaking and deliberations of water governance (ANA, 2013). Maybe, the lack of these key establishments in the water management and governance justifies why the pursuits of extraction firms and illicit extractors ('Zamazamas') persistent to inflict substantial environmental devastation in South Africa, predominantly on water reserves (Askham and van der Poll, 2017). Implicit in these arguments, Goldin (2010) discloses that the extensive pollution of water reserves in mining areas.

To add to the complications, traditional leaders (Chiefs and Kings) have been excluded from the institutional structure of the IWRM. Meanwhile, in South Africa, these traditional leaders play a significant role in land management (Hall, 2006). About 80 per cent of the country's land areas in rural communities are in the custody traditional authorities who are in charge of the distribution and management (Department of Mineral and Natural Resources, 2011, Mwendera,

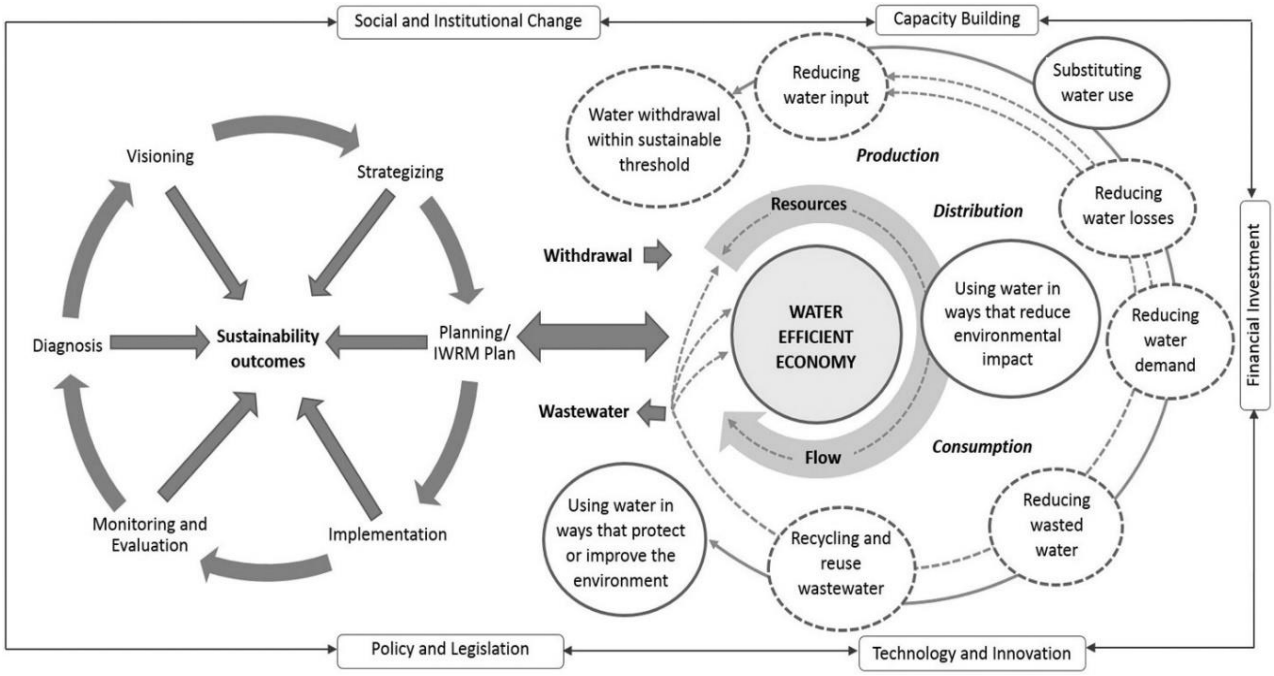
2003 & Donnenfeld, 2018). Muller et al., (2009: 69) questioned, “how then can water resources management strategies be implemented effectively without involving these institutions in the water-scarce country like South Africa”? The unavoidable conflicted nature of water distribution between competing uses and consumers legitimises the current inequalities of rights and power among participants. These skirmishes and bastardy of power incorporated into water distribution serve as a significant impediment to IWRM execution (Knuppe, 2011).

2.8 Strategic framework towards achieving IWRM in South Africa

Sustainable water management requires persistent efforts towards developing measures to achieve sustainability within the administration and monitoring of water reserves (UNDESA, 2015). The goal of sustainability is prioritising and the fulfilling of societal requirements in a just (socially desirable) manner, to build a vibrant economy with marginal costs (MC) not surpassing marginal revenue (MR) (economically efficient), and to preserve and uphold long-term ecological sustainability (environmentally manageable) (Dalal-Clayton and Bass, 2002 and Muller et al., 2017). These components form the core of the sustainable development agenda (SDGs). The sustainable development objectives are to provide desirable results for water administrators, to promote thought processes of the resource sustenance, hydrological cycle, and its impact on the environment (Acheampong et al., 2016 and Maestu, 2015).

As the quest for inventive and better techniques to address sustainability complications in water administration persists, a conceptual framework that synergises the critical elements of sustainable water management has been formulated by different scholars. To comprehend the connections and relations between social, economic, and the environmental, and to establish channel towards sustainable water management, grounded on political, institutional and governance factors are depicted in Figure 2.4. The diagram below illustrates the correlation and integrational approaches with the potential of achieving sustainability goals.

Figure 2.4 Strategic framework for sustainable water management



(Adapted from UNDESA & GWP 2006) cited from Acheampong et al., 2016

This strategic framework was undertaken to formulate a system which recognises the interrelationships between the various water resource administrative components, and builds correlations to create various benefits and wellbeing while, utilising water on a sustainable basis (Pollard and du Toit, 2007). The structure focused on the process that enhances the integration, and to achieve water sustainability through efficiency. The first part of the framework constitutes a systematic process which entails six distinctive processes: Diagnosing; Visioning; Strategizing; IWRM Planning; Implementing, Monitoring and Evaluating (Acheampong et al., 2016, Leendertse et al., 2006, Jønch-Clausen, 2004). To attain the primary goal of IWRM, which seeks to achieve water security and sustainability (UNDESA & GWP, 2006), cited from Acheampong et al., (2015: 11), the following was adopted as the fundamental principles to reach sustainability goals.

i. *Step 1: "Diagnosis": Requires assessing the present state of water challenges concerns, diagnosing, and acknowledging the challenges, threats, and possibilities.*
ii. *Step 2: "Visioning": Interested Parties evaluate the difficulties, their triggers, and effects, and then formulate possible solutions that speaks to the challenges of water administration.*

iii. *Step 3: "Strategizing": This is about the identification and a concept from the previous phases, participants initiating the development of situations and appropriate policies through discussions and engagements. These circumstances and strategies are assessed to pick the best strategy addresses the vision*

iv. *Step 4 "IWRM Plan": After the appraisal of the situations and the most appropriate strategy selected, an IWRM plan is established. The strategy must foresee how the modification will be accomplished to show principles of sustainable water management. It provides detailed information about the roles and responsibilities, timetable, cost, goals to be accomplished and gauges for supervising and assessment.*

v. *Step 5 "Implementation": The programme is approved and executed by the government through the responsible department in a synchronized manner. The endorsement by the interested party, government, and financial backers such as banks. Human and financial capital are important elements to fast-track the execution of the implementation phase*

vi. *Step 6 "Monitoring and Evaluation": Participants evaluate the progress achieved in connection with the execution of the programme in accordance with the suggested cost and objectives. Comprehensive public discussion and active participant engagements offer responses and opinions programme and to establish whether it is relevant to make adjustments to the initial programme or replicate certain phases of the procedure.*

Acheampong et al., (2016) reveal that these six principles are vital in promoting the interaction of multiple role-players and government in water management. For the realisation of the IWRM concept, it is critical to create a conducive environment for the policies and strategies to be implemented as stipulated (Anderson et al., 2008 & GWP, 2005). The second component of the outline identifies the strategies for the IWRM goal, which involve processes to be applied to improve water efficiency, social equity, and reduce environmental impact (Jones, Newborne and Phillips, 2006). Inherently in the framework is the "decoupling principle of dematerialisation, which implies the reduction in the number of water withdrawals" (Acheampong et al., 2016). Verlag (2011) further alluded that the IWRM framework promotes a decrease in water loss and wastage by promoting maintenance and fixing leakages on

infrastructure, and mounting of effective and modern leak detection screens. By resolving these challenges, water provision to various consumers can be increased considerably by an estimated amount of more than 50 per cent in South Africa, and in countries globally as it is estimated that water lost through leaks and burst pipe account for 50 per cent of the total volume of water supplied in the pipe structured (Parks, Mclaren, Toumi, and Rivett, 2019). The framework further advocates for reprocessing sewage water through innovative know-hows which can augment substantially the quantities in the water reserves, minimise ecological damage, and provide opportunities for recycling and reuse in water-use related programmes such as machines cooling-off, plants and golf courses watering, and flushing toilets (Acheampong et al., 2016).

Exploiting the outline suggests that there is are sound and suitable links that demonstrate robust economic, social and environmental pillars of sustainable, which assist in breaking the "incessant cycle of over-abstraction, over-consumption and wastewater pollution; develop systemic sector coordination, collaboration and stakeholder interaction; encourage the adoption of sustainable technologies and innovative practices; incorporate water resource efficiency measures such as reuse, reduce and recycle strategies; and ensure sustainable livelihoods through equitable access to water" (Acheampong et al., 2016: 12). The principles further entail a holistic procedure that involves embracing an ecosystem procedure, which is based on interconnectedness among various water dimensions which include: economic, social, and environmental dimensions at different levels, and incorporating water resource management through drafting, organisation and administration which encapsulate the role-players, institutions, policies and sectors across water sustainability (Hooper, 2003).

The collaborative and participatory decision-making process at every stage promotes accountability and transparency. Life cycle thinking; a perspective that considers sustainability over the entire life process; and adaptive management; taking into account the uncertainties linked to increasingly complex and interconnected water issues, water resource management must be a dynamic process capable of adapting and responding to changing situations (Reed, 2008: 2420). The structure also offers insight, not only on the transactions involving water management objectives, for instance, conserving water, economic growth,

and ecological sustainability, but stipulates the interdependency and interconnectivity within the water management structure. The framework lay-bare the strategies in addressing issues the "rebound effects" which is often linked with enhanced water efficiency that might arise from a decrease in the variable cost of water per unit output, and reduction in fixed water price, which incentivise higher levels of use (Acheampong et al., 2016).

2.9 The current legislation, policies, and strategies driving water security in South Africa

Before 1994, water provision in South Africa was fragmented and patchy, with no single national government or department accountable for its administration. The law dealing with water resource is scattered through the legislation (Pietersen, 2011). The Water Act 54 of 1956 constitutes the most important legislation in this respect, in that it deals specifically with the control, conservation and consumption of water (Kahinda, 2009 & Meissner, Funke, and Nienaber, 2013). Although this Act does not exclude wetlands, lakes, and lagoons from its provisions, it is clear from the definitions of public water, public stream, natural channel, standard flow, riparian land, and surplus water, as well as from the provisions of the Act, that it is aimed mainly at inland running water. This uncoordinated Water Act led to different levels, and quality of services differ between black and white communities. Further compounding the problem was the absence of any comprehensible and cohesive national water policy or legislation or support structure (Folifac, 2003 & Hendry, 2015).

Due to the unsustainable and inequitable nature of these policies post-1994, the new democratic government of South Africa saw the pressing need for brand-new legislation, policies, and strategies for the country, of which the water sector was just one. A resilient political determination was shown to implement sustainable water development through comprehensive water policies (de Coning and Sherwell, 2004). Mackay (2013: 53) indicates that different major stages were followed in developing the new strategy governing water management in the country. These include: "Constitutional development; the development of the Water Law Principles in 1996; the White Paper on a National Water Policy for South Africa 1997; the National Water Act 1998 and implementation initiatives such as the establishment of the National Water Resource Strategy 2002". On meta-policy context, the

development of the White Paper was viewed in the context of several other significant policy developments, such as the RDP 1994; GEAR; Batho Pele (people first) Principle; the White Paper on Local Government, and many others.

Multiple policy programmes are also evident in the water-related section, specifically the "DWAF Strategic Framework on Water Services 2003, as well as the White Paper on Water Supply and Sanitation (1994), and, at a later stage, the White Paper on Basic Household Sanitation 2001" (Tissington, 2011: 21). Figure 2.5 below reflects the existing legislation and policies in water management post-independence in south Africa.

Figure 2.5 Legislations and policies in water management post-1994



Source: Constitution of (1996), DWS 2008

2.9.1 Constitution of the Republic of South Africa of 1996

Environmental rights are incorporated into several national statutes and given various interpretations. Although environmental rights have traditionally been regarded as "third-generation" rights, which tend to be group rights, modern constitutions have incorporated this right as an environmental human right (Allen,

2012 & Boyle, 2012). Alternatively, in other cases, environmental rights need the law to safeguard natural assets and the ecosystem by taking decisive action, thus implementing proper environment strategies and legislations. An alternative strategy is to make it an obligation for every citizen in the country to protect and preserve the natural environment (du Plessis, 2015). Feris (2008) and Bilchitz (2015), cited from Kotze and du Plessis (2010: 58), highlight that over the past four decades, countless suggestions had been put across to be part of environmental privileges in the country's Constitution: the first provision in section 29 of the provisional Constitution was extended by section 24 of the Constitution and stated that:

Everyone has the right –

i. "to an environment, that is not harmful to their health or wellbeing; and,
ii. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that: –
   a. prevent pollution and ecological degradation.
   b. promote conservation; and,
   c. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

The Constitution of the Republic of South Africa (No. 108 of 1996) creates provisions for water legislations. "The Bill of Rights in the Constitution guarantees fundamental human rights to all people of South Africa. Among other things, it affords everyone the right to live in an environment that is not harmful to health and wellbeing, and to have access to sufficient water, extending these benefits to future generations. The Constitution sets out the objectives of local government, including to provide water services sustainably, and to promote a safe and healthy environment" (SAHRC, 2002: 348).

The local government regulation provides an interpretation to this constitutional requirement, and it stipulates for the local government to encourage a harmless and healthful environment in their jurisdictions and collaborate with other spheres of government for the attainment of the basic privileges stipulated in sections 24, 25, 26, 27 and 29 of the constitution (Kotze et al., 2010). The Constitution emphasises that the national administration is the custodians of groundwater and

surface water reserves and that the local administrations have the task of supplying municipal water and sanitation services (SAHRC, 2002).

As stated previously, the advancement of water privileges and legislations in South Africa primarily revolve around “Roman-Dutch Law” (RML) in which streams and rivers were regarded as assets belonging to the state, and were accessible to all the inhabitants, however, they were controlled and regulated by the state in the public interest – this is often referred to as the “public trust doctrine” (Tewari, 2009, Coning et al., 2004). “The idea of public trust goes back to Roman times. The Roman Emperor Justinian codified the law in AD 528, which has been known as the Institutes of Justinian (Lee, 1956 pp. 33-45). The Institutes of Justinian stated that by the law of nature, some things are accepted as common to humanity such as air, seashore, etc. These are defined as 'commons' in today's parlance” (Tewari, 2009: 697).

This public trust doctrine was later approved by England's judicial system and became part of the Magna Carta in AD 1215. The Magna Carta sought to restrict the authority of the king and barred him from giving special rights to nobles to hunt or fish in specific areas. The King was the custodian the land, yet he was compelled to safeguard it for the use by the general public (Averchenkova, Gannon and Curran 2019; Soyapi, 2017 & Gowlland-Gualtieri, 2007). “The English Common Law was established though decisions were made by judges, and they twisted the Roman notion of common property and defined that the king held that common property for the benefit of subjects” (Pound, 1918: 1051). The king held them “in trust” for the good every individual. The notion of guardianship was eventually integrated into the South African legislation during the transition to democracy in 194 as these values were firmly in line with African customary law, which regarded water as a public commodity used in the benefits of the society. “The public trust principles are deeply enshrined in the Fundamental Principles and Objectives for a New Water Legislation in South Africa (Principles 12 and 13 WLRP, 1996)” (Stein, 2002: 6).

The national administration through the DWS is controlling body, overlooking and authoritative as the public executor of the nation's water assets to guarantee that water is “protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner, for the benefit of all individuals and by its

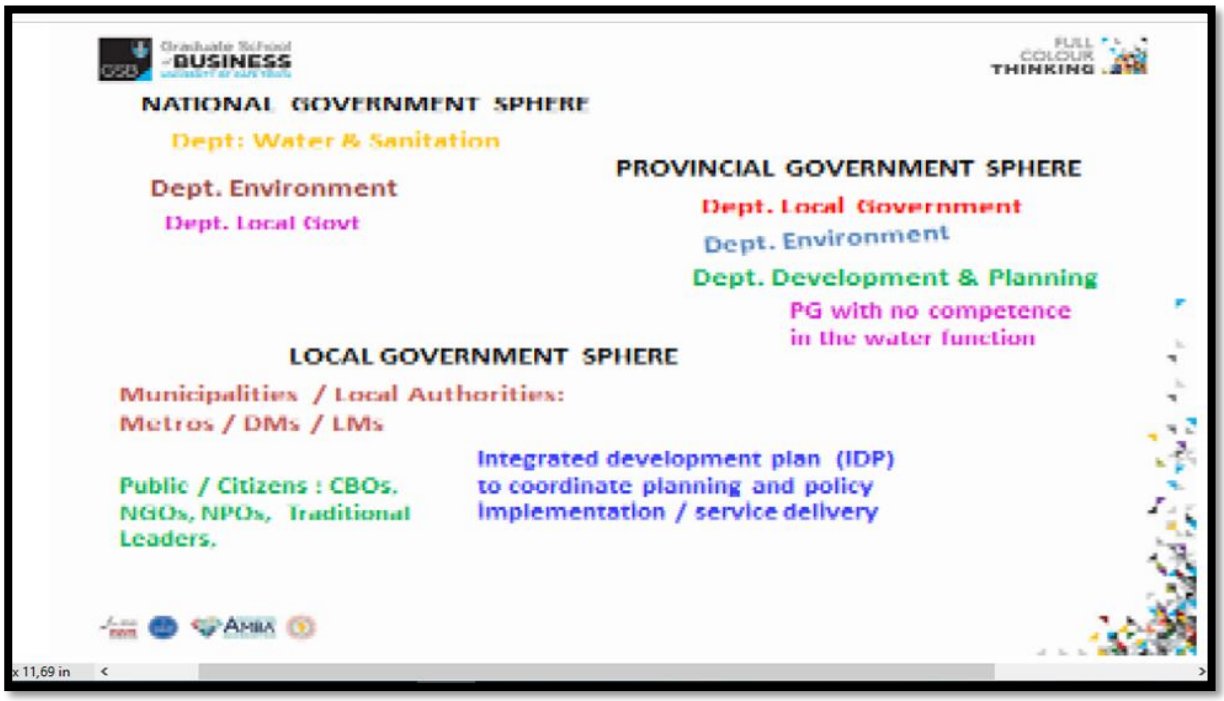
constitutional mandate" (Algotsson et al., 2009: 3). The Minister of DWS is accountable and responsible for the sector and has the executive power to ensure that water is apportioned impartially and used sustainably to the interest of the country's population, and that its ecological worth is conserved (Tewari, 2009 and Algotsson et al., 2009). Equal access to water was deemed essential due to the inequitable legislation, policies, and regulations of the past. The notion of public confidence in the country's legislation provides total autonomy and power to the national administration of the country; however, it does not mean the or suggests that it owns every water asset in the country (van Schyff, 2011).

Reddy (2016) indicates that water provisions are the legal mandate of local government, in the South African perspective, are municipalities. Municipalities are responsible under the constitution to guarantee that societies, both 'countrysides', towns and cities enjoy equal access to sufficient and safe water. Nevertheless, where there are challenges in water provision within a municipal jurisdiction, the local administration through the provincial government can seek assistance from national administration of the DWS, which is the ombudsman, overseer, and regulator in the sector (Smith, 2009 and Weaver et al., 2017). The DWA at any level is accountable for guaranteeing the protection and controlling of the national water assets from exploitation and overconsumption. Water is a natural resource that, by its very nature, must be collectively owned and enjoyed (Stain 2002: 6).

DESA (2005) and Batchelor (2007), highlight that cooperative governance underscores the values and ideals of the Constitution, and provides ways and means of achieving democratic, participative, transparent, and accountable water governance. Cooperative governance means that water management activities are not carried out by the national administration alone, but also by the provincial and local administrations; thus, bringing the governance of water as close as possible to the people (Hassan, Mtsweni, Wilkinson, Weston, Mutundo, Magagula, Sithole, Farolfi and Dinar, 2014). The Constitution dictates that the national and regional administrations provide assistance and capacity to the local government to perform their functions effectively, again, the constitution mandates all the three spheres of government to take collective responsibilities in providing quality and affordable

water to the citizens. Figure 4.2 simplified the relationship between the three spheres of water governance as stipulated by the 1996 Constitution of South Africa.

Figure 2.6 The structural of the three spheres of water governance



Source: Adapted from Debbile, 2017

2.9.2 National Environmental Management Act of 1998 (NEMA)

"The National Environmental Management Act, 107 of 1998 (NEMA), is a national environmental management framework legislation which defines the environment as the surroundings in which humans exist, and includes the land, water, and atmosphere" (Blackmore, 2015: 94). Besides, it incorporates the mutual relations, permutations, the characteristics, and circumstances of all living creatures that live within an environs. This comprehensive interpretation of the environment binds into the theory of "Integrated Environmental Management" (IEM), which NEMA stimulates (du Toit, 2016).

Section 24 of NEMA cited from Ridl and Couzens, (2010: 84), provides that: "everyone has the right to have the environment protected for the benefit of present and future generations". Similarly, the WSA and the NWA prescribes national rules and standards for environmental management to realise social, environmental, and economic sustainability. The NEMA policy advocates for the "polluter pay" principle

for the maintenance of the damaged environment (Blackmore, 2015). Pollution, in the context of NEMA, is any activities by humans that affect the natural beauty of the environment or affects the natural organisation within the ecosystem (Ridl et al., 2010). The NEMA (Act 107 of 1998), stipulates that any government department whose activities affects the environment must exercise these functions in accordance to NEMA principles, or Environmental Implementation Plan, which is instituted by the Minister of Environmental Affairs and Tourism, and the Environmental Co-ordination Committee of (Section 16) with emphasis on sustainable development (Kidd, 1999)

Sustainable development' is defined in section (1) of the NEMA 107 of 1998 as "the integration of social, economic and environmental factors into the planning implementation and decision-making to ensure that development serves present and future generation" (Glazewski and Posnik, 1999: 214). Ridl and Couzens (2010: 94) also defined sustainable development as the "right that development is fulfilled to equitably meet developmental and environmental needs of present and future generations". Marais, Retief, Sandham, and Cilliers, (2014), argue that achieving sustainable development, and improve the standard of living for the population, require the states to minimise and eradicate any unsustainable production practices, tackle overconsumption of natural resources, and promote policies and strategies that recognise the demographic distribution in the country.

Section 2(3) of NEMA identifies social, economic, and environmental factors as the three interlinked concepts, and a central principle to sustainable development (Feris, 2010). This principle highlights that: social sustainability points to "moral capital", which can be attained by effective community participation and active civil society. Collective principles and equal rights, as well as society, religion, and cultural interaction, are necessary for its maintenance and implementation. In addition to the maintenance of 'natural capital', economic sustainability adds scale to allocation and efficiency (Basiago, 1999: 151).

Against this background, economic sustainability placed individuals and their requirements at the centre of its debates, and provide tangible, emotional, cultural, and social capital to the population-based on fairness and equitably (DESA, 2013). Environmental sustainability has, as its goal, the improvement of human welfare by protecting natural resources used for human needs, and ensuring that waste is

limited. Environmental sustainability lays down specific guidelines for environmental authorisations. In order to address the vision of integrated environmental management and to minimise the potential effect of development activities on the environment, the socio-economic conditions and cultural heritage of the listed activities must be measured, examined, evaluated, and reported to the competent authority responsible for awarding the appropriate environmental authorisation mentioned by this act (Townsend, 1996).

It is relevant to comprehend the framework of section 23 (1) of the NEMA which has, as its objective as, to encourage the formulation and implementation of suitable environmental management instruments that guarantee the integrated management actions. This section stresses that integrated environmental management is the overarching, broader, functional aspect of managing activities, which impact on the environment, and, within which specific tools are applied, so that the impact can be assessed (Couzena and Dent, 2006). The general objectives of integrated environmental management, as stated in section 23 (2) of NEMA cited from DEA, (2010: 45) is listed as:

i. "to promote the integration of the principles of environmental management into the making of all decisions which may have a significant effect on the environment,
ii. to identify, predict, and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequence and alternatives and options for mitigation of activities, to minimise negative impacts, maximise benefits, and to promote compliance with the principles of environmental management,
iii. to ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them,
iv. to ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment,
v. to ensure the consideration of environmental attributes in management and decision making, which may have a significant effect on the environment,
vi. to identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued by the principles of environmental management."

The environmental strategy offers an innovative structure for NEMA to concentrates more on a system-based approach to water management. It offers an alternative to conflicts of sectors competing for water, with a strategy of sustaining the core of the environment by involving all the stakeholders and the consumers of the assets to develop a collective stance and joint action (Leendertse et al., 2008). Such a strategy to water administration considers multiple levels of intervention such as safeguarding the up course of catchment areas, pollution control and minimising ecological exploitation (Leendertse et al., 2008).

2.9.3 Water Service Act 108 of 1997

"The Water Service Act (WSA) is the fundamental governing framework for water services institutions, which are primarily municipalities, giving effect to the Bill of Rights by providing access to basic water supply and sanitation services that are necessary to secure sufficient water, and an environment that is not harmful to human health or wellbeing" (Algotsson et al., 2009: 2). To realise this goal, the WSA stresses that water service providers promote effective water resource management. The government must preserve the quality of water resources and guarantee their sustenance in the interests of all water consumers, thus administering water using an integrated approach (Coning et al., 2004).

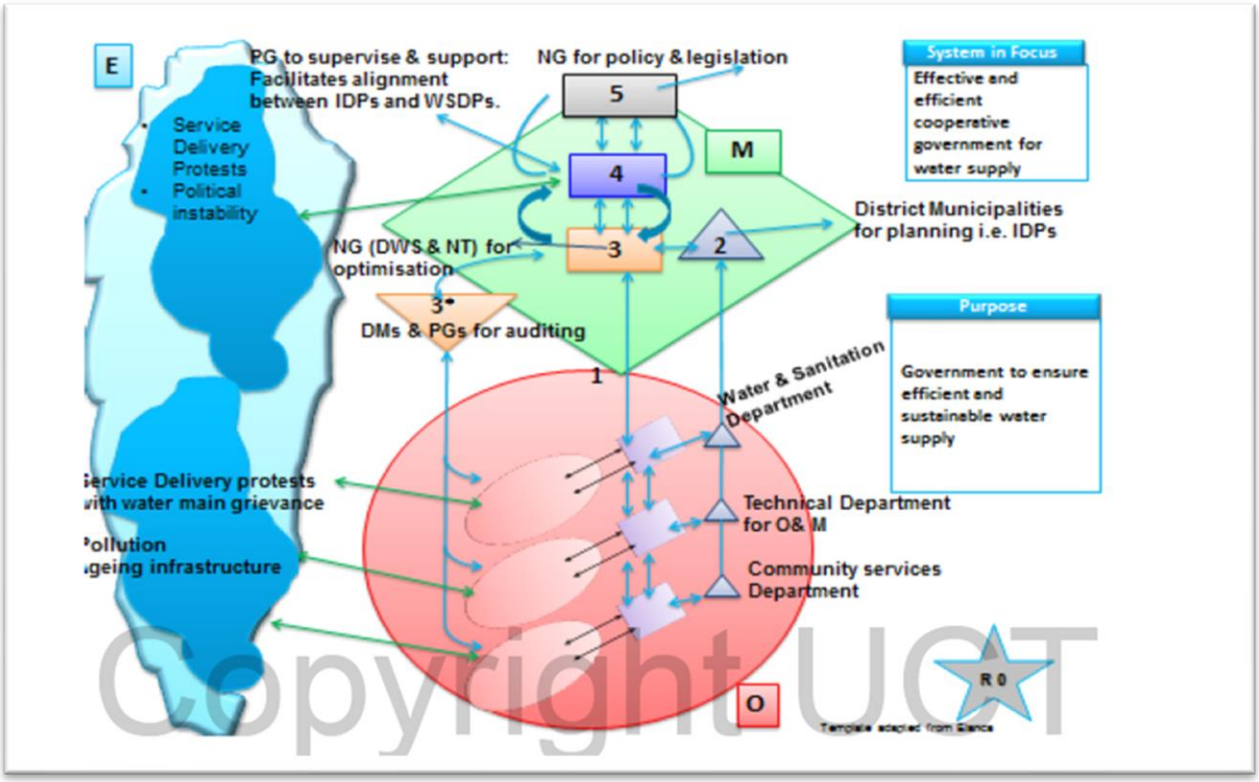
To guarantee that water resources are administered in a way that balances quantity, quality, dependability, and consistency, Section 9 of the Act authorised the Minister to recommend mandatory and binding national benchmarks and requirements relating to the water service provisions. In brief, the WSA of 1997 (Act 108 1997), stresses the right of access to basic water provision and sanitation and strive to safeguard water assets, and promote development for individual welfare. (Gabru, 2005).

The three tiers of administration need to comply with the standards of cooperative governance in providing water and hygienic services. The act stress that routines different from the inclusive management of the assets must be carried out in a way that is in agreement with the broader objectives of sustainable water management, and that water provision and hygienic services are not provided in "monopolistic or near-monopolistic circumstances", the welfare of the user and the fundamental

objectives of public policy must be encouraged (Mckenna, Kelly, Donahue and Matte, 2009).

The Act recognises that there are commitments and obligations on all three layer of administration to guarantee that water provision and hygienic services are delivered in a way that is effective, impartial, and sustainably; that all layers of management are duty-bound to ensure that water provision is adequate for small- and large-scales economic production, within the requirements of sustainable development (Mckenna et al., 2009). The Act sanctions the national DWA functions as a guardian of the country's water assets, and places responsibilities on the WSP to take practical and realistic actions to achieve the bill of rights stated in the constitution. The primary goal of the act is to assist the local administrations in performing their roles as water providers, and to attain the constitutional mandates of upholding and protecting the welfare of the public (Brettenny and Sharp, 2017). Figure 2.7 reveals the fundamental roles and responsibilities of WSA of 1997.

Figure 2.7 diagrammatic reflection of Water Service Act of 1997



Source: IELRC, 1997 and Debbile, 2017

2.9.4 National Water Act 36 of 1998

"The National Water Act (NWA) gives effect to the post-1994 water law reforms and is a significant piece of legislation to develop the principles of efficiency, equity, and sustainability within the water sector" (Algotsson et al., 2009: 2). The reforms introduced by the NWA require an equitable allocation of water to all water consumers, and it places importance on managing the effects of water use on the land, especially the water environment and resource. The NWA identifies eleven types of water use which may have a detrimental effect on the water resource. Water uses in sections 21(f), (g) & (f), 62 that relate to the management of Wastewater Treatment Works (Folifac, 2007: 9).

In other words, the NWA (36, of 1998), strived to transform how water was controlled and managed, from a system of rights based on land ownership (the riparian system) to a system designed to allocate water equally in the public interest (Tewari, 2009: 703). There is the need to be a liberal redistribution of water to communities that were historically barred from accessing water to a system that assists in bridging the gap between the commercial and vibrant economies from survivalist and subsistent counterparts while sustaining prevailing beneficial water consumptions and promoting better competencies required in our arid nation (Boccaletti et al., 2010). The NWA (36, of 1998) superseded the Water Act 54 of 1956 (Water Act), stressed on the administration of surface water provision and capacity, giving precedence to the agricultural and industrial sectors. The prevalent element in the two distinctive of regulation is that they regulate water consumption via the granting of authorisations and water use licences, correspondingly (Schreiner, Sithole and van Koppen, 2017). The legislation established this policy firmly in the country water privilege, with the proclamation of the act. The preface of the NWA proclaims that water is a natural resource that belongs to all people (Viljoen, 2017: 191).

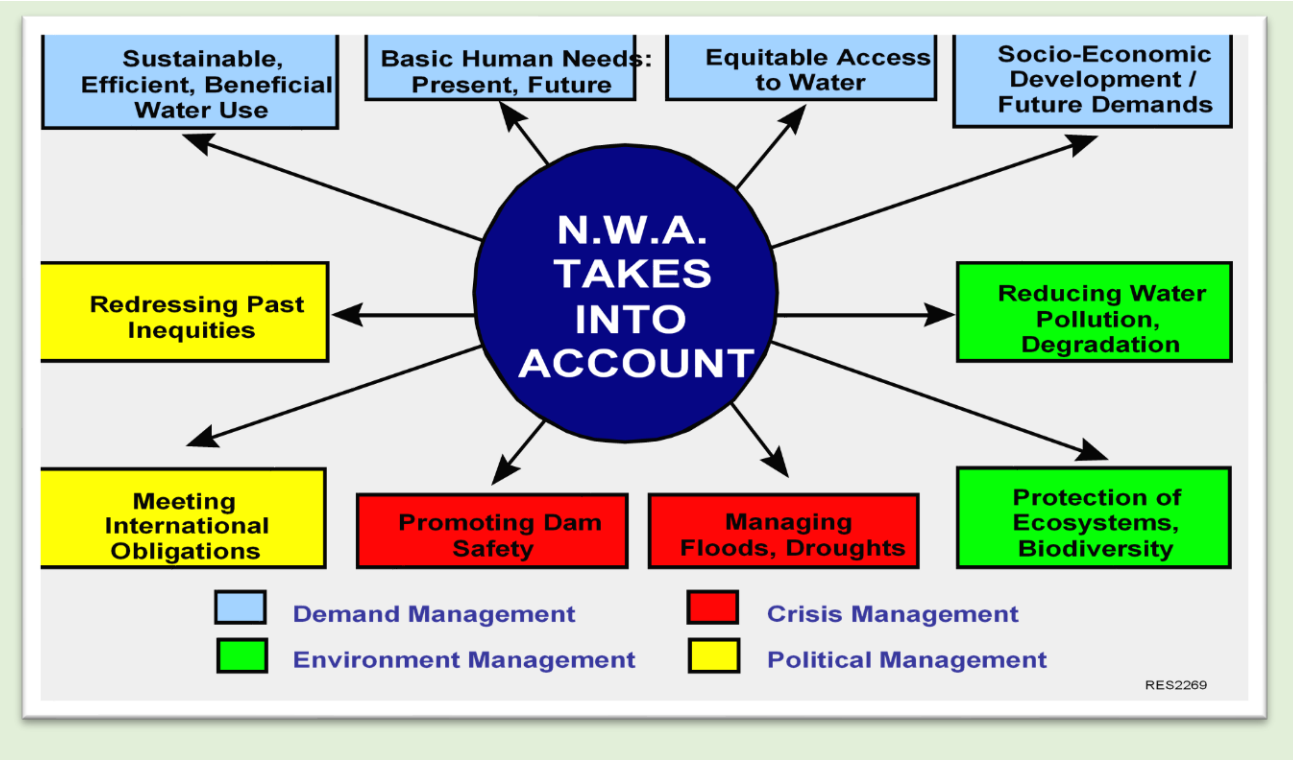
As the public trustee of the nation's water resources the National Government, acting through the Minister, must ensure that water is protected, used, developed, conserved, managed, and controlled sustainably and equitably, for the benefit of all persons, and by its constitutional mandate (Viljoen, 2017: 188). It further set rules and standards to monitor the discharge of wastewater or sewage. To realise the transformations, as under the principles of equality and sustainable use, the

NWA promotes water consumption with circumvention, control its use, transfers, and regulate of all water resources in South Africa (Mackay, 2013). The policy like NEMA also promotes the “polluter pays principle”, which is currently a global water management strategy. The restructurings in the water sector post-independence aimed at stressing the monitoring of government regulations overall water the water assets to determine the appropriate water management and consumption in the welfare of the population. Any breach of the requirements of the NWA is a crime punishable (Folifac, 2003; Coning, 2006 & van der Schyff, 2011).

In short, the political shift in South Africa generated an exclusive prospect with the mandatory governmental determination to transform past legislation and policies, to adopt the amalgamation approach to water governance regarding of volume and quality, sustainability, and groundwater, with robust prominence on equity and distribution and efficiency (Mukheibir and Sparks, 2003). The legislation and policies transformation procedures settled on essential values on wide and open stakeholders engagements prior to the enactment of NWA (36, of 198). Chapter 1 of the National Water Act 1998 (Act 36 of 1998) sets out the basic principles (Razzaque and Kleing, 2014). It states that "sustainability and equity are identified as focal guiding principles in the protection, use, development, conservation, management and control of water resources" (Razzaque and Kleing, Karodia and Weston, 2002). Molobela and Sinha (2009: 997) opined that “the constitutional decree relays explicitly to the nation's water resources and revolves primarily around the right of all people in the country to an environment that is not harmful to their health or wellbeing, and the right to have the environment protected for the benefit of present and future generations (this manifests in the emphasis placed on sustainable use), and the right to have access to adequate food and water”. Furthermore, Currie and Klaaren, 2007 & Corder and Mavedzenge, (2019) and Viljoen, (2017), mentioned the other less direct, but contributes substantially to the underlying public trustee's as legitimate binding mandate, which is the equality (which is a mandated requirement, that the Minister ought to ensure that equitable distributions are achieved); property, access to information, just administrative action, access to courts, fundamental values and principles governing public administration and the obligation to see to the adequate performance of municipalities are addressed (Viljoen, 2017: 188).

It can be highlight that all activities that endorse equal and sustainable water consumption, while giving precedents to all applicability constitutional requirements, is regarded as public interest (King and Reddell, 2015). Stated differently – "every person in South Africa has the right to demand that every action undertaken by the National Government that affects the nation's water resources, must promote sustainable and equitable water use while endorsing all applicable constitutional principles" (Tewari, 2009: 702). This privilege is held by the general population, and this informed the bill of right of section 24 of the constitution (Algotsson et al.,2009). This right acknowledges the fundamental human requirements currently and impending generations, and the necessity to safeguard water reserves, the necessity to share some water assets with other nations, the obligation to encourage social and economic growth through the use of water, and the necessity to create appropriate establishments to drive the agenda of the NWA (Mensah and Casadevall, 2019 & Cosgrove and Locks, 2015). Figure 4.8 summarises the critical components of the NWA (36, of 1998).

Figure 2.8 The core and critical components of the NWA of 1998



Source: DWS, (2008) cited from Schulze Roland: UKZN (2009)

2.9.5 National Water Resource Strategy of 2004 (1) and 2013 (2)

The NWRS of 2004(1) is a crucial document, and a legislative tool of executing and administering the NWA (36, of 1998). The 2004 (1), of the NWRS which is the first version that interpreted the basics and core components of integrated water resource management, and offered a detailed outlook of the water scenario in South Africa and the key interventions needed (Kahinda and Boroto, 2009 and Claasen, 2013). It is a binding document regulating and guiding all authorities and institutions involved in water sector management. In addition, it is a final document that stipulates the framework for the "protection, use, development, conservation, management, and control of water resources for the entire country". (Nkondo, van Zyl and Schreiner, 2012). In other words, it offers the guideline within which water is administered at regional or watershed areas in the confined of the water management zone.

Furthermore, this policy document provides relevant information about how the assets should be administered, and the organisations that should oversee its implementation and enforcement. It provides quantifiable data about the current and future availability, the conditions and demands for water in each of the 19 water management areas (Loucks and van Beek, 2017). The key components and drivers of NWRS of 2004 is its liberal decentralisation of the tasks, power of water administrators at catchment and the local levels and the water users associations (WUA). The establishments, representative of WUA and other participants, are active participants in the administration of water reserves at the local levels. This presents the DWS opportunity to move away from the multiple player roles such as operator, formulator, controller, and enforcer to the leader of a sector with responsibilities of policymaker, supervisor, and overseer (van Berg, 2013).

Add to the above, the NWRS of 2004 affords opportunities for the effective teamwork and corporation among various institutions in every level of governance involved in the water sector. The policy document is an evolving National Spatial Development Framework, which assists in bestowing an improved comprehension of water as input on the growth of all sectors of the economy. This document, not only stresses on integrated water management, but also emphasises on water preservation and procedures to enhance better efficiency in water consumption,

and frameworks that promote the backing that must be offered to realise these objectives (Palmer et al., 2016 & Molobela and Sinha, 2011).

In brief, the NWRS of 2004(1) has accomplished many successes in water management in South Africa - notable ones include; operative and resourceful planning and infrastructure upgrades which is the bedrock of South Africa's economy and social upliftment, enhancement of intervention programmes such as the execution of water distribution restructuring, water protection and demand management, water reserve security and mediations to enhance governance, expansion in the knowledge and awareness and the insights of future water demands and supplies, and increased provision of information as a general requirement for transparent and accountable management of water resource.

Nevertheless, the NWRS of 2004 has some significant weaknesses in its implementation, among them: limited implementation of water conservation and demand management, limited implementation of water allocation reform to redress past racial and gender imbalances in access to water for productive uses, the inadequate establishment of water management institutions and decentralisation of water management, inadequate regulation of water resource and compliance monitoring and enforcement, scarcity of technical and management skills to implement the National Water Act, and poor integration of monitoring and information management (Peters, Woodhouse, 2019: 862).

Based on these weaknesses and shortcomings of the NWRS of 2004 (1), a new NWRS of 2013 (2) was formulated in 2012, and implemented in 2013. Cited from Bylis (2016: 14), "the NWRS of 2013 (2) focuses on equitable and sustainable access to, and of water, by all South Africans. Equity and redistribution to be achieved through the authorisation process, and other mechanisms and programmes, such as water allocation reforms, financial support to urban and rural economic development initiatives". Furthermore, the NWRS (2) seeks to address these three main objectives, namely; "to ensure that water supports the development and the eradication of poverty and inequality, that it contributes to the economy and job creation, and that it is protected, used, developed, conserved, managed, and controlled in a sustainable and manner"(Baylis, 2013: 14).

The NWRS2 was formulated within changing circumstances. It recognises that monitoring and accumulating relevant information may not only impact on the

detailed appraisals of the water situation as well as the degree of water challenges in the country but vastly enhance the formulations and implementation policies and strategies as well. The National Water legislation (NWL Section 68 of Water Services Act) requires the Minister of the sector to disclose the national data and information and to make available statistics evidence from the databases, implementation, and monitoring of national policies. The monitoring must not be carried out merely for administrative purposes, but to address pragmatic challenges relating to trans-boundaries river flows. Nearly 60 per cent of the country's rivers are jointly used through trans-boundaries rivers and streams. This policy stressed that IWRM must be applied in a way that corresponds to global water practices and agreements, while at the same time meeting the requirements of the regulations overseeing water governance in South Africa (Nkondo et al., 2012).

In addition, NWRS2 actively encourages technology and modernisation that contributes to effective problem solving, and meet the requirements for water safety and wellbeing of people, societies, productivity and efficient consumption of water, as well as protect the ecosystem (Harris, Balfour, Zwinkels, Gobel, van Heyningen and Frame, 2018). This policy strategy further promotes the development of a clear regulatory framework for water resources and coordinating regulatory standards and processes with other government departments. Compliance monitoring and enforcement are the major priorities identified by the strategy, and legal, financial and forensic capacity developed to ensure effective prosecution for the ultimate protection of South African water resources against any illegal action by institutions, or persons, in contravention of the required quality and quantity standard (DWS, 2012: 30).

The regulation of the sector under this policy is to safeguard that standard values and principles set up to preserved, and to comply with the governing requirements of the Policy. The objectives of the sector and the country must be maintained within the integrity of the NWRS of 2013, and all enacted policies and regulations that have effects on water reserves in South Africa (Molobela et al., 2011). Additionally, this policy underscores that the realisation of these goals and objectives will demand backing from robust institutions, knowledgeable and competent workforce with the indispensable capital to carry out the vision (Nkondo

et al., 2012). A funding strategy outlines, with a financial capital backing to implement all essential programmes, are required to execute this strategy effectively and efficiently. This can be achieved within the backdrop that the state, developmental organisations, private institutions, and other donors collaborate to provide the financial to backing to water governance in South Africa (Ruiter, 2013). Furthermore, NWRS2 stipulates the expertise, capabilities and the know-how are required to support effective enactment, and delineates the approach that must be incorporated to promote and improve competency levels of employees (SHRM, 2012). The policy further stresses on the teamwork and cooperation with different skills training establishments, including tertiary institutions and further education & training (FET) colleges. Capacitating of employees, and shared strategies must be maintained in the "water sector skills task team (WSSTT)", which must function under the umbrella, the "water sector leadership group (WSLG)", to find out the skill weaknesses, and to formulate the necessary training programmes and materials that improve proficiencies of the workforce at different levels (Vienings and Lima, 2015).

2.10 Conclusion

From the literature presented above, it is evident that within the global, regional and national context, challenges arise as a result of complexities in policies governing water resource management (Kahinda et al., 2009, Molobela et al., 2011, Palh-Wostl et al., 2013 & Meissner et al., 2014). Water insufficiency and water quality deterioration are increasingly becoming pervasive problems in most areas around the globe. The justifications are the significant upsurge in the global water withdrawals. In the past century, the global extraction increased from 600km^3 to 3900 km^3. These were as a result of explosion in population growth and improved living standards, combined with questionable formulations and execution of water management policies (Hinrichsen et al., 2012 & Kahil et al., 2014). The exploitation of water assets and reserves present a significant menace to human water security and ecological sustenance throughout the world, which thus far has been addressed through substantial capital injections to guarantee water security in both developed and developing countries. Nevertheless, the destruction to water assets and the ecology are scarcely taken into consideration (Vorosmarty et al., 2010).

The literature discloses that till date, quite a few comprehensive studies exist regarding water policy assessment, in comparison with the numerous researches conducted on water resource management. While water resource management unearthed the consumption and the development of water resources in an effective, ecologically good, impartial and realistic way to gratify communities' demand for the resource, it is equally critical to remember that water policies and programmes are essential tools within efficient IWRM, and need to be scrutinised and comprehend to promote effective governance and decision-making, and to assist in identifying priority areas for action (Herbertson and Tate, 2001 & Loucks et al., 2017).

As noted in the literature review, "water policy and governance relate to the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and the delivery of water services at different levels of society" (Rogers et al., 2003: 15). Alternatively, more concisely, water governance are sets of structures which regulate decision-making about water resource development and administration. Therefore, water governance is a lot more about how decisions are made- "how, by whom, and under what conditions decisions are made than the decisions themselves" (Batchelor, 2003). It deals with how the distribution of the assets and controlling strategies are applied in the administration of water and other related assets, and generally incorporates into both formal and informal establishments by which power is applied. The comparatively new expression for reviewing this blend of formal and informal establishments is distributed governance (Ferragina, Marra and Quagliarotti, 2002). Water policy analysis, in the form of democratisation and stakeholder's participation in water management, are areas which are underdeveloped and have been neglected by decision-makers and other scholars. The limited capacity of government departments and other organisations to work together is a significant constraint to water management and governance (Tropp, 2007).

Government institutions and groups, tasked with water resources management, do not necessarily comprehend activities, agencies, commitments, concerns, and financing of other agencies. Even in situations where agencies are willing to search for cross-sectoral strategies to water administration, the composition of interdepartmental collaboration is strictly constrained. There is no appropriate

configuration for “cross-pollination” among departments and, at times, between sections within the same organisation (Bliss and Bowe, 2011). Furthermore, cooperative procedures are usually restricted by official procedures and “red tape”. This fragmentation of responsibilities among these agencies and institutions hinder harmonisation and hinders efforts to amalgamate policies to manage water resources effectively. Consequence, there is a necessity to develop and adapt approaches, strategies and tools that are in the context of decentralised decision-making, stakeholder’s engagement and transparency that will lead to more democratic water management (Bliss et al., 2011).

The literature further explored different evidence to support the argument of why different policies and strategies have been unsuccessful in achieving the desired outcomes of water security in many developing countries, including South Africa. Categorically identified in the literature is a lack of democratisation in water governance, and a limited platform for different stakeholders to voice their views, which must be supported by the department. At the strategy, the study uses substantiation obtained from an interpretivism paradigm to contend for environmental and integrated water policy framework, which guarantees that if proper governance structures are in place effective water management can be achieved.

The final consideration in the literature demonstrates that the DWS operates several monitoring schemes that accumulate some of the essential facts and evidence. Nevertheless, the techniques established functioned, mainly in ‘silo’ from one another. Spatial coverage is inadequate and imperfect, and, as a result, little or no data is assembled in some sections. Challenges are also being felt with the value and consistency of the data. While efforts have been made, the propagation of, and accessibility to data, have not been effective or incomprehensive. Accessibility to appropriate information from institutions such as national, regional, and local administrations, water boards, private institutions, and water consumers, remained a major challenge. The challenge of decision-making in the circumstance of uncertainty concerning climate variability and water demand remained unpredictable. In this context, much of the literature concurred that the history does not assist as a correct guide for the future, based the degree of questionable water policies, unsustainable practices, degradation in water quality,

social and economic challenges. These challenges include changes in rainfall patterns, environmental degradation, infrastructure degenerated, and population explosion.

In order to address these deficiencies and weaknesses, all the prevailing strategic monitoring and appraisal structures must be amalgamated into coherent, monitoring, evaluation, and data organised schemes. The implementation of participating strategies that are more emboldening must be considered. Efforts must be directed towards affording opportunities for societies and grassroots organisations to be part of the decision-making process. Also, strategies for effective water management must take into account the availability capital such as human and financial resources. The human resource must be developed around planning and monitoring at the communities' level.

Based on the above analysis, this research analysed the combined insights from the inclusive governance strategies, delineated in two discrete methods. First, it comprehended the prevailing water policies, and their effect on key participants, in the water sector. Second, it stipulated the theoretical framework of understanding the obstacles connected in addressing water security through sustainable water management in some provinces within South Africa. Thus, combining these two analytical theories provided the researcher with the necessary understanding required to scrutinise the present-day issues, and impending challenges that water governance in South Africa. In addition, the study added to the existing literature on the fundamentals that adhered to by policymakers seeking to achieve water security through IWRM framework in South Africa and globally.

CHAPTER THREE

METHODOLOGICAL CONSIDERATIONS

3.1 Introduction

This chapter considers the research design and data collection instrumentation. The chapter also provides a full description of the research paradigm and methodologies that were used in collecting data and the evaluation thereof, so that the objectives of the study could be accomplished. The research methodology and design have a substantial impact on the quality of the research outcomes. Saunders, Lewis, and Thornhill (2009: 67) defined methodology of research as the "theory of how the research should be undertaken, including the theoretical and philosophical assumptions upon which research is based, and the implications of the research methods adopted". This study is grounded on both quantitative and qualitative approaches, and made use of the secondary data analysis as well as a primary instrument which entails interviews, and questionnaires for collecting data. The chapter commences by deliberating on the research philosophies and methodological viewpoints which explained the selection of the research strategy. This is followed by an exploration of the study groups, sampling, and data collection strategies. Typical issues, such as legitimacy and dependability, are also deliberated in this chapter.

3.2. The Philosophical Considerations

A research paradigm is a critical component in a research methodology because it reflects research as the search for truth (Kivunja and Kuyini, 2017). The aim of the study is not merely the collection of facts, but also the development of understanding and the acquisition of insight. Research paradigms assist in building on knowledge steadily so that the picture of reality is enlarged and expanded, and the depth of understanding increased (Cooper and White 2012). Mora, Steenkan and Raisinhani (2012), asserted that a researcher who applies paradigms and philosophies at the beginning of a study could inform a methodological choice, develop the appropriate theoretical basis in the field of research, and provide the formulation of generally valid theories to form the theoretical basis of the discipline. Research paradigms also influence research design, research methods and data collection strategies (Makombe, 2017).

For this research, some fundamental philosophical paradigms were considered. Philosophical paradigms such as positivism, interpretivism, critical, and creative paradigms were analysed by the researcher for methodological choice. For instance, creative philosophy focuses on language as a structural influence on social life and its role in defining social reality (Gaut, 2010). Positivism, by definition, is "a systematic way of doing research, which emphasises the importance of observable facts" (Alakwe, 2017: 41). Positivists are of the view that social realism can be studied independently of the researcher. They further indicate how researchers should approach social reality. Babbie (2011) indicates that the genesis of positivism can be tracked down to Auguste Comte (1798 – 1858), who observed human beings as a phenomenon that needed to be studied scientifically. Positivism, therefore, is a method to social research that requires the application of the natural science model of research as the point of departure for investigations of social phenomena, and the justifications of the social world (Denscombe, 2008:14; 2010b:120).

The Positivist defines a worldview to research, which is based on the scientific method of inquiry. Alakwe (2017), is of the view that positivism hangs on scientific interpretations that lean themselves to statistical examination. It has an "atomistic, ontological view of the world as including distinct, noticeable features and events that relate in an observable, determined, and unvarying manner" (Aliyu, Bello, Kasim and Martin, 2014: 83). Positivism is often associated with a quantitative research method. For this logic, positivists prefer an analytic explanation of calculable data (Thomson, 2015). A positivist is of the view that real events can be perceived as empirically and clarified with scientific scrutiny. Zukauskas, Vveinhardt and Andrivkaitiene (2018: 6) argue that positivism is directly linked with the experimental model. This model formulates laws that apply to the population of the study. These laws substantiate the bases of visible and quantifiable behaviour. Positivists are of the notion that an unbiased actuality exists beyond as individual understandings together with its cause-and-impact relationships (Aliyu et al., 2014)

Caldwell (1980) concurs that positivists use scientific theories in postulating hypotheses, which are subjected to empirical testing. This seeks to suggest that science is empirical, starting from specific propositions from universal explanations

of reality. A hypothesis is, therefore, established to assist researchers in subjecting the hypothesis to rigorous experimental examination for accepting, refuting, or revising the interpretation. In evaluating the validity of a scientific theory, the researcher takes into consideration whether the information gathered (i.e. theory-based predictions) is reliable with the data obtained. Positivism research encourages experimentation to determine the realities of the study to eliminate the complexity of the external world. In addition, (Scharff, 1989), affirms that positivism is associated with the creation of laws that are universal to all study. Cohen (1980) and Heidtman et al., (2000) contend that the main aim of positivism is to seek generalisations (theories). The arguments are, however, affiliated to natural science laws that are not necessarily appropriate to social structures. In all, positivism "*equates legitimacy with science and scientific methods*" (Ferrarotti, 1999: 538).

Critical philosophy is characterised by sensitivity to the power relations which mediate and influence behaviour, principles, and practices (Kauffman et al., 2008). Feminist philosophy is preoccupied with demonstrating the status of male-dominated current academic research in the social sciences is. They argue that the male-dominated study presents social reality only from the viewpoint of men, with women being mostly invisible and marginalised (Sabbarwal, 2000 & Parpart et al., 2000). While a Marxist research philosophy looks at understanding aspects of social change and struggles between classes in society (Rummel, 1998), it is essential to note that Sale Casarotto, Bucciarelli and Losacco (2002), as well as Khaldi (2015), point to the fact that different research philosophies can be conducted using quantitative and qualitative methods. Though all these paradigms may be useful, to a certain degree, in analysing and interpreting data in this research.

Nevertheless, for the purpose of this research, the interpretivism paradigm and pragmatic worldview were mainly employed. The interpretivism paradigm can be traced back to "Edmund Husserl's (1859 – 1938) philosophy of phenomenology (the study of human consciousness and self-awareness, and to the German philosopher Wilhelm Dilthey's (1833 – 1911) philosophy of hermeneutics (hermeneutics is the study of interpretation and was expounded upon in later years by Martin Heidegger (1889 – 1976) and Max Weber (1864 - 1920)" (Mackenzie and Knipe, 2006, Kelliher,

2005 & Ponolis, 2015). The critical element of interpretivism is based on how humans interpret their reality through social interaction and explain the meaning of something from a specific view. Interpretivism underscores the relevance of insiders' perspectives to comprehend social reality (Chowdhury, 2014). Interpretivism is linked to thoughts that provide insight into the world as others understanding or experience it. Interpretivism is different from the positivism on theories regarding the nature of realism, what is assumed as knowledge and its sources, principles, and their role in the research method.

Interpretivism further argues that researchers should be responsive to the social perspective in which meaning is generated. "Social realism is thus approached from the perspective of human beings who actively construct this reality" (Mason, 2002: 62). Interpretivists argue that knowledge is subjective because it is socially constructed and mind-dependent (Kivunja et al., 2017: 33). Fieser and Dowden (195) further asserted that "truth lies within the human experience. Statements on what is right or wrong are, therefore, culture-bound historically, and context-dependent, although some may be universal. Within this context, communities' stories, belief systems and claims of spiritual and earth connections find space as legitimate knowledge".

In line with this research, interpretivism is used to demonstrate the relevant application of the qualitative approach for enhancing comprehension of complicated and contentious issues, and to highlight some water policies constrains in South Africa. Besides, this paradigm was remarkably helpful in gaining some understanding of sophisticated and technicality in the water administration challenges. In this context, this translates into a gathering of useful data and knowledge through inductive qualitative research approaches, such as structured and in-depth interviews, and content reviews. In brief, interpretivism in this research is "qualitative and applied", thus data was gathered through structured and in-depth interviews, shared impressions, concerns, and devising solutions through broader engagement with experts in the water administration society. This paradigm is coherent with strategies for interview surveys explained by Bailey (1994) to acquire unambiguous participants expressions to communicate and share thoughts. Cited from Null et al., (2012) Ferreira et al., (2005), explained how this paradigm was used to interviewed 89 sample population on how the

strategic water model in California was developed, and solicited a variety of ideas and suggestions from technical experts within the State of California. Connick, Innes, Kaplan and Booher (2006) also applied an interpretivism method to enhance the understanding of the collective decision-making process in California on water management in San Francisco and the Sacramento Area Water Forum.

In line with the practical examples enumerated, this philosophical principle was used by the researcher mainly in dissecting the first and third objectives of the study, which relates to identifying the current policies and programmes aimed at achieving water security in South Africa. The paradigm further assisted in analysing the relevance, practicability and applicability of the current policies and programmes to the water challenges in South Africa today. For instance, the questions for this research are mainly the 'open-ended', descriptive, and non-directional. This afforded the participants to share their views on issues of water policies, their impact, and challenges of accessing water in present-day South Africa with the researcher.

Secondly, the interpretivism approach assisted the researcher in understanding the perspective, or settings of the respondents, by visiting and collecting data individually. It helped in interpreting the findings, a phenomenon that moulded the researcher's own experience and backdrop. The interpretative methods gave the study enormous knowledge to respond to the matters of influence, challenges and to interrogate issues such as "why and how", and about strategies designed to tackle current challenges such as climate change and water security in South Africa post-independence. Understanding the views and thoughts of water administrators and managers is significant since the collection of specialists are heterogeneous.

Collections of people formulate policies, so it assists in comprehending their thought. This is particularly valid for individuals who are figureheads in their disciplines, whose views and suggestions carry substance among associates, political heads, and the general public. The opinions of the experts engaged for this research highlight area where agreement might prevail among and between sectors that constitute different groups and experts, and where differences in opinion and judgements hindered decision-making. Comprehending how water experts contribute implies that similar group experts might collaborate, as well as parties

with contrasting opinions, must bargain to reach a consensus. This form of communication and experience assisted the researcher in understanding individuals and groups, and ultimately, how policies are formulated and rectify in water management a vital component of this research.

Another paradigm used in this study is pragmatism. Pragmatism is derived from the work of Peirce, James, Mead, and Dewey (1974) and Cherryholmes (1992). Other writers of this philosophy include Murphy (1990), Patton (1990), and Rorty (1990). (Kaushik and Walsh, 2019: 3). Pragmatism exists in many forms, but out of a lot, pragmatism as a worldview arises out of actions, situations, and consequences rather than antecedent conditions (as in post-positivism) (Kaushik et al., 2019: 3). The term pragmatism is originally taken from the Greek word 'pragma', which means action, and which is the central concept of pragmatism (Kilpinen, 1999: 4). Elkjaer and Simpson (2011: 4) disclosed that "pragmatist philosophy holds the view that human actions can never be separated from the past experiences, and from the beliefs that have originated from those experiences". Human perspectives are inherently connected to the action. Individuals conducts are grounded on the potential outcomes of their actions, and they use the outcomes of their conducts to anticipate the implications of comparable conducts in the future (Kaushik et al., 2019).

The main contention of pragmatist philosophy is that the connotation of human conducts and opinions is based on the outcomes. External forces do not determine humans; they are themselves capable of shaping their experience through their actions and intelligence (Wang, 2015: 59). Pragmatists hold the belief that reality is "not static—it changes at every turn of events". Correspondingly, the world is also not static"—it is in a constant state of transition. The world is also changing through actions—action is the way to transform reality. Actions have the responsibility of an intermediary. Therefore, actions are crucial in pragmatism (Wang, 2015: 56). Patton (1990) argued that there is an apprehension with applications—what works—and answers to challenges. Rather than concentrating on techniques, researchers should emphasise on the questions of research, and should apply every method at their disposal to understand the problem.

Central to the application of pragmatism is the formulation of strategies which can best answer the research questions this means integrating the outcomes of both

quantitative and qualitative data (Creswell, 2013, Creswell et al., 2010 & Morgan, 2014). The prominence here is the approach that the researcher finds suitable to deal with the hypothetical questions effectively, instead of the techniques 'per se' (Teddlie and Tashakkori, 2009; Creswell and Plano Clark, 2011). As a philosophy underpinning the mixed approach, Morgan (2007), Patton (1990), Tashakkori and Teddlie (2009) conveyed the significance of concentrating interest on the study problem in social science research and then applying different methods to obtain knowledge about the problem. Pragmatism includes a healthy dose of pluralism, by which we mean that it is not logically contradictory to claim that quantitative and qualitative research are both useful, even if they appear to be contradictory; perhaps what is seen as contradictory are different perspectives that are complementary and enable one to more thoroughly to see his or her world (Brierley, 2017: 5).

In short, pragmatism provides a rational base of research: First, pragmatism is not obligated to single paradigm research. It leans itself to a mixed approach of research. This suggests that it derives freely from both quantitative (positivism) and qualitative (interpretivism) conventions in dealing with research. Second, researchers have the liberty to choose. This means the researcher has the freedom to select the approach, method and techniques of analysis that best suit the goal and the objectives. Third, pragmatists do not see the world as an outright harmony. Equally, mixed techniques researchers look to numerous methods for gathering and analysing data instead of confining to one strategy such as "quantitative, or qualitative" and, the pragmatist researchers consider "what and how" to conduct the research, grounded on the anticipated outcomes thus, what they intend to achieve and where they want to go with it. Mixed approach researchers ought to identify determination for their blending, the justification for their purpose; thus, why quantitative, and qualitative data ought to be incorporated in the first place. Based on the operational challenges existing in water management, the lack of public participation and engagement, ageing infrastructure, the inadequate funding, operational and maintenance challenges, destruction, burglary, exploitation and attitude of non-payment for services among many South Africans, and the desire to address the specified objectives effectively, the pragmatic worldview was deemed relevant in the study. The pragmatic paradigm allowed the researcher to design a triangulate method of data collection.

The triangulate approach assisted the researcher to integrate qualitative and quantitative strategies to acquire data relevant to the current challenges of managing the water resource, and to scrutinise the strengths and weaknesses of the existing policies in water governance, as well as dissecting structural reforms needed in achieving water security in South Africa. The qualitative component propelled the data collection to be more transparent, flexible, and adaptable, and not confined to technicalities or jargons. In this regard, the data collection was an iterative process; thus, a flexible and non-sequential approach. The quantitative design assisted in identifying the scientific theories and knowledge involved in water management, the combination of choices accessible to the provision the large demands of water for equal distribution of water and the impact of water resource to economic development, the interactive relationship between different actors to create opportunities and solve problems and the regulatory framework, and the involvement of different role-players participating in water governance.

3.3 Research Design

Research design is defined by Babbie (2007: 21) as, "A set of decisions regarding what topic is to be studied, among which population group, with what research methods to focus on in the perspective of a particular study." This definition implies that research design is about the product of the research and the steps to be followed in arriving at the anticipated outcome. Hence, based on this definition, the research design for the topic under discussion was to assess at the end of the study, whether the current policies and programmes are achieving water security, or not.

Typically, water policies and programmes comprised of interpersonal and inter-organisational relations that connect participants involved in policymaking, both "horizontally", that is, traversing departments, and between cities and rural communities; and "vertically", namely from local, national and to global levels (Tropp, 2007). Efficient policies and programmes need appropriate official and unofficial measures to improve "joined-up" decision making by institutions at various levels and scales (Grigg et al., 2011). From a policies and programmes standpoint, government institutions are definitely not the only, or inevitably, the most important actors: non-government institutions, for instance, the private companies and civil organisations, often contribute differently, but substantially in

water management (Bulkeley, 2005). Based on the various literature on water management and practical coordinated activities across different sectors and scales have contributed to a drastic pragmatic sustainable of water governance (Meissner et al., 2005, Weston et al., 2016, Carden et al., 2016). These transitions require four suitable and innovative strategies that ought to exist in any form of water management; these include:

(a) structure of the problem in question, to develop a long-term sustainability vision established and organised the transition arena;

(b) develop future water management visions, a transitional agenda that derive the transitional relevance path;

(c) create and carry out transitional experiments that mobilise the outcomes of transition networks; and

(d) monitor, evaluate, and learn lessons on management experiments that depend on the transition making adjustments to the visions, agenda, and coalitions towards water management (Olsson et al., 2006; Loorbach, 2010; Bornemann et al., 2011).

In identifying the research methods that would be most appropriate in this study, and to ensure that the objectives set for the study are grounded and reach a desirable conclusion, the researcher opted for the mixed research method, with emphasis on qualitative and quantitative design.

Qualitative research is grounded on an inquisition procedure of comprehension established on distinctive methodological conventions of investigation that delve into social or human challenges. This study is based on complicated, inclusive analysis statements, articles, comprehensive perspective of participants. Again, the study was conducted in a natural background. This was based on Denzin and Lincoln (2000:186) analogy of qualitative research which state that, qualitative research is naturalistic; it attempts to study the everyday life of different groups of people and communities in their natural setting; it is particularly useful to study educational settings and processes. In other words, qualitative research encompasses an interpretive, naturalistic method to its subject matter, to make sense of, or interpret phenomena, in terms of the meaning people bring to them. This was emphasised by Haradham (2018: 27) he highlights that qualitative research pursues to investigate and to discover matters about the challenges at hand, which often are not known challenges.

According to Myers (2009), qualitative research is intended to assist researchers to appreciate individuals, social and cultural backgrounds in which they dwell. Such research grants the complications and disagreements of situations-under-research to be scrutinised thoroughly and embodied (Philip, 1998). Arguing from a different angle, qualitative research offers a practical point of view through analysing human activities as its primary focus, and to comprehend human actions. Abutabenjeh and Jaradat (2018: 251) further referred to qualitative research methodology as the "methods for examining social research data without converting them to a numerical format". It is imperative to recognise that qualitative research is mostly applicable when the research questions do not readily lend themselves to quantifiable data. In other words, while quantitative analysis is grounded on the logical-positive paradigm, which utilises experimental research methods, qualitative research is underpinned by a phenomenological paradigm, which makes use of a variety of interpretive research methodologies (Best & Khan, 2006: 246).

A number of phrases, terms, and expressions, for instance, "ethnography, case study, participant observational and phenomenological", have been used to refer to the qualitative method of research. Nevertheless, Erickson (1986: 119) used the word "interpretive"; the term mostly and commonly used to describe this research methodology. This term refers to the entire family of methods that represent all the qualitative approaches, and to prevent the misunderstanding, "approaches are simply non-quantitative" (Goundar, 2012). Applicable to this study, however, is the content analysis and field research in the form of semi-structured interviews and open discussion, which were used to analyse different policies in water management, in post-independence South Africa. By adopting both content analysis and field research, a critical requirement was to get the research participants actively involved in the entire research process (Gaventa et al., 1993).

3.3.1 Justification for Qualitative Research Method in this Study

Different scholars and academics such as Roshan et al., (2009); Hammarberg et al., (2004); Lincoln et al., (2000); Creswell (2003) and Biggerstaff (2012) indicate that human learning and research are best studied using qualitative data. In selecting a research methodology, Maxwell (2012: 219) argues that it is appropriate to choose that paradigm whose assumptions are best met by phenomenon being

investigate. Yin (2011) indicates that qualitative research is primarily exploratory research. It is used to gain an understanding of underlying reasons, opinions, and motivations. It provides insights into the problem or helps to develop ideas or hypotheses for potential quantitative research. Qualitative Research is also used to uncover trends in thought and opinions, and to delve deeper into the problem (Creswell, 2003). Qualitative research seeks to investigate 'research questions' about individuals' and group experiences and perceptions, to come up with the substance of meanings, and to understand how particular phenomena are generated in particular socio-cultural and environmental contexts (Koutiva et al., 2016).

This study is about analysing data that involved information about stakeholders, perceived levels of water security, attitudes, fairness, levels of responsibility by the authorities, and other stakeholders, the importance of different groups in managing water, and strategic programs designed to achieve water security in South Africa. The key issue here is acquiring a holistic and broader understanding of water governance in South Africa. In order to achieve this goal, a conventional focus was on clarification and setting-specific information, in an effort to expound patterns and themes that build toward a localised theory that fits the data, understanding the perception of the population and water managers, and the description of the processes that characterised the policies.

Qualitative research is, therefore, more appropriate to provide the insight necessary to understand the participants' roles in the event, their perceptions, and experiences in water sector management. Besides, qualitative was deemed appropriate because the study seeks to establish an in-depth understanding of people's experience, and what drives decision-making in water management. This approach allowed the local knowledge and expertise to emerge from the local communities and organisations, which are well suited in describing how and why interventions should be incorporated in water management. The approach was also deemed relevant to examine water managers' practices, which involve day-to-day and long-term decision making within the water sector. The open-ended, semi-structured and in-depth qualitative methods, allowed the conversation to emerge as original, enabling a more detailed picture of the decision-making process. Thematic content analysis, with an interpretative phenomenological rationale, was

used to explore, in depth, the water consumers' meanings, perceptions, knowledge and social influences regarding household water consumption, water conservation, and water-saving behaviours and technologies.

3.3.2 Rationale for Quantitative Approach in the Study

Quantitative research, on the other hand, quantifies problems by way of generating numerical data, or data that can be transformed into useful statistics. In other words, quantitative research quantifies attitudes, opinions, behaviours, and other defined variables, and generalises results from a larger sample population (Creswell, 2003). This research method uses measurable data to formulate facts and uncover patterns in research. Quantitative data collection methods are much more structured than qualitative research. The purpose of quantitative analysis is to generate knowledge and create an understanding of the social world (Creswell, 2014). This research method is used by social scientists, including communication researchers, to observe phenomena or occurrences affecting individuals. Social scientists are concerned with the study of people. Quantitative research is a way to learn about a specific group of people, known as a sample population. Using scientific inquiry, the quantitative analysis relies on data that are observed or measured to examine questions about the sample population (Fowler, 2008). There are two broad classifications of quantitative research: descriptive, experimental, and causal-comparative (Leedy and Ormrod, 2001). The descriptive research approach is a primary research method that examines the situation, as it exists in its current state. This type of research involves identification of attributes of a specific phenomenon, based on an observational basis, or the exploration of the correlation between two or more phenomena (Williams, 2007).

For the purpose of this study, a quantitative research method was deemed appropriate for statistical analysis, the correlation between water demand and supply, and the quantification of the relationship between influential factors and performance. The quantitative research was also relevant for water accounting, such as cost-effective interventions, suitable technological interventions, the system for analysing water usage, dwindling and output of water resources, and the general and broad picture of water consumption and depletion of water resources in South Africa, post-independence (IWMI's Water Balance Framework).

Decentralisation of water management, thus, from central to a regional and local structure, was dealt with using a quantitative approach. The quantitative research method provided the researcher with the opportunity to analyse households' livelihood practices, such as agriculture and aquaculture, which are related to water management water. The quantitative approach gave answers on how households deal with water management in terms of reduction in their water usage, and their perception about operation and maintenance.

3.3.3 Justification for Mixed Method in the Research

Qualitative research is open-ended and allows contributors to form their responses. Quantitative research, on the other hand, is closed-ended, and requires participants to pick from response options that a researcher has formulated (Creswell, 2014; Ridenour & Newman, 2008). A mixed research method is basically a mix or combination of both quantitative and qualitative research techniques, methods, approaches, concepts, or language, into a single study (Chandigarh et al., 2015). Greene (2007) viewed mixed research as mixing mental archetypes and beliefs, and hence defined mixed research as incorporating multiple philosophies, values, personal understandings, theories, methodologies, and approaches in gathering and analysing data. The mixed research method gives shape and cohesion to, and broadens the possibilities of long-standing applications, of mixed methods. This gives a better understanding of outcomes because mixed research methods provide strengths that offset the weaknesses of separately applied quantitative and qualitative research methods (Creswell, 2007). It also encourages the collection of more comprehensive evidence for study problems; it helps answer questions that quantitative or qualitative methods distinctively cannot answer (Almalki, 2016 & Johnson et al., 2007).

A concurrent mixed research method was deemed appropriate in specific components of the study because it provides a more comprehensive and broader view of the water sector. The mixed research approach was relevant in scrutinising trends of household water use in South Africa, domestic water challenges, water pricing and privatisation of water resources, as well as policy management. This approach did not only assist the researcher to comprehend fully where and how water is consumed at homes, but why water is still regarded as a "common good". The mixed research was well-placed in investigating social practices, quantitative

on material infrastructure, the balance between water demand and supply, and cost intervention strategies. This approach was also relevant in understanding information on competencies, the socio-economic context of water resource, sectoral divergent, and to devise robust water management strategies in South Africa.

3.4 Description of the Study Sites

"Located on the southern tip of Africa, the Republic of South Africa stretches between the longitudes from 17^0 to 33^0 E, and latitude of 22^0 to 35^0 S. Namibia bounds the country on the northwest, while Botswana and Zimbabwe are located in the north, Mozambique and Swaziland are in the northeast. Lesotho, a landlocked country, forms an enclave within the Republic of South Africa" (Schulze, 2009). The South Atlantic and the Indian Oceans wash the relatively unindented coastline some 2,800 km long, west, and east respectively of the longitude 20^0 E. The Republic has nine provinces: Northern Province, Mpumalanga, KwaZulu-Natal, Eastern Cape Province, Western Cape Province, North Cape Province, North West Province, Gauteng, and Free State. The total land area of the Republic of South Africa is 1,223,410 km^2. Topographically, South Africa may be divided into four zones, the Plateau, the Escarpment, the folded Mountains and the Coastal Plain (Kahinda et al., 2009). Besides these, Kahinda et al., (2009: 6), reveals that "approximately 86 per cent of the area of the Republic of South Africa lies in the summer rainfall area. A narrow belt along the southern coast, some 4 million ha in extent, receives rain during all seasons. Thirteen million ha in the southwestern corner has a Mediterranean climate with winter rainfall and dry summer. The rainfall decreases from east to west, from over 1,000 mm in the east to 50-100 mm in the Namib and Namaqualand areas in the west. Barely one-third of the summer rainfall area receives more than 600 mm annual precipitation.

Evaporation throughout most of South Africa is high due to the semi-arid and arid conditions. The loss by evaporation from open water surfaces exceeds, by far, the average rainfall, ranging from 2,500 mm in the dry west to 1,500 mm in the more humid temperate regions. Furthermore, South Africa's rivers are small in comparison to those of many other countries. Furthermore, many of South Africa's larger rivers are internationally sourced. Eleven of the 19 water management areas in South Africa are facing a water deficit, a 'deficit' being defined as water demands

being more than water availability (Mwendera et al., 2003). To support this argument, Benoit (2019) argues that the population of South Africa has increased from 56,02 million in 2016 to 58,78 million in 2018, which is a 4,9 per cent increase, and hence more than double the 2 per cent water reserve that was theoretically available. Based on this statistical evidence, one would expect water demand to increase in proportion to population increase without significant intervention in water usage, which is the current situation in South Africa. The geographical position, climatic conditions, and history of the country, have all added to water challenges in different scales and magnitude.

However, for the purpose of this study, the researcher restricted himself and collected data from four study sites in South Africa, and this is illustrated in figure 3.1. These are Grahamstown in the Eastern Cape, Johannesburg in Gauteng, Cape Town in the Western Cape, and Bloemfontein in the Free State. Sites for this study were selected and measured against the principles of conservation, demands, and supply, governance, and management of the water resources. These fundamental principles include equity, sustainability, and efficiency (Rodina et al., 2016). These principles are the core objectives of water service management systems, which entails reliable supply to users in sufficient quality and quantity.

These principles informed the researcher to pick Grahamstown and Johannesburg. Grahamstown in the Eastern Cape, and Johannesburg in Gauteng, are significant in this study due to high levels of pollution and overexploitation of water resources. For instance, Gauteng in particular, accounts for 32 per cent of the national economic output, and is the commercial hub of South Africa (Turok, 2012). Mining activities account for most of the economic activities in the province, and has led to the industrialisation of the region. Based on these circumstances, Gauteng, particularly Johannesburg, continues to support an influx of humans to the area. Subsequently, the growth rate of the population is far higher than that of the other cities and regions in South Africa (Turok, 2012). This urban centre is among the worst in the country identified for pollution in the water resource (Scherman, et al., 2004). Most of the streets have dirty washing water (sullage) flowing in them, and sewage blockage is common. Water supply in Johannesburg and Grahamstown are constrained by drought, infrastructure backlogs, population growth, empty dams, power supply constraints, leakages, and non-payment by residents. It is, therefore,

critical to investigate the causes, the effects and to formulate alternative policies to achieve water security in these communities.

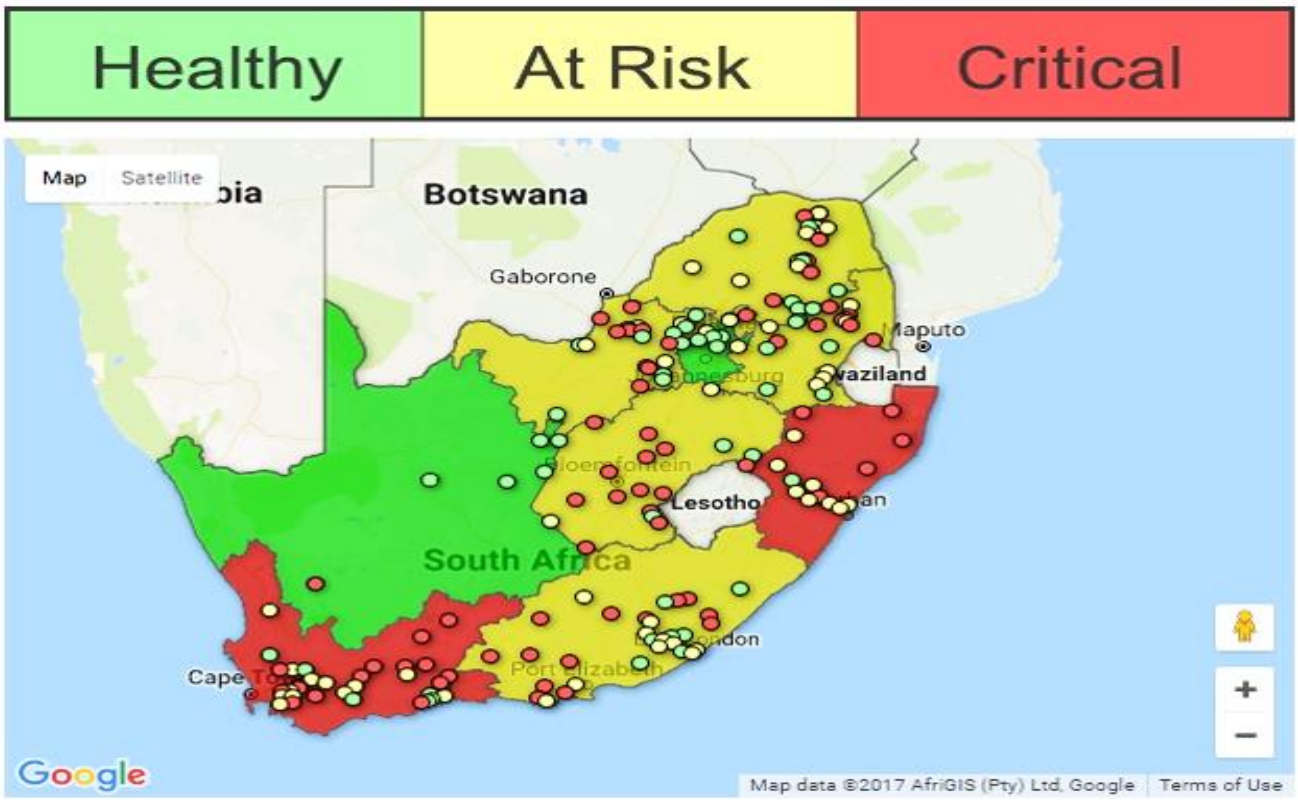
Cape Town and Bloemfontein are of significance to the research due to high levels of inequalities regarding access to safe water, rapid urbanisation and urban sprawl, widespread illegal water connections, decreasing water storage and abstraction, spreading of invasive alien species, poor agricultural practices, low levels of rainfall, and increasing periods of drought (Unkwandu, 2009). These drivers, together with broader implications of Western Cape and Free State Provinces declining water supply, which faces an imminent shortage by 2025, and the inability of the water resources in the provinces to cope with the massive population growth and high levels of pollution, have resulted in the degradation of water-related ecosystems and ecological infrastructure. Collecting data in these cities and town assisted the researcher in understanding the systematic, structural, and infrastructural challenges in providing water to the population. Figure 3.1 display a map of South Africa with the study areas.

Figure 3.1 Map showing the study sites that were used for this research

No water stress (South African Water Stress: 2030)

Low water stress (Based on CSIR Environmental Outlook, 2010)

Severe water stress



Source: Southafrica-info.com, 2017

3.5 The Sampling Population and Sample Methods

Sampling is defined as the drawing of a limited number of cases from the study population (Babbie, 2007: 190). Sampling must be done in such a manner that the selection of elements from the target population accurately portrays the total population from which the components are selected. There are two main categories of sampling: probability and nonprobability sampling. The probability sampling is a method whereby all elements in the study population have the opportunity of being included in the sample, and the likelihood that any one of them will be selected can be calculated. The probability sampling is made up of simple random, stratified, systematic and cluster sampling methods. Nonprobability sampling, on the other hand, is the method in which population elements are selected because of the researcher's understanding that they are representative of the population

available. Nonprobability includes convenience or accessibility, random, purposive, quota and snowball sampling (Vogt 2007). For this research, a nonprobability sampling technique was used to select the respondents; this, because the study did not employ a large-scale social survey. It is, therefore, appropriate to use purposive or judgemental sampling, and snowball sampling procedures for the study.

Purposive sampling is a nonprobability technique where the researcher relies on the experience, ingenuity, or previous research findings to select respondents who seem to be appropriate for the research (Palinkas et al., 2015). In other words, purposive, or judgemental sampling, is used when the researcher knows the characteristics to be studied, its elements, and the purpose of the study. This is often augmented by snowball sampling in which the participants identify other possible candidates who fit the study criteria. Activities of policymakers in the Department of Water and Sanitation, Water Boards, Environmental Officers, and other stakeholders, are known to the researcher; therefore, the purposive sampling technique was employed.

Water policies and programmes required comprehensive and sustainable strategies based on sound financial-economic, environmental, public health, technical and social impacts grounded on effective decision-making, planning, implementation, and monitoring. Multi-criteria decision analysis is a technical-methodological method of obtaining data (Ortiz, Gomez, Aledo and Urgeghe, 2018). It is a tool developed in the field of decision theory for resolving operational research problems, with a finite number of decision options amongst which decision-makers have to evaluate and rank base on the weights of a finite set of evaluation criteria (Figueira et al., 2005, Lu et al., 2007). Qualitative is combined with a typical quantitative elaboration using mathematical tools. This mixed-method strategy tends to be the base argument, or even the methodological ideal, in all the water policies analysis literature, which seeks explanations and solutions for complexity through adaption of multi-transdisciplinary approaches. Therefore, the selection of participants for this research was underpinned on multi-criteria decision analysis (MCDA). The MCDA was used to select 56 experts and practitioners in the field of water from various government and research institutions in various parts of South Africa, based on their knowledge, skills, expertise, experience, positions, ranks,

and job specification of participants in the water sector. Furthermore, households from specific communities were also targeted since they represent communities where water scarcity is evident almost annually. The study earmarked people aged 18 and older, who are responsible for their households.

Purposive sampling approach was also used to select 16 participants from private institutions, and specific individuals who could potentially give an informed opinion on specific issues, and are familiar with the unique historical, socio-cultural, and political context in which the research is embedded. In order to ensure that the participants' group represented diverse interests of water sector management, care was taken to include specific institutions and organisations, such as Mvula Water Trust, the Water User Association (WUA), the International Water Management Institute (IWMI), the Association for Water and Rural Development (AWARD) Water Institute of Southern Africa (WISA), and the Federation for Sustainable Environment (FSE). Other participants included traditional authorities, political leaders and Policy Think-Tanks in Water Research Commission, and South African Young Water Professional (YWP).

Snowball sampling was also used to complement the purposive sampling techniques. This sampling method is usually considered as random sampling and often used when few individuals from the relevant population are approached. These individuals then act as informants to identify other members from the same community to be included in the sample population. According to Babbie (2010: 208), snowball sampling is appropriate when the members of a particular population are difficult to locate; such individuals can be migrant workers or undocumented immigrants. Babbie further disclosed that in snowball sampling, the researcher collects data from few members of the target population he or she can locate, then asks those individuals to provide the information needed to locate other members of that population that they happen to know (Babbie 2010: 193). This technique was used to identify the participants from households and community members that stay far away, and that could not easily be reached by the researcher, but have significant knowledge and experience to contribute to the study. The sampling units are the water institutions, as well as experts in the field of water management and governance. The sample size was determined using the formula by Bartlet et al., (2001) and Duntoye (2009), who state that for social

sciences, a sample size of about 10 per cent is adequately representative. Therefore, the sample of the study was computed according to the formula indicated:

Equation 1........ **(N = $\frac{P}{m}$)**

(N = Sample size; P = Estimated population in the study area and (m) = Margin of tolerance error of the proportion to the population size).

Using the above formula, the sample sizes of the four study sites were determined. Firstly, Johannesburg, in the Gauteng Province was selected, explicitly due to its strategic position and its significance in supplying water in the Gauteng province and beyond. Based on StatsSA (2015) employment statistics, water bodies and organisations employed over 3000 people in South Africa, and it is impossible to survey all of them due to time and financial constraints. According to the same statistics, it is estimated that over 400 people are employed in the Department of Water and Sanitation in Gauteng Province, and in Rand Water in the Rustenburg District, and other institutions within this study area. Using Equation 1 and a margin of error, which is pecked at 35 per cent, the sample size was computed.

By computation:

$$\mathbf{(N = \frac{P}{m}\ )\ m = \frac{400}{35} = 11\ ...}$$

(The margin of error = 11)

$$\mathbf{N = \frac{400}{11} = 36...}$$

(Sample size in Johannesburg water units in Gauteng Province is 36)

A total of 36 respondents were purposely drawn from different water institutions and organisations, both from the public and private sector within Johannesburg. The technique used here was expert sampling, where participants were selected based on their know-how and knowledge on the subject being deliberated. This technique was chosen primarily because experts are well-informed on the content; strategic water use and waste management, coordinating of research programmes and provision of strategic support to the government, and to the department. Water management and governance arrangement is the other attribute considered. The skill and professional base participants included: water quality specialists, Policy

Think-Tanks from provincial water institutions, the major political parties in South Africa, NGOs, Catchment Management Agencies (CMA) and community members.

It is essential to note that some of the respondents were also drawn from Pretoria, though they are not based in Johannesburg. In Pretoria, the expert's sample population was purposively drawn from the National Department of Water and Sanitation, particularly directors, managers, water scientists, and engineers. This sample group was chosen based on their in-depth knowledge and expertise in the Constitution, the relevant pieces of legislation in water governance and management, and efficiency in strategy directive and governance structure in water management. Their inputs assisted the researcher in gaining in-depth knowledge of the policy and legislative framework intended for the transformation of water allocation, to redress the historical racial discrimination in access to water, and the National Water Act (NWA) promulgated in 1998.

A significant amount of data was also obtained from Cape Town. A random sampling technique was also used to collect data from respondents at Overberg District and Stellenbosch Municipality. According to StatsSA (2015), approximately 150 people are directly and indirectly employed in the water sector in the two sites, and the Provincial Department of Water and Sanitation. Using a margin of error of 25 per cent, a computation was worked out as shown below:

By computation:

$$\mathbf{(N = \frac{p}{m})\ \ m = \frac{150}{25} = 6...}$$

(The Margin of error for statistical compilation is 6)

$$\mathbf{N = \frac{150}{6} = 25...}$$

(There, the Sample Size Western Cape Province is 25)

A sample size of 25 respondents were purposively drawn from both the private and public institutions from the province. These respondents are experts from the Provincial Department of Water and Sanitation, the Overberg Water Board, as well as managers and employees of NGOs in water organisations. Expert sampling was also carried out in selecting participants based on their aptitudes and experiences in managing water resource in drought conditions, protecting and promoting environmental health and functional ecosystems for future generations, and their

competencies in creating awareness and education throughout the whole province of Western Cape, especially during the drought season in 2015.

Thirdly, the researcher obtained data from the Orange Free State Province. Using purposive and snowball sampling techniques, data were solicited from relevant public and private institutions, as well as individuals within specific communities. Based on the 2015 StatsSA report, approximately 160 people are directly and indirectly linked to the water sector management in the province. Using a 25 per cent margin of error, a computation was worked as:

$$\mathbf{(N = \frac{p}{m})\ m = \frac{160}{25} = 6...}$$

(The margin of error based on the statistical compilation is 6)

$$\mathbf{N = \frac{160}{6} = 27...}$$

(Therefore, the sample size in Free State Province is 27)

A sample population of 27 participants were drawn from the Province of the Orange Free State. These participants included directors from the Provincial Department of Water and Sanitation, as well as managers from Bloem Water Boards. Others include NGOs in water management, and the Langenhoven Park community. The expert sampling technique was used in setting up the criteria for selecting respondents. Respondents with knowledge and expertise in waste and bulk water management and distribution, operational and optimisation of procedures for strategic management and governance of water resources, and their contributions to provincial water sector policies and programmes, were taken into consideration.

Finally, data were also solicited in the Eastern Cape Province. The sample size for this province was also determined based on the total number of personnel involved in water governance, which is estimated to be 122 according to the StatsSA report of 2015. Snowball and purposive sampling techniques were the main instruments used to select the respondents in this province. Using 25 per cent as a margin of error, the calculation was shown as follow:

$$\mathbf{(N = \frac{p}{m})\ m = \frac{122}{25} = 6...}$$

(The margin of error based on the statistical compilation is 6)

$$\mathbf{N = \frac{120}{6} = 20...}$$

(Therefore, the sample size in Eastern Cape Province is 20).

The researcher drew a sample size of 20 respondents from government officials from the Eastern Cape Department of Water and Sanitation, NGOs in water management in the province, as well as participants from Head office of the Amatola Water Board. A substantial amount of data was also solicited from the Institute of Water Research Institute from Rhodes University, policy experts and Kingwood community, a suburb in Grahamstown. The researcher further exploited an expert sampling method to select these sample groups. Taking into consideration the skills, capabilities, and experiences of the participants which included: specialisation in water distribution and monitoring, community participation in water resource management, and effective communication and better understanding among individuals and organisations in the water sector. In all, a total number of 109 participants were engaged in this study, with their precise composition set out in the table below.

Table 3.1 Participants from the national, provincial DWS and Water Boards

Institutions/Agencies	Participant's Role in Water Management	Participants number	The overall number of participants in an institution
National Department of Water and Sanitation (Pretoria)	**1. Directorate of Water Resource Management** **Main Functions and Responsibilities** • to manage water resources • to exercise control over water utilisation • to ensure and coordinate the execution of regionally coordinated activities	2	4
	2. Directorate: Water Distribution and Maintenance **Main Functions and Responsibilities** • render survey services • protecting the quality of the country's water resources • exercise control over water pollution	2	

	• to develop water sector capacity, support for planning and management of intergovernmental institutions		
Provincial Department of Water and Sanitation (Eastern Cape)	**Water Distribution and Maintenance Division** **Main Functions and Responsibilities** • to refurbish ageing infrastructure • to plan for long-term water infrastructure • to monitor and protect catchment areas • to coordinate activities of water users and management institutions	2	**8**
Gauteng Province (Johannesburg and Pretoria)	**Bulk Water and Wastewater Service** **Main Functions and Responsibilities** • in charge of bulk water supply from Rand Water/Megalise • wastewater treatment: maintenance of wastewater treatment plants, raw/sewage water treatment • evaluate and develop groundwater	2	
Western Cape Province	**Planning and Development Division** **Main Functions and Responsibilities** • to provide infrastructure planning, master plans assets register • to monitor water demand and conservation: consumer education, metering/ connections • to undertake the department-directed hydrological research	2	
Free State Province	**Management and Administration Support** **Main Functions and Responsibilities** • to provide management/ strategic support • to support human services • to support administrative services	2	

Institutions/Agencies	**Participant's Role in Water Management**	**Participants number**	**The overall number of Participants in an institution**
Amatola Water	**Planning and Development Division** **Main Functions and Responsibilities** • water and wastewater quality • water quality management and monitoring • stakeholder relationship and support • enhancement of strategic effectiveness	5	**5**
Bloem Water	**1. Corporate Governance and Integrated Sustainability Division** **Main Functions and Responsibilities** • to manage the Board and its operation • to research into sound governance practices, facilitate corporate events and to advise on matters of compliance **Employee Engineering Services** **Main Functions and Responsibilities** • to manage assets and infrastructure • in charge of the environmental management system • in charge of environmental performance review	2 8	**10**
Rand Water	**Group Strategic Division** **Main Functions and Responsibilities** • to develop water sector capacity • responsible for corporate planning • in charge of corporate research and development • responsible for financial and economic planning **Employees Water Infrastructure Division** **Main Functions and Responsibilities** • to manage infrastructure • water purification	4 9	**13**

	• water quality analysis • fixing, repairing, and replacing of water pipes and infrastructure		
Overberg Water	**Operational Managers** **Main Functions and Responsibilities** • to monitor water availability- catchment areas • to promote effective water use-drought implication • to provide support to water sector operations • grant water use right- license by resources • to ensure water quality is produced **Corporate Service Division** **Main Functions and Responsibilities** • to provide risk advisory services • to support institutional establishment and management services • to promote stakeholders' engagement	2 8	**10**

Table 3.3 Research participants from private sector organisation and companies

Organisation/Agency	Participant's Ranks and Responsibilities	Participant's number	The overall number of participants in an institution
Mvula Trust Water (East London, Eastern Cape)	**Regional managers** **Main Functions and Responsibilities** • to implement water and sanitation projects at community levels • to provide advisory and consultancy • services • provide education and awareness on sustainable water use • build social cohesion with communities on water use	2	
Water User Association (WUA)	**Managers Water Monitoring and Dispute Resolution**	5	

	Main Functions and Responsibilities • gather water use information from consumers • monitor water availability and quality • resolve water disputes and conflicts between municipalities and consumers • represent stakeholders' needs		
International Water Management Institute (IWMI) Gauteng Province branch	**Provincial Director** **Main Functions and Responsibilities** • community participation in water resource management • promote sustainable water use • promote co-operative governance in the water sector • encourage improve water management technologies and practices	2	
Association for Water and Rural Development (AWARD) Gauteng	**Regional Coordinators** **Main Functions and Responsibilities** • support systemic participatory governance of water resources • educate and train communities on IWRM to improve water security • give communities support to practice water conservation in municipalities • monitor, evaluate and reporting of water issues	2	
Water Institute of Southern Africa (WISA)	**Regional Representatives** **Main Functions and Responsibilities** • give support and encourage innovation and research in the water sector • encourage and promote communication and understanding among stakeholders	4	
Federation for Sustainable Environment (FSE, Gauteng)	**Executive Director** **Main Functions and Responsibilities**	1	

	• protect and promote environmental health and functional ecosystem • facilitate and promote remedy for existing environmental degradation • encourage the facilitation of information relating to the environment, especially water resources		

Table 3.4 Research Participants from University Water Institution, households, communities' members, and political organisations

Institutions/Households	Participants Ranks and Responsibilities	Participants numbers	The Overall participant in an institution
Institute for Water Research (Rhodes University, Grahamstown)	**Coordinators for Research** **Main Functions and Responsibilities** • research into structure, service, and the component of the natural water system • capacity building and community education for the water sector • practice adaptive IWRM in South Africa and beyond	3	**6**
Stellenbosch University Water Institute (Cape Town)	**Director and Coordinators for Postgraduates students** **Main Functions and Responsibilities** • map the status and predict climate change impact on water resource and other related ecosystem services with a focus on society • develop a methodology for integrated assessment for the implementation of integrated water resource management strategies • build capacity on climate change impact and sustainable water management among public and private stakeholders	3	
Households and community members (Eastern Cape, Gauteng, Western Cape, and Free State)	Grahamstown Midrand Stellenbosch Langenhoven Park	6 7 8 13	**34**

Political organisations, Gauteng Legislatures	**Portfolio Committee Members on water and sanitation.** **African National Congress (ANC)** **Democratic Alliance (DA)** **Economic Freedom Fighters (EFF)** **Main Functions and Responsibilities** • formulate and implement by-laws on issues of water and sanitation in the province • hold the provincial executives accountable on the environment and other issues	1 1 1	**3**

Table 3.4 Total number of participants in the study

Agency	Participant Number
Government Department and Institutions	50
Private Sector Organisations and Companies	16
Research Institutions and Policy Think Tank	6
Households and Communities	34
Political Organisation	3
Total participant number	**109**

Source: Field survey July 2019

3.6 Data collection techniques

In setting out to collect data, researchers often have several date collection techniques or methods at their disposal. It is important to choose an appropriate technique or method for the research at hand, to enhance the validity of the findings. Several factors guide researchers regarding the use of appropriate techniques (Onwuebuzie et al., 2012). These are, among other things, the nature of the research problem to be investigated, and the characteristics of the research

subjects. A researcher would have to look at an appropriate and user-friendly method, such as the interview schedule, which transcends the boundaries of illiteracy (Boyce et al., 2006). Data collection for this study was divided into two activities: primary and secondary. Before the actual data collection process began on the 20th of September 2019, a preliminary data collection, or the pilot study, was done in June - July 2019. The primary objectives of the pilot study were to:

(i) check the appropriateness of the selected study site and sample groups
(ii) identify critical informant for later fieldwork
(iii) contextualise the study and the primary interactions of each stakeholder
(iv) develop preliminary knowledge of water management strategies and governance styles, and
(v) to collect the data for subsequent analysis.

Field or primary data were obtained through structured and semi-structured interviews, closed and open questionnaires, while secondary data were solicited from the review of the literature and content analysis. Two field workers were employed by the researcher to assist in distributing the questionnaires, and to interpret and explain the questions to participants, where necessary.

3.6.1. Interviews

An interview is the most common research technique used in social science research. This, because it is the prime of qualitative data collection tool, using personal contact and interaction between the interviewer and interviewee (Bless & Higson-Smith 2005). Interviews can be either face-to-face, or telephonic, and can be either unstructured or structured. The unstructured interview involves asking respondents to comment on broadly defined issues. In this method, the interviewer only interrupts to seek clarification. On the other hand, structured interviews are more formal, usually based on a structured questionnaire (Oltmann, 2016). Structured interviews are a set of predetermined questions that are asked in a particular manner, and are conducted in a 'step by step' format (Granot et al., 2012). The structured interview involved interactions between an interviewer and a respondent, in which the interviewer has a general plan of inquiry, including the topics to be covered, but not a set of questions that must be asked with particular words and, in a particular order (Babbie and Moutton, 2001).

Kabir (2016: 212) contends that structured interviews are particularly useful in the following pursuits:

i. “explore, probing and searching to determine what is specifically significant about a person or situation
ii. determining how individuals perceive their situation and its significance on them
iii. identifying the cause-and-effect relationships
iv. finding explanations for deviations from common behaviours by individuals or subgroups
v. making sure the respondents correctly understand what was asked
vi. following up incomplete or non-responsive answer
vii. getting responses from individuals who might not respond to or might not understand a questionnaire."

There are two main types of structured interviews: semi-structured and in-depth interviews, with each having its strengths and weaknesses (Zojceska, 2018). A semi-structured interview creates room for new information and insights to be incorporated as the interview is carried out (Dumay et al., 2011). This form of interview is more structured than an open interview; this is because semi-structured interviews work with a general framework of themes. In a semi-structured interview, several questions are predetermined before, but freedom is left for deviation within the limit (Zorn et al., 2018). The interviewer is expected to formulate most of the questions based on the interviewee's responses, and has the freedom to follow up on tangents and ideas as they come up throughout the interview process.

There are some fundamental advantages associated with semi-structured interviews, among them, being: A semi-structured interview is a more open format which mitigates bias that might be imposed by the leading questions which often form a part of structured interviews. It also allows an interviewer to incorporate new information and follow new ideas as they come up in the interview, without being bound by a preconceived set of ideas (Mathers et al., 2002). Nevertheless, the main disadvantage of using a semi-structured interview format is that it requires some skill on the part of the interviewer, who must be able to establish rapport with the interviewee, and allow enough room to explore related ideas, while still keeping focus. Data from semi-structured interviews is also typically harder to organise and analyse than data from questionnaires (Jamshed, 2014).

In-depth interviewing is also a qualitative research technique that involves conducting intensive individual interviews with a small number of respondents to explore their perspectives on a particular idea, program, or situation (Boyce et al., 2006: 5). According to Boyce et al., (2006), in-depth interviews are useful when you want detailed information about a person's thoughts and behaviours, or want to explore new issues in depth. These interviews are often used to provide context to other data (such as outcome data), offering a complete picture of what happened in the program and why. The primary advantage of in-depth interviews is that they provide much more detailed information than what is available through other data collection methods, such as surveys. Besides, it provides a more relaxed atmosphere in which to collect information— people may feel more comfortable having a conversation with you about their program, as opposed to filling out a survey (Boyce et al., 2006). Nevertheless, there are a few limitations and pitfalls, each of which is described below:

i. Prone to bias: Because participants might want to 'prove' that a program is working, their interview responses might be biased. Responses from community members and program participants could also be biased due to their stake in the program, or for many other reasons.
ii. It can be time-intensive: Interviews can be a time-intensive evaluation activity because of the time it takes to conduct interviews, transcribe them, and analyse the results.
iii. If the interviewer is not highly skilled and experienced, the entire process can be undermined
iv. The process can be relatively costly compared to other methods,
v. Not generalisation: When in-depth interviews are conducted, generalisation about the results is usually not possible because small samples are chosen, and random sampling methods are not used.

For the purpose of this study, the two sets of structured interview methods were used. The in-depth interview layout for respondents in the government institutions, such as National Department of Water and Sanitation in Pretoria, and the four provincial departments, Gauteng, Eastern Cape, Free State, and the Western Cape, and the four Water Boards earmarked for the study: Amatola Water in the Eastern Cape, Bloem Water in Free State, Overberg Water in the Western Cape, and Rand

Water in Gauteng Province. In-depth interviews were deemed most suitable for this group of respondents because the researcher is looking for in-depth knowledge, decision-making processes, structures of governance and level of responsibilities of authorities in water management in South Africa. In other words, the in-depth interview design for these participants was carefully crafted to solicit comprehensive information on policy development and implementation, management of water resource, monitoring and evaluation practices. Other questions revolved around the agreements and treaties of internationally shared water resources in South Africa and its neighbouring countries, the sustainability of water resources, climate change and its impact on water supply, urbanisation, and its implications on water resources.

Finally, cost recovery and infrastructure decay, inadequate planning and economic growth, and its consequences on water resources, were probed into by the researcher using the in-depth interview style. This technique also provided an opportunity for the researcher to analyse the relationships between and amongst different characteristics, sites, and categories. The strength of this data collection instrument enhanced the reliability and validity of results. Besides, this data collection instrument provided in-depth, and quality of data as the researcher could follow up on answers and probe for greater detail. Questions could be added or altered, in real-time if needed. It also allowed the researcher to explain or help clarify issues, increasing the likelihood of insightful responses. Similarly, face-to-face contact allowed respondents to open-up on a one-on-one basis, and for the researcher to be more flexible in administering interviews to individuals

The semi-structured interviews were designed for households in four selected communities: Grahamstown, Midrand, Langenhoven park and Stellenbosch. These communities were selected as indicated earlier due to their strategic positions in their provinces, historical backgrounds in water provision, population growth, and water provision challenges. The interview guide was mainly open-ended questionnaires and open discussions between the researcher and the respondents. The instruments allowed the researcher to probe for views and opinions on the following; the demand and supply of water in South Africa post-independence, over-consumption of water resources, inefficiencies and weaknesses in water policies, wastage, leakages, lack of maintenance and refurbishment, as well as cost

recovery mechanisms. Other prominent issues covered with this instrument included domestic water challenges, stakeholders involvement in water management, catchment characteristics, the perceived level of water scarcity, the importance of stakeholders in managing water resources, fast-moving nature of water policy debates, management change in South Africa, and the contextual water resource monitoring governance issues that affect sustainable water service delivery in communities and households.

3.6.2. Questionnaires

Questionnaires can be thought of as a kind of written interview that can be carried out either by face to face, by telephone, computer or post (Kothari, 2004 & Mathers et al., 2009). In other words, "a questionnaire is a printed document that contains instructions, questions and statements that are compiled to obtain answers from respondents" (Bird, 2009). Questionnaires provide a relatively cheap, quick, and efficient way of obtaining large amounts of information from a large sample population (Artino et al., 2014). Often a questionnaire uses both open and closed questions to collect data, depending on the information and the resources available to the researcher.

3.6.2.1 Closed-ended Questionnaire

Close-ended questionnaires are question set-ups that provide a simple response from a respondent. They are designed such that there is not much thought into the single word answer (Reja et al., 2003). In other words, closed questions are structure to provide one and a quick answer; thus, they only allow responses that fit into pre-decided categories. In this case, answers can be placed into a category of nominal data. This category is restricted to as few as two options, i.e., dichotomous (e.g., 'yes' or 'no,' 'male' or 'female'), or include quite complex lists of alternatives from which the respondent can choose (Cohen et al., 2002). Closed questions can also provide ordinal data (which can be ranked). This often involves using a continuous rating scale to measure the strength of attitudes or emotions (Lovalace et al., 2013). There are notable strengths and weaknesses associated with the closed questionnaire method. These include:

i. They are economical: this denotes that they can provide enormous amounts of research data for relatively low costs. Therefore, a large sample size can be

obtained which should be representative of the population, which a researcher can then simplify

ii. Easy to process: this means that respondent inputs can be easily be converted into quantitative information

iii. Reliability and consistency: this suggests that all participants are asked precisely the same questions, in the same order. This means a questionnaire can be replicated easily to check for reliability.

Nevertheless, the closed questionnaire has a limitation with detail, because there is less scope for participants to provide answers which reflect their opinions and feeling on the topic.

3.6.2.2 Open Questionnaire

Open-ended questions are defined as free-form survey questions that allows a respondent to answer in open text format, based on their complete knowledge, feeling, and understanding. This means that the response to the question is not limited to a set of options (Raja et al., 2003). In other words, open questions are often used for complex questions that cannot be answered in a few simple categories but require more detail and discussion (Bailey, 2008).

One of the fundamental strengths of the open questionnaire is that rich and detailed information can be obtained, as open questions provide the respondents' opportunity to elaborate on their answers. This means the researcher can find out why a person, or a group of people, hold particular views and attitudes. However, some of the fundamental limitations to open questionnaires are: they are time-consuming in terms of respondents answering the questions and analysing of the information given, and this data collection method is not suitable for less-educated respondents, as open questions require superior writing skills and a better ability to express one's feelings verbally.

Both closed and open questionnaires were used in this study to obtain information from the external stakeholders, private sector organisations and companies in water management and governance in the study areas. For this study, participants were drawn from Mvula Water Trust (MWT), International Water Management Institute (IWMI), Water User Association (WUA), Association for Water and Rural Development (AWARD), Water Institute of Southern Africa (WISA) and Federation

for Sustainable Environment (FSE). Other participants included the Water Research Institute at Rhodes and Stellenbosch Universities, as well as Policy Think-Tanks from different institutions. The closed questions were used to solicit information that involved quantitative insights, such as rating, trends and percentages of water consumption over a period of time, to restrict responses from respondents, and to obtain large scale data from households and communities water demands and supply. This data collection method was successful because more information was extracted within a short period, and it was cost-effective.

The open questionnaire added richness to the survey result that was difficult, if not impossible, to achieve, compared to the closed question. This method assisted the researcher in obtaining information relating to water consumption in South Africa, in comparison to other selected countries in Africa and Europe, the identification of people's water management practices, social organisations and institutions in water management, the role of traditional leaders in ensuring water security in their communities, the strategies and formula in distributing water among different sectors of the economy, the processes and procedures involved in passing laws in the water sector, the level of awareness in the IWRM at schools and communities, and their influence on water conservations in South Africa. The open questionnaire further assisted the researcher in understanding regulatory instruments designed to achieve water security in South Africa, dams and catchment areas safety and climate challenges of climate change.

3.6.3 Content Documents

The study also relied on secondary sources, or content documents, as complementary to primary data sources. Content analysis involves the use of existing materials by researchers and the analysis of data initially collected by others. In other words, content analysis is "the study of recorded human communication such as books, websites, paintings, and laws" Babbie (2010: 394). It is an unobtrusive method of data collection because it involves different nonreactive research techniques (techniques that have no impact on the people being studied). Content analysis was perceived by Rubin and Babbie (1997: 421) as a "way of transforming qualitative material into quantitative data", implying that every form of communication, whether recorded or not, can be transformed into quantitative data by coding and tabulating the correspondence.

The content analysis was used in this study specifically to contextualise water governance, management, and sustainable water service supply in all echelons of government. In addition, secondary data assisted the researcher in understanding the relationship, as well as different types of international and national policies in water management and governance, interpretation and operationalisation in the water legislation, strategies, guidelines, and the analysis of contextual limitations that make policies ineffective to analyse and implement. Finally, the secondary data was useful to the researcher in contextualising the relevant legislative framework such as the Annual Performance Appraisal (APA), Public Finance Management Act, National Water Resource Strategy, National Water Act, Water Services Act, and the Water Research Act promulgated to serve as policy guidelines, and to regulate accountability and human resource development in the water sector.

Undoubtedly, in this research, since it is impossible to compile and study all communities and water institutions, publications on water policies, governance and water security in South Africa was relied on. Documents from this source became part of the unit of analysis of official documents on policies and programmes of the government of South Africa, and literature on water policies and governance nationally and internationally, textbooks, articles, and reports were depended on. Web documents, relating to the research topic, also served as an integral component of the data for this study. The use of content analysis in this study was economical in terms of time and money which were invested. In addition, the unobtrusive nature of content analysis made it possible to investigate the problem under discussion without affecting the people concerned, because the data had already been established. Table 3.6 summarises data collected from the key participants.

Table 3.5 Summary of the data collected and their key respondents

Types of data collected			
Objectives	**Key informants**	**Qualitative data obtained**	**Quantitative data obtained**
To identify the current policies and programmes	Participants from the National Department of Water and	1997 Water Service Act; 1998 National Water Act; National	The number of policies enacted post-independent

aimed at achieving water security in South Africa	Sanitation and Content documents	Water Resource Strategy; National Water and Sanitation Master Plan and other policies and programmes enacted post-independent in 1994. Road map of adaptive systems formulation and implementation processes	and percentage of their approval.
To explore the extent to which grassroots and other stakeholders are involved in the formulation and adaption of legislation and policies that seek to achieve water security in South Africa	Participants from both National and Provincial Department of Water and Sanitation; respondents from the all the NGOs (MWT, WUA, IWMI, WISA, and AWARD); households and Community members and 2012 Policy Guidelines on water management: Department of Water and Sanitation	The role of different stakeholders in policy formulation and implementation; identification of objectives and influence of stakeholders concerning water management and governance; guiding principles for adaptive policy formulation and Implementation; enabling conditions for an adaptive policy formulation and implementation process	The number and percentage of stakeholders engaged in policy formulation and implementation as well as demographic characteristics of the participants (age, educational background of respondents, income status and gender.

To investigate the systematic and structural constraints restricting the implementation of sustainable water policies and programmes to achieve water security in South Africa	Interviews with participants from the Water Boards (Amatola, Bloem, Rand and Overberg Boards) and Experts from Water Institutes from Rhodes and Stellenbosch Universities and respondents from households and communities	Identification of social, economic and political factors impeding policies and programmes formulation and implementation (funding gab, management skills, staff skills levels constraint, fragmentation of governance and institutions, infrastructure constraints, operational and maintenance constraints); the impact of climate change on water security in South Africa; cost to the economy, government revenue, GDP and jobs for lack of investment in water security	Constraints in balancing water supply and demand, redistribution for transformation, projecting water use demand, financial management constraints, revenue collection challenges; improved data and information sharing to improve planning and management of transboundary waters and to foster collective goodwill and collaborative efforts.
To analyse the strengths and weaknesses of water policies and strategies towards the	Informants from National and Provincial Department of Water and Sanitation; Participants from	(SWOT Analysis) of water accessibilities to households and communities, water quality improvement,	Assessment of the current state and trend, level of knowledge and functionality of water policies and

attainment of water security in South Africa	Water Boards; Experts from Water Institutes from Rhodes and Stellenbosch Universities and content documents and analysis	catchment management practices. Gaps between water supply and demand, overused and abuse of resources, water linkages and environmental problems associated with water resources	legislation, number, and percentages of households and communities connected to water and sanitation post-independent. Number and percentages of backlogs to water supply in South Africa households and communities, water deficit and under-pricing of water.
To formulate appropriate sustainable strategies within the institutional framework towards achieving water security in South Africa	Participants from National and Provincial Department of Water and Sanitation, Managers from the Water Boards, respondents from the NGOs, Experts from the Water Research Institutes from Rhodes and Stellenbosch Universities, informants from the households and	Water resource control legislation, Integrated Water Resource Management Strategies, education, and awareness creation, grassroots and stakeholder participation in water management, identification of new and innovative investment opportunities; identifying management options for integrating national	Assessment, monitoring and evaluation strategies; levels and scale of capital investment required to achieve water security; using institutional mapping to build a picture of how development planning institutions work at present and how coordination can be maximised for application of the policies

	community members and content analysis	objectives with sustainable management of water resources at the local levels.	

Source: Researcher, 2019

3.7 Data Analysis

After obtaining data from the sample groups, data analysis began. According to Kawulick (2004), data analysis is a process used by researchers to reduce data to a story, and then interpret it to derive meaning. The data analysis process helps in reducing a large chunk of data into smaller fragments, which make sense. Data analysis is the most crucial part of any research because the procedure involves the interpretation of data gathered through the use of analytical and logical reasoning to determine patterns, relationships, or trends, of the topic under discussion (Ashirwadam, 2010). Data analysis for this study relied mainly on both qualitative and quantitative techniques.

Qualitative analysis involves the "why and how" of decision making, as opposed to "what, where and when" of quantitative analysis (Creswell, 2009). Since the qualitative study focuses on in-depth reasoning and quality of results, many researchers prefer it over the quantitative analysis that focuses on bigger sample sizes. This type of study does not use any statistical tools in the process. Qualitative analysis needs small and focused samples instead of the large random samples that quantitative analysis uses. The qualitative analysis classifies data into patterns to arrange and conclude results (Miller, 2015). The data used can be in many forms, such as texts, images, sounds, etc. The most important requirement needed in qualitative analysis is the presence of in-depth knowledge of the subject matter.

Quantitative analysis, on the other hand, is a technique that seeks to understand behaviour by using mathematical and statistical modelling, measurement, and research (Kenton, 2019). Quantitative analysts aim to represent a given reality in terms of a numerical value. In other words, quantitative analysis is employed for several reasons, including measurement, performance evaluation or valuation of a

financial instrument, and predicting real-world events, such as climate change. The choice of the mixed-method approach combined a method of triangulation and, therefore, followed a three-pronged analysis approach.

3.7.1 Interview Analysis

UCLA (2005) is of the view that after finishing a key informant interview, the interviewer should analyse data by making notes and writing down any additional comments or impressions. For clarity and effective analysis, all the interviews data were audio typed, recorded, and transcribed. The transcription of the interviews was analysed using a constant comparative strategy. In analysing this data, a text is required by the researcher to align the theme with the theoretical framework, concepts, the research design, aims, objectives and the research questions. Usually, qualitative interview results are a large amount of detailed, contextually laden information. Establishing theories, policies, and water management programmes is a significant concern for the study. Therefore, the qualitative data was analysed using different analysis techniques specifically, thematic analysis, word cloud technique and content analysis. The choice of these techniques were based on the type of data obtained, the objective to be achieved and the research question. The subsequent section described in detail each of the analysis techniques.

3.7.1.1 Thematic Analysis

Thematic analysis is a qualitative research method that is widely used across a range of epistemologies and research questions (Braun et al., 2014). It is a method for identifying, analysing, organising, describing, and reporting themes found within a data set (Braun et al., 2014). Thematic analysis strives to identify patterns of themes in the interview data. One of the advantages of thematic analysis is that it's a flexible method which can be used both for explorative studies, when you don't have a clear idea of what patterns you are searching for, as well as for more deductive studies, where you know exactly what you are interested in (Nowell et al., 2017). Braun et al., (2014) and Nowell et al., (2004) all argued that thematic analysis is a useful method for examining the perspectives of different research participants, for highlighting similarities and differences, and for generating unanticipated insights. Thematic analysis is also useful for summarising critical features of a large data set, as it forces the researcher to take a well-structured

approach to handle data, helping to produce a clear and organised final report (King, 2004).

For the purpose of this study, thematic analysis was used to summarise and analysed data obtained from semi-structured and in-depth interviews into themes and patterns. The themes were chosen based on their relevance to the research questions set out for this study. The main themes identified with thematic analysis included: water policies and their intended goals, existing pricing policies, the legal and institutional framework in the water sector, the changing demand for water resources, climate change and its impact on the water sector, the dysfunctional institutions in water governance, and involvement of the public in the decision-making process. The open coding thematic analysis led to the initial identification and marking of descriptive names for specific units or segments of meaning about the research objectives. This analysis technique assisted the researcher in the breakdown, scrutiny, conceptualisation, deliberation, and categorisation of raw data. Using thematic coding, primary subtitles were developed based on the respondent's perceptions, which was built on a multi-dimensional preliminary framework for further analysis. Relational database management system, an excel program further assisted the researcher in organising the data into the matrix – rows representing "case" and columns "opinions." This program enabled the researcher to link one data set with another.

3.7.1.2 Word Cloud Analysis

Qualitative data were also analysed using text data mining technique, a text analytics process of deriving high-quality information from text. High-quality information is typically derived through the devising of patterns and trends through means such as statistical pattern learning, and what the keywords or phrases used by subjects are. This is an artificial intelligence (AI) approach that uses natural language processing (NLP) to transform the free (unstructured) text in documents and databases into normalized, structured data. This compares favourably to the manual way of coding the data as described by (Kuckartz, 2019). However, the ability of the researcher in giving meaning to the results was critical. The data from the instruments were transcribed, and the text analysed accordingly, using the techniques described.

The first step in the analysis was done through feature extraction to reduce the number of resources required to describe a large set of textual data. This approach assisted in constructing combinations of the variables without losing information. Specifically, the 'bag-of-words' model was applied, which is ideal for simplifying representation used in natural language processing and information retrieval (IR). In this model, a text (such as a sentence or a document) is represented as a bag (multiset) of these words, disregarding grammar and even word order, but keeping multiplicity. In this way, the keywords used by respondents to answer questions are identified.

The second and final step in the text analysis was developing a word cloud. Bletzer (2015) defined a word cloud as a visual representation of the most used keywords or terms in a text. Cloud word was used mainly to analyse the qualitative documents in this study. The font size of a keyword into a word cloud is proportional to its frequency; bigger font implies more frequently mentioned keywords or terms (DePaolo and Wilkinson, 2014). The font size and the fullness of words are therefore generated by software, based on how frequent the word is used and how many words were captured (minimum frequency of 2 was set, implying a word mentioned once will not appear in the word cloud).

3.7.2 Content Analysis

Content analysis is a systematic procedure for reviewing or evaluating documents, both printed and electronic (computer-based and internet-transmitted materials). As with other analytical methods in qualitative research, content analysis requires that data be examined and interpreted to deduct meaning, gain understanding and develop empirical knowledge (Corbin and Strauss, 2008)**.** Content analysis is often used in combination with other qualitative research methods as a means of triangulation—"it is the combination of different methodologies in the study of the same phenomenon" (Denzin, 2007).

For the purpose of this research, content analysis was used to collect qualitative data. The data were collected from the international, continental, national, and local official department. The international, continental, and local documents were referenced to understand water and resources challenges throughout the whole world. Content analysis was done by summarising each work in relation to each

other work and highlighting gaps in other publications. In analysing the content materials, the researcher reviewed all the relevant existing materials for requisite information. The information was then linked to the rationale, and the purpose of the study. In other words, the relationship of the topic to the existing literature was developed. Some information was grouped together to allow for the flow of ideas. The existing documents and relevant information were then evaluated by the researcher.

Questionnaire

Descriptive statistics analysis technique was used in this study to analyse the quantitative data obtained from the field. Descriptive statistics is a mathematical technique used to see underlying patterns of data (Martindale et al., 2010). The method involved the conversion of data into a numerical form before analysing it. This is done to make the data readable so that the relationship of the research questions could be studied, tested, and conclusions drawn.

The data analysis was carried using Microsoft Excel. The Excel database was carried out so that every response item on the questionnaire was carefully entered as a number code, under a question header in Microsoft excel. This was done after the entire survey was done. A detailed review was then carried out on each questionnaire after entering, so as to ensure accuracy, as well as being able to refer back to the aim and objectives of the study. Williams (2003) indicates that it is critically significant to be referring to the aims, objectives and the research questions that were earmarked to be achieved in the study.

The statistical computation includes the mean, median, mode, standard deviation, kurtosis, skewness, and coefficient of variation involving the demand and supply of water within the study area. This was done using the right statistical formulations. The mean assisted in explaining the average value of water demand; the median provided the intermediate values of an ordered sequence, or positional average; the mode identified the value within sectors of the economy that consumes the most water resources; the standard deviation assisted in measuring the "spread", or variability of water consumption; kurtosis measured the degree of flatness or peak of water accountability on the mode of frequency curves; the skewness provided the symmetry of the data, and the coefficient of variation gave the relative measure of the data obtained. Pivot tables and charts on Microsoft excel

worksheet were used to draw graphs. The graphs used in the study were bar graphs, box-and-whisker, and pie chart. The graphs contained frequencies and percentages, which were important in illustrating the findings.

Neutral responses were obtained and were expressed in the form of reasons; these involved participants that displayed hesitance overexpressing positive or negative opinions. According to Palmer (2006), participants responses can be inclined toward neutral because they want to avoid negative sensations of issues. Alternatively, it is argued that a degree of cognitive effort is required to provide answers which entail recalling instances or situations related to questions, and then applying this to the Likert Scale (Maness et al. 2018). Krosnik et al. (2009) also suggest that neutral responses are influenced by social desirability, where participants may be reluctant to voice unpopular opinions. Arguing the neutral response option, Krosnik (2009) and DeCastellarnau (2017) suggests that it enables respondents to express neutrality, preventing random responses where a participant may express no attitude.

3.8 Validity and Reliability

Validity takes into account whether the results and conclusions are legitimate and, indeed, what they were intended to achieve (Haradhan, 2017). According to Haradhan (2017), validity seeks to answer these queries: do the observed changes in the dependent variable relate to the changes in the independent variable? Bolarinwa (2015) views validity as a link between a construct and the data. Reliability, on the other hand, subscribes to dependability or conformity. From the viewpoint of Mohajan (2017), reliability can be assessed by asking these two main questions; will the appraisal yield the same outcome in a different circumstance? Secondly, if various researchers on different occasions made similar observations, will the outcome be the same? The subsequent sub-sections below, elaborated in detail, how validity and reliability were achieved in this study.

3.8.1 Reliability

The reliability of interviews depends on what the researcher sees and hears. Lincoln and Guba (1995) indicated that credibility, transferability, dependability, and confirmability are critical in creating reliability. One of the measures that were used to ensure credibility and transferability in this study was to ensure that those engaged for interviews had in-depth knowledge and experience to discuss the

issues and problems that the study envisaged to explore. Pieces and extracts from the interviews were used to prove and explain important themes for this study, which further served as a grounding for the outcome of the study. Conformity is to ensure that there is no bias in the interpretation of respondent's views, and this was addressed by ensuring that information given by the participants was interpreted genuinely, devoid of researcher's own opinions and sentiments.

The entire interviews were transcribed and manually coded to assist and ensure a profound comprehension of the interview content, and respondents' intentions. The use of constant comparative analysis guaranteed that systematic comparative was created, and that the research establishes the link between the analysis and resultant theories. Constant comparative analysis was also critical in advancing trustworthiness of the theories that emerged from the data, as the researcher was able to explicitly acme those codes and classifications that had the analytical weight to be used in developing the theory. Establishing saturation was also a factor in ensuring that the data assembled included data sufficient to provide credibility to the theory claimed. The research set strong, clear guidelines and several mechanisms to assist in ensuring the following rules took place. Using conference call soundtracks and digital audio recorder to capture the interviews to avoid the researcher from adding or excluding any information from the respondents' engagements. Manual coding the interviews by means of ground theory practice assisted in ensuring impartial clarification of the data, which further facilitated to reduce bias. The use of memos also assisted the study to stay accountable to objectives and the concept that emerged, by abetting reflection and helping in the research procedure.

3.8.2 Questionnaire validity

Designing the questionnaire for this study was guided by the general aim of the study, the research objectives, and questions. After completing the questionnaire, it was tested before using it on a large scale of the population. In order to ascertain if the questionnaire would derive the outcome anticipated, it was sent to the researcher's supervisor, and a statistics professional, to read through and check for any ambiguities and determine if the questionnaire was scientifically structured for computer analysis and reading. Different errors were picked up and were corrected accordingly.

3.8.3 Content validity

Content validity arises when the experiment provides adequate coverage of the subject being studied. This includes measuring things as well as having an adequate sample. Samples should be both large enough, and taken for target groups. The perfect question gives a full measure of all aspects of what is being investigated. For the purpose of this study, the content was first analysed by a language expert in terms of grammar rules and understanding. The developed draft was subsequently examined by an expert in water management, and the researcher's supervisor.

Regarding the content validity, an expert was asked to read the content on water policies and governance, as well as water management strategies in the study, and compare it to the Constitution of South Africa, the WSA Act of 1997, the NWA of 1998, and the NWRS of both 2004 and 2013. The expert was asked to assess the content between ten (10) if the content perfectly matches his expectation, and zero (0) if it does not meet all his views and expectations. The Lawshe Content Validity Rate (LCVR) was used to determine the content of the study. In this evaluation tool, a score of below five (5) was not considered. In LCVR, the expert evaluation content was taken into consideration, as well as how high or low the Lawshe coefficient was calculated based on the compliance coefficient that the expert provided to each item was well contemplation on and necessary corrections and adjustment were made to improve the standard of the study.

3.9 Methodological Reflections

This section highlights some of the challenges and opportunities the researcher encountered practically while carrying out this study. The challenges relate to social and principle matters linked with researching an institution, or department, outside one's field of work. Out of personal exploration and contemplation, the researcher sought to understand how, and to what extent these constraints could either shape or impede a research process. With open-mind and deep introspection, the researcher reflected on this research in line with the methodology of the study, which included both limitations in choosing appropriate research philosophy that suits the multiple settings, and the positives. The reflection also focused on the personal dealings with respondents.

The positives of this study, to the researcher, are divided into three main categories or themes: improvement in secondary and primary research skills; enhancement of time-management skills, and augmentation level of self-confidence. Before this research was carried out, the researcher had some basic secondary research skills; nevertheless, these skills significantly enhanced as a result of this study. The 21st century has been branded as the age of information, and, in this era, organisations, both public and private, do derive competitive advantage from information in different aspects of the organisation, and information related to internal and external influences impacting on the provision of services (Howlett et al., 2018 & Sivarajah et al., 2016). Understanding information from such perspective demands skills, expertise, and knowledge in secondary research. Hence, the secondary research skills and knowledge gained through conducting this research have contributed enormously to the researcher's career progression, especially with the data collection, grouping, sorting, scrutiny and presentation specifically, with the collaborative administrative structures dealing with water provision to the local communities.

Furthermore, conducting this research has instilled in immeasurable fieldwork or practical research skills in the researcher. It was an extraordinary experience to carry out a research of this magnitude which entailed the collection of data through field surveys and examining such huge data in the right order. The utmost comprehensive and detailed qualitative and quantitative research strategies have been learned during the research, and this gave the researcher real-world and pragmatic experiences in conducting field study through organising interviews and distributing and collecting questionnaires. Though the primary data were achieved through interviews and questionnaire only, the researcher was able to analyse the strengths and weaknesses of different data collection techniques, for instance, a focus group discussion and observation, and acquired deeper understanding regarding these data collection strategies. Encountering these primary data collections and scrutiny them has made a massive contribution to the researchers' advancement as a researcher and an intellectual. In today's global scarcity of water and climate change, the importance of water security is more significant than never before. Therefore, being empowered with primary research skills and understanding, the researcher can contribute to the knowledge of sustainable

water use through the acquisition of primary information on water demand and supply, as well as factors hindering policy implementation strategy formulation.

On personal and professional levels, the researcher benefited immensely from this study by enhancing his “time-management skills”. Specifically, the study program demanded extensive groundwork and preparation at each phase of the research, as each phase had to be managed in a well-structured format based on time perspective. Preliminary, I had a challenge in terms of ensuring steady progress of my research to correspond with my schedule. This challenge arose primarily at the introduction stages of the research. At the preliminary stages, the time needed for the introduction was underrated, and was incessantly behind schedule regarding putting together a comprehensive background and preliminary literature review. However, this challenge was dealt with by re-adjusting and re-forecasting the scheduling for the research, and becoming more disciplined in terms of adhering to the lay-down programs. Precisely, all the superfluous events were circumvented in the course of the study, and daily plans were strictly adhered to.

Conducting this research also increased the level of my self-confidence immensely. I could achieve this mainly by overcoming my fear of self-doubt in communication with the primary respondents; thus, addressing respondents on the field with confidence. At the preliminary stages of the study, the researcher was nervous and confused with the appropriate strategies to adapt in soliciting data, since I was approaching individuals I was not acquainted with. This uneasiness created panic and negatively affected my level of self-confidence. Nevertheless, due to tremendous energies, which involved devoting countless periods planning for the fieldwork, and reassurance and support from my supervisor, colleagues, and family, I overcame the phobia and conducted the field study confidently. Moreover, my interpersonal communication skills improved significantly post the field survey.

However, all was not smooth sailing conducting this research. Materials for this research were assembled with some challenges, which had an impact on the sample size and data collection strategies. Firstly, as an individual undertaking this research, contrast of being funded by an institution or government, required I have to use my personal resources to commute to the respondents. Secondly, in the course of doing this research, I noticed that my values and perceptions could not be disregarded entirely in the analysis and interpretation of the data. This is

because my pre-conceived knowledge and thought of water governance and management of water reserves in South Africa influenced the analysis of specific data. This was, nevertheless, minimised by continuous referring to outcomes from participants for corroboration. Data were validated by triangulation with similar data from other sources, thereby reducing any possible bias or misinterpretation of the data by the researcher.

The third constraint relates to the limited availability of interviewees. Meeting dates and times were frequently rescheduled on the availability of the interviewees. The frequent changes in the interview schedules could be attributed to two main reasons. The first related challenge was to gain access to senior-level management due to their demanding schedules. Their availability depended on changes to different work-related commitments. The other challenge was the hesitance by some participants to express their opinions unreservedly, supposedly because of the concern that any criticisms might offence the seniors and attract their fury and likely resentment.

In some cases, there was inadequate cooperation from the senior managers who thought they were being investigated to leak information to media. At a certain occasion, they appeared to contest the legitimacy and significance of what I was undertaking. For example, in the national DWS Rand and Bloem Water Boards, none of the staff was willing to corporate with the researcher on issues such as finance and revenue, or political interference in decisions involving water governance, managerial skills, and competence. The researcher was referred to their libraries and archives to seek the information, which, in most cases, was not available. In most private organisations and companies, the researcher had to use the library and the websites to get data, because leadership and management were also not willing to divulge certain information, because they were classified as confidential. In addition, most of the senior managers referred the researcher to the junior staff, because their internal arrangements coincided with the arranged bookings. Nevertheless, sufficient data were obtained from government policy documents and other related literature, which were triangulated to make useable explanations and conclusions for this study.

The challenge experienced during the fieldwork also related to the experimentation of the questionnaire, and the successive piloting activities in specific households

ended up becoming a challenge when some questions regarding their income statement were posed. During the piloting exercise, respondents hinted that they were not content to disclose their actual incomes. The issues regarding the income statement were doctored to allow the respondents to divulge only their income categories. However, the statistical analysis could not display the affordability of respondents, since the actual figures were missing. Despite this challenge, adequate data were accessed and triangulated to conclude the income status of households and affordability of water provisions. Another limitation was the approach used for communication with the participants. The original method, which was via email made some organisations and institutions, for instance, the national and provincial DWS in the Western Cape and Free State Provinces to delay in responding to the questionnaires. The IWMI, WISA, and AWARD were also slow in responding to emails. In contrast, others did not have email addresses listed as a form of contact. These constraints prompted the researcher to change this strategy of soliciting data to face-to-face interviews, which was very expensive for the researcher.

Other significant constraints to the study were time, language barrier and inadequate finance. Time constraints restricted the size of the sample population. The researcher was faced with time constraints which involved balancing working and studying. The fact that the researcher is an employee at the Eastern Cape of Department Education posed a problem during the data collection period. The Eastern Cape Department of Education could only grant three weeks of leave since the field of the research is not directly linked to the curriculum of high schools. Moreover, PhD study is not recognised by Basic Education. This phenomenon led to the challenge of making constant follow-ups with respondents. Time constraints were also experienced during data analysing the process, as the volume of data was enormous. Another major problem encountered was a language barrier, as a Ghanaian by origin, researching in South Africa, posed a challenge with the issue of language. Though I did work hard to build relationships of trust, I frequently felt that my inability to communicate very well in the local languages impacted the mode and quality of communication, notwithstanding the pleasure of having access to interpreters. This problem was, however, minimised since the field assistants were fluent in most of the local languages, and they assisted in translating questions to the participants in their mother tongue.

Limited access to finance also affected the sample size of this study. The inability of the researcher to reach all the participants earmarked for the study affected the sample population. In certain instances, the researcher had to settle on emailing and holding telephonic interviews with some respondents due to the high cost of reaching them; this affected the quality of responses obtained. Furthermore, the field assistants hired by the researcher could not work for a couple of months due to limited funds and my inability to pay them. These challenges influenced the sample size of the research. Nevertheless, the study sample did not change the substance of the research. This is because a small population sample equitably gave an accurate impression of the target population since scholarly strategies were strictly considered.

CHAPTER FOUR

EMPIRICAL EVIDENCE

4.1 Introduction

This chapter is devoted to the presentation of empirical data obtained. Empirical evidence, in this case, entails data obtained from the field between May- July 2019, and data collected from secondary sources. The data is a mix of qualitative and quantitative. Therefore, different techniques were applied in analysing the data based on the nature and character of the data, the research questions, and the objectives to be met. As stated earlier, the data obtained from the interviews and the questionnaire were presented based on the focal questions of the study. The SPSS software was used to analyse the quantitative data, whereas the word cloud and thematic strategy was utilised to analyse the qualitative component of the data. Descriptive statistics were used to illustrate and recap the nominal data and other characteristics of the subjects. Descriptive statistics were further used to present the data in frequency distribution tables, pie charts and bar graphs.

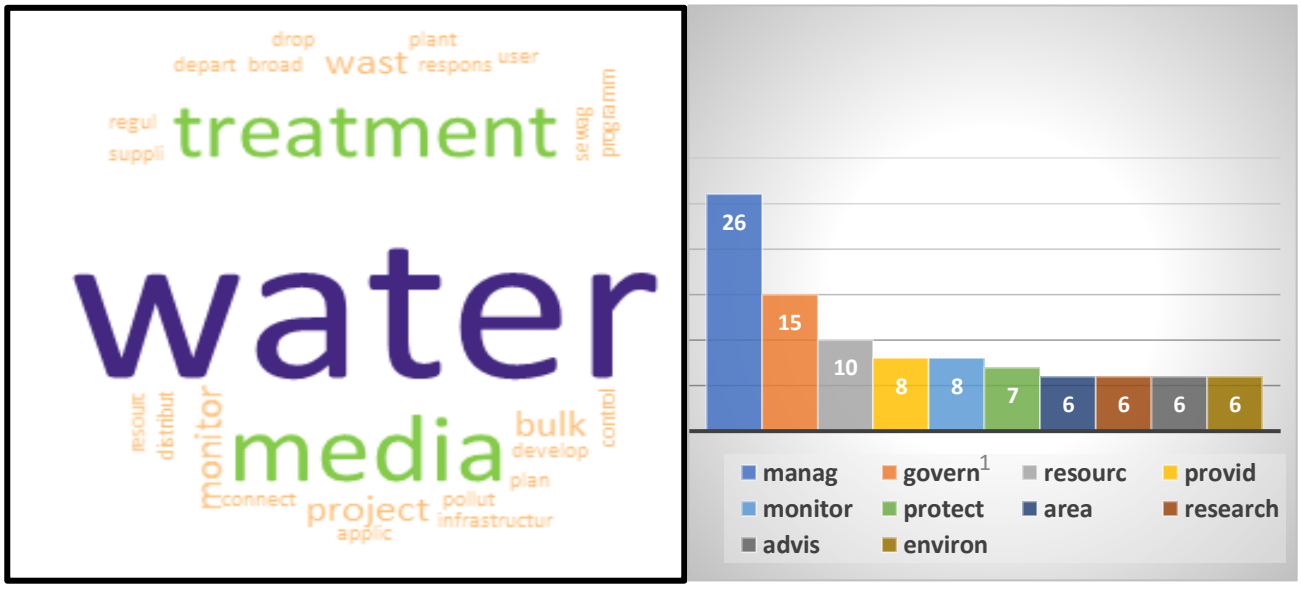
4.2 Appraisal of current legislations and policies toward water security

In order to assess the current legislation, policies, and strategies driving water security in South Africa, as indicated in the first research question, the research applied both qualitative and quantitative methods to obtain relevant data from respondents for analysis and discussion. Key data components interrogated in this case were respondents' connectivity to water resources, experience of employees in the water sector, the legislation and policy interventions that exist in the department towards water management, and water resource management strategies.

4.2.1 Respondents connectivity to the water sector

This section investigated the connectivity of respondents to the South Africa water sector. The issue of respondents involvement in the water industry is critical to this study because it informed the researcher of the perspectives, views, relationships, and the perceptions respondents have towards water resources and its management. Figure 4.1 reflects the responses of the participants.

Figure 4.1Respondents connectivity to the water sector



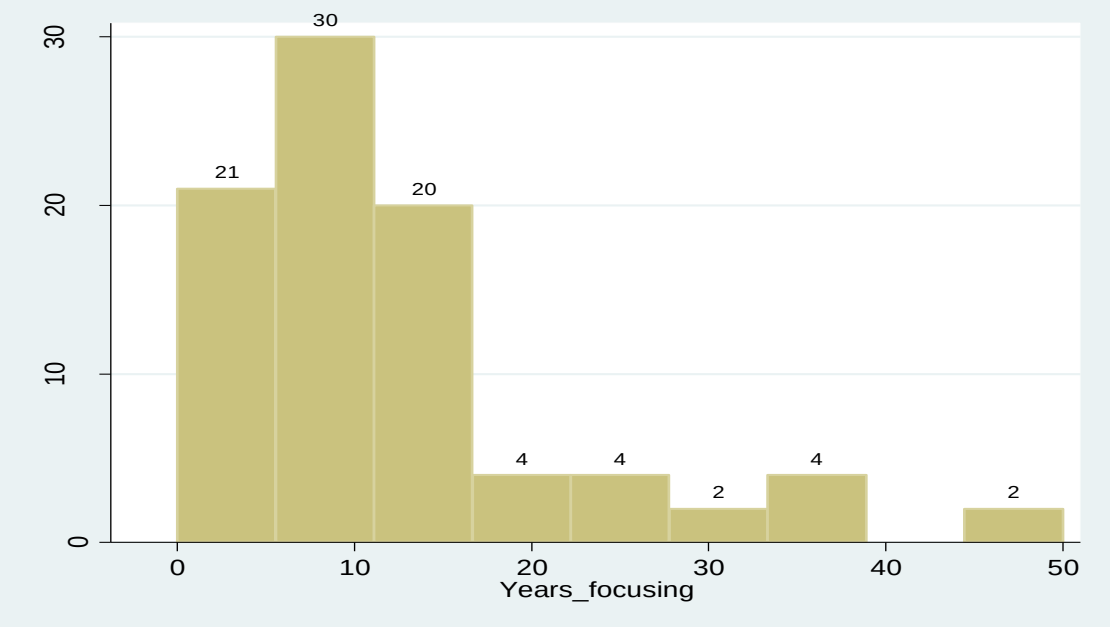
Source: Field survey, September 2019

The word water emerges as the top mentioned word in the responses, followed by "bulk water supply which entails reservoirs, bulk pipelines, bulk water supply from Rand Water/Magalies, water treatment plants, blue drop, to wastewater treatment which includes; maintenance of wastewater treatment plants, raw and sewage water treatment, maintaining green drop to scientific services, pollution control, media products and academies". It is critical to note that in each of these divisions, the majority of the respondents, 41 per cent, were in either management or governance positions, followed by the resource providers of 10 per cent. The responses of the participants suggest that the water sector is a broad field, with respondents coming from a diverse background with different functions within the sector.

4.2.2 Experience of respondents on water management

Administering water for sustainable consumption and for economic growth is both technical and governance constraints, in which expertise and experience play a key role. Sound management practices are based on pragmatic decisions making it closely linked to experienced employees. Based on this analogy, years of working in the water field was deemed to be relevant in assessing human capital within the water sector, relative to water management and governance. Figure 4.2 illustrates the results of the respondents

Figure 4.2 Experience of respondents to the water sector



Source: Field survey, September 2019

The median, or average working experience, of the respondents, was ten (10) years, with spread data values stretching more to the right, meaning the distribution is positively skewed. This description indicates that the bulk of the participants have had more than ten years of working experience in the water sector. The spreading suggests that only a small proportion of the respondents have a working experience of below ten (10) years in the water sector. This analysis, therefore, suggests that there are experienced staff, experts, and knowledgeable staff working in different sectors of water administration. This is a phenomenon that could be regarded as positive because the experienced personnel have the potential to build a culture that encourages creativity and innovation, which is a critical strategy and a requirement for the forward movement and sustainability of water reserves. Furthermore, the staff component in the sector is a great advantage, as the less experienced personnel can build on their knowledge and expertise from the experienced workforce.

4.2.3 Water management policies and strategies reforms passed post-1994

This question investigated the different legislations, policies, and strategies passed post-independence, and established propensity to promote water security. In line with this study, it is critical to discuss these interventions to understand how they have contributed, and, if they continue to contribute towards water security in

South Africa. Respondents were asked to indicate the water management and development reforms passed by the government and other institutions post-independence. Figure 4.3 reflects the opinions of the respondents.

Figure 4.3 Policies and legislations post-independent



Source: Field Survey, September 2019

The figure indicates that several reforms and other related legislative frameworks have been passed post-independence, to guarantee that both the national and local departments are able to supply safe and reliable water to the population. The key words mentioned are the act, the national policies, the service act. Other keywords are water planning, strategy framework, water bills, water sustainability strategies, among others. Nevertheless, a director in the national office of the DWS based in Pretoria, and different literature enumerated in detailed key legislations, policies, strategic framework, and regulations passed post-independent in 1994 in South Africa. Table 4.1 presents these interventions and programmes in detailed

Table 4.1 Water legislation, policies, strategies, and bills passed post-1994

Year Promulgated	***Name of Act / Legislation***	***Framework***	***Relation to water security***
1994	*"White Paper on water supply and sanitation policy."*	*"Policy"*	*"This document is dedicated to the millions of SA citizens who struggle daily with the burden of not having the most basic services".*
1996 (April)	*Water law principles."*	*"Policy"*	*"Set of principles submitted by various role players and stakeholders; guided DWAF*

			(DWS) in drafting a new water act".
1996 (Dec)	*"Constitution of the Republic of South Africa (Act 108 of 1996)"*	*Legislation*	*"The supreme law of the SA embraces human rights principles and sets forth the right of access to water as part of a list of social and economic rights. These include the right to a healthy environment, housing, health care, food, security, education, and culture. The state must take legislative and other measures, within its available resources, to achieve the progressive realisation of each of these rights".*
1997 (Dec)	*"Water Services Act 108 of 1997"*	*"Legislation"*	*"To provide for, the right to access to basic water".*
1998 (Aug)	*"National Water Act 36 of 1998"*	*"Legislation"*	*"The act recognises that water in SA is scarce and unevenly distributed and belongs to all; and that the government is responsible for water resources and their use. This should be sustained in a sustainable way by means of, inter alia, an integrated water catchment management of all water resources, and where appropriate, the delegation of management functions to a regional or catchment level, to enable everyone to participate. It also legislates the way the water resource is protected and used how a municipality may return effluent and other wastewater back to the water resource".*
1998 (Nov)	*"National Environmental Management Act 107 of 1998"*	*"Legislation"*	*"To provide for cooperative, environmental governance by establishing principles for decision making on matters affecting the environment, governance, and procedures for coordinating environmental functions exercised by organs of state".*
2004 (Sept.)	*"National Water Resource Strategy, 2004."*	*"Strategy"*	*"To provide an overview of South Africa's water situation; strategies for water resource management, arrangements for cooperative governance and a strategic perspective for each of the nine water management*

			areas and to collaborate participation and sharing agreement and institutional arrangements in place in all transboundary basis".
2013 (June)	*"National Water Resources Strategy 2013"*	*"Strategy"*	*"To address the water challenges and accommodate management interventions in a structured manner, the various identified interventions have been clustered into logical and meaningful overarching strategies.* *Provides a framework for the protection, use, development, conservation, management, and control of water resources for the whole country (DWA, 2013:35)".*

Sources: The 1996 Constitution of South Africa

4.2.4 Evaluation of current water legislation, policies, and strategies

The water policies and programmes developed since the dawn of democracy and subsequent legislation, envisaged the need for water security. However, as evident from the decisions taken, or not taken, implementation has been found wanting (NWSF, 2018). For instance, the water management, as a system with tools such as NWRS, and the associated CMA, WSDP, as well as IDP, are judged on the ability to review and assess water intervention programmes every five years based on the information that is collected on water provision. However, the ability to do this has significantly declined over time, and most of the assessment is no longer systematic, but ad hoc, disparate, and mainly under the control of consultants.

In line with these assumptions, this study seeks the views of respondents, both from public and private institutions, on the current national water policies and programmes fulfilling its mandate of addressing water challenges in South Africa. Participants were asked to specify if the current policies and programmes are adequate, effective, and efficient to address water challenges, and to justify their decisions. Table 4.2 reflects the positions of respondents on these issues.

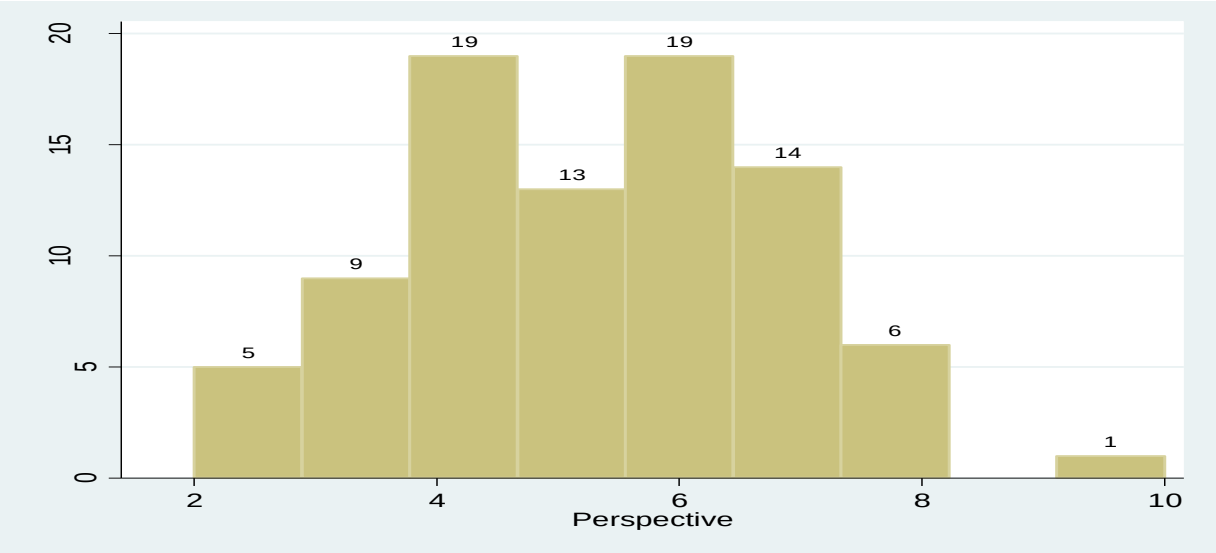
Table 4.2 Evaluation of the current policies and programmes on water

In your opinion, does South Africa have appropriate water policies and programmes to address water security? YES / NO					
		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	No	44	51	51	51
	Yes	42	49	49	100.0
	Total	86	100.0	100.0	

Source: Field survey, September 2019

Out of 86 respondents engaged, forty-four (44) of them, translating to 51 per cent of respondents, revealed that the existing policies and strategies are not appropriate to address the contemporary challenges of water security, while 42, representing 49 per cent indicated otherwise. The breakdown of the rating ranges from 0-10. The figures denote that ten (10) represent "flawless" or perfect, while zero (0) signifies "imperfect". Based on the responses of participants, a graph depicting a standard, or bale-shape distribution, was produced. An interpretation, or statistical breakdown of this distribution, showed that the majority of the participants rated the policies between four (4) and six (6), with 14 of the respondents rating the programmes below four (4), while six (6) participants gauged the programmes above seven (7). As depicted below, the mean or average rating of the policies and programmes is evaluated at five (5), with a standard deviation of 1.987. Figure 4.4 reflects a graphical breakdown of the distribution of the respondents.

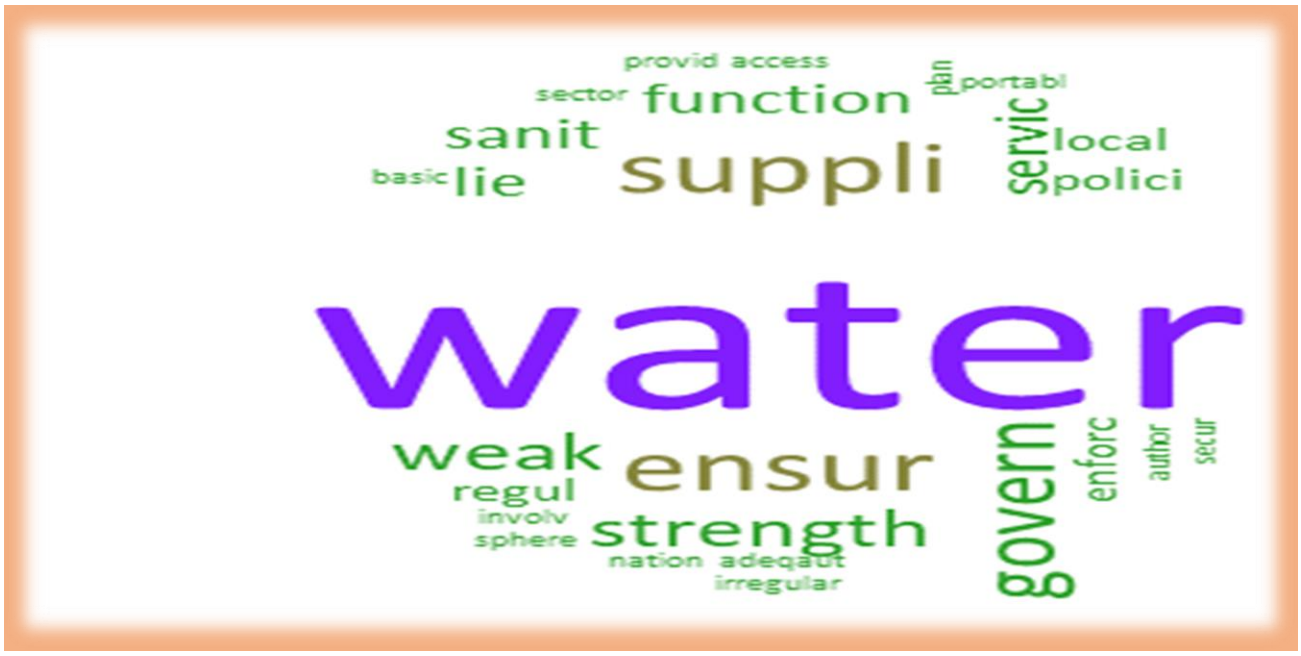
Figure 4.4 Assessment of legislation and policies, on water management



Source: Field survey, September 2019

Various justifications were given based on the positions of participants, with the focus on the insufficient supply of water both in quality and quantity, weak governance, poor sanitation, uncoordinated regulations, and legislations which embrace inadequate monitoring and evaluation procedures in the water sector. Figure 4.5 reflects the justification of respondents towards these policies and programmes using the 'bag-of-words' model.

Figure 4.5 Justification for the perceptions



Source: Field survey, September 2019

Respondents mentioned that water provision in South Africa, post-independence, is one of many successes; however, there is still a measure of anger with the pace, as evidenced by demonstrations across the country about water provision.

An executive director in charge of a “key strategic area of water consumption and waste management of Water Research Commission” based in Gezina in Pretoria, when asked to comment on ……. stated that:

"Nationally, the policies and programmes have enabled more than 80% of households to have the quality of water-related services. Furthermore, the policies and the programmes advocate for a more coordinated approach to water resource management in planning, implementation, monitoring and evaluation. However, there are some challenges to the policies, especially the implementation."

(Per.com, 2019a)

This view was supported by the Director for Regulation, who reside in the Western Cape Provincial office of the DWS disclosed in an interview that:

"The policies and the programmes ensure access of all South Africans to enough water to meet their basic human needs and recognise aquatic ecosystems as having a legitimate right to their water. Water for minimum human and ecological needs constitutes an untouchable." (Per.com 2019b)

Nevertheless, a PhD student in the Water Institute at the University of Western Cape based in Cape Town stated in an interview that:

'The current policies and programmes do not go far enough to address the challenges of increasing pollution by both the municipalities and industries, decreasing water quality, revenue shortfalls, infrastructure decay and maintenance, increasing evaporation due to climate change, weak consolidation of institutions and the challenge of policies implementation."

(Per.com, 2019c)

These sentiments were strongly supported by an employee, residing in the Western Cape Provincial office of the DWS. She mentioned that:

"There is a serious problem with implementing some of the current policies and programmes. In her views under the current legislation, for instance, every river

has to be studied in detail before the ecological reserve can be determined and taking into account the huge shortage of skills in the country and only a few in the department with the necessary skills to undertake such tasks. We also lack capacity in policing pollution." (Per.com, 2019d)

Another employee in the Finance and Regulation Division of the National DWS pointed in an interview that:

"Increasing the number of people with clean and safe access to drinking water and meeting the strict and rigorous environment guidelines require financial resources. However, currently, there are only four main sources of revenue from the department. These are; taxes, charges on water usage, money allocation from the national budget and transfers from international agencies. The distribution of these is a political decision, considering issues of economic efficiency, social equity, environmental sustainability, and affordability constraints. The call for sustainable cost recovery demand increasing attention on water tariffs, willingness to pay and realistic charges of water usage. In many provinces and municipalities paying the minimum tariffs on the water used is a major challenge to tackle, before increasing tariffs. These challenges are not addressed by the current policies."

(Per.com 2019e)

The views and sentiments expressed by the respondents suggest that the policies and programmes have achieved some success in terms of accessibility. A considerable number of the inhabitants have accessibility to water. However, the policies and the programmes are hampered by weak governance and regulations, exploitation, pollution of water resources and high levels of wastage through leakages.

4.2.5 Water management strategies at provincial and at the national levels

One of the keys, and fundamental focus driving this study, was to examine if there are adequate programmes and strategies in place to address water security in the country. Discussions with many respondents revealed different strategies and intervention programmes had been introduced by both the national, and provincial departments, with the aim of managing water resources. In view of this, it is of significance for this study to identify and analyse these programmes with respondents to ascertain their level of understanding and applicability of the

programmes in achieving water security in South Africa, since these programmes form the bedrock of water management in the DWS. Table 4.3 displayed the outcomes of interviews conducted with some respondents within the DWS.

Table 4.3 Programmes and regulations undertaken by the DWS post-1994

			Responses	Per cent of
		N	Per cent	Cases
Programmes	8.1 An active water management program	20	23%	75%
	8.2 A water management taskforce on water issues	16	19%	75%
	8.3 Academic program focused on water issues	13	15%	54%
	8.4 Research group/lab focused on water	15	17%	60%
	8.5 Extension/outreach services addressing water issues	14	16%	64%
	8.7 Others	8	9%	62%
Total		**86**	**100.0%**	**377%**

Source: Field survey, September 2019

Multiple response analysis was done, and the results are presented in Table 4.3 above. Two programmes identified by 75 per cent of cases each are – 'an active management programme', and 'water management taskforce on water issues'; followed by extension/outreach services addressing water issues at 64 per cent, the academic programme focused on water issues were reported by 54 per cent of the participants, and research group/laboratory activities.

This analysis suggests that the Department of Water and Sanitation placed more weight on active water management practices, and the water management taskforce on water issues, than any other programmes involving water management. Typical issues mentioned under these programmes included: water conservation practices and water demand and supply management. An overwhelming number of participants mentioned water restrictions, tariff structures, changes in agricultural practices, sanitation systems, water education, re-use of greywater and leak reduction as demand-side management. The supply-side management entails planning and management, desalination, rainfall harvesting, control of water pollution, enhancement of supervising and prediction structures for flood and drought.

4.2.6 Water resource management practices under the policy and strategy

Besides the planning and managing water reserves against the four major issues affecting water supply in the country (climate change, population increase and economic growth, increase pollution of water resources and poor policies coordination), the Department of Water and Sanitation has introduced different water management strategic measures to tackle these challenges, and to address the challenges of poor management of the water resources, and to enhance accessibility to essential water provision, especially to the rural population as promulgated in the NWRS. In line with this objective, this study scrutinised the water resource management issues with both senior and junior management employees of the department. Table 4.4 shows the results of interviews conducted with the participants.

Table 4.4 Water resource management strategies by DWS

			Responses	
		Number of Participants	Per cent	Per cent of cases
Issue	Water Conservation	25	29%	92%
	Water Quality Management	19	22%	79%
	Watershed Management	10	12%	30%
	Storm Water Management	7	8%	29%
	Wastewater Management	12	14%	42%
	Others	13	15%	38%
Total		**86**	**100.0%**	**310%**

Source: Field survey, September 2019

The table above illustrates that water conservation is identified by 92 per cent of all the participants, followed by water quality management at 79 per cent. Storm and watershed management was mentioned by 30 per cent and 29 per cent, respectively. Participants mentioned conservation practices such as detection of leaks; waste minimisation (inspiring consumers to reduce wasteful consumptions); funding of infrastructure, know-hows that minimise water consumptions without dropping consumer satisfaction, and/or productivity; reprocessing of industrial sewages and wastewaters such as recycling and re-use, and relocation of freshwater resources as the common conservation practised by the department.

An open conversation with bulk and wastewater treatment manager in Pretoria posits that:

"*The conservation strategies that are to promote demand management are mainly through the pricing of water at an economical rate, charging for pollution (polluter pay principle) or by community-based pollution control practices, regulating and restricting specific water uses, through public education on how of use water wisely, promoting recycling and reuse." (Per.com, 2019f).*

As indicated in the table above, barely 30 per cent of the total participants mentioned watershed and storm as a water management option. In-depth interviews suggest that there is a lack of understanding, capabilities, skills, and expertise within the department to undertake this water management practice.

Thoughtful interpretations of these responses suggest that though the department of DWS has diverse water management programmes and practices, these programmes are not addressing the root causes of water scarcity in the country (instead of treating symptoms). There are gaps in the designing execution, checking and appraisal phases, lack of working across or weak coordination among the sectors, key stakeholders at administrative levels, poor amalgamation of "bottom-up and top-down" management approach and weak combination of local and scientific knowledge.

Given the above challenges, it is appropriate to restructure the current programmes to be more accommodative; thus, perceiving water as inherent to food and energy security, economic development, and social justice. Recognition of water at that level would guarantee that it attracts urgent attention by policymaking, and not be regarded as a theoretical and a free-good resource. It would also generate better harmonisation among sectors associated with water, for instance, those in power, forest and cultivation and thereby reinforcing water administration.

4.3. Grassroots participation in water management and governance

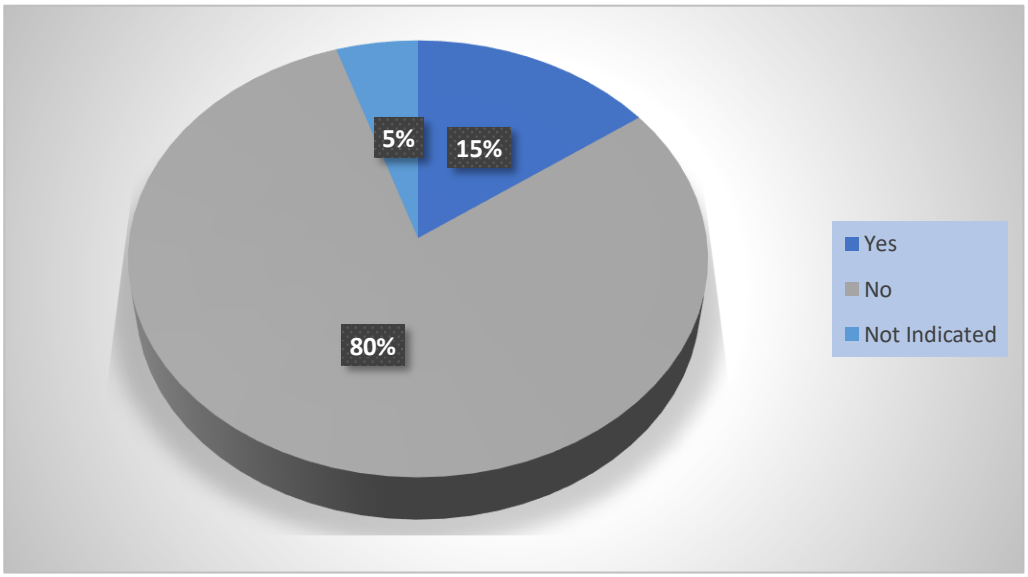
The next research question is to examine the level at which interested parties and other grassroots organisations are absorbed in the formulation and execution of policies. In line with this question, the study engaged extensively with external stakeholders and communities in the form of "face-to-face interviews" as well as

open and closed questionnaires. The subsequent sections analysed the findings, and the results are presented in the forms of diagrams and graphs.

4.3.1 Levels of policies and legislation awareness among the population

The motives behind these questions are to access the level of awareness, understanding, responsiveness and applicability of grassroots and communities on the various legislation and policies. As indicated earlier, the end-users of any legislation, or policy, are the consumers of the resources, of which households and communities form the substantial constituent; therefore, their awareness and understanding of the programmes will determine their level of successes. In line with these, respondents were asked to indicate if they are abreast with some of the current strategies, policies and legislation governing water. Below are the responses obtained. Out of 68 respondents who responded to the survey, 55 of them, representing 80 per cent, reported 'No', meaning they are not aware of any of the programs, with only 15 per cent indicating they are aware.

Figure 4.6 Grassroots awareness in water policies



Source: Field survey, September 2019

The interpretation of the responses suggests that there is a lack of awareness among the grassroots and communities on programmes that are supposed to drive water security. These outcomes indicate that the department, municipalities and WSP do not have a communications strategy of getting grassroots and communities involved in water administration and governance. The public and the residents are

left out entirely in any form of management, and this discourages them from participating in decision-making on water management approaches. Proper water management requires communities issues inculcated throughout the process, especially when planning for programmes and activities that impact on the inhabitants generally. It must follow the values of social justice, active public engagement, and broad base policymaking, which directly, or indirectly, enhances economic growth, improves water quality across communities.

4.3.2 Factors hindering grassroots and community's awareness of policies

This question was exploited to establish the significant factors impeding effective public and local engagement in water management. The water reforms, post-independence, put communities and grassroots participation at the centre of management and governance. The policies envisage that water administration is delegated to provincial levels, through CMAs, and the communities. Nevertheless, this is not always the case. Community and grassroots participation have been neglected in every level of management. Given these circumstances, the study explored this phenomenon to understand the reasons behind this. Respondents were to rate their levels of obstacles under the following measurement "Not an obstacle; somewhat an obstacle, important obstacle and major obstacle". The table below depicts the views of respondents on this matter.

Table 4.5 Factors and levels of awareness of policies and legislations

		Not an obstacle	Somewhat an obstacle	Important obstacle	Major obstacle
Lack of available data on water resources	Count	0	3	8	9
	Row N %	0.0%	15.0%	40.0%	45.0%
Language is too technical to understand and follow	Count	1	5	6	8
	Row N %	5.0%	25.0%	30.0%	40.0%
Time and venues not conducive for the population	Count	0	4	8	8
	Row N %	0.0%	20.0%	40.0%	40.0%
Lack of benchmarking to evaluate water quality, quantity, and service providers' performance	Count	1	2	5	12
	Row N %	5.0%	10.0%	25.0%	60.0%
Poor communication of the policies and programmes to the communities	Count	2	3	3	12
	Row N %	10.0%	15.0%	15.0%	60.0%
Weak judicial system to report complains and conflicts	Count	1	1	7	11
	Row N %	5.0%	5.0%	35.0%	55.0%
Limited information sharing across local authorities	Count	0	3	5	12
	Row N %	0.0%	15.0%	25.0%	60.0%
Limited monitoring/evaluation guiding decision-making	Count	0	1	4	15
	Row N %	0.0%	5.0%	20.0%	75.0%

Weak stakeholder engagement in water policy and projects	Count	0	0	3	17
	Row N %	0.0%	0.0%	15.0%	85.0%
Other, please specify	Count	1	0	0	0
	Row N %	100.0%	0.0%	0.0%	0.0%

Source: Field survey, September 2019

The answers to the questions revealed that the majority of the respondents ranked the challenges from 'important to major obstacles'. Only 25 per cent graded 'Not able to understand the language used in the policy and programmes as somewhat of an obstacle'. In view of this statistical break-down, it can be understood that grassroots and communities involvement in managing water resources are hindered by lack of information, poor communication and knowledge, and the mismatch between the department, grassroots organisations and societies in the designing and execution of policies and strategies. This, rather than coordination and collaboration which has hindered proficiency among sectors, and prevented the taking up of convergent purposes of sustainable management that address water security.

4.3.3. Stakeholders engagement in water management

Hypothetically, the move towards stakeholders management has numerous benefits in the water sector. These include improving governance, building democratic values into participants, promoting sustainable development, as well as stakeholders empowerment. These benefits are demonstrated through the applicability of local knowledge and talents to enhance water management. Other gains include empowering the marginalised population often left out in the decision-making to partake in water governance, thereby increasing the acceptability of the policies and programmes, and augmenting organisational responsibility in water management. The underlying questions in this circumstance must be, are these theoretical issues realistic and applicable in South Africa? Could participants engagement in water management and governance be the cornerstone to policymaking and planning in the country? Based on these critical issues, this study scrutinised the stakeholder's participation in water management. Respondents were asked to indicate forms of engagement, and the challenges involved in the water sector.

Figure 4.7 Views of respondents towards public engagement



Source: Field survey, September 2019

Stakeholder engagements are mainly modelled around workshops, meetings, community-level interactions, and other forms of engagement. A significant number of the respondents indicated that water is a limited, susceptible but indispensable assets, which should be administered in an integrated means which must be based on a participating strategy involving the consumers, organisers, implementers, and policymakers at every level. The respondents alluded that public participation and engagement promote openness and accountability in terms of taking decisions around developing and protecting water resources.

Some of the participants further alluded that active participation of all stakeholders in decision-making often foster an atmosphere of cordiality, openness, and reciprocated appreciation, which encourages clarity and confidence among interested parties. Such environment enhances the accomplishment of the programmes due to increase recognition by all participants. Obviously, this type of environment is extremely suitable, especially when the strategies are critically connected to numerous participants and implicating multiple benefits.

A water and sanitation expert and consultant in the national office of the DWS who was engaged in an in-depth interview elaborate this position by commenting that:

"Water assets planning without the involvement of participants in decision-making is exceedingly futile. Intervention actions exclusive of adequate involvement of

interested parties often seem to be deficient in fine-tuning. Subsequently, an even greater obstacle of implementation actions. The question of participant involvement is sturdily linked to the demand for decentralisation or water administration at the lowest appropriate level". (Per.com, 2019g).

This view was supported by another director for monitoring and evaluation who reside in the Free State provincial office of DWS. This participant stated that:

"The democratisation and decentralisation of water resource management to more regional and localised levels of water management areas places a responsibility on localised water management institutions such as the catchment management areas (CMA). The task of CMA is to engage stakeholders in strategic planning that recognise the need to plan for water security through the development of CMS." (Per.com, 2019h).

A water consultant, with vast knowledge and numerous publications in water management who is stationed in King William's Town in the Eastern Cape Province, reiterated that:

"The inclusive and collaboration of participation brings together ideas from different stakeholders such as agriculture, forestry and local government into the water sector. In addition, public participation promotes transparency, ensure inclusiveness of water management and provide a solid foundation on which planning and decision-making processes are built upon." (Per.com 2019i)

Nevertheless, not all the participants agree to these sentiments towards stakeholders' engagement in water management. A respondent in DWS in the Western Cape regional office in charge of research, training, and public awareness, expressed a distinctive opinion towards stakeholders' engagement in water management. He argued that:

"Though the legislation governing water resource in South Africa stressed on public participation in all levels of management, the major constraints is enforcing the policy within the context of water management. Significant constraints include; under-representation of certain groups in societies, limited inclusiveness, time-consuming, ill-informed population, and lack of democratic attitude by certain groups involved in water management. Usually, well-organised interest groups,

well-educated white-collar workers and people are over-represented. Unorganised communities and organisations are often not represented at all." (Per.com 2019j)

This view was validated by a researcher in water management from the Water Institute at Rhodes University. Who mentioned in an interview that:

"Bringing all the different stakeholders together to have their views and preferences is expensive. It makes engagement complex and complicated because individual stakeholders come with diverse background and hence generates the setting of many targets, which often prevent prioritisation of decisions regarding effective resource use. Furthermore, the amount of time required for organise and coordinate participatory activities become huge. It takes time to train or develop competences and know-how for them to understand and constructive contribution to water management." (Per.com, 2019k).

These views, expressed by different respondents, suggest that public participation means different things to different people. It is prescribed administrative activities performed to fulfil procedural requirements, or public relation events formulated to "sell" policies of the government. Nevertheless, the primary purpose of public engagement is to, “share responsibility and social learning, and to promote sustainable water management. To achieve public engagement, it must not be treated as a mere technique" (Boakye et al., 2012: 511). Active public engagement is, actually, a new style of administration. It requires knowledge of participatory approaches and methods. More importantly, however, it requires an open, transparent, and outward-looking government that recognises that it cannot solve current water management problems on its own, and has sufficient confidence to enter into direct discussion with its citizens. This is the real challenge of public participation (Razzaque, 2009: 364).

4.3.4 Public participation in water management at community levels

Awareness creation and public participation or involvement are vital components in the restructuring programmes in the new water sector approaches and strategies. The policies provide the water sector organisations with a way forward that requires them to minimise the information gap at any stage, both in government and private institutions. Communication with different age cohort is an obligation of all water organisations, each undertaking the required procedures

to enhance their exploits in connection with the policy, and in collaboration with the DWS, the water leading institution. It is, nevertheless, established that gaps exist in the current channel of disseminating news and knowledge on water issues among the participants, especially the local communities and the grassroots organisations. Based on these shortcomings, the study analysed the different mechanisms in place for grassroots involvement in water administration and policymaking procedures. The critical question here is, 'do grassroots participation processes meet the requirements of the legislation?' Participants were asked to specify the structures through which they interact on issues pertaining to water, their rights and responsibilities in the process and constraints associated with this development.

Figure 4.8 Public participation in water management at the local level



Source: Field survey, September 2019

The Figure shows that mass communication, public participation, discussions, and stakeholder forums are mostly used in getting their messages across. As indicated earlier, public participation is regarded as a high priority in water governance. It is a strategy to enhance the comprehension of the IWRM strategy, inform the public of the legislations, policies and strategies of governing water and afford the grassroots organisations opportunity to contribute directly to water management.

These sentiments were echoed during an interview with a director for community liaison officer in the DWS, based in Bloemfontein. This participant mentioned that:

"Community engagements and grassroots participation initiatives are some of the interventions programmes embarked by the Department of Water and Sanitation to bring government closer to the communities in as far as water provision is concerned. According to this respondent, the department, working with all stakeholders in various communities is committed to ensuring that the members of the public are empowered with the necessary information that educates and inform them about water management and conservation." (Per.com, 2019l).

This view was supported by a media-liaison officer and spoke person in the national office of the DWS based in Pretoria. The respondent alluded that:

"Community awareness campaigns are organised to educate communities and people on the importance of water conservation in light of the water challenges such as water leakages, vandalism, illegal connections and water wastage. This is done through media briefing, community engagement, roadshows, community forums and other social media platforms." (Per.com, 2019m).

This view was augmented by an employee in the Gauteng DWS, in the planning and development division. This respondent mentioned during an interview that:

"Department of Water and Sanitation (DWS) and Department of Performance, Monitoring and Evaluation (DPME) under the Premier Office, often host Operation Phakisa with a clear objective of creating awareness on water conservation, water security, water infrastructure maintenance, climate change and drought, wetlands and streams management, and rainwater harvesting programmes. Furthermore, these campaigns aimed to increase knowledge and advance the importance of water demand management in the sustainable development and utilisation of water resources." (Per.com, 2019n).

Nevertheless, not all the respondents gave a "thumbs up" to this initiative often embarked on by the DWS. Some of the respondents see these programmes as "box-ticking" exercises; thus, as exercises often carried out by the department just to fulfil the constitutional requirements. For instance, some of the respondents alluded that while the constitutional requirements stressed that the public must be informed, consulted, involved, collaborated with, or empowered to participate in the decision-making procedure, these only occur theoretically, and have not necessarily been practice pragmatically. The privileges and responsibilities of the

various participant groups have not been simplified or clarified; this often results in misunderstanding and discouragement in the entire procedure of public awareness campaigns.

An interview conducted with a public relation officer of the Amatola Water in the Eastern Cape Province mentioned that:

"In most cases, the quality of the responses from the communities and participants are shallow and unproductive due to lack of understanding of water issues. The absence of competent personnel to participate efficiently, professionally, and impartially, due to weak standard of education, barriers in terms of language, the inaccessibility of the locations, lack of budget and time constrictions to organise consultations affect the quality of engagements. These inadequacies often extend to the NGOs and CBOs, who are supposed to act as "watchdogs" or agents of certain institutions. They are anticipated to pass their views on or participate actively in the enactment and administration in the proposals and happenings associated with water assets. Their inability to participate is often restricted by time, finance and constraint involving human resource" (Per.com 2019o).

This argument was supported by another respondent in the Rand Water monitoring and evaluation division. This respondent mentioned that:

"In most situations, there is a low level of interest in water-related issues among most communities and organisations in the province. Community engagements are often complicated due to a lack of interest. Engagements in water-related issues are often not practicable. The level of support and commitment in water conservation and management are far below their immediate pressing social development needs such as housing, hunger and poverty." (Per.com, 2019p).

A director of the Bloem Water responsible for stakeholders' engagement and communication stated in an interview that:

"There is absence of clear interpretation, purposes and responsibilities of communities in the engagement processes. This problem could be blamed on political interference and poor communication among stakeholders. There are range of definitions and terminologies used in the various engagements that are often misunderstood or judged contrarily by diverse interests in an engagement.

Secondly, there are challenges of personal and political interests during stakeholders engagements. These predicaments often occur as individuals or groups overshadow the engagements to advance their statuses or personal or political interests." (Per.com, 2019q).

The views and sentiments expressed by the respondents suggest that community, or public participation, is a critical and essential component in water management in South Africa, but faces a lot of complexities and challenges hindering its fundamental goal of driving water security. Notable ones include:

(i) carefully managing consensus building and conflict to maximise the quality of the decision without threatening the potential for implementation,

(ii) being aware of and implementing strategies to manage asymmetrical power relationships between participants to maximise the quality of the decision,

(iii) to ensure that participants obtain the benefits from a participation program that exceed the costs of running the program, and

(iv) to define criteria for a legal process, and a legal decision, that gratifies all participants. Strategies to address these challenges are focused on how the participation processes are managed or carried out.

These constraints suggest that conflict resolution ought to focus on identifying the fundamental interests of the diverse participants instead of preserving the established prearranged statuses.

Implementing an “interest-based approach” gives prospects for finding shared benefits and functioning towards common goals and objectives. In the process, new, alternative models might be developed, which would not have been reflected upon if different participants' principle were considered which opt for rigid choice. In short, selecting the appropriate participation technique must be guided by the principle of efficiency, proficiency, equitability, and applicability. Above all, any method must be supported by the values of honesty, frankness, trustworthiness, and reliability.

4.3.5 Cross-sectoral challenges in water management and governance

IWRM has emerged as a participatory approach for coordinating water and other related resources. To assess the effectiveness of stakeholders involvement in water

administration, some significant elements, or principles, need to be assessed in line with stakeholders' engagement in water governance. These include the scope of participants, communication with the public, capacity building, timing, financing, harmonisation of the activities, and many others. In line with these principles, the study analysed the rating of characteristics among stakeholders in water governance. Respondents were asked to rate the levels of stakeholders' involvement in water governance using the following measuring tools: "Very poor, Poor, Fair, Good and Very good". Table 4.6 reflects the responses of the respondents.

Table 4.6 Assessment of cross-sectoral engagement in water management

		Very poor	Poor	Fair	Good	Very good
Coordination of activities	Count	0	4	5	2	0
	Row N	0.0%	36%	46%	18%	0.0%
Information sharing	Count	0	5	3	3	0
	Row N	0.0%	46%	27%	27%	0.0%
Harmonisation of policies	Count	1	5	5	0	0
	Row N	9%	46%	46%	0.0%	0.0%
Joint working	Count	0	5	5	1	0
	Row N	0.0%	46%	46%	9%	0.0%
Collaborating with multiple sectors in managing water resources in national, provincial, and local levels	Count	0	5	4	2	0
	Row N	0.0%	46%	36%	18%	0.0%
Consider and apply solutions and management practices from multiple disciplines (Science, Economics, and engineering)	Count	0	6	4	1	0
	Row N	0.0%	55%	36%	9%	0.0%
Applying an interactive management approach involving planning, executing, monitoring, evaluation and revising.	Count	0	5	6	0	0
	Row N %	0.0%	46%	55%	0.0%	0.0%

Source: Field survey, September 2019

As portrayed in the table above, only 18 per cent of the participants' concord that there is proper coordination of activities among various stakeholders in water management, and only 46 per cent disclosed that the coordination activities are fair. At the same time, 36 per cent rated these activities as weak. In terms of information sharing, 46 per cent of the respondents disclosed that it is terrible, 27 per cent indicated that the process is fair, while the same number said it is right. Regarding harmonisation of policies, the result exposes a gloomy picture as none of the respondents rated either good or very good, and the majority of the respondents, 46 per cent, rated the harmonisation process as fair and poor. In contrast, 9 per cent rated the process as very bad. Rating of joint working is not

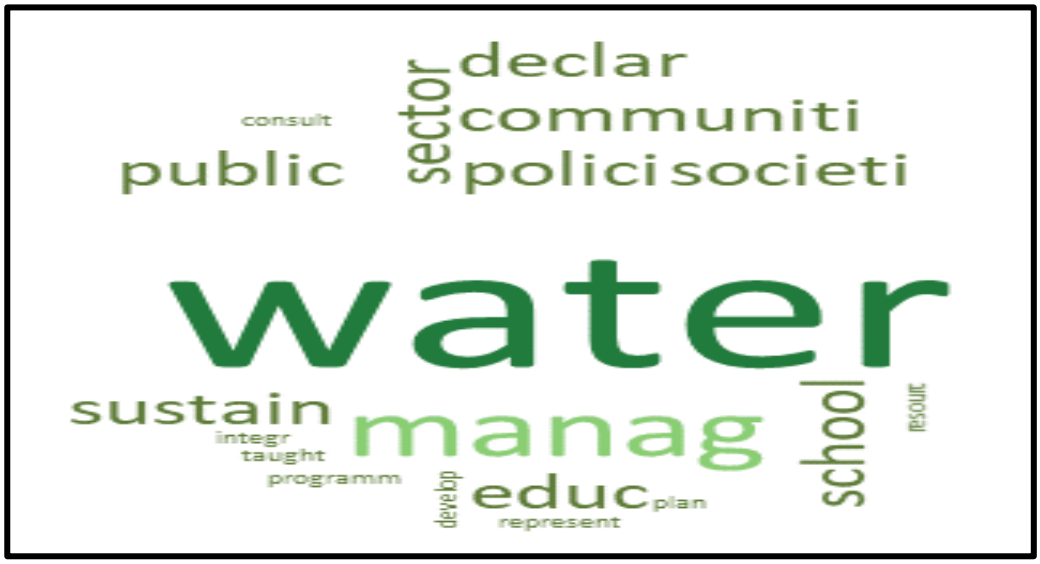
much different from the other rating; only 9 per cent rated this activity as useful, while 46 per cent rated it as fair and bad.

This analysis suggests that there are few stakeholder engagements in water management in South Africa. The traditional top-down management approach engaged by the national and provincial DWS is ineffective in managing water resources holistically. Such management style does not involve the stakeholders, and is over-dependent on government. Non-involvement of stakeholders reduces the effectiveness and the resource of productive stakeholders. Complete backing and involvement from interested parties (thus government, private institutions, and communities) are relevant players in IWRM strategies for sustainable water consumption.

4.3.6 Channels of communication on public education and awareness

Policymakers and implementers within the DWA, disseminate their memos, interventions, and their execution strategies, through different channels of communication. The identification of an appropriate communication channel is coaxed by several circumstances; these include the efficiency of the channel to reach the focus population, the cost involves, and time or period it takes. In most instances, it is essential to integrate these channels to get the message effectively delivered. This study highlights the existing communication channels that implementers often use in the execution of their policies. In line with set-up, participants were asked to specify the communication channels for dissemination of information driving the water security initiatives. Figure 4.9 reflects the opinions of the respondents:

Figure 4.9 Communication channels for public education



Source: Field survey, September 2019

The figure shows that the DWS and other organisations disseminate or communicate their information and intervention programmes via sustainable integrated programmes taught in schools, and universities, water management programmes carried out by educational activities, public consultation and community learning interaction, facilitated training workshops and meeting, social interaction and community conversations.

An executive director in strategic planning and development in the provincial office of the DWS based in Johannesburg in the Gauteng Province pointed out during an interview that:

"One of the main channels by which the department disseminate its programmes and get people empowered is the hosting of awareness campaigns at some identified schools, colleges and universities to such as World Water Day and also the incorporation of water sustainability into the school syllabus and curriculums. According to the respondent knowledge and understanding of water issues among students and learners is the core ingredient of solving water-related problems. It is a fact that greater knowledge allows people to contribute to innovation and problem-solving. The concept of water literacy and other forms of literacy such as health literacy integrated integrate topic knowledge and the capacity to apply this knowledge to decisions-making."

(Per.com, 2019r).

A community liaison officer at Mvula Water Trust, a Western Cape branch, said in an interview that:

"Public consultation and community learning interactions are channels of communication embarked by the department and private organisations to disseminate its programmes and policies to the general public. Civil societies, local communities, private sector, and academia are actively engaged in decision-making through notice letter, email, EIA and EMP report, public meetings, and focus group meeting. Furthermore, it is important that the impacts and management plans are communicated to stakeholders in a way in which they can understand. In addition, all stakeholders comments are captured in the Comment and Response Report (CRR), which can be analysed for potential project impacts and risks." (Per.com, 2019s).

These views were reiterated by a water and sanitation consultant in the national office of the DWS based in Pretoria. This respondent mentioned that:

"Schools are the best avenues for reaching the youth and children and influencing future leaders. Again, younger generations should be highly targeted as they are easier to influence and will be taking responsibility in the future. Building a generation that understands the importance of water, saving water resources, fighting illegal connections, and paying water bills would help the water sector have a better future. Engagement with the youth takes both formal and non-formal education. The formal type targets the curriculum while the informal targets extra-mural or extra-curricular activities, entertainment activities and publications. Moreover, NGOs with specialisation in water issues are considered partners of these programmes and are playing a significant role in reaching out to other target audiences and advancing water agenda." (Per.com, 2019t).

However, some of the respondents expressed different views on the programmes and process through which information is disseminated. For instance, a respondent indicated that in terms of the NDP and the NWSMP, the active citizenry (participatory democracy) must be pursued in the drafting of policies and programmes. Catchment management forums (CMF) are vehicles to facilitate the participation of all participants. The participation in these forums are problematic for communities, especially for those characterised by widespread poverty.

Information is disseminated through emails; documents are made available on websites; travel and opportunity costs, present challenges.

A public liaison officer in the water chamber, a private consultant company in South Africa, based in Johannesburg, said during an interview that:

"*The current channels of communication regarding water issues are too old, very conventional and have outlived their usefulness. These conventional communication channels are one-way process of dissemination information and are peripheral to the development process. The current awareness campaign strategies are not and cannot change the perceptions, attitudes, behaviour, and culture of the population towards water usage. Effective communication instruments must carry rational messages which ought to contain compelling messages targeting specific groups through the use of facts, numbers, statistics, benefits, losses, risks, budgets, pros and cons of water consumption and must contain emotional messages of inspiring and touching the feelings of the target groups through ethical, religious, and patriotic message. It is widely believed that since every person has a role model, a father figure, or an influencer that can impact decision, it is vital to involve the social influencers to communicate messages of water management as the youth would like to follow messages of their role models." (Per.com, 2019u).*

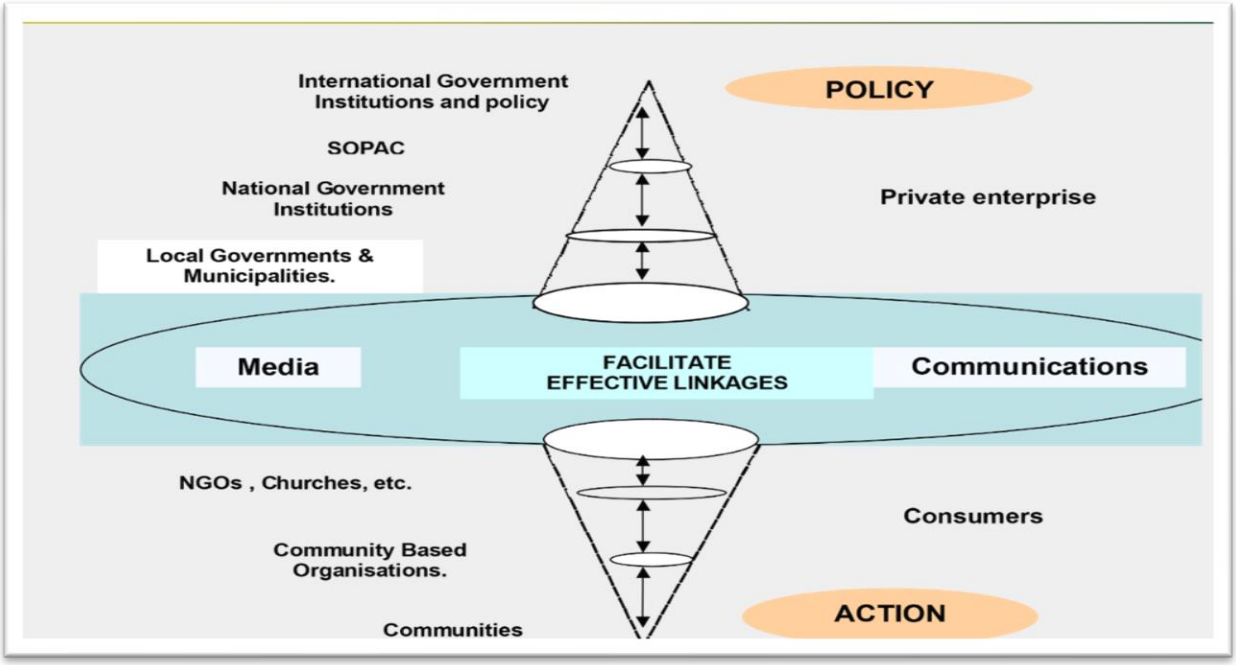
This view was echoed by a researcher and lecturer of water affairs at the University of Western Cape based in Cape Town during a face-to-face interview mentioned that:

"*To promote understanding and support of Integrated Water Resources Management (IWRM) and increase its effectiveness as a strategy to contribute to economic and social development then its management must be a joint responsibility of WSO, the general public, private sector, NGOs, and other target groups. All have to work together to manage water and other related resources that ensure equity and maximum contribution to the economic, social, and sustainable development of the country and provinces. It is that broadcast and multimedia, social media, web media, printed materials, direct communication, out-of-home – events, workshops and training must be encouraged in communicating water management strategies. Furthermore, water issues should become trendy in South Africa. It should be seen on billboards, read in newspapers, heard on the radio, watched on TV, shared on Facebook, emailed, published on news sites, addressed*

in mosques and churches, discussed in coffee shops and restaurants, taught in schools and universities, and called for by influential figures and organisations. It is strongly believed that with this, water issues will be fashionable to the extent that funding agencies and other target audiences will be attracted in joining." (Per.com, 2019v).

The diagram below epitomised an effective and efficient communication channel.

Figure 4.10 Effective channel of communication in the water sector



Source: IWRM communication Strategy 2008

From these comments and opinions, it appears all and sundry is a participant in water governance, and both the NWA and NWRS demands realistic participation at every stage in the policymaking program. Effective engagement entails well-versed participants, be it the conventionally marginalised class, for instance, women and minorities, or administrators managing the reserves or distributing water resources. Participation must be shared responsibilities among participants at all stages from “planning, development, allocation, conservation, protection, monitoring and evaluation”. The participation strategy that foster lifelong consent, with a collective understanding, stakeholders buy-in, proprietorship and taking accountability of water resources, all these factors are imperative in the water management in South Africa.

Furthermore, analysis from interviews suggest that for effective communication to take place, it is imperative to adapt communication channels appropriate for the audience and effective messaging. Effective communication channels require unambiguous message; languages, watchwords addressed to focused groups. Additionally, effective communication is the apparent exchange between administrators and all participants, better adaptability that leads to identifying the needed capital required to adjust innovations, population characteristics, and sustainable development is required. Such communication paradigms and practices are grounded on thoughtful the influences that lead to changes of attitudes by participants by employing response practises consultation from the public, reviews, and scrutiny of criticisms. This includes analysing information concerning the establishment and transformation of behaviours or outlooks. Participants and focus group have diverse convincing control on the development of resources and the accomplishment of its strategic guidelines.

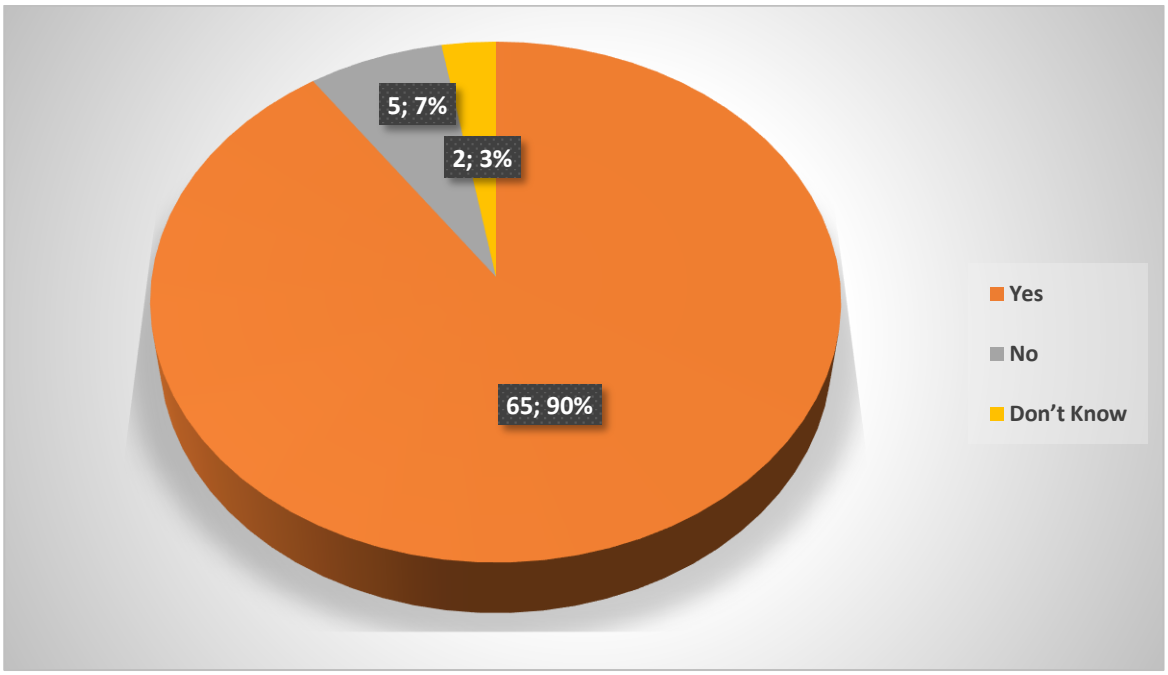
4.4 The structural and systematic constraints to policy implementation

Responses to the challenges of policy execution were deliberated in the third research question of the study. The general view is that the challenges of implementing policies and programmes are stringently related to, and/or impacted on, by lack of resources such as finance, human capacity, and political will. There is an understanding that the failure to implement policies and programmes has played a role in the water delivery complications experienced daily in South Africa. In line with these presumptions, the study engaged on these component perceptions of the policies implementation, institutional and governance constraints to policy implementation, resource and capacity challenges and cross-sectoral challenges to water management, to analyse the focal question.

4.4.1 Perceptions of water policies implementation

The perception related to the constraints of policy implementation was analysed in the study to assess its effectiveness on water provision in South Africa. The objective of this question was to assess the views of respondents on whether there are challenges to the execution of government policies and strategies designed to drive water security. In line with these, respondents were asked to indicate if there are challenges hindering policy implementation in South Africa. Answers to the questions are depicted in Figure 4.11

Figure 4.11 Perception of implementation challenges



Source: Field survey, September 2019

The figure shows that out of 72 respondents engaged on this issue, 65 of them (representing 90%) believed that there are challenges to the policy implementation, 5 (representing 7%) had a contrary view. The interpretation of these responses suggests that implementation of water policies, programmes and strategies in South Africa is exasperated by multiples of significant challenges, on which all other limitations tend to revolve. These are inadequate of financial resources and human capital limitation for effective execution sustainable development programmes, run, sustain the infrastructure efficiently, and to supply satisfactory and excellence water to the citizens.

4.4.2 Institutional and governance constraints to policy implementation

Institutional challenges to policy implementation occur at the tactical, strategic, and implementation stages. These impediments restrict the capability of the department and organisations to collaborate "vertically and horizontally", to incorporate actions within their structures, and to step up with innovative systems that mobilise resources for infrastructure development and cost retrieval. This deficiency of amalgamating philosophy warrants reliance on prevailing organisational "silos", and spreads disinterest in the water sector. Given these inferences, this study scrutinised institutional challenges to policy implementation.

Respondents were asked to choose from these variables 'Not relevant, Fairly severe, Severe and Very severe'. Table 4.7 depicts the answers to the question:

Table 4.7 Institutional constraints to water management

		Not relevant	Fairly severe	Severe	Very severe
Lack of Appropriate Water Policies and Programmes	Count	0	19	25	16
	Row N	0.0%	32%	42%	26%
Fragmented Approaches to Policies and programmes	Count	0	4	12	12
	Row N	0.0%	14%	43%	43%
Multiple institutions, each with their piece of legislation often with overlapping, unclear allocation of responsibilities	Count	0	13	35	25
	Row N	0.0%	18%	48%	34%
Lack of coordination among multiple players and resources	Count	0	6	28	41
	Row N	0.0%	8%	37%	55%
Poor working relationship among partners.	Count	0	12	34	29
	Row N	0.0%	16%	45%	39%
Fragmentation of water-related tasks	Count	0	12	28	34
	Row N	0.0%	16%	38%	46%
Poor programme planning and design intervention programme	Count	0	8	39	22
	Row N	0.0%	12%	57%	32%
The weak information management system that does not provide/poor quality of data and information for decision making	Count	0	12	39	23
	Row N	0.0%	16%	53%	31%
Absence of sound and comprehensive national policies on water resources	Count	0	26	32	14
	Row N %	0.0%	36%	44%	19%
The multiplicity of laws, each dealing with separate aspects of the management of the resources, thus encouraging compartmentalisation	Count	0	14	43	18
	Row N	0.0%	19%	57%	24%
Poor management dynamics in the water supply and demand the municipality.	Count	0	4	25	46
	Row N	0.0%	5%	33%	61%
Lack of strategic vision across the water-related sector	Count	0	11	29	33
	Row N	0.0%	15%	40%	45%
The absence of a credible framework for involving civil society in the management process	Count	0	16	27	29
	Row N	0.0%	22%	38%	40%
Institutional arrangements for integrated water resources management are weak/ non-existent.	Count	0	15	39	20
	Row N	0.0%	20%	53%	27%
Poor governance and leadership structure that works in water resource management	Count	0	10	20	43
	Row N	0.0%	14%	27%	59%
Lack of/inadequate human resources in the water sector	Count	0	5	26	44
	Row N	0.0%	7%	35%	59%
Inadequate equipment and proper infrastructure network	Count	0	3	48	24
	Row N	0.0%	4%	64%	32%
Inadequate financing	Count	0	4	26	46
	Row N	0.0%	5%	34%	61%

Weak technical capabilities/lack of a critical mass for water resources management	Count	0	5	38	33
	Row N	0.0%	7%	50%	43%
Inadequate Research and Technology	Count	0	17	37	18
	Row N	0.0%	24%	51%	25%
Lack of correlation between water supply and demand	Count	0	2	32	41
	Row N	0.0%	3%	43%	55%
Improper land use planning and soil management in catchment areas	Count	0	17	40	16
	Row N	0.0%	23%	55%	22%
Lack of clear-cut strategies on pollution prevention, control, and regulations	Count	0	6	29	40
	Row N	0.0%	8%	39%	53%
Lack of/poor Stakeholder Participation and engagement	Count	0	7	27	41
	Row N	0.0%	9%	36%	55%
Limited/No Public Awareness and Education	Count	0	5	27	43
	Row N	0.0%	7%	36%	57%
Lack of/ Weak Promotion of economic, social, and ecological values link to water resources	Count	0	16	35	24
	Row N	0.0%	21%	47%	32%

Source: Field survey, September 2019

The above table summarised the responses given by the respondents. As indicated, none of the respondents indicated that any of the constraints are relevant, very few indicated not severe. Majority of the respondents indicated at least 'severe', and cumulatively severe, and 'very severe' takes up around 80 per cent of respondents responses. Notably, constraints identified are lack of resources, expertise, high level of corruption, poor governance structure, lack of infrastructure, poor skills, lack of funding and investment (inadequate finance), technology and overall capacity.

It was suggested by the majority of the respondents that all water management structures including WWTWs must be upgraded and managed adequately by skilled, capacitated of staff, raising funds, enhance technology, and proper coordination of policies, re-institution of the blue and green drop. Furthermore, it was mentioned that CMAs must be better managed, polluted water must be addressed from the source – dilution is no solution to pollution, especially in a water-scarce country; housing developments must be integrated with the supply of water and the capacity of WWTWs; the polluter pays principle must be enforced.

4.4.3 Resource and capacity challenges in policy implementation

Capacity challenges, in terms of human resources, expertise and infrastructure, remain a significant constraint to the implementation of policies and programmes.

Formulating and implementing water policies to attain water security, entails resources, knowledge, and know-how. Nevertheless, the department, and the other water service providers, do not have the needed capacity to carry out its responsibilities effectively to achieve water security. Given these constraints, the study explored the capacity constraints hindering the performance of water management in South Africa. Respondents were asked to choose from the variables, 'Not an obstacle, Somewhat an obstacle, Important obstacle and Major obstacle'. The table below reflects the responses of the respondents:

Table 4.8 Resources and capacity challenges to policy implementation

		Not an obstacle	Somewhat an obstacle	Important obstacle	Major obstacle
Lack of staff and managerial capacities (Human resources e.g. skilled personnel)	Count	0	2	30	43
	Row N	0.0%	3%	40%	57%
Lack of financial resources (technical, financial management etc.)	Count	0	6	33	34
	Row N	0.0%	8%	45%	47%
Infrastructure decay and inadequacy	Count	0	8	35	32
	Row N	0.0%	11%	47%	43%
Strong political interference in strategic and professional matters	Count	1	20	34	20
	Row N	1%	27%	45%	27%
Lack of monitoring, and inadequate data and management system to facilitate water supply and resources management	Count	1	19	34	21
	Row N	1%	25%	45%	28%
Lack of competencies to operate modern facilities and technologies to enhance water provision.	Count	1	8	43	30
	Row N	1%	11%	57%	40%

Source: Field survey, September 2019

The table above indicates that of the listed challenges, namely, lack of staff and managerial capacities, human and skilled personnel, and lack of financial resources, were mentioned as major obstacles by 57 and 47 per cent of respondents, respectively. The other four constraints (infrastructure decay and inadequacy, strong political interference on strategic and professional matters, lack of monitoring and lack of competencies to operate modern facilities) were all mentioned under 'significant obstacle' with ratings of 47, 45 and 57 per cent, respectively. A remarkable majority of the respondents mentioned that capacity building and enrichment are significant and vital at the personal, organisational and community level in water management.

An in-depth discussion with a Director for Technical and Civil Service in the national office of the DWS based in Pretoria pointed out that:

"The entire DWS has a challenge of attracting skills, expertise and human capital as a result of budget constraints. The National Treasury continues to cut down the budget for the department over the past years as a cost-cutting measure embarked by the government. This budget constraint has resulted in our inability to employ competent and high skilled employees or even retained some of our best and qualified staff such as engineers, technicians and technologists as a result of emigration, unsatisfactory working conditions accompanied by low salaries and wages." (Per.com, 2019w).

Another respondent reinforced this view at the Human Resource Division at Western Cape DWS, who said in an interview that:

"The department faces considerable challenges in securing qualified staff over a consistent period. It has high staff turnover and vacancy rates, an ageing workforce, and a shortage of skilled engineers. Moreover, the department has many senior officials without relevant qualifications because they received promotions based on length of service and not the expertise necessary to fulfil their functions. In some cases, the department has failed to take disciplinary steps against officials who have incurred or permitted irregular expenditure or those who have committed confirmed cases of financial misconduct, as prescribed by the PFMA. Moreover, *the department had not conducted a skills audit in the last 20 years to ascertain the human capacity gaps." (Per.com, 2019x).*

A Director for planning and strategic development, in charge of government water schemes, quoted a report from a NEWS & ANALYSIS: "Understanding water issues and challenges (I): Department of Water and Sanitation *February 6, 2019."*

"According to the report, the Department has consistently experienced instability in its leadership. Over the past ten years, it has had eight different directors-general (DG), fulfilling the position on ten different occasions, and mostly occupied in an acting capacity. Although the Department only has nine approved deputy directors-general (DDG) positions, 11 people have simultaneously occupied DDG positions in the past. Suspensions within leadership streams have also become common practice, placing additional challenges on the already strained structures within the Department. In 2017, the DG, the chief financial officer (CFO) of the Water Trading Entity and three DDGs were all placed on suspension. When the DG was suspended, the Department's CFO was called upon to act as DG in the interim,

which created further instability in the crucial role of the Department's finance office. Some suspended employees have since returned to their position, while others have been transferred to other departments or are still awaiting the conclusion of their disciplinary processes. The instability in leadership structures cultivates an environment that disregards internal controls and leads to deteriorated financial management. Those placed in leadership positions are ultimately responsible for implementing plans and projects. When there is a continuous shuffle between divisions within the water Department, there is no continuity and little accountability and control over implementation."

(Source: DWS website February 6th, 2019).

In view of the above sentiments, it can be concluded that severe challenges are facing the water sector in terms of capacity constraints. These challenges are as a result of structural issues, as well as poor coordination of training and capacity development for the department. Among these challenges are the poor coordination of capacity and training programmes for the water service sector, limited use of public tertiary institutions in skills development for the water services sector, capacity constraints within the relevant SETAs – both the LGSETA and the ESETA. Based on these challenges, it is imperative that the department established a coordinating structure for training and building capacity for the water sector and must marshal resources necessary to accelerate the skills shortages.

4.5 Strengths and weaknesses of policies regarding water governance

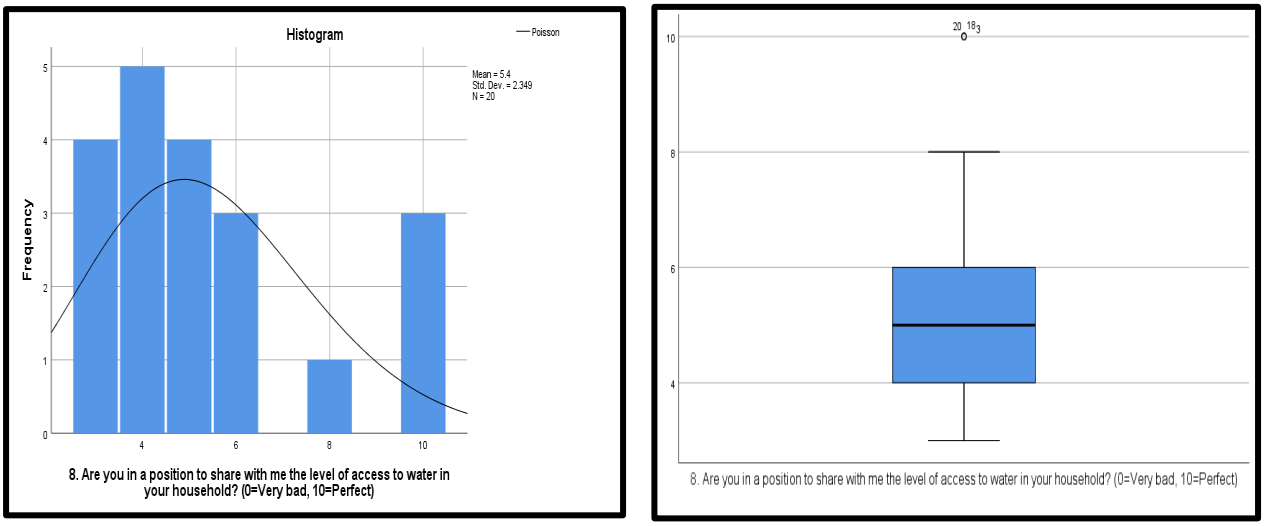
The government of South Africa have made noticeable improvement towards achieving the right to sustainable water for all. This development, however, is not experienced equitably. Different classes of societies, different geographical regions and districts in South Africa have different levels of accessing water, based on income and social status. People living in rural and informal communities still do not have any reliable access to water, both in quantity and quality. The consequence of this situation has created vulnerable and exposed groups, including learners and women, mainly in the Eastern Cape, Free State, KwaZulu-Natal, Limpopo, and some communities in the Western Cape. Based on this empirical evidence, the fourth research question for the study probed the strengths and weaknesses of South African water policies. Critical questions explored in this context are, what are the levels of accessibility to water, what is the degree of

infrastructure sustainability, what policy implementation structures are there, how is pollution control managed, what are the measures to the adaptability to climate change, and what are the cost recovery strategies.

4.5.1 The impact of the policies on water accessibility among households

The aim of this question is to measure the level of water accessibility by households and communities. The appraisal of every legislation, or policy, is measured by the number of homes and societies that have access to safe and adequate water. Therefore, the responses of this question gave a clear picture of the level of success or failure of the current legislation and policies. The responses are presented graphically below

Figure 4.12 Figure Levels of access to water by local communities



Source: Field survey, September 2019

An interpretation of these graphs is such that a score of zero (0) to ten (10) was used as a rating scale, with 0 being equal to very bad, while is ten equated as perfect. As shown in both the bar graph and the box-and-whisker, the mean, or average score of all the responses, is 5,4. From these graphs, it could be seen that the modal score is four (4), this indicated that majority of the respondents rated their water accessibility below average, thus below good. This is clearly shown on the box and whisky plot where the skewness is more to the left. Nevertheless, the distribution revealed that three (3) of the respondents, translating to 15 per cent, rated their supply as perfect. In breaking down of these responses depict the practical situations of water provision in the country, where a small number of the population has outstanding and uninterrupted water supply, in contrast to the

majority of the population who have poor and interrupted water supply. In-depth interviews with respondents revealed clearly that there had been a rise in the number of homes and communities with access to water, due to proactive and policy reforms initiated by the government through the DWS post-independence.

An interview with the Director for Planning and Strategic Development based in the national office of DWS in Pretoria revealed during an interview that:

"The number and percentage of households with access to piped water had increased post-independent in 1994; 13,8 million households had access to piped water in 2018 compared to 9,3 million in 2006. An estimated 46,3% of households had access to piped water in their dwellings in 2018. A further 28,5% accessed water on-site while 12,3% relied on communal taps, and 1,9% relied on neighbours' taps. Add to the above a total of 97,7% of households in metros have access to tap water. The breakdown to access to water revealed as follows Nelson Mandela Bay (99,9%), City of Cape Town (99,5%), Buffalo City and City of Johannesburg (both 98,8%). Mangaung (90,1%) and City of Tshwane (93,3%). Moreover, he disclosed that two-thirds (62,4%) of households rated the water services they received as 'good' in 2018." (Per.com, 2019y).

Another interaction with the Strategic Executive Director in the Water Research Institute at Rhodes University also pointed out that:

"Generally, South Africa water sector has some excellent forward-looking water policies and programmes towards water security. For example, the second edition of the NWRS is clear about SA water security and steps that need to be taken to address the problem, for instance, through the different reconciliation strategy, water demand and conservation management, as well as the gradual introduction of wastewater(grey) water reuse, while at the same time exploring the possibility of desalination for coastal cities. (Per.com, 2019a1).

However, not all the respondents agreed that the country has the right water policies and programmes to meet the growing demands for water and the threat of climate change. The figure below reflects some of the challenges in the water in many communities in South Africa.

Figure 4.13 An image of a water crisis in Grahamstown in the Eastern Cape



Source: Photograph taken by the researcher in a suburb of Grahamstown in September 2019

An interview with a researcher in the Africa Check, an NGO Water Company based in Johannesburg, revealed the more detailed figures of water accessibility in the country. He mentioned that:

"In 2015 the general to accessibility to piped water homes stood at 89,5%. Breaking the number revealed that 43,3 per cent had piped water in their homes, 28,6 per cent had access to water in their yards, 2,7 per cent had the use of a neighbour's tap, 14,9 had to make use of community taps. In comparison, 10,8 per cent or 5,5 million people had no access to piped water. This breakdown suggests that the number of those with access to piped is lower than we are made to believe. Add to these constraints; 36.8 per cent of South Africa's municipal water is lost before it reaches customers – most of lost occur as result of leaks and deteriorating water supply systems. Consequently, the government loses R7-billion in revenue and South Africa, which is a water-stressed country, loses 1,580-million cubic litres of water each year. Yet these policies and strategies have not addressed all these challenges." (Per.com, 2019, a2).

Table 4.9 supports the assertions of water distribution post-independence in South Africa

Table 4.9 Water access and usage among racial groups in South Africa

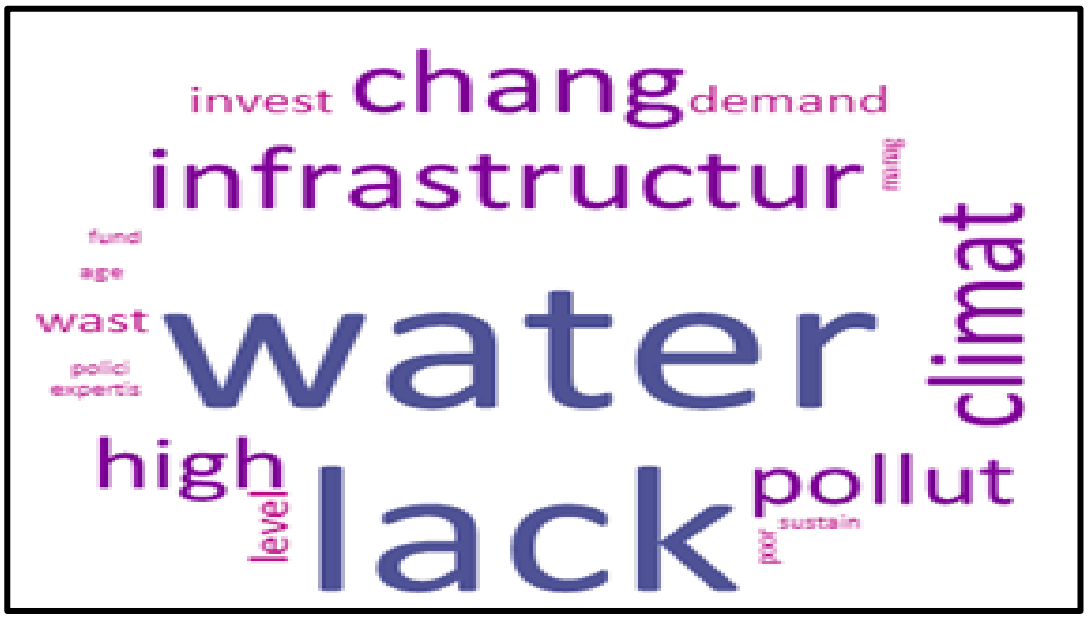
Group	The poverty rate of individuals (%)	Percentage shares of	
		Population	Poor individuals
Black	55	80	93.3
Coloured	34	8.7	6.3
Indian	7.1	2.5	0.4
Whites	0.4	8.6	0.1
All	47.7	100	100

Source: Molobela and Sinha, University of South Africa 2011

Table 4.9 provides a synopsis of how water is consumed among racial classification, privileged, and underprivileged population. The information from the table above revealed that "Black Africans are the major population group in the country, with a percentage of 80 per cent, while Indians are having the least population of 2,5 per cent. In this 80 per cent, 55 per cent of black individuals are faced with poverty and with no access to safe drinking water. The insufficient access to water resources has resulted in the majority of the black population drink low quality water against excessive labour or cash costs, especially during periods of drought. The same holds for productive water use, for example, for cropping. On the other hand, white individuals are the least impacted with poverty at only 0,4 per cent and have access to adequate and safe water all the time" (Molobela and Sinha 2011: 996).

In line with the study findings and the observation by Molobela et al., (2011), it can be confirmed that the severe disparity in access to, and control over resources, could be attributed significantly to ineffective water policies and inefficient institutional arrangements for managing water resources. To address these challenges and make water resources sustainable, it is suggested that administering water reserves must be based on stakeholder participation, in which communities are actively involved in policymaking. This move will enhance a better understanding of demands, especially the basic of what communities required. Other factors mentioned extensively by the respondents as weaknesses to the current policies, are displayed in the figure below.

Figure 4.14 The main weaknesses of the policies and legislations



Source: Field survey, September 2019

The figure above represents a word cloud illustrating the challenges of South Africa's water sector. As depicted, majority of the respondents shared belief that the lack of, or decaying of water infrastructure, the threat of climate variation and unprecedented levels of water pollution, as being the most challenging, and a threat to water security, for which there are no clear strategies to address them by the current policies and programmes. Other constraints mentioned, but on a smaller scale, include inadequate investment in water sector, insufficient or weak waste management practices, and poor coordination of activities and intervention programmes.

In an exclusive interview with the Executive Director for Policy Analyst and Strategist in the Water shortage SA, in Johannesburg, it was mentioned that:

" So, while the policies and post-independent deservedly attracted wide praise as the most effective regulatory mechanism implemented by the Department of Water Affairs in the early 1990s. Nevertheless, the policies are outdated, hampered by complex governance structures. Furthermore, they had failed and continue to fail in addressing water security. The sustainability of the resource has not been achieved more than 40% of water resource is used to flushed down toilets, rivers are being polluted at an alarming rate, and a significant amount of water resource is lost through leaks – both in public and private sectors an indication that theses

traditional approaches of water management are not working. Moreover, water infrastructure had become very old, while WSAs have failed to allocate adequate operations and maintenance." (Per.com, 2019a3).

Generally, well developed, infrastructure networks are needed to process and convey water (this from refinery yards, and supply structures). This is a significant phase in guaranteeing the safety of drinking water. Nevertheless, the majority of the participants interviewed disclosed that there have backlogs of overdue repairs of "storage, treatment, and distribution systems" in the country.

An Employee at bulk water and waste treatment in Phakamisa in King William's Town, in the Eastern Cape, disclosed that:

"South Africa's water infrastructure is at risk of failure. The consistently poor performance of water and sanitation infrastructure is attributed to poor governance by both the national and local departments, poor asset management and insufficient maintenance, lack of technical skills within key planning and operational divisions in both the Department and municipalities, poor enforcement of policies, theft and vandalism of infrastructure, financial mismanagement, corruption and funding shortfalls have contributed greatly to infrastructure decayed in the water sector" (Per.com, 2019a4).

Another major constraint flagged by most of the participants of which the policies and legislations are very silenced; is the threat of climate change on water security.

An in-depth interview with a climatologist in the Department of Geography and Environmental Studies at the University of Cape Town quoted a phrase from National Climate Change Response Policy (NCCRP) conference of September 2018 which highlighted that:

"In reality climate change is already posing a significant threat to water security in the country. The temperatures in the country are increasing, with a minimum temperature rising faster than maximum temperatures. In effect, some provinces are experiencing an increase in warm extremes and a decrease in cold extremes. Temperature increases, in turn, has influenced the rate at which water evaporates and has led to changing rainfall patterns. It had further affected the soil moisture and the amount of runoff flowing into rivers and groundwater resource. Nevertheless, in spite of the threats of climate change towards water security in the

country, the current policies and programmes are yet to integrate the climate change adequately into its intervention strategy."

(Source: Climate Support Programme CPP3, September 2018)

In the context of South Africa, policies should be redesigned to incorporate climate variation intervention strategies that ensure the development objectives are resilient to climate change. This can be achieved through education and raising awareness of climate change within the public and private institutions.

Another common challenge alluded to by the majority of respondents is the pollution of water resources. This challenge is further supported by a piece of evidence in a caption by the daily newspaper—the Infrastructurenews of 1St of April 2017.

Figure 4.15 "Water pollution - SA's biggest threat to water security

Minister of Water and Sanitation Gugile Nkwinti has singled out pollution as the biggest threat to South Africa's water quality",



Source: The Infrastructurenews, April 1, 2017

In an interview with CEO of Federation of Sustainable Environment (FSE) based in Johannesburg on the issue of water pollution mentioned that:

"*Water pollution arises from several sources in the catchment areas, whether direct discharge or diffuse pollution arising from runoff from land-based activities. Water pollution affects both surface and groundwater resources. Pollution is mobile*

moving along the length of a water resource with the potential for increased cumulative impacts from multiple sources. She emphases that the water resource quality within South Africa is declining with assessments reflecting that some 83% of water resources having some form of implication for the fitness of use for one or other user groups. This deterioration of water quality is one of the major threats to the country's ability to provide sufficient water of a suitable quality that can support development needs, whilst at the same time ensuring the environmental sustainability of the water use." (Per.com, 2019a5).

Her views were augmented by an environmental activist and expert in water management with numerous publications in environmental justice. Mentioned to the researcher in the course of interaction that:

"The groundwater in the mining district of Johannesburg, Gauteng Province, is heavily contaminated and acidified as a result of oxidation of pyrite contained in the mine tailings dumps. This situation has elevated concentrations of heavy metals. The groundwater table is close to surface, the upper 20 cm of soil profiles are severely contaminated by heavy metals due to capillary rise and evaporation of the groundwater. Moreover, the polluted groundwater is discharged into streams in the area and contributes up to 20% of the streamflow. This results in an increase in the acidity of the stream water. The effect of the contaminated water from the mines can persist for more than 10 km and beyond the source." (Per.com, 2019a6).

As indicated, pollution of water bodies remains one of the significant risks to water safety in South Africa. Though the NEMA Act 1998, NWA of 1998 and NWRS of 2013, all have detailed concepts and models of pollution of water bodies, especially at the catchment areas, yet the implementation of these programmes remained a challenge. It is, therefore, prudent that legislation and policies be redesigned with more focus on the conservation of the current water reserves by averting infringement and worsening of water value. A yearly register of offenders in this regards, with the degree of the offence, be made available in the Department of Environment Affairs, so that societal and legal justice can be exerted on them. One of the challenges mentioned by some respondents as a weakness to the current policies and programmes towards water management and governance in the assets is the lack of funding in the sector. As mentioned earlier, the country is presently over-consuming its natural resources, including water. In addition, extractions are

estimated to surge in all three sectors (agriculture, manufacturing, and domestic). At the same time, a large amount of the country's water infrastructure is in very poor conditions, and investment in the water sector is meagre.

This analogy was supported by the Director of Water Institute of Southern Africa (WISA), an international NGO in water governance based in Johannesburg. He mentioned that:

"Inadequate investment due to insufficient funding has been identified as a major contributor to poor operations and maintenance performance. The lack of investment hampers the operating and maintaining of water supply facilities as money is not available to buy spare parts, properly train staff and provide competitive salaries to attract highly qualified personnel. External support agencies have traditionally been reluctant to finance operation and maintenance activities while national governments have often given it a low priority. National governments are frequently stressed for cash, especially hard currency, which is needed to pay for spare parts, and the water supply agencies usually lose out to others, judged more important higher profile sectors." (Per.com, 2019a7).

There are numerous integrated strategies that could provide a sustainable answer to investment in the water sector. However, determining which option will eventually deliver the greatest return requires a comprehensive work at community and watershed levels by professionals with in-depth knowledge of the current circumstances and limitations in their respective water institutions. Insufficient, or weak waste management practices, such as water recycling and re-use, were mentioned by a percentage of respondents. Some of the respondents indicated that there are severe challenges and misunderstanding involving wastewater recycling and re-use. These constraints are often exacerbated by a lack of clarity and direction by the polices on waste management.

In an interview with the manager of bulk water and waste treatment, in Cape Town, in the Western Cape Regional Office explicitly said that:

"In South Africa, barely 10% of wastewater is treated or reuse or both. This is due to inadequate financial provision, technical know-how, and lack of political will. The rapid and unplanned growth of cities makes the management of wastewater more complex. Existing wastewater treatment plants are often not functioning or

overloaded and thus discharge into the environment (rivers, lakes, sea, etc.) effluents not suitable for safe reuse. These effluents often contaminate soil and downstream water supplies, creating public health risks, environmental damage, and unpleasant living conditions. Moreover, the escalation in wastewater in these cities are gloomy and is expected to get worse as long as population growth continues to outpace sanitation services."

(Per.com, 2019a8).

The image below collaborates the view expressed by the respondent regarding the sewage situation in some cities and towns in South Africa.

Figure 4.16 A picture of wastewater in a community in Pretoria



Source: Field survey, September 2019

This view was validated by the director in the bulk and waste management division in the national office of DWS. This respondent in an interview revealed that:

"Out of 59 million tonnes of general waste produced in South Africa in 2019, more than 90% of them ended up in landfills with barely 10% recycled. The rapid growth in solid waste and the shortage of suitable land for the dispose of waste means that South Africa is running out of space for waste disposal. Moreover, the recycling behaviour of households is closely linked to the capability of municipalities to provide adequate refuse removal services. Though more than 80% of municipalities

have recycling strategies, they are struggling with implementation due to a lack of capacity, infrastructure and capital."

(Per.com 2019a9).

In order to avert this situation, it would be rational to design policies and programmes that would improve the quantity of sewage water that is processed and re-used. Failure to efficiently address these challenges could have a devastating consequence on the population, the ecosystem, and economic growth.

Beside the challenges mentioned already, policies incoherent and weak coordination were also mentioned by a significant number of respondents. It was disclosed that one of the fundamental constraints facing the South Africa's water sector is the fragmentation and compartmentalisation of water policies and programmes. Government strategies towards water security are formulated and implemented on 'silo', which is often a barrier to sustainable water management.

In an interview with the Director and Coordinator of Water Institute of Stellenbosch University, based in Cape Town, posits that:

"In the water sector, horizontal coordination is very weak with more than eight (8) department sharing the responsibility of water management. The ambitious reform programmes in 2015 created an additional five fresh state institutions, and regionalisation ballooned further the numeral of independent regional organisations. This phenomenon resulted in a merrier situation, with a proliferation of actors and a massive influx of funds opening up multiple opportunities for rent-seeking and scramble for resources". (Per.com 2019a10).

A PhD student, researching in polices monitoring and evaluation in the water sector in South Africa, disclosed during an interview that:

"The water sector is bedevilled with fragmented planning and management, horizontally and vertically, strengthened by South Africa's pluralistic legal system, where land and water resources are regulated by a range of institutions, including statutory and customary laws."

On the same point, a member of Bisho legislature in the Environment Committee on the ticket of the Democratic Alliance voiced out that:

"There is a clash between the institution of traditional leadership and the legislation governing water management. There are fundamental constraints that exist in integrating traditional systems of managing water resources with the existing statutory legislations. For instance, the National Water Act in South Africa post-independent does not explicitly recognise customary water management structures and in fact, conventional water management structures are not mentioned at all in the Act. However, the Traditional Leadership and Governance Framework Act (Act No. 41 of 2003) the provision that empowers traditional leadership to collaborate with other institutions in promoting sustainable water resource and requires national and provincial government to provide for their involvement through legislation, policies, and other programmes. The lack of monitoring and evaluation strategies to ensure inclusivity and equal access of water by all members of the society and the challenges in empowering women and enhancing gender equality in water accessibility has made the situation much complicated." (Per.com, 2019a13).

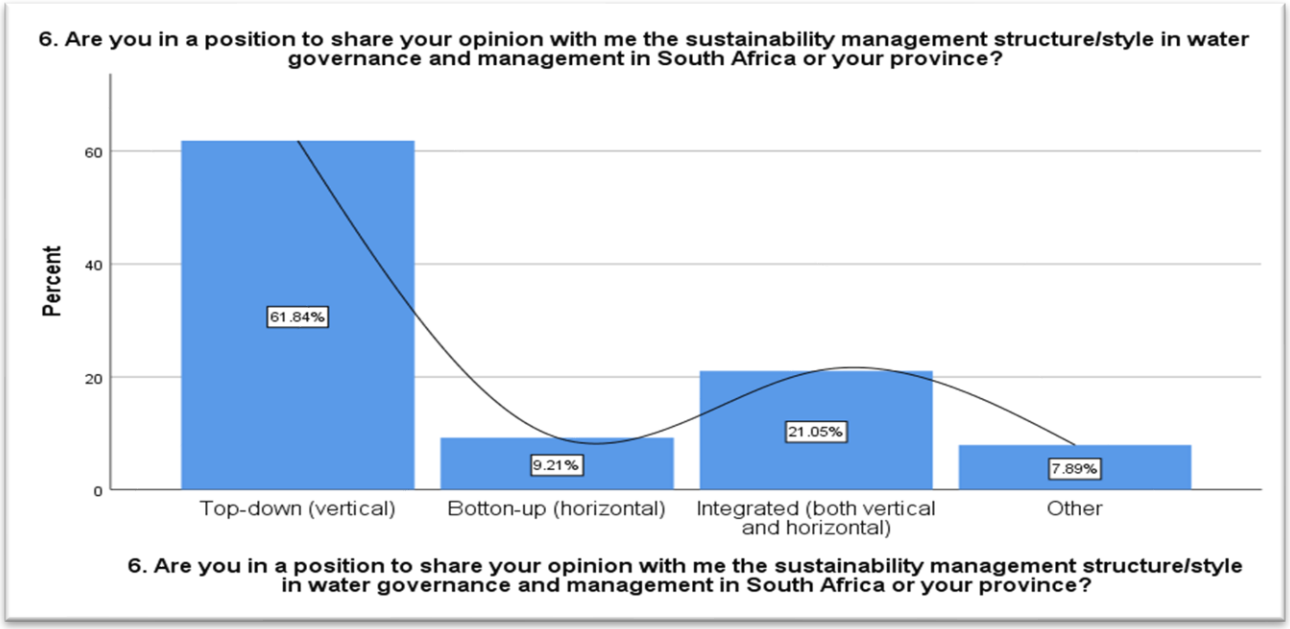
In line with these overwhelming challenges and contradictions, there is a need to redesign the policies and the programmes to suit the current environment to account for the growing demand for water and climate change. The strategies should also consider the enactment of rationing mechanisms, progress in infrastructure development, enhancement of cooperation among stakeholders through efficient and effective communication, and regular updates on the water situation with the general public.

4.5.2 Structural challenges to programmes and policies implementation

Water policies implementation has also been mentioned by respondents as a challenge to address water security in South Africa. According to water legislations and policies, water resource management is entrusted to the provincial government, through CMAs and other stakeholders to deal with specific matters applicable to the location and its residents. The purpose for creating integrated water management relate to the proximity they share with the local communities, NGOs, and knowledge base. Decision-making, operation, and supervising are all enhanced, due to the fact that CMAs have simpler accessibility to data. However, integrated water management programmes sound theoretical, and their implementation not clearly defined by the current policies and legislations. Based

on these assumptions, respondents were asked to choose from these four variables, "Top-down, Bottom-up, Integrated and Other approaches". Figure 4.16, depict the answers of the participants

Figure 4.17 Structural and procedures of implementing policies



Source: Field survey 2019

The responses show that out of 76 respondents surveyed, 47 of them (representing 62%) were of the view that policies are implemented on the top-down basis, 16 of the respondents (representing 21%) mentioned the integrated approach, seven (translating to 9%), indicated the bottom-up method. In contrast, 6 of the respondents (representing 8%) mentioned the other methods. The interpretation of these responses suggests that, in the majority of cases, policy formulation and implementation are not oriented or informed by grassroots realities. Consultants, top politicians, and administrators determine policies and programmes without consulting with grassroots and communities. The decentralised nature of the water programmes has failed miserably to integrate the significant stakeholders such as NGOs, communities, and grassroots; hence, national-level plans are implemented without consultation with the local communities. The majority of respondents mentioned inclusively, collaborated, integrated, open forum, and decentralisation as being critical and essential components required to achieve sustainable water management. Interestingly, these components are the foundation and the basis of current policies and programmes; however, how they should be implemented, enforced, monitored, and evaluated have not clearly been defined by the policies.

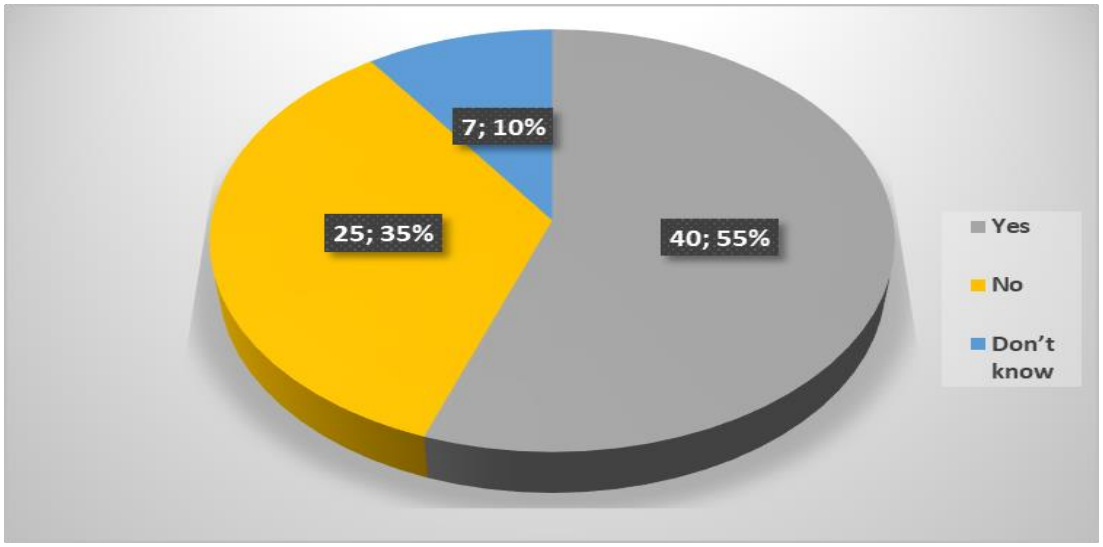
4.6 Strategic policies and legislations towards water security in South Africa

This research question interrogated the type of strategic policies and legislations that should be designed to address the challenges affecting water provision in South Africa effectively. The rationale of this research question was to establish if participants have alternative strategies, proposals, and recommendations that can improve water management practices in the country to achieve the ultimate goal of water security.

4.6.1 Perspectives of the current policies and programmes

In view of the many challenges impeding effective management and governance of water assets in the country, this study deemed it relevant to seek opinions from respondents to ascertain if they see it necessary to reform the current legislation, policies and regulations in governing water management in South Africa; also if they have alternative strategies in place to manage water resources effectively. This question was posed: "Should the policies and programmes currently governing water be reformed?" Figure 4.17 depicts the answers of the respondents.

Figure 4.18 perspectives on water policy reforms

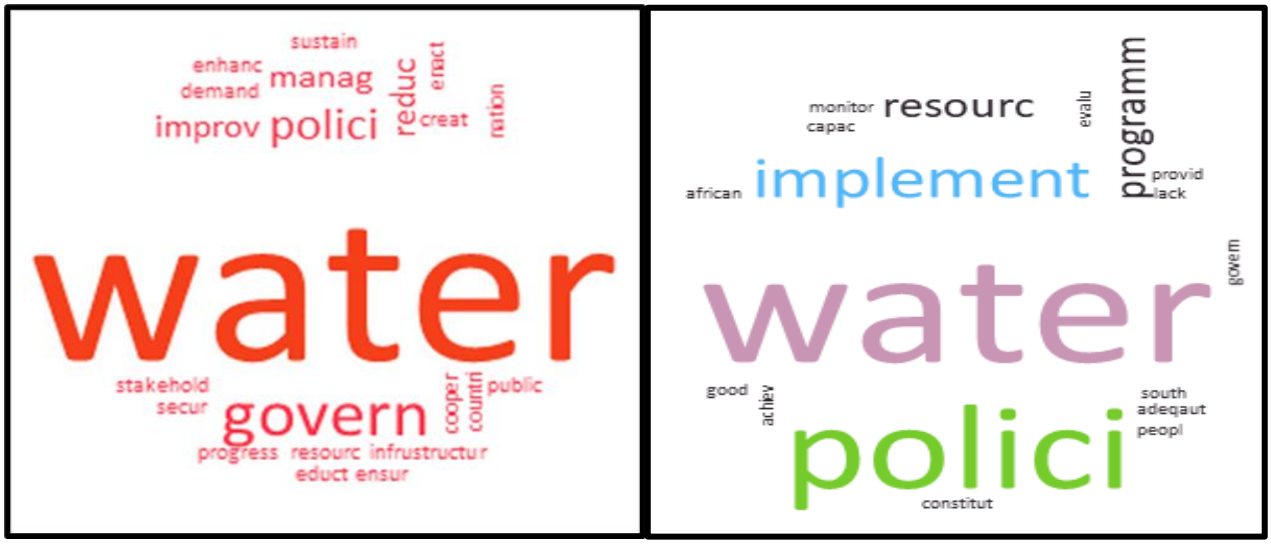


Source: Field survey, September 2019

The responses to the question show that out of 72 respondents surveyed, 40 of them (representing 55%) indicated that there should be a general reform in the water industry regarding legislation, policies, and strategies, against 25 (representing 35%) who indicated otherwise. In a follow-up question, respondents were asked to suggest what changes or reforms they would like to see on the

legislations, policies, and regulations. Figure 4.18 reflects the opinions and views of the respondents.

Figure 4.19 Water management strategies and recommendations



Source: Field survey, September 2019

The figures above represent two kinds of strategic reforms envisaged by the respondents. The first box, to the left, proposed policy changes, while the second box, to the right, advocated for implementation reforms.

Respondents engaged during interviews are of the view that there is a need to reform and implement integrated policies that ensure governance instead of the management of water resources, promote sustainability that takes into account both the demand and supply sides of the resources, enactment of rationing mechanisms, to improve infrastructure development, and enhance cooperation among stakeholders.

An interview with the Director for International Water Management Institute, based in Pretoria, revealed that:

"Water legislations and policies in South Africa must be redesigned and be guided on the principles of governance that provide an overarching framework for local and national governments to deliver, in partnership with the corporate sector and a broader range of stakeholders. Again, the policies must be sound, clear, tangible, easy to understand and result oriented that addresses the current and future water challenges." (Per.com, 2019a15).

Another interview conducted with a coordinator of the Water Institute of Southern Africa, also in Pretoria, disclosed that:

"To overcome the gaps in the current water policies and programmes will demand taking practical and proactive action on capacity building at the individual, institutional and societal levels. It will demand a providing conducive environment in terms of resources, institutional and legal provisions to strengthen knowledge transfer, and skills development, specifically galvanising and stimulating the youth and the residents to study water-related courses." (Per.com, 2019, a16).

In line with the above submission, it can be deduced that creating a more collaborative strategy in water administration will assist in addressing the requirements of all role-players that include government, private and local communities at the appropriate scale. It will further assist in, "reducing path dependency, and encourage the formulation of innovative and forward-looking water strategies across policy fields, and territorial and institutional levels' (Molobela et al., 2011: 999).

4.6.2 Governance strategies to enhance water security in South Africa

The responses, in terms of water management and governance by respondents, have different knowledge and opinions on how water assets should be administered to achieve water security. In line with these, respondents were asked to choose from a set of variables, and their level of significance in water governance. The following outcomes were obtained.

Table 4.10 Suggested governance tools to support the water management

		N/A	Low priority	Middle priority	Top priority
17.1 Fostering cooperation across levels of governments	Count	0	1	1	17
	Row N %	0.0%	5%	5%	90%
17.2 Enhancing synergies with other policy areas	Count	1	0	7	11
	Row N %	5%	0.0%	37%	58%
17.3 Improving stakeholder engagement	Count	1	0	0	17
	Row N %	5.6%	0.0%	0.0%	94.4%
17.4 Raising awareness on water availability, risks, quality, costs	Count	0	0	2	17
	Row N %	0.0%	0.0%	11%	89%
17.5 Developing new laws or regulations	Count	0	2	6	11
	Row N %	0.0%	11%	37%	58%
17.6 Building/Operating/Maintaining water infrastructure	Count	0	0	5	14
	Row N %	0.0%	0.0%	26%	74%
17.7 Ensuring value for money (higher quality at lower cost)	Count	0	3	10	6
	Row N %	0.0%	16%	53%	32%
17.8 Increasing the willingness to pay of water users	Count	0	3	10	6
	Row N %	0.0%	16%	53%	32%
17.9 Fostering capacity building, training, qualifications	Count	0	0	7	12

	Row N %	0.0%	0.0%	39%	63%
17.10 Developing technical and non-technical innovation	Count	0	4	7	8
	Row N %	0.0%	21%	37%	42%
17.11 Sharing information, commitments, actions (e.g. advertising campaign) for building trust and confidence	Count	0	6	9	4
	Row N %	0.0%	32%	47%	21%
17.12 Others, please specify	Count	0	1	1	0
	Row N %	0.0%	50%	50%	0.0%

Source: Field survey, September 2019

The top priorities, in terms of a proportion, are improving stakeholder engagement (94%), fostering cooperation across levels of government (90%), raising awareness on water availability, risk, quality, costs (89.5%), building operating maintaining water infrastructure (74%), fostering capacity building (63%) and enhancing synergies with other policy areas (58%). The other factors are mostly middle priority. Detailed scrutiny of the data revealed that the principle of water governance should provide an outline for the local, provincial, and national government to provide, in collaboration with the business segment, and extensive shareholders. Furthermore, comprehensive state policies and legislation with vibrant, concrete, practical and result-driven strategies targets, that balance the present and future consumption of water must be considered.

4.7 Conclusion

In this chapter, the pragmatic outcomes of the researcher vis-à-vis legislation and policies on water management in South Africa have been investigated, deliberated on, and analysed. The data were acquired through the questionnaire, in-depth and semi-structured interviews, and content documents. Germane actors and participants were identified and tagged to partake in the study, using a purposive sampling method. In all, one hundred and nine (109) participants contributed to the study. All the information in the questionnaire and interview guides were grounded on specific facts, realities and understanding regarding legislation, policies, and strategies on water management in some specific provinces and communities in South Africa.

The information collected through the questionnaire and interviews were analysed extensively in the chapter, with the primary focus of establishing the structural and systematic constraints hindering policies implementation in achieving water security in the country. The understandings of governance implementation challenges, and recommendations of alternative strategies in water management, forms part of the research questions, and identification of significant gaps

hindering sustainable development goal, such as administrative, information, capacity, funding, objective, and accountability gaps were identified. It was established during the interviews and questionnaire, that though South Africa has some proactive legislation, policies and regulations on water management, they are hampered by implementation constraints such as lack of capacity, fragmentation of policies and programmes, lack of accountability and transparency, inadequate information, insufficient or inadequate funding, and weak stakeholder and public engagements.

Based on these facts, new strategies and implementation plans should be sought in this regard by integrating approaches to water governance, which will assist in addressing the needs of all actors, including government, corporates, communities and grassroots organisations at the appropriate scale. In addition, a fostering nexus methods between water, energy and food should be developed to promote a comprehensible blend of strategic tools across water-linked policy sectors, support correlation among the diverse consumers, for instance, municipal, manufacturing, cultivation and devise harmonised policy in tackling water quality, degradation and other challenges.

CHAPTER FIVE

ANALYSIS AND DISCUSSION

5.1 Introduction

In line with the pragmatic outcomes in chapter four, chapter five deliberates what the outcomes mean in the context of this study. The outcomes uncovered an innumerable of deficiencies and gaps in the current policies and regulations designed to address water security issues in South Africa. Notably, among them, are policy fragmentation, poor governance, capacity challenges, weak stakeholders' engagement, and the threat of climate variation. To guarantee that there is a clear-cut and distinctive comprehension of the critical matters, and how they are connected to the argument advanced at the beginning of the study, interrogating whether South Africa has the right and appropriate policies and programmes to achieve water security, the analysis and discussions are organised in a way that addressed the research objectives as stated in chapter one. The research objectives deal with five main themes; assessment of the current policies and programmes, grassroots participation in the governance of water assets, systematic and structural constraints to water administration, strengths and weaknesses of the policies and programmes, and appropriate management strategies to address water security challenges in South Africa.

5.2 Assessment of the policies and strategies towards water security

In addressing the first objective, the study analysed findings of the current legislation, policies and programmes designed to address water security in the new South Africa. As seen in Table 4.1 and Figure 4.3 in Chapter 4, post-independence in 1994, the new government of South Africa undertook several reforms to transform the country's perspective, primacies, and strategies to water administration and governance (Funke, Findlater and Nortje, 2007). Since the end of apartheid in the early 1990s, and the adoption of a democratic dispensation in 1994, South Africa went through a period of radical political and societal changes. In 1996, the Constitution of the Republic of South Africa (Act No 108 of 1996) cemented the foundation for a democratic society. Chapter 2 of the Bill of Rights states that: “everyone has the right to an environment that is not harmful to their health and well-being, to protect the environment for present and future generations, and to have access to sufficient food and water”. In this context, the

water sector was overhauled, and the new government published the White Paper on a National Water Policy for South Africa. The 1994 White Paper on Water Supply and Sanitation, and the 1996 water law principles (Schreiner et al., 2011: 97).

In the scholarly literature of Razzaque (2008: 365), it was indicated that the constitutions of many countries included explicit privileges to water resources (or more generally) the right to a secure or protected environment. For instance, "Constitution of Cambodia 1993: act 59; Constitution of Eritrea 1996: act 10; Constitution of Ghana 1992: act 11; Constitution of Ethiopia 1998: act 90 (1); Constitution of Gambia 1996: act 21 (4); Constitution of Uganda 1995 act 14; Constitution of Laos 1991: act 17". Regarding South Africa, the Constitution (Act 108 of 1996), the National Environmental Management Act 107 of 1998, the Water Service Act 108 of 1997, the National Water Act 36 of 1998 and the National Water Resource Strategy 2004 and 2013, were some of the key legislation, regulations and policies in the water reform processes mentioned by the respondents engaged in interviews, and also from several pieces of literature. The Constitution stipulates the basis of the country's progressive environmental legislation by guaranteeing South Africans the right to a safe environment. The findings established that South Africa is the first country globally to adopt national water legislation that serves as a tool in the transformation of society based on social and environmental justice (Funke et al., 2007: 14).

Folifac (2007) alluded; WSA of 1997 (Act 108 of 1997) was formulated mainly to ensure that the privilege of accessing the minimum water provision is enforced, and provided a regulatory structure to water provision and creation of water service institutions such as water boards, and WSP. According to Oosthuizen, Visser, Pooe, Mathu and Alexander (2015; 21), and views from the respondents, it was established that the WSA operates on three major principles; "consumers and end-users must have a constitutional right to receive water and related water services, but have responsibilities to ensure that such water is not wasted or polluted; local government structures, referred to as water services authorities (WSA), whose primary responsibility is to supply water to the water services providers (WSP); whilst, water services providers provide water and other related water services to the consumer and end-user".

Furthermore, the WSA establishes a wide-ranging statutory structure for the provision of water and hygiene services to support life and individual cleanliness, and acknowledges the need to operate in a way that is coherent with the broader objectives of water governance. It promotes collaborative governance with prominence on building capacity at all stages. It lays out the responsibilities of DWS and even in an incident of non-delivery by regional and municipal administrators and workforce (Folifac, 2007). Equally, mentioned in the discussion and the literature, was the "National Water Policy of 1997" (DWAF 1997). This policy redefined proprietorship and distribution of water. It affirms that all water reserves, regardless of where it exists in the geographical area, are public assets, and that the national administration will act as a public custodian.

The NWA of 1998 (Act 36 of 1998) was mentioned by a significant number of respondents and the various literature. Numerous interviewees, as well as scholarly literature of Knüppe et al., (2015), alluded that the NWA of 1998 considered as one of the most broad-minded and advance pieces of environmental law globally. This policy encompasses a mission and the vision of fairness, effectiveness, proficiency, efficiency and the sustainable allocation and consumption of water resources, as well as the preservation of the ecosystem. (van Wyk et al., 2009). There are ranges of advanced strategies connected to this policy, for instance, "the classification of water resources, ecological reserve, and qualitative resource objectives in Chapter 3 of the Water Act". This policy ingenuities are driven by the necessity to balance the safety of environment with the consumption of water for a productive reason such as irrigation for agriculture, manufacturing, and mining activities and, by extension, the sustainable land management.

Another water management strategy alluded to by the literature and discussion is the National Water Resource Strategy (NWRS of 2004). As shown in Table 4.1, the NWRS stipulates the national execution framework, and splits the country into 19 WMA, which matches the boundaries of significant watersheds (Funke et al., 2007). The CMAs, established at the WMA level, were meant to perform specific management functions assigned to them. For example, within the study, it was mentioned that CMAs are expected to collaborate and pursue conformity on water-connected issues among different participants and interested parties. They also

have governing panels to guarantee that participants are being represented, and to avert dominant decision making by influential individuals or groups with entrusted powers (Schreiner, 2013). Besides, CMAs have a mandate to increasingly develop catchment management strategies (CMS), to achieve the protection, use, development, conservation, management, and control of water resources in the respective WMAs in which they operate" (Pengelly et al., 2017: 44).

The findings, NWRS2 of 2013, obtained both from the literature and discussions, were analysed. As shown in Table 4.1, the key and underlying principle of this strategy is to guarantee that the country's water reserves are "protected, used, developed, conserved, managed and controlled efficiently and sustainably towards achieving South Africa's development priorities equitably over the next five to ten years" (Schreiner, 2013). The policy answers to main concern set by the government within the NDP and NWA necessities which promote sustainable development. The NWRS2 admits that South Africa is a water-scarce nation and is confronted with numerous water constraints and alarms, which entails safety of provision, degradation of the environment and resource exploitation, and the inefficient consumption of water (Mukheibir et al., 2003). According to Meissner et al., (2013), the management and implementation of NWRS2 require competent and accountable management. The Strategy outlines the institutional arrangements that must be established or reinforced to co-ordinate activities related to efficient water resource management within a defined geographical area, or catchment boundary. The organisations are obligated to carry out their duties within a developmental administration strategy, and to recognise the participation of all role-players in the layout plan for management within their demarcated areas. Smart business strategies are elevated within the overall water value chain management and water footprint (Mazibuko et al., 2006).

As noted by Zhuwakinyu (2012), and the discussions above, it is an undeniable fact that South Africa, through the DWS, has enacted numerous policies, regulations, and strategies post-independence in 1994 to address numerous water challenges and to achieve water security. However, their efficiency and effectiveness in this regard have received mixed views and perceptions among different literature and respondents. As witnessed in Table 4.2, in Section 4.2, 51 per cent of the respondents indicated that the current policy document and strategies are not

productive, are inefficient, outdated, and underlined by complex governance structures that have failed and continue to fail in addressing water constraints in the country against 49 per cent who deemed the programmes are good enough and are forward-looking, and appropriate in achieving water security.

As attested in Figure 4.5, different justifications and findings were given based on the standpoint of the respondents. The views expressed by the respondents, pro to the current policies and programmes, point to the facts that before 1994, an estimated 59 per cent of the population of around 38 million had access to basic water provisions. This has now increased to over 86 per cent of a total population of around 55 million inhabitants, who now have access at least to basic water provisions by March 2016. Regarding of hygienic supply, 52 per cent of the population of 38 million before 1994 had access to at least basic hygienic facilities, and this number has now improved to around 79 per cent of the entire population of around 55 million (Parks et al., 2019). Besides, the findings revealed that the overwhelming majority of the respondents, representing 75 per cent of the interviewees, believed that the policies and programmes have integrated water pollution strategies, reduced health hazards and have protected the ecosystems by introducing know-hows at reasonable prices for sanitation, industrial and municipal sewage processing, tackling the effect of underground water pollution and by creating at the national level, monitoring structures and proactive legal institutions.

Furthermore, statistical evidence suggests that 70 per cent of the respondents among the group believed that the policy documents and the strategies adapted have and continue to prevent, protect, and promote sustainable water use as well as addressing the water challenges in the country. For example, within the study, it was established that the second edition of the NWRS was clear about South Africa water security, and steps that need to be taken to address the problem, e.g. through the different reconciliation strategy, water demand and conservation management, as well as the gradual introduction of wastewater(grey) re-use, while at the same time, exploring the possibility of desalination for coastal cities.

Nevertheless, the findings revealed that 80 per cent of the respondents opposing the current policies and programmes, conceded that the country does not have the right and appropriate policy guidance and strategic framework to attain water

security in the country. Most of their arguments stem from the fact that the policies and strategies do not go far enough to tackle the challenges of municipalities as the major polluters of water resources in the country. Regarding water quality, there is a blurred line between WSP and WSA in most of the municipalities, especially the rural centres. Respondents expressed the view that there is a lack of right, appropriate and innovative policy guidance, and strategies to address municipal water supply failure. Municipalities are classified as water service authorities, and are constitutionally mandated to provide water services to communities. Nevertheless, most municipalities in the country have failed, and continued to struggle in providing these basic services of water in the last 26 years, resulting in community revolt and political unrest, as many communities find themselves without a reliable supply of water for days, weeks, months, even years.

Oosthuizen et al.,(2015) alluded that while recognising the development of the new policies and strategies by the government of South Africa, such as the NWRS 2, it is crucial to understand that these policies and programmes are still linked very profoundly on the prior 2000 policy ideologies of DWAF. Those programmes were formulated based on some of the most pressing or stressing challenges at a specific era, such as the unequal distribution of water, greyish water study, dam storage issues and other environmental challenges. Nevertheless, these exceptional, complementary acts of targeting to guarantee equal access of high-quality water to all citizens, while at the same time economising this finite asset, is tremendously under stress as most institutions, independent researchers and the study finding, confirmed (Oosthuizen et al., 2015). Respondents, therefore, are of the view that the recent national policy documents, such as NWRS 2 and NDP, lacked substance, direction, momentum, and impetus in addressing the real challenges of water in South Africa. As a respondent simply put it, “it is a sad reflection of the status of water resources in the country since these policy documents narrate only the surface issues, or problem areas, which are widely known and acknowledged, but salient on the more critical facets of how to go about confronting the crises”. Furthermore, they do not offer any innovative insight or strategies compared with the earlier (1990) water policies.

Intrinsically linked to the views expressed above, are the opinions of some respondents amplifying nimbleness of the current policy document towards

groundwater management. According to these respondents, and scholarly literature of Schreiner et al., (2018), there is a lack of depth in addressing the impartial administrative features of the underground water. Although there are rules governing groundwater exploitation, they are insufficient, unproductive, and highly compromised. Even the new policy (NWRS2) is just theoretical repeating the regulations of existing policies, instead of formulating innovative programmes that would incorporate market and organisational components into water governance.

Adding to the complexity of water management and governance due to policy gaps, the literature and the discussions identified dissonance between the policies and actual actions on the ground (Kapfudzarruwa and Sowman, 2009). The majority, 90 per cent of the respondents, believed that failure to implement policies and programmes are aggravated by bureaucratic implementation procedures, within and among government departments and ineffective communication with key stakeholders. For instance, the findings alluded that eight diverse sectors within the government are responsible for components of water: water provision, pollution control, and infrastructure planning and many more. However, as mentioned in Section 4.3, Chapter 4, little, or no coordination and interaction, occurs among these institutions.

Regarding water governance challenges, more than 60 per cent of all respondents believed that the state institutions empowered to administer and control the resource in South Africa, are unproductive with limited capitals, lack independence from political interference, and are poorly defined with overlapping authorities. Respondents singled out the incompetence, ineptitude and ineptness of some of the provincial and regional DWS, and some of the water Boards as a significant obstacle to effective water management in South Africa. These institutions were alternatively described as sedentary in their responsibilities, redundant, unpredictable, unfashionable, manipulated by politicians, weak and poor oversight by authorities, absence of simplicity on objectives, or dysfunctional. These views are exclusive findings of an expert engaged, and are not reflected in public survey data, since they mostly articulated as an insider perspective and the concealed character of water administration and governance.

As mentioned in Section 4.3 in Chapter 4, the study also analysed water management practices such as water preservation, water quality, watershed,

stormwater, and wastewater administration. It was widely acknowledged that the department engages the active water and water management task force, as shown in both Table 4.3 and 4.4. It was indicated that the water sector placed more weight on active water management practices and water management taskforce on water issues than any other programmes that involve water management. The views expressed by respondents were supported by scholarly literature which suggests that the conservation practices, such as water restriction, tariff structures, changes in agricultural practices, sanitation systems, water education, reuse of greywater and leak reduction are demand-side conservation practices, while planning and management, desalination, rainfall harvesting, control of water pollution and improvement of monitoring and forecasting systems for flood and drought, are the supply-side conservation strategies.

The general challenges confronting water management flagged by the majority of respondents are that the current management programmes are not speaking to the fundamental causes of challenges in South Africa's water administration, such as pollution, overconsumption, leaks, maintenance of infrastructure. However, they are instead treating symptoms of the problems. It was expressed that while more than 75 per cent of the entire water produced is utilised for agriculture production, the municipal provision for consumption within households is insufficient, inequitably distributed, and nearly absent in slums. In rural communities, despite assurances on the part of governments to deliver adequate and quality water, numerous villages remained with no reliable sources of water. This scarcity and inadequate provision of water were significantly blamed on poor water administration, which, has, resulted in "unequal access", rather than a typical scarcity. These are the views of about 60 per cent of the respondents.

Regarding water quality, the findings revealed that safeguarding water quality, both surface and groundwater, was exclusively relevant to academics, research groups and other institutions as represented in Table 4.3 and Table 4.4. While challenges with environmental water quality were characteristically regarded as a historical matter, instead of a major existing problem, some of the participants mentioned that large parts of water pathways in South Africa are already impaired, suggesting that adequate quality water cannot be secured. The majority of the respondents (85 per cent), supported by scientific literature (Mackay et al., 2003), expressed the

view that companies and organisations responsible for polluting the surface and groundwater, must be held responsible for water-quality diminishing. Some views and perspectives of improving water quality throughout South Africa must entail raising and enforcing regulatory standards, improving the management of wastewater and runoff contamination such as stormwater, and constriction of non-point discharging into rivers. Respondents alluded that this could be achieved through effective monitoring of groundwater quality.

However, an overwhelming number of respondents (75 per cent) expressed that water management practices in South Africa, post-independence, are often carried out "on an ad hoc basis", without any precise determinations or comprehensible strategy, or focus, that drives "optimum water efficiency". As a respondent commented, echoing a popular thought, "water management in South Africa is like a 'headless, leaderless' process". The primary and fundamental reason behind the poor water management practices relates to the undistinguishable, undefined, and vague split of power between the national, provincial, and local bodies concerning the water resources. Besides, the majority of the respondents blamed the existing laws, policies, and regulations such as WSA, NWA, NWRS, and they asserted that the policies are only strong theoretically, but woefully ineffective on the field due to the fact that they lack deterrent measures, are hampered by qualified personnel and top-down implementation strategies as portrayed in Table 4.10, and Figure 4.16 in Section 4.5.2 in Chapter 4. Overwhelmingly, respondents called for stringent water audits and evaluation of companies and industries, for water management and conservation to have any meaningful influence. The obligation of persons and civil organisations must be to coordinate and supplement government efforts towards water management and conservation. Additionally, the majority of the respondents and literature of Maphela and Cloete (2019), alluded that micro-community participation practises, such as watershed management, rainwater harvesting through tanks and barrels must be promoted to supplement water provisions.

5.3 Public participation in water governance in South Africa

One of the critical issues that popped up in this research is the grassroots and stakeholder's participation in water governance and management. According to the European Environmental Agency EEA, (2014) and discussions, public participation

was defined as, “the involvement of individuals, associations, organisations, or groups (i.e. public) in the process of preparations and implementation of policies and strategies to raise awareness and increase acceptance and commitment by promoting a sense of ownership”.

In many parts of the world, public participation is a popular jargon in water asset administration and guidelines (Razzaque, 2008). “For instance, the National Water Policy of Bangladesh (1999) requires the participation of local communities in the water sector development projects, both in the planning and management processes” (IWMI, 2013). The “National Water Policy of India (2002) promotes the participation of communities in the planning, development, and management of water resource projects. The Water Policy of Pakistan (2004) calls for an enabling environment for active stakeholder consultation and participation at all levels, and in all aspects of the water sector, including agriculture (irrigation), municipality water supply, industries, flood protection and drought activities” (Razzaque, 2008: 363). Comparable instances could be taken from Africa, Latin America, Europe, and North America, where public involvement has become the new catchphrase and maxim in national water policies and programmes (Razzaque, 2008). Additionally, many constitutions and water-specified laws included the provision of public and grassroots participation in water management (Razzaque, 2008). This legislation and policies mostly promote public involvement of municipalities and societies in the water asset administration and conservation.

Public involvement in environmental policymaking in South Africa earned a stable and robust legal endorsement during the “Consultative National Environmental Policy Process (CONNEPP) in 1995, which led to the adoption of the National Environmental Management Act (NEMA) in 1998” (Boakye and Akpor, 2012: 511). The legislation seeks to tackle the historical segregation of the population in policymaking, and afford an equal right to inhabitants as preserved in the South African constitution of 1996. The democratisation processes wedged on the hypothetical and philosophical, rational, and discerning on the water administration sector, as well as with the feeling of a growing need to contribute to the policymaking procedure because of the absence of trust and acceptability in the apartheid government. The WSA of 1997, NWA of 1998, and NWRS of both 2004 and 2013 advocated for people-oriented institutions in water management

instead of the technocratic-oriented of the past. The people-oriented people management provides prospects and opportunities for water management organisations to share thoughts and knowledge with communities (Boakye et al., 2012). Water administrators, thus, required to deal with various participant interests to if they are to succeed in the execution of administrative strategies governing water.

One of the critical issues that have come up in this research is that, while there is strong advocacy of public involvement in the Constitution and NWA, the country is yet to realise an all-inclusive and practical strategy to public participation at the level of WMAs (du Toit et al., 2008). Responses to this argument suggest that the actual prerequisite to active participation is not clearly documented. These circumstances have led to a situation where stakeholders' engagements are poorly conceptualised, misapplied and mostly confused to participants. Participants exhaustion is often the outcome of this, complemented by increasing exasperation with the enactment of the substances of the act (du Toit, 2016). The intent of regionalised democratic water resource governance is subsequently endangered if the public involvement procedures are not plainly defined in the public realm.

Regarding levels of awareness and participation in the water management processes, the findings, and other literature, suggests that public participation and stakeholder engagements form the cornerstone of the policy reforms on water administration in the new South Africa. The prerequisite of the reforms dictates that the citizens must be made aware, and be informed, of regulations to enable them to participate and contribute to the governance of water resources. Nevertheless, Figure 4.6 in Section 4.3.1 in Chapter 4, revealed that 80 per cent of the respondents had no knowledge or awareness of the public participation processes, compared to only 15 per cent of respondents with the knowledge of public participation programmes. This low rate of understanding, awareness, and participation contradicts the principle and philosophy of sustainable water management, which is grounded on the active involvement of communities in the devising and execution of the policies and strategies. The public participation process is described by Theron, Ceaser and Davis (2007) as a process whereby beneficiaries participate, influence, direct and eventually "own" their water resources.

The above observation suggests that South Africa, in its twenty-five years of democracy, is yet to develop pragmatic, progressive and mandatory policies, and programmes regarding public participation in water governance. Presently, it counts profoundly on the ward committees and councillors to accomplish these functions. Though these committees are meant to recognise serious problems affecting their districts and reflect upon them, they often fail to incorporate water management issues into their deliberations. Besides, government effort to promote public participation and engagement on water management, through "imbizos", are often unproductive, since, rather than being a medium for honest and open community rendezvous with local authorities, it tends to be a “public relations exercise at best, and, at worst, sites for capture by political elites”. All these tendencies have created a gap between the government and communities because programmes are mostly futile.

Another observation derived from the discussion is the absence of political will and poor comprehension of the content of public engagements by the state representatives and personnel, tasked with organising public engagements. For instance, a respondent cited the number of violent protests related to water within the local communities, and the numerous of cases that have gone through courts and even the “Constitutional Court”, on the dissatisfaction of communities towards water provision, is a strong indication that public involvement in water management is conducted on an *ad hoc* basis, with little or no input from the stakeholders. The views and discussions suggest that the current strategies of public engagements are not working and require a new methodology. Respondents, therefore, alluded that civil societies and communities should be empowered to exert pressure on the department to legitimate stakeholder participation, and to bring a clearer insight of public involvement in water governance, both at national and community levels. While the public is yet to comprehend the prospects associated with public engagement entirely, civil society and organisations must strive to increase that consciousness amongst the population on the intrinsic advantages of public engagement and how to administer it effectively. Furthermore, it was suggested by the respondents that the government must develop engagement strategies and systems, and must publicise those strategies and develop officers to apply them. Skilling government the officers with the expertise and familiarity will be essential to execute stakeholders engagement efficiently.

Another theme that emerged from the discussions are factors hampering the effectiveness of public participation and engagements in water governance, as indicated in Table 4.5, in Chapter 4. According to Razzaque (2008), when civil societies and other stakeholders engage in the policymaking, a consensus is achieved on the very critical issues facing the water sector generally. Boakye et al., (2012) state that, "the quality and effectiveness of the water policies and programmes wholly depends on the extent of involvement of all stakeholders (communities in particular) in decision-making, from its inception to the implementation stages".

Nevertheless, Future Africa Forum (FAF, 2018: 109) alluded that, the state of affairs concerning public participation is far removed from that envisaged by the constitution and other policy prescripts, as public participation is seen as the proverbial elephant in the room. This observation suggests that government superficially notes the importance of public participation for democracy and governance, but defies engaging it due to the perceived complexity the process of participation may hold for them. Where participation does occur, it is normal or mostly for routine, and not planned to integrate thoughts and requests put forward by the individuals, or to discuss with essential matters around the impacts of development sincerely. In most cases where government initiates development projects, they are generally implemented with limited or non-existent engagement (See Section 4.3.2 of Chapter 4).

The respondents mentioned different reasons as the contributing factors to the weak public participation and public engagement processes. Table 4.5 revealed that 85 per cent attributed the weakness to communication, with knowledge gaps in the content issues, plus other factors such as cost in time and money, and perceived incompetence within government institutions in dealing with the thorny issue as the significant factors. For instance, within the study, it was discovered that over 70 per cent of the participants attributed poor public participation in water management to the manner in which public institutions operate, which is not always in line with participating procedures. For instance, prescribed decision-making events are often prolonged, does not often link up with the aspirations of people involved, who usually are looking for rapid resolution and outcomes. The findings further established that more than 65 per cent of participants perceived

participatory organisation and structure of composition as lacking fair representativeness, mostly disproportionately and biased towards wealthy and well-educated citizens.

A severe but personal challenged, alluded to by an interviewee, was a communication barrier that exists in the participation processes. For instance, it was indicated that "most of the participants in the Olifants-Doorn WMA are mostly Afrikaans speakers, and it will be a requirement for state actors to be able to communicate in this way. Unfortunately, many staff members of the Department of Water and Sanitation are not Afrikaans speakers, which makes communication difficult and constitutes, consequently, a barrier to increasing trust between the Department and rural communities who dominate the previously disadvantaged group". Besides the lack of expertise, interest, and the language barrier, the findings identified the deficiency in data, both in hydrological, social, and economic issues. This is mainly as a result of the poor coordination and information sharing among the institutions accountable for cross-cutting issues of the environment, notably aquatic, terrestrial and the atmosphere.

These observations confirmed the views of Akhmouch and Clavreul (2016) regarding barriers to public participation in water management globally. Akhmouch et al., (2016: 6) enumerated the significant challenges to include; "poor and weak political leadership that is not willing to shift the balance of power to stakeholders, key actors that share the same intentions, perspectives and interest; lack of clarity on the use of stakeholder inputs, for instance, to build consensus, to take decisions, to share information, to raise awareness which often result in mistrust and consultation fatigue; constraint of institutional fragmentation with overlapping mandates and conflicting goals, often leading to inadequacy, poor and weak co-operation across authorities, communities other water-related sectors and scales; lack/ inadequate funding to sustain the engagement process, logistical expenses related to meeting venues or support material, and the lack of competent and dedicated staff; and conflict of interest and consultation capture, especially when certain groups, actors and lobbies are better organised to voice their concerns."

As stated in Razzaque (2008), effective public participation process rests on a comprehensive appreciation that water policy requires a whole lot of interested

parties between departments and government institutions, and between diverse stages of administrations. Besides, private players, financial institutions, service providers, environmental activists, communities, provincial watershed institutions, NGOs, global institutions, donor organisations, intellectuals, and professionals, have critical roles and responsibilities to play in terms of policy planning, execution, monitoring and are accountable for whatever outcomes. Supporting these findings Akhmouch et al., (2016) underscores that public participation must adopt a "multi-stakeholder membership", acknowledging that administering water is a collective duty across decisionmakers and interested parties. The diversity of membership and opinions will promote and enhance "cross-fertilisation" of ideas and offer numerous inspections to determine what is working, and what is not working, and what could work better in terms of water management. The promotion of these principles were thought through and considered during peer-review of national strategy conversations in the Netherlands, Germany, Malaysia, Singapore, Brazil and Tunisia, where the opinions and expertise from extensive participants were embodied in the public participation procedure, and thus assisted in shaping, drafting, formulating, developing and implementing some of the robust and advanced water policies which have driven their sustainable and stable water governance (Razzaque, 2008).

Another critical theme explored by the study was the channels through which awareness is created in the water sector, as indicated in Figure 4.9 of chapter 4. As indicated earlier, South Africa's water governance has adopted the IWRM as its policy for governance. Ackerlund (2011) and Bakker (2008) pointed out that IWRM is a strategy which encourages the harmonised advancement and running of water, land and other connected assets to derive the economic and social wellbeing in a reasonable and justifiable manner without conceding to the sustainability of the vibrant environment. Hence, the Anderson et al., (2008) reflection, that NWRM is a "cross-sectoral policy instrument" designed to switch from the conventional fragmentation strategy to water administration which, is associated with poor service provision and untenable and unmanageable asset use.

NWRM, based on scholarly literature and the researcher's interpretation, is grounded on the knowledge that water assets are an essential element of the ecology, a natural asset, a social and economic commodity. This understanding

makes water management everybody's issues, not the government or a sector mandate; it entails the involvement of various shareholders, including the general public. Therefore, communication within the IWRM strategy is critical in the water governance structure (Refer to Section 4.3.5 of Chapter 4). According to Funke et al., (2007), one of the fundamental goals of water reform programmes in the country, after independence, is to improve the communication and create awareness among the public and the stakeholders' towards participation in water issues, policies development, conservations strategies, environmental management and public health.

As established in the finding, the DWS have comprehensive communicating channels through which it disseminates its policies and programmes towards water management; however, despite this acknowledgement, communication channels are rarely strategic. “Strategic communication in this context is a pre-requisite and an instrument of effective policymaking and public participation: from formulating a vision, negotiating and decision making, developing, and implementing plans to monitoring impacts” (Tomowski, 2006: 22). In other words, communication serves as information swap, building agreement among different views and benefits, and advances the establishment of experience, policymaking and capacities within government, civil organisation, and private institutions (Tomowski, 2006). Accordingly, OECD (2008) and UNDP (2012), view interaction and conscious-building as one of nine fundamental processes to provide support for tactical procedures for achieving sustainable water management. In a certain sense, two-way communiqué is the “lifeblood” of any approach. Devoid of it, a plan will not be accomplished, since teamwork or collaboration is the tool on which interested parties rely on.

The key findings revealed that the majority of the participants were of the view that the current channels of disseminating information in this sector are out of fashion, lack people-centred approach, and also lack long-term vision towards achievable goals. There is evidence in Section 4.3.5 of Chapter 4 that traditionally the government and the department have been resistant to come up with strategic and innovative channels of communication that will enable participation of the interested parties at every stage of water administration. In addition, the traditional community forums that served as channels for residents to air their views, discuss

problems and reach decisions on critical issues, such as accountability and transparency, have been abandoned, or replaced, by formal administrative structures at local levels, which are only set-up to communicate government policies and programmes to the communities without adequate engagements.

Again, it was established that strategic communication in water management and governance is more than just spreading the news, but vigorous in soliciting stakeholders' viewpoint. It guarantees a “two-way flow of communication”, tackles human issues such as sociology, psychology, culture, behaviour, and politics, and helps to build consensus and partnerships in the water sector. Results from Section 4.3.5 further reported that there are both internal and external factors that affect human interaction that must be taken into consideration. The internal elements are the human characteristics, which include: customs and ethics, manners and behaviour, sentiments and beliefs, cultural and social relationships that must be spoken to, shaped, touched and directed towards sustainable use of water resources. The external factors, according to Tomowski (2006: 16), include materials such as pictures or movies, the carrier of a message, as well as media, such as print or broadcast media, information and communication technology (ICT), street theatre, a wall or interpersonal or group communication, and vehicles' that bring messages of water sustainability and management to the target audience.

5.4 The structural and systematic challenges to policies implementation

One of the central issues that this research explored is the systematic and structural constraints that have impeded policies and programmes designed to achieve water security in South Africa. This has been mirrored in Section 4.4 in Chapter 4. A myriad of studies, for instance, Collignon and Vézina, (2000); Vörösmarty et al., (2005); Siebrits et al., (2014); Valipour (2015), and researchers from disciplines ranging from geopolitics Heijnen et al., (2014) and Valipour, (2015) and Mollinga from socio-politics (2008), have enumerated the structural challenges that have hindered implementation of South Africa's water policies. Their observations are supported by the respondents of this research – refer to Figure 4.11 of Chapter 4). As depicted in Figure 4.11, 90 per cent of participants concord that there are systematic and structural challenges hindering effective execution of

strategies and regulations devised to drive the water security agenda in South Africa.

The views expressed by the respondents and other pieces of literature, suggests that policies do not thrive or flop on their qualities; instead, their accomplishments are dependent on their process of execution (Hudson, Hunter, and Peckham, 2019). There are several factors advanced by this research as policy implementation gaps. These gaps were in two broad areas, namely, institutional and governance constraints, as well as resource and capacity challenges to policy implementation.

Table 4.7 of Chapter 4, enumerated in detail the institutional and governance constraints hindering the execution of policies and programmes, devised to drive the water security project. The views of respondents and the literature of Hirji and Davis, (2009), suggest that a lack of comprehending the interconnection or interrelation between multiples downstream water requirements, including estuaries, offshore, and aquifers, exacerbates further the established constraints among the respective public institutions that administer these reserves. Hudson et al., (2019), alluded that to understand how to enhance and support policy better, it is imperative to appreciate the very nature of the policy failure – rationally the underlying reasons why things go wrong will assist and guide you seek for possible answers. There is increasing curiosity in the notion of "policy failure" (Volker 2014), but, like McConnell (2015) indicated, "failure resides at the end of a success-failure equation", it is characterised by outright of non-achievement. As indicated by a respondent, "failure is rarely unequivocal and absolute, even policies that have become known as typical policy failures have also, to some extent, produced small and modest successes". The findings of the study categorised institutional and governance implementation failure into three broad areas, namely, weak governance structure, fragmentation, and poor collaboration within policymaking.

The field data from interviews, questionnaires administered, and content documents suggest that poor governance is a significant obstacle to policy implementation. The majority of respondents alluded that water governance remains barely understood in South Africa, even though water scarcity is endemic in the country. In South Africa, water administration revolves around in three factors; accessibility to water, water service provision, and engagement in water administration (Weaver et al., 2017). Regarding of accessibility, South Africa has

“annually average per capita water below 500 cubic metres, hence, classified as water-scarce compared to a world benchmark of 1000 cubic metres” (Muller et al., 2009: 19). More than 50 per cent of the rural inhabitants are unable to access drinking water, despite the efforts by the government to enhance provision through the 1997 Water Act that sought to guarantee safe drinking water access to every citizen (Schreiner and Hassan 2011). Water service provision in South Africa has been decentralised at the operational levels. According to (Weaver, 2010), these services are associated with high levels of rationing, inadequate reporting, poor-quality provision, and tremendous losses. Legislation governing the supply and utilisation of the resources lack features of openness and accountability from the top to the end-user. Moreover, weak infrastructure, pollution, and mismanagement of the reserve by communities have exacerbated water service provision (See Section 4.4.2 of Chapter 4).

Community involvement in water administration can be either explicit or implicit. The implicit explains the use of elected representatives in the decision-making process in water resource management, while the explicit explains the direct participation of people in policymaking in terms of the management of the reserves. Involvement, though exist in the country’s water administrative structure, is at a shallow point, and has unproductive response systems which suppress people from publicising their complaints and taking measures to rectify the shortcomings. The South African government has set up local institutions, such as WUA, WRMA and RMAWSRB all to improve individual involvement. Although the media, NGOs and research institutions, formal and informal structures, were vocal to promote participation in water governance, as observed by Weaver (2017) and the majority of the respondents, all these structures have nevertheless failed to make any meaningful contribution to water governance. According to Pollard et al., (2008), incorporating the three dimensions of water administration in the South Africa context is challenging and must be reviewed.

For progress towards achieving water security, governance structure must shift towards decentralisation or "local universality". “Decentralisation describes the transfer of responsibility, power, authority, and resources to a low-level government from a higher-level one, to enhance efficiency and effectiveness at policymaking, financial management and service delivery stages” (Laryea-Adjei & van Dijk, 2012:

218). Decentralisation reforms in South Africa can contribute positively to water governance in terms of accessibility and quality of water supply (Laryea-Adjei et al., 2012). Due to the vested nature of South Africa water provision, it is provided by the state; the DWS spearheads water governance, management and service provision through the establishment of institutional bodies promulgated from the WSA of 1997, and NWA of 1998, which was later revised in the NWRS of 2004 and 2013. Through the legislation and policies reforms, value for water and decentralisation water administration in the form of participation strategy was instituted, outlining privileges and responsibilities of different participants. The primary goal is to improve transparency and accountability, which underpinned water governance under the Acts, which are the legal framework on water resources management.

Fragmentation, and poor collaboration within policymaking, were also mentioned by a number of respondents as one of the institutional constraints to water management. As mentioned in Section 4.4.2, the diversity of interested parties in the water sector makes it susceptible to politicisation, and the threat of manipulations, often at the policymaking level. As shown in Table 4.7 of Chapter 4, more than 70 per cent of the respondents alluded that policymaking has been developed in separate managerial silos, even though most mediations or interventions have broader impacts that affect other organisations. Furthermore, despite the increasing interest in formulating concepts and strategies to encourage inter-organisational collaboration, implementation has been at best inconsistent and sporadic. The vulnerability of collective decision making, and the inability to create a common platform to solve problems through effective administrative procedures, remains one of the justifications for successive execution obstacles (Hudson et al., 2019).

Ansell, Sørensen, and Torfing (2017), as well as views from respondents, specify that policy designers require incessant partnership with a variety of participants from political organisations, professional bodies, and administrators at all levels, as well as communities and grassroots organisation and consumers, to formulate and implement pragmatic programmes. Ansell et al. (2017), highlight the need for policies to be designed in a way that "connects actors vertically and horizontally in the process of collaboration and joint deliberation". This was supported by a

respondent who disclosed that engagements should not be seen as a long and cumbersome search for unanimous agreement; “rather, it should be seen as a search for sufficient common ground to proceed, without which there will be ongoing conflicts over policy legitimacy and organizational mission. The imperative, therefore, is for policy design and implementation to become an integrated process, rather than merely a series of discrete and distinct stages. Policymakers should be equipped with requisite skills, competencies, capacities, and capabilities to address these systemic flaws.

As indicated in Section 4.4.3 in Chapter 4, several capacities associated challenges present impediments to the execution of water policies in South Africa. Capacity, involving human resource expertise, financial, and infrastructure development, remains significant constraints. The majority of respondents asserted that formulating and executing water policies to achieve sustainable development goals, involves capital and skills. Table 4.8 enumerated the significant challenges, and these include deficiency of human capital, which entails; skilled personnel and lack of financial resources. Other implementation constraints, grouped under important challenges, were poor planning and broken infrastructure, lack of interest by political authorities, stakeholders support, and improper monitoring processes.

The South Africa Academy of Engineering (SAAE, 2020), alluded that the main hindrances to policies implementation in South Africa are porous administration, deficiency of knowledge, experienced and qualified experts and technical workforce, political meddling in the daily manoeuvres, and weak supervision resulting from the limited separation of powers between political decision-makers and the executive administrators in the water sector. A significant area which was identified by most of the respondents as an obstacle to proper policy execution was lack of financial resources. More than 70 per cent of the respondents alluded that the lack of investment makes it problematic to fund for projects or expand the existing ones, to rehabilitate or fix of broken infrastructure, payment of salaries of staff, variable costs (processing of wastewater) and upkeep and operational expenditure, all at the same time. According to SAAE (2020), implementation challenges are compounded by the fact that many water service authorities are not financially sustainable because of the limited revenue base. Out of 278 municipalities in the country, 144, representing 52 per cent of all water sector authorities, depend on grants to fund

over 90 per cent of their physical infrastructure and other expenses, 58 per cent collect below 70 per cent of the projected proceeds, and 42 per cent have no reliable source revenue and water expenditure of over 40 per cent (Hollingworth, Koch, Chimuti and Malzbender, 2011). Again, consumer debt is but one of the reasons municipalities do not have the ability to provide adequate water and sanitation services, consistently and reliably for all their residents, and can be attributed to poor supply chain management. It was established that despite consumer debt, municipalities are, themselves, financially reckless with the money that they do have. The study findings established that these are some of the issues affecting the implementation of the national policy and goals of expanding services and access to safe drinking water. Furthermore, it was mentioned that revenue generated is often inadequate for public services, even to achieve break-evens. Water charges are set at levels that may not even cover up administrative expenses, paying of salaries and wages as well as maintenance expenditure (See section 4.3.3 of Chapter 4). In 2019, the Helen Suzman Foundation (HSF), and the Council for Scientific and Industrial Research (CSIR), reported that "the DWS national institution, empowered to ensure that the country's water resources are managed sustainably and equitably for everyone's benefit, faces severe financial challenges that compromised its ability to function effectively. By their observation, abysmal financial management remains one of the biggest challenges in the department, and its water trading entities. In the 2017/2018 financial year, the department reported an overdraft of R119 million, cumulative unauthorised spending of R933 million, the irregular expenditure of R6.1 billion, R16 million of fruitless and wasteful expenditure, and accruals and payables to the value of just over R2 billion".

These observations were supported by Imonikhe and Moodley (2018), who argued that that services and amenities in the third world are constrained by inadequate capitals, often as a result of incompetency and ineffectiveness in generating revenues, and over subsidised tariffs. Policies implementation will only be effective if the financial structures are in place to promote the resources, and the investments are adequate, and accurate in time, manner, and quantities. Hart-Velt and Okun (1991) indicate the necessity for services to possess the capability to convert capital into meaningful developments and endeavours. Funding should serve as a tool for supporting and reaching micro-level water strategies such as

processing, growing staff capacity, infrastructure development and maintaining data management.

Another critical area that has been noted by the research is the lack of human capital and trained personnel. As indicated in Section 4 in Chapter 4, “because operation and maintenance of water supplies and sanitation in developing countries are highly neglected, official data on the number of people served by these services are often overly optimistic because, in all honesty, many of these facilities are broken, or operating at reduced capacity, due to lack of personnel”. According to SAAE and HSF (2019), apart from financial challenges, the water sector under the DWS is also faced with significant constraint of acquiring competent workforce over a reasonable period. For instance, the findings from the study revealed that the lack of qualified in-house engineering experts have resulted in poor quality service delivery. SAAE (2019), alluded that the DWS, in 2017 and 2018, needed 30, 000 “skilled artisans”, and 30, 000 experienced treatment-plant operators in the municipalities. Again, in 2018, there were about 50 000 vacant funded posts in the water sector, most of the engineering and expert skills, giving the sector a vacancy rate of just less than 15 per cent. The problem is even direr in rural provinces such as the Eastern Cape, Limpopo and KwaZulu Natal, who are battling to fill technical posts. Masindi and Duncker (2016) further alluded that, “the civil engineering capacity (expressed as civil engineering professionals per 100 000 people) in local government is too low to deliver, operate and maintain local government infrastructure in a sustainable manner. Whereas, before 1994, there were 20 engineers per 100 000 people, this has now dropped to 3 per 100 000 people, a ratio that is indicative of a crisis”.

Further observation revealed that the water sector has high turnover rates of staff as well as extreme figures in vacancy percentages, an ageing staff, scarcity of qualified engineers, water scientists, technicians, and artisans (Section 4.4.3 of in Chapter 4). The DWS acknowledged that a number of its senior employees are with no appropriate qualifications since they were promoted on the grounds of long service, and not on the professional knowledge prerequisite to undertake their responsibilities. The field study revealed that the DWS has no apparent staff retention, development, and progression strategy. Neither does the department have a vibrant training and development strategy to upgrade the skills and

competences of its employees or attract new and qualified personnel. Equally, Sershen, Roda, Stenstrom, Schmid, Dent, Bux, Hanke, Buckley and Fennemore (2016) detailed that there is no desire to convert the study work into working strategies and programmes due to absence of expertise at the management and technical posts levels to undertake such exercise. Furthermore, loss of knowledge and skills by the exodus of experts to the more lucrative private sector, or migrating abroad, where they are well recognised with the right incentives and remunerations. As indicated by Hartvelt et al., (1991), a significant constraint is that specialised knowledge and know-how are not readily available in South Africa, and the department has few prospects to attract and retain the right skills due to low salary scales, and the lack of incentives. Furthermore, there are uncoordinated and fragmented development and training activities, and it is imperative to align training and development programmes to the long-term goals of the department. This to say that the human resource division must liaise with the strategic vision, mission and growth plan of the department and the performance management systems of the department.

One of the issues that were analysed and discussed in Chapter 4 was poor planning, lack of investment and broken infrastructure. Table 4.8 in Chapter 4 revealed that 65 per cent of the respondents believed that poor planning towards broken infrastructure is significant constraints to policies implementation in South Africa. The views of the respondents collaborate with the findings of HSF (2019), which alluded that, “infrastructure is crucial in achieving increased levels of economic growth and social upliftment. However, the country's water infrastructure is at risk of failure. The consistently poor performance of water and sanitation infrastructure is accredited to poor planning at national and local departments, poor asset management and insufficient maintenance, lack of technical skills within crucial planning and operational divisions in both Department and municipalities, weak enforcement of policies, theft and vandalism of infrastructure, financial mismanagement and funding shortfalls” are fundamental constraints to water provision in the country.

The observation by some of the respondents suggests that some provinces had adequate facilities for a particular facet of services. For instance, in a utility, they have adequate infrastructure for water supply, but ageing and insufficient facilities

for distribution. According to SAAE (2019), while water supply infrastructure has been provided to serve almost 95 per cent of the population, barely 60 per cent of the citizens have access to reliable services. It was observed that the infrastructure constraints are further compounded by the fact that many water institutions, specifically the municipalities, and notably, the lesser and mainly the countryside municipalities, do not have adequate knowledge or information about their infrastructure. They are mostly uninformed of what infrastructure assets are under their control, where these properties are found, the lifespan of the assets, and what resources are needed to extend the lifespan of this infrastructure. Without these data, it is nearly impossible to establish the resources required to sustain the infrastructure. These outcomes proved that the auditing of infrastructure in most municipalities are not only in the disorganised state but not existing.

As indicated by multiple literature and respondents, there are mounting complications meeting the escalating demands of water to consumers due to infrastructure breakdowns; in water purification plants or transferring water from processing centres to households due to leakages. Based on these circumstances, the department had embarked on massive infrastructure projects to bridge the demand gap. However, it was mentioned by the majority of respondents that most, if not all, of the infrastructure projects, do not get completed in stipulated time and periods, thus prolonging the future increase of service provision. Furthermore, it was also indicated that due to funding challenges, infrastructure projects are mostly delayed or finalised through a different stages approach. The government usually apportion roughly 10 to 12 per cent of their yearly operational budgets on maintenance and repair. Nevertheless, these are just budget estimates. The actual information or budget spend by municipalities on maintenance and repairs are not readily accessible. This phenomenon is not legitimate with achieving goals linked to modernisation, excellence standards, innovative and transparency as enumerated in the state strategic guidelines.

Policy execution in the water sector could be effective only if the sector has the right and appropriate infrastructure capacity and ability to meet the demands of the growing population. The water sector depends tremendously on the infrastructure for continuing its operation; this suggests that the sector need to make adequate investments in infrastructure development (Kang and Lansay, 2012). Policymakers

and experts in South Africa' water sector must, therefore, consider innovative methods of boosting their infrastructure capability. They must also reserve resources for infrastructure expansion, explicitly by meeting the established programmes and people desires. The national administration, as well the provincial departments, must guarantee that funds that go into infrastructure development projects add value to the water industry. The sector, as well as municipalities, need quality infrastructure for their local economies. The intervention by the national government is critical, because infrastructure is vital for local economies, and such interventions should not only be funded but also capacity to ensure municipalities are able to deliver on their essential services.

Another significant matter that was acknowledged and discussed within Chapter 4, as a barrier to policy implementation, related to political meddling in the daily activities, and overreaching of power due to the misunderstanding and blare definition of separation of powers between political decision-makers and the executive administration in WSP. It is important to acknowledge, from the onset, that two views came up regarding political involvement in water management, or governance: "proper and improper" interference. Some of the group of respondents believed that the right (proper) political interference entails actions that offer officials, or managers, with relevant data that relates to the influence policies, decision-making, and holds managers, or the sector leaders, accountable for their decisions under the law. In addition, the interference provides politicians with facts that are useful for policymaking and enlightening their constituencies, and follow acceptable processes with sufficient clarity to guarantee that the people are convinced that legislations are legally implemented, based on the rule of laws without stakeholders' bias or prejudice (Wang, Pan, Yaya, Yadav, and Yao, 2019).

Nevertheless, the focus and area of interest in this research is the improper political interference. An overwhelming majority of respondents asserted that the improper interference contravenes practices, pursues to prejudice the regulations on the decision-making process, or "aims to violate the letter, or spirit of laws and policies, that are regulated, or designed, to be implemented". Wang et al., (2016) alluded that the improper political interference takes the formula or structure of imposing the service provider to incur charges that are uneconomical, forced service providers to hire additional workers, more than they needed, and provided

patronage or influence to the appointment of staff or senior managers (Molobela and Sinha, 2011). Political coerce may also compel the service providers to make capital spending in some societies, or areas, before they are due, based on fraudulent and misleading operational practices that are due them—the result of this unethical practice reduces efficiency and perhaps diminished credibility.

The outcomes of the research confirm the fact that there is a connection between the service provider's autonomy and investing in the water infrastructure within South Africa (Ruiters and Matji, 2015). For instance, the findings established that greater independence in the DWS, in recent times, has increased the investment in water infrastructure. The rational of autonomy is to provide as much as possible a steady regulatory framework, protect the water sector from manipulation for short-term political expediency and encouraging shareholders to make the sustainable investment in the sector (Ruiter et al., 2015). In line with the scholarly literature of Wang et al., (2019), and the views of some respondents, it can be concluded that in making important decisions, the sector and the key stakeholders must be afforded a satisfactory level of independence that permits them to perform within the required capability – "financial, operational and intellectual capacity", and be granted space to defend their operation of delivering water services. Moreover, at the level of governance, there is frequent friction between autonomy, integration, accountability, and responsibility. The regulatory authority must be granted adequate independence to prevent unnecessary manipulation from the political heads, and to remain accountable, while being adequately incorporated into the policymaking space that guarantees the application of its determinations (Imonikhe et al.,2018).

5.5 The strengths and weaknesses of the water policies and strategies

In this section, the researcher explores the strengths and the weaknesses of current water policies and strategies towards the attainment of water security in South Africa, as stated in the fourth objective of the research. The findings were identified and measured based on the degree of connectivity of households and communities to water resources, lack of/or decaying water infrastructure, the threat of climate change and levels of pollution and water quality. Other components assessed were the funding of water projects, level of investments, and intervention strategies.

Evaluating the strengths and weaknesses of water policies, based on households connectivity to water, the findings established that more than 50 per cent of the total respondents rated their accessibility below "good", with only 15 per cent grading their accessibility as "perfect." This was discussed and analysed in Section 4.5.1 of Chapter 4. Since 1994, the government of South Africa has taken relevant reforms aiming to promote "equity, sustainability, representativity and efficiency through water management, decentralisation, new local and regional institutions, water user's registration and licensing, and the emergence of water rights' markets" (Molobela et al., 2011: 994). The left-wing of the country's water legislation sought to bring fundamental reforms in the manner in which the resource is utilised and distributed among various consumers and groups. The primary goal is to ensure an improved and healthier balance between "efficiency, sustainability and equity" demands in water distributions (Molobela et al., 2003).

As mentioned by some of the respondents in Section 4.5.1 in Chapter 4, the legislation, policies, and strategies enacted post-independence, have significantly improved the quantity and quality households and community's connectivity to water. For instance, the findings and data from StatsSA (2016: 14), revealed that, "the number and percentage of households with access to piped water, had increased since 1994, and that 13,8 million households had access to piped water in 2018, compared to 9,3 million in 2006. The increase in the percentage of households with access to water coincided with a decline in the percentage of households who paid for the piped water they received. More than two-thirds (61,4%) of households rated the water services as 'good' in 2014. In comparison, the percentage of users who rated water quality as average, increased from 15,8 per cent in 2005, to 31,8 per cent in 2009, before it eventually declined to 26,4 per cent in 2014".

Further breakdown of water accessibility from the General Household Survey Report in 2017 by StatsSA (GHSR, 2017: 34) revealed that "although 90 per cent of South African households had access to piped water in 2018, per capita water consumption was found to be below the Reconstruction and Development Programme (RDP) standard (25 ℓ/cap·d) for 45 per cent of the households. Water supply frequency and reliability is a significant problem; only 15 per cent of respondents declared that they have access to a source of water every day at any

given time, while almost 80 per cent do not have daily access. Households often resort to several water sources, such as fetching water from rivers, streams, stagnant water pools and dams, wells, and springs to meet their needs. Some have invested in storage capacity to cope with the unreliability of water supply. As a result of this situation, 71 per cent of respondents were willing to pay a once-off connection fee for improved water service. Households not willing to pay were characterised as lower water consumption users with lower educational level, and per capita income". The findings established that gender and socio-economic conditions play significant roles on the willingness to pay for water provision and other charges, as men and households with low-income status, were found to be unwilling to pay, more often than women. Other issues analysed in section 4.5 of Chapter 4, under the strengths and weaknesses of the policies and strategies, relates to the influence of the policies in tackling infrastructure constraints faced by the water sector. As shown in Figure 4.13 of Chapter 4, infrastructure issues were mentioned repeatedly by the interviewees.

Post-independence in 1994, the policies and programmes have achieved much in terms of water infrastructure development. According to Powertech (2012), the country's water infrastructure is comprised of "bulk abstraction and conveyance" (BAC), this includes mainly processing and supply. It was established that, as part of the water improvement strategy, the DWS oversees and operates 151 water and wastewater infrastructure projects across the whole of South Africa with an overall projected cost between 2009/10 and 2014/2015 of 69 billion (Zhuwakinyu, 2012). The NWRS of 2004 and 2013 have water infrastructure development as its bedrock. The policy strategy has seen modern infrastructure being built, or existing infrastructure being renovated, revitalised, modernised, or retained. Infrastructure expenditure incorporates direct disbursement on national water funded infrastructure projects carried out through the DWS's public agencies, while the indirect disbursement on provincial bulk water and wastewater infrastructure projects are carried out through transfers to WSA and water boards (NWRS2, 2013).

Again, the NWRS policy framework spearheaded the creation of the "Trans-Caledon Tunnel Authority" (TCTA), an institution accountable for the mega infrastructure projects (Powertech, 2012). The NWRS (2013) and NDP (2012) mentioned "Olifant

river water resources development in Limpopo, which involved the construction of the Hoop dam, and bulk raw water distribution system which saw the delivering of water to the mining industry, agriculture and domestic use in the Greater Sekhukhune, Waterberg and Capricorn District Municipalities in the Limpopo Province". Furthermore, the TCTA also established, and is administering, the R1.7 billion "Komati Water Scheme", a project that is augmenting the Eskom power station in Mpumalanga, as well as the R7.5 billion-second phase of the Lesotho Highland Water Project (LHWP,) which supplies water for households in Gauteng.

Despite these successes enumerated above, in terms of infrastructure development through the policy, the findings of this research, and some scholarly literature, identified significant weaknesses in the current policies, specifically in terms of water infrastructure development and maintenance. Ruiter et al., (2015) alluded that water infrastructure is a hierarchical by nature in South Africa, grounded on administrative, and or, political demarcations. The chain of command ranges from the national administration to the municipalities, with the task of implementing each sphere of governance, though changeable within provincial borders. Besides, Ruiter et al., (2015), pointed out that the formal institutions in water governance, and infrastructure reform cum policy recommendation package of the 1990s, and beginning of 2000s, which relied mainly on reformation and private-public partnerships (PPP), the formation of the independent ombudsman improved competition, though produced some encouraging outcomes. Nevertheless, it was established that these set of restructurings were not applicable in South Africa. One of the many hindrances to the implementation of this initiative is the weakness of South African policy implementation guidelines, and inappropriate governance structure that regulates and directs South Africa's water infrastructure institutions. It is critical to note that a significant part of weaknesses regarding water policies mentioned by most of the respondents, as well as literature from Ruiter et al., (2015), is poor auditing or inventory of infrastructure assets. Ruiter et al., (2015) pointed out that presently, the DWS managed assets worth R160 billion; nevertheless, the water infrastructure property stock for several municipalities are imperfect, incomplete, and disorganised, or non-existent. This implies that the actual depreciation cost of the country's water infrastructure is ambiguous, unclear, and misleading. Grounded on this facts, Ruiter et al., (2015: 661) disclosed that, "in 2011 the under-investment in the water sector was

projected to be more than R600 billion, and an estimated R66.3 billion is needed for water resource infrastructure development annually, according to the National Water Resource Strategy, to meet the increasing water demand over the next 20 years (DWA, 2011a; 2013a, 2013b). Also, South Africa loses R7 billion, or 25 per cent of its non-billed water due to leaking or burst water pipes, and collapsing infrastructure annually". Moreover, the policies have no direction and mechanism on how to raise capital and resources to finance large scale infrastructure projects; apart from relying on TCTA to finance and execute water projects.

The findings further discovered that there is no strategic plan for the maintenance and renovation of infrastructure projects. A significant number of the interviewees alluded that water infrastructure assets have not been adequately maintained for an extended period in most areas in South Africa, especially within the rural municipalities in the Eastern Cape, Limpopo and KwaZulu Natal. A respondent stated: "once water infrastructure has been built, it must be operated and maintained, and the initial decision on how to maintain the assets can have long-term implications on the viability of the project". Furthermore, it was mentioned that the management of water infrastructure has been sluggish to conform with the South African government's transformational ideology regarding equity and service provision. This is attributed to inadequate capacity in the sector, such as the engineering field, due to non-competitive levels of rewards and incentives in the water sector.

Also discussed in Section 4.5, in the context of weaknesses of the current policies, is the ambiguity and lack of clarity of the policies on financial management and cost recovery strategies. According to Toxopeus (2019) cited from HSF report of 2019, poor financial management remains a significant constraint to the DWS and its Trading Entity. For instance, in their document, it was indicated that "in 2017/18, the department reported an overdraft of R119 million, unauthorised corporate spending of R933 million, an irregular expenditure of 6.1 billion, R16 million of fruitless and wasteful expenditure, and accruals and payables to the value of just over R2 billion. The Water Trading Entity is worse off in terms of the financial situation. It was indicated that it recorded an overdraft of R1.4 billion, fruitless and wasteful expenditure of R1 billion, accruals and payments to the value of R1.4 billion and a deficit of R573 million". In line with this study, it was indicated

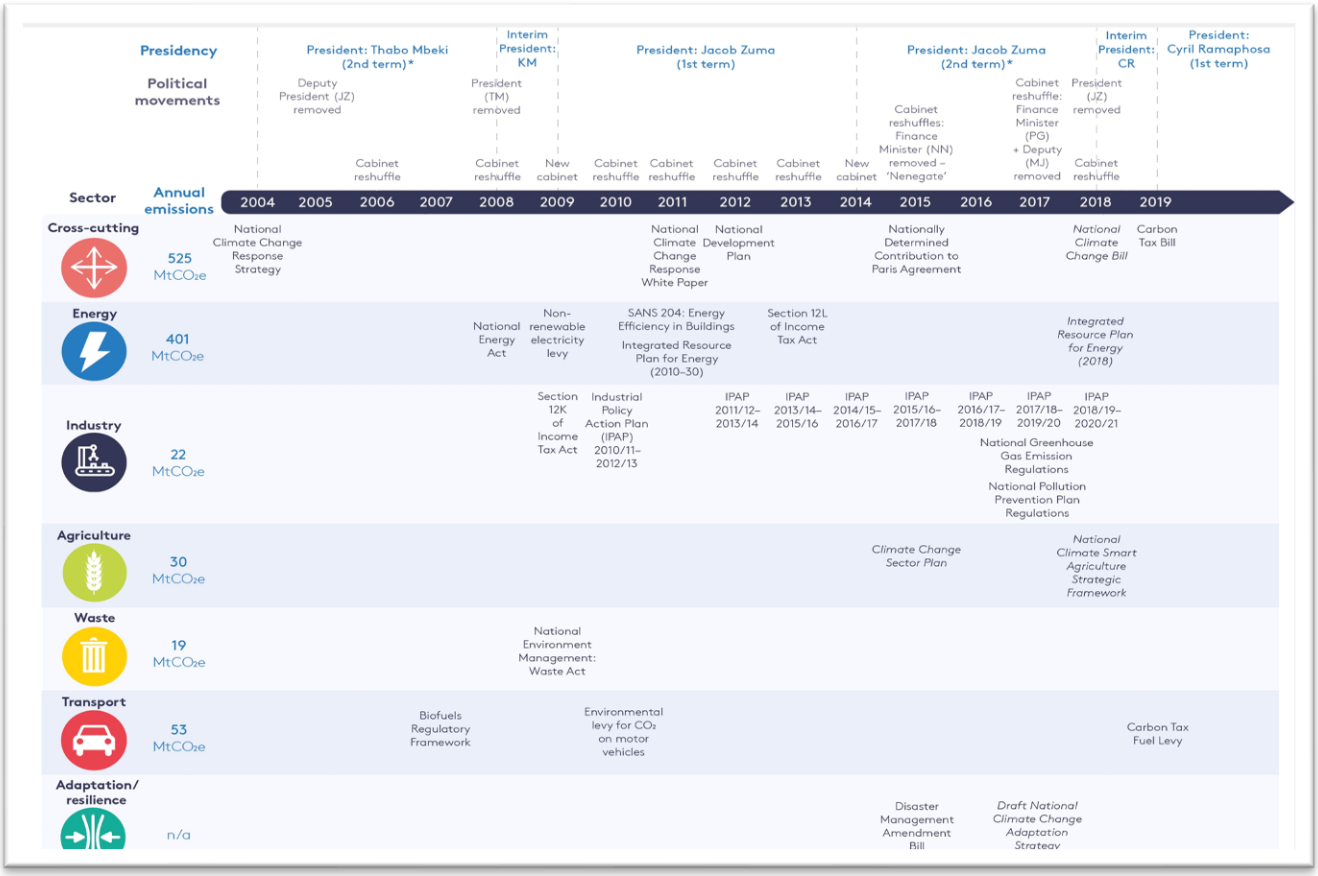
that the policies, as they exist currently, are blurred on effective and appropriate strategies to avoid unauthorised, irregular, fruitless, and wasteful expenditure, as detailed by the "Public Finance Management Amendment" (Act No. 29 of 1999). It was indicated that a significant portion of the department's improper disbursement was as a result of hiring out agencies to execute the department's projects without following correct procurement processes. Besides, the water sector is woefully under-funded, revenue collection is abysmal, and there is inadequate or no funding maintenance and repair work. These inadequacies have resulted in massive deterioration and break-ups of water infrastructure in many municipalities. As stated by a significant number of respondents, proper strategies and transparency in tariffs determination procedures are much needed in the water sector to address the challenges of infrastructure funding.

One issue was also mentioned repeatedly by the interviewees, and was analysed in greater detail in Section 4.5 of Chapter 4. This relates to the effect of the policies and regulations on climate change. Molobela et al., (2011) disclosed that climate change is a major threat to the country's water availability as well as other natural assets. It was, however, stated that climate change is a global problem and difficult to manage, and it is inevitable. Comprehensive studies on the effect of climate variability on natural assets, including water, is continuing. South Africa is among the few countries at the forefront globally to tackle climate change challenges. The country agreed to the "United Framework Convention on Climate Change (UNFCCC) in 1997, and ratified the Kyoto Protocol in 2002" (Averchenkova, Gannon and Curran, 2019: 8). The findings pointed out that over the past twenty years, South Africa had implemented a range of national and sectoral policies, programmes and strategies that aimed at mitigating climate change effects on water resources (See Figure 5.1). For instance, it was indicated that to enable the water sector to formulate and implement these policies, the department created an elaborate system and structure of climate governance, with numerous institutions and consultative and decision-making processes. Based on extensive engagement with experts, and the analysis of the policy documents, it was revealed that the enactment of a climate change response for the water sector through the NWRS, played a critical role in government's IWRP procedure, which promotes the contemporary preservation of the "water balance reconciliation strategies" for water management areas which have been developed recently for water provision

schemes for up to 75 per cent of the country's population, and the areas which, together, generate well over 80 per cent of the national GDP.

Averchenkova et al., (2019), alluded that the current policy, for instance, the NWRS of both 2004 and 2013, have integrated climate variability contemplations in the short, medium and long terms water developments across all the critical sectors of the economy, "agriculture, industry, energy, science and technology". It has also promoted sustenance of "state-of-the-art water-related research and capacity development in all aspects of climate change", to guarantee the accessibility of constantly high quality, comprehensive and current data, as well as an instrument which will assist in examining the information. Again, through the policies, they have implemented the very best watersheds and water resource management practices that guarantee a greater level of water safety, and the asset protection under fluctuating climatic conditions and, in particular, funding in water preservation and water demand management.

Figure 5.1 Timeline of climate-related policies and strategies from 2004-19



Source: White Paper on National Climate Change Report cited from Averchenkova, Gannon and Curran, 2019

Nevertheless, despite the multiple policies, regulations and programmes designed to minimise climate change impact on water security, ensuring a coherent policy formulation and implementation both vertically and horizontally, remained a severe obstacle in the country due to the fragmentation nature of responsibility of climate policy (Averchenkova et al., 2019). It was widely believed among respondents, that there is a lack of clarity among government structures and, in most cases, this has led to poor coordination on how the policies should be aligned and be implemented. The lack of alignment and clarity have impacted on the effectiveness of the policies, especially at the implementation level.

As indicated in Section 4.5 of Chapter 4, the country's existing strategies to address climate change was considered insufficient, although South Africa has pledged at the 2009 "UN Climate Change Conference in Copenhagen to reduce its carbon emissions rate, and has also instituted a National Action Plan on Climate Change". More than 85 per cent of the interviewees believed that climate change and climate extremes are still impacting on water accessibility, both in quality and quantity as witnessed in changes in rainfall patterns nowadays. Rainfalls of late are often characterised with severe thunderstorms, inundations, and drought, plus alterations in soil texture and overflow, and the consequences of rising evaporation and altering temperature conditions on the aquatic system. Nevertheless, the climate change issues do not feature significantly in the policies and programmes and have failed to recognise the real threat of climate change on the existing water resources, and have not developed any concrete strategies or adaption mechanism to anticipate any future impact on the resources. According to Mukheibir et al., (2003), the current management strategies and policies only seek to guarantee that the existing water provision meets a growing demand. Over 65 per cent of the respondents seemed to believe that, although there may be some strategies in place to deal with the future shortages that may be as a result of climate unpredictability, it was, nevertheless, generally observed, that the current policies and programmes lack robust and vigorous long-term planning, and strategies that are needed to tackle climate change impact on water security.

The common consensus among the majority of the respondents, and many scholarly works of literature, such as Averchenkova et al., (2019) and Zhuwakinyu (2019), is that that the existing policies and strategies are silent on how to build

capacity to deal with climate change and other related challenges. For instance, one of the critical findings established that shortage of human and financial resources, and an absence of right and suitable expertise and skills, inadequate researches, and under-resourced institutions stand as significant obstacles to effective implementation of policies to tackle the climate change debacle. These constraints are aggravated by growing complexities of the task involved in formulating and implementing sectoral and multisector decentralisation and resilience policies. It was indicated that these constraints are more severe at provincial and municipal levels (Zhuwakinyu, 2020).

Also indicated, as an underlying weakness to the policies, regulations and strategies, is the lack of a comprehensive climate finance strategy that outlines the allocation of resources to support climate change activities, as well as a lack of precision on how to attract international funding and investment to bolster the fight against climate change impact, and to minimise the effects of climate change on water provision in the country. Based on these weaknesses, as enumerated it was established by many of the respondents, that there is an urgent need to appreciate the effect of climate change on water availability and accessibility, and to formulate a national climate adaptation policy and strategy, which should incorporate sustainable livelihood, enhancement of entrepreneurial skills of people living in ecologically fragile zones, as well the integration of national, regional and international collaboration in the climate change policies.

In the context of water pollution, the study analysed the strengths, as well as the weaknesses, of the policies and strategies designed to address the problems, as mentioned in Section 4.5 Chapter 4. Water pollution, according to National Water Act 1998, cited from Nkosi and Odeku (2011: 2574) "is the direct, or indirect changes of physical, chemical or biological components of water resources, to make it unfit for any desired use, or harmful, or potentially harmful, to human's health or safety, or any aquatic or non-aquatic organisms". Many scholarly pieces of literature, such as Nkosi et al., (2011), Mukheibir et al., (2003), as well as many of the respondents, alluded that, based on the Constitution of South Africa, the state is the guardian of all the natural assets, and must guarantee that water, a limited commodity, is well-preserved for the present and future generations. It is, therefore,

rational to enact relevant legislation and policies to ensure that this resource is preserved (Feris, 2010).

Since independence, the focus has been on the right to this resources, as provided in Section 27 of the Constitution, which states that, “everyone has the right to have access to sufficient and safe water, and that the state must take reasonable legislative and other measures, within its mandate, to achieve the progressive realisation of each of these rights” (Nkosi et al., 2014: 2576). The outcomes from many engagements with respondents, and literature of Zhuwakinyu (2012) indicate that post-1994, the government of South Africa, through the DWS, have formulated and passed numerous legislations and policies aimed at minimising water resource pollution. For instance, it was indicated in the study that the NWA of 1998 was promulgated to manage and regulate water resource pollution, and how individuals obtained safe water, and were provided with the fair and equitable utilisation of water assets. The act is grounded on the constitutional privilege of the ability to access water, as stated in Section 27(1)(a) and (2) (Meissner, 2017).

It was established that one of the fundamental principles and purposes of NWA is to lessen and avoid pollution and destruction of water reserves. This was stated in Section 2(h) of the NWA. Section 19 of the NWA was enacted to deal with the prevention and remedying effect of pollution. For instance, some of the interviewees alluded that the NWA provides that a titleholder of land, an individual in possession of the land, or an individual who dwells or engages the land, in any circumstances which cause, or is liable of polluting water resources, must take any means possible to prevent such contamination or discharge from happening, continuing or recurring. This Act is stated in Section 19(1). The policies of South Africa, such as the WSA (Act108 of 1997), NEMA together with the NWA of 1998, ratified several water institutions, such as the water service authority (WSA), water service providers, water service intermediaries, catchment management agency (CMA), water boards and water service committees with a mandate of taking any reasonable actions which may include, “to cease, modify or control any act or process causing pollution, to comply with any prescribed waste standard or management practice, to contain or prevent the movement of pollutants, to eliminate any source of pollution, to remedy the effect of the pollution and any

disturbance to the bed or bank of a watercourse, as indicated in Section 19(2)(a-f)" (Nkosi et al.,(2014: 139).

Regarding section 19(4) and (5) of the NWA, the CMA has a mandate and a responsibility to recuperate every cost incurred if an individual, or a company declined, or failed to fulfil, or conform in full, or in part, with the regulations and directive given in terms of section (3) the content of which is primarily to prevent water pollution of any kind (Nkosi et al., 2014). It was generally established that there are numerous and sufficient policies and strategies in place to confront and address the challenges of water pollution. It agreed that there are legislative frameworks laid down that ensure, in situations where water is polluted, the perpetrator is made to rectify the wrong done to make the resource safe for use, or conceivably provide compensation. However, in case the perpetrator is not yielding, sanctions and penalties, in the diverse format, are invoked to make the offender answerable, and to allow the law to be applied.

Nevertheless, in spite of these numerous legislations, policies and strategies in the new South Africa, water resource pollution remained one of the greatest threats to South African water security, as indicated Section 4.5 in Chapter 4. Many of the respondents, as well as several scholarly pieces of literature, acknowledged that South Africa's water predicament has become one of the biggest threats the country faces, and that this is primarily linked to an increase in the pollution of water reserves. The respondents unanimously mentioned that pollution of the reserves is much more severe and intimidating than water scarcity (Figure 4.14 of Chapter 4). There is no question that the amalgamation of water shortages and water contamination is threatening (Sheng, Jia, Michelson and Abudu, 2017). As established by the findings, not only is South Africa water-scarce and unevenly distributed, but the little that is available is contaminated with chemicals, waste, and other forms of pollution that render the resource unusable. According to Mariete (2019), while pollution is not entirely new issue in the country, water pollution and contamination grew uncontrollably, beginning from the commercialisation of mining, agriculture, and industrialisation in South Africa. The period was also characterised with the rise in population, extensive public works projects and increased food production, with little or no consideration for the environmental consequences (Sheng et al., 2017).

As indicated earlier, the numerous policies and programmes enacted to address water pollution in the country have severe gaps in terms of effectiveness, implementation, and coordination. Mariete (2019), alluded that the policies, legislation, strategies, as well as the institutional mechanisms, are disjointed amongst numerous of governmental institutions, water boards, CMAs, and metros and local municipalities. One of the weaknesses in the current policies and strategies reported by the majority of the respondents, as well as scholarly literature from Mariete (2019), is that legislative instruments regulating water resource pollution, such as the NEMA, NWA and NWRS of 2004 in South Africa, are not well-defined, and this has hindered the process of dealing with water pollution effectively. The legislative framework on the water sector places the government in a situation where it must be reactive, instead of proactive in water pollution. Besides, many of the respondents felt that the delegation of authority and responsibilities between the government agencies and the administrative duties from national, provincial, and local governments are very ambiguous. The institutional obligations and responsibilities, as well as accountability, are patchy, overlapping and loosely configured.

On the subject of water quality, the majority, 95 per cent of the interviewees, agreed that the water quality has deteriorated, or is declining at an alarming rate. This was attributed mainly to large scale mining activities, commercial agriculture, as well as industrialisation or unprocessed industrial discharge and poor sewage disposal, that have led to contamination of water bodies on a large scale which has affected and continues to affect the water reserves in the country (See Figure 4.15 in Chapter 4). Strangely, all the participants; from the national institutions, academics, researchers, private institutions, NGOs, the media, and local community organisations, all acknowledged the degree of contamination in the Vaal river, accepting that it as one of the most contaminated and overexploited reserves in the country, while at the same time acknowledging it significant to the country. The findings established that the deterioration of the groundwater sources by mining companies and heavy pollution has severe consequences for the environment, social and economic, especially on the vulnerable communities around the water sources.

According to Mariete (2019), it has become copiously clear that supplying clean and quality water to a growing population of South Africa has become a dominant challenge, primarily due to broken water infrastructure and massive pollution of water resources. For instance, it was mentioned that the water quality in the country is dwindling, with estimates suggesting that more than 83 per cent of water reserves have some levels of contamination, and have some consequence for the suitability of consumption for one or other consumers.

The worsening of water quality had created a significant threat to South Africa's capacity to provide adequate water at an appropriate amount which can sustain developmental requirements, while at the same time guaranteeing the ecological sustainability of the water usage. Mariete (2019) alluded; "acid mine water often contains toxic heavy metals and radioactive particles, or is acidic and can be extremely harmful to the health of humans, animals, and plants". Accordingly, places in the "Witbank Coalfields in the Mpumalanga Province, EMalahleni Wastewater Reclamation Plant practice osmosis to desalinate underground water and supply safe water to the local communities". Whereas reverse osmosis is mainly used for treating wastewater for reuse, other treatment practices and technologies can be used. This can be done by partnering with Anglo "American, EMalahleni Local Municipality and BHP Billiton Energy Coal South Africa" (BECSA).

Notwithstanding these signs of progress which must be supported, there was a considerable amount of discontent among some respondents regarding the sustainability of these projects. The majority of them alluded that there is a lack of mechanisms and procedures. They indicated that the existing legislation and regulations generally concentrated on the theories and underlying principles, and short of methods and strategies for implementation, for instance, oversight, surveillance, reporting, assessment, and how to punish offenders. As indicated above, the recently revised "Water Pollution Prevention and Control Law" (WPPCL) advocates for harsher punishments against non-compliers. Nevertheless, without more comprehensive guidelines for applying the legislation and fundamental reform of the law-enforcement structure, effective enforcement of these procedures continues to be a problem. Furthermore, it was indicated that there are insufficient institutional mechanisms. The national administration depends on local

institutions to enforce the law. The findings discovered that in most instances, local administrations are of the view that enforcing the regulations might lead to losses in local economic and reduction in revenue; therefore, enforcement at this level turn to be lenient towards offenders, or take a 'luke-warm' attitudes by the law enforcement agencies. Inadequate available resources to law enforcement authorities also result in ineffective administrative enforcement capability

Many of the respondents apportioned these inadequacies to a lack of effective and robust legislation and policy that mitigates water pollution. For instance, it was observed that the policies and strategies are weak in addressing the challenge of data and information availability, a situation which often led to weak systems for monitoring, which pose high risks to the decision-making process and planning. In terms of data and information availability, they felt that the South African government should be responsible in making data on repair and maintenance of water infrastructure available, hydrological matters accessible to the people, and also adopt innovative monitoring technologies to improve water resource management.

5.6 Implementation of new strategies to improve water management

"Sustainable water management is a strategy for maintaining future water resources that include increasing water supply, and managing it in a way to promote and sustain economic growth for current and future generations" (Hoeksrra, 2006: 10). In this context, sustainable water resource management must concurrently comply with "social, economic, and environmental demands". This suggests that water resources management must be built on a sustainable long-term strategic outlook using applicable development criteria in accordance with the goal of sustainable development (Feng, 2001). As specified in Section 4.6 of Chapter 4, the political transformation in South Africa brought many constraints to the government, communities, private institutions, NGOs, and academics. These challenges include developing an appropriate strategy to decentralise water administration complications, and the delegation of obligations and accountability to the provincial and local spheres of government.

The findings established that the focus of water management strategy, after 1994, has been on technical and modern engineering strategies. Molobela et al., (2011), highlights that the engineering conservation strategy has achieved considerable

breakthroughs in water resource development. Furthermore, through this strategy, the water-related hazard had been reduced drastically in the past two decades. Nonetheless, there are considerable setbacks to this strategy as a result of inadequate of experience in their execution, upkeep, and the administration of water projects, some of which have created severe threats to the local communities, the economy, and the environment. Furthermore, many of the interviewees, as well as scholarly literature of Knuppe et al., (2015), Feng (2001) and Molobela et al., (2011), point to the fact that the engineering water management has led to situations where a number of the water initiatives were formulated with a solitary purpose, but deprived of the "integrated or multi-objective functions". As shown in Figure 4.14 in Chapter 4, the majority of the interviewees (55 per cent) alluded that the current management strategies are outdated, with complex governance structures that have failed, and continue to fail with very little water resilience as a consequence. Besides, the human and financial resources required to implement these strategies are severely lacking. Furthermore, the transformation and restructuring in South Africa, post-1994, have resulted in rapid socio-economic development, urbanisation and rapid population growth, the industrialisation of the economy, as well as intensification and modernisation of agriculture. These factors have impacted significantly and have led to remarkably increased in water demand, causing conflict between the supply of the resources which this current management strategy can no longer support.

Based on the above circumstances and constraints, many of the respondents felt that the current management strategies are no longer applicable or useful, and must be revised to water resource governance which integrates more comprehensive social, economic, and environment or ecological issues. As reflected in Figure 4.18, many of the interviewees alluded that traditional knowledge and expertise must be returned to the foreground, along with language that is understandable to policymakers to invent or formulate a policy that will lessen the gaps between science, social changes and management strategies. This view confirmed the observation of Molobela (2011), who stated that the involvement of societies during policymaking would help them to understand the basics of water governance, and also empower societies in water management practices, which will assist in reducing mismanagement and waste of water resources.

One other issue that features strongly among many of the respondents regarding water management is the integrated governance of water resources (IGWR). The results obtained from the literature of Meissner et al., (2015), and the findings from interviewees, indicate that though awareness in water management among stakeholders has improved over the past twenty years, as well as the establishment of new policies and strategies, the sustainability of water resource in the country remains a significant challenge. A large number of the respondents proposed that the future water management strategies must stress on decentralisation of management practices, prioritisation of localised administrative structures, and the creation of robust management and institutions that supervised and monitored the catchment management areas. Furthermore, legislation and programmes that are geared towards multiple water conservation strategies must be encouraged. Additionally, joint management strategies (public, private, stakeholder) must be promoted at all stages of water administration.

As shown in Section 4.6.2 of Chapter 4, enhancement in the institutions as a strategy of water governance was also analysed in this study. It was highlighted in the different sections of this study, and supported by various literature that institutional management strategies are partly to be blamed for water challenges. For instance, much of the literature attributes the constraints to complicated and fragmented strategies, and limited human and financial resources required to enforce the implementation. The majority of the respondents in Table 4.10, identified fostering cooperation across national boundaries and government, raising awareness of water availability, and building operation and maintaining water infrastructure, as the most and top priority strategies that must be revised in governance to drive water security. “Institutional strategies in water governance are the interactions among structures, processes, rules and traditions that determine how to make decisions and share power, exercise responsibility and ensure accountability and whether stakeholders have a say in the management (and use) of water resources” (Meissner et al., 2015: 21). As depicted in Table 4.10, and supported by scholarly literature of Knuppe (2015), governance, and its performance in the water sector, is driven by numerous social role-players, involving government institutions, private organisation, NGOs, societies, and multiple interested parties.

The dominant critique among respondents was the dis-inclination of the South African government and civil society to focus on water governance as an internal issue, and to solve water challenges through a "nationalistic", rather than a transboundary problem. Molobela et al., (2015) alluded that because a river is a shared asset, irrespective of the type of management conducted around it, it is only normal that water used in one section of the catchment area will have external consequences on the other side. Hence, the most appropriate sustainable approach of management is a collaboration of "benefit-sharing model". An approach or a strategy that disregard unilateral measures, but instead promote "bilateral coordination and multilateral agreement between nations sharing transboundary river waters – with the river basin as the centre of negotiation". Participants were primarily unified in the conviction that, while South Africa's national water concerns and wellbeing ought to be protected, a transboundary collaboration between countries is vital in meeting water demands and attaining regional stability.

On the issues of building operations, and the maintenance of water infrastructure as a governance strategy tool, the findings established that the sector operations and delivery of water services had been a focus of numerous challenges which have led to disagreeable outcomes to both the government and the citizens. It is thought that the government operations in water production, collection and delivery procedures are associated with incompetence, ineptitude and inefficiency. It was felt among respondents that the underlying causes reside with the vulnerability of the organisational structure, or weak operational and maintenance of infrastructure, and the weaknesses of supervising letting illicit connections to pipes and burglaries (Lacombe et al., 2019). These circumstances have led to poor service provisions, lower incomes, lessened repairs and maintenance, extremely unaccounted water lost, weak capital funding, flawed liability to undertakers, insufficient incentives system, overstaffing and wrong placement of employees as well as lack of guidelines and implementation regulations (Calow, Ludi and Tucker, 2013).

Also mentioned were institutional arrangements and instruments that are urgently required for improving efficiency and enhancing water provision and consistency of facilities (Kirby and Ahmad, 2014). There are also suggestions and evidence that

the world is restructuring the governance model, which is primarily drifting away from public administration to privatisation in water governance (Nleya, 2008). Ultimately, in the view of many respondents and growing literature on water markets, a strategic approach, which suggests that privatisation of water governance is ideal for improving the value of the water provision, expanding water facilities, enhancing effectiveness in operation and appropriate maintenance of infrastructure, to securing adequate funding for the water industry (IWMI, 2013). The main conclusion drawn from the discussions, suggests that privatisation would see the incorporation of more technologies in the management of water resources, and would increase private capital commitment to the sector.

Generally, many of the respondents believed that the water sector in South Africa must vigorously enhance their current mitigating approaches in dealing with problems such as illicit connections and infrastructure destruction. It was stated that although there are some existing monitoring teams and task forces, they are nonetheless ineffective and inefficient as they ought to be, because of the issues of autonomy, and ill-equipped in terms of capacity to handle complicated issues related to inadequate funding and support. Abu-Zeid et al., (2003) alluded that the formulation of appropriate strategies will create a conducive atmosphere for water services to provide quality services. The government must, therefore, establish a legal structure that considers these challenges, and must provide water services with the required legal backing to control issues such as unlawful connections, sabotage, leaks, and water loss, and should execute policies appropriately. Furthermore, some of the respondents suggested that there must be a joint pursuit in the national interest, or initiatives to advance technological innovation and modernisation of water assets. Again, there must be a working collaboration with policymakers and other stakeholders to ensure long term investability, comprehensive localisation and job creation, within the sector designed to unleash a multiplier across the entire economy.

5.7 Conclusion

In this chapter, the empirical findings on the current policies and programmes designed to drive water security in South Africa were discussed and analysed. The analysis and the discussions of the obtained data revealed that South Africa has numerous water policies and programmes and a track record in innovation.

Unfortunately, the attractiveness of many of these policies and programmes have typically not witnessed commendable improvement in water provision and management of the resource. A significant challenge remains concerning the implementation of the policies and strategies. Notably among them are; inadequate capital in terms of finance and human expertise. Other constraints are poor governance and management structure, unproductive stakeholders involvement and participation, ageing and broken infrastructure, and the threat of climate change. Furthermore, the government and water service providers are at the extreme due to a lack of political commitment to channel resources in the appropriate sectors, which have resulted to what is herein described to as a gap between policies and service provision. Based on these circumstances, the water sector is faced with inadequate investments and funding, leading to millions of South Africans not having access to basic water (Ruiters, 2015).

With a growing population and demand for water, an improved living standards, necessitating growth in agricultural, manufacturing, energy and municipality water demands, the country faces a mammoth task on how to allocate, consume and safeguard limited water reserves. With the desire to grow the economy and create jobs for the massive unemployed population, as well as the pressing need to provide water services to millions of the population who lack access to such facilities, water demand will continue to grow in the country. Nevertheless, placing this growth within the context of the water shortages within the country, stresses the need for innovative policies and strategies to water administration and governance in South Africa, policies that acknowledge the threatening nature of water reserves in the country and emphases on using IWRM. As indicated in the study, IWRM will enhance water governance and promote inclusive decision making, which will drive the equal distribution of water assets. The IWRM will promote the transformation that is geared towards more sustainable habits with a shift towards participatory governance and cooperative decision making, cross-sectoral collaboration and application of decentralised administrative strategies (Pahl-Wostl, 2009).

The findings of the study revealed that there is an increasing demand for policy reform to address these problems and minimise the loopholes and limit the rapid alteration in water administration. Based on the findings of this research, it can be

argued that the lack of investment, tied with the incompetence at the local and national administration, undermines the effectiveness of water governance. Therefore, attaining water security in the context of South Africa would require modifying the organisational framework and the funding model in the water sector. The next chapter looks at conclusions and recommendations in the context of the study.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Introduction

This chapter provides the conclusions and recommendations of the research. Based on the findings, the researcher points out recommendations that could be enforced to achieve a water security agenda envisaged by the Government of South Africa. The section is structured into two parts. The first part presents scrutiny on how the information provided in this study answers the research questions, which is to investigate the structural and systematic constraints hindering the implementation of policies and programmes from achieving water security, while the second part considers recommendations in the context of the objectives of the research.

2.2 Recapping the key study findings

One of the issues this research was keen on exploring was whether South Africa has appropriate policies and programmes to address the challenges of water security for its citizens. In addressing this objective, the researcher interacted with a lot of key participants in the water sector and numerous literature published both locally and globally relating to water legislation, policies, and strategies. As highlighted in Section 5.2 in Chapter 5, South Africa has sound legislation and policies that guide water resource governance. The legislative framework consists of the "White Paper on Water supply and Sanitation (1994); Water Law Principles (1996); the Constitution of South Africa (108 of 1996); the National Water Policy White Paper (1997); Water Service Act (Act 108 of 1997); the National Water Act (Act 36 of 1998); National Environmental Manage Act (Act 107 of 1997) and the National Water Resource Strategy of (2004 and 2013)". As Schreiner et al., (2011) stated, the legislation, policies and strategies enacted post-independence had overseen remarkable gains in terms of water accessibility to households. Recent census statistics (StatsSA, 2017), reveal that almost half of all South Africans have an in-house water provision, while additional quarter has a water connection in their yard, while 23 per cent source their water from a communal standpipe within 200 metres. Besides, it was found that the Constitution of South Africa, together with these policies have spearheaded the rights to self-esteem, access to adequate and quality water, a concentrated focus in attaining universal access to water

services, supported by substantial capital grants and operating subsidies for the provision of free basic water to ensure that price is not a barrier to access, an innovative incentive-based approach in regulating water and wastewater quality, and a reduction in pollution of water resources (Molobela et al., 2011). High-level commitment, backed by substantial spending on infrastructure development and servicing subsidies, has led to some extraordinary success. The finding revealed that as of 2009, water services infrastructure had been extended to 96 per cent of the population, up from 59 per cent in 1994 (DWS, 2009). Simply put, the number of additional people reached by new water services infrastructure since 1994 is far greater than the total population of "Angola, Chile, or the Netherlands" (Schreiner et al., 2011). The fundamental principles of the policies have ensured that water resources are protected, and the resources are managed and distributed equitably, sustainably and used efficiently. These principles guide the fundamental objectives of the water service administrative procedures, namely, to reliably provide consumers with enough quantity and quality of water.

By any standard, this is a substantial achievement which could be attributed mainly to the legislation, policies, and the strategies enacted. Nevertheless, as stated in Section 5.2 in Chapter 5, the majority of the respondents, representing 51 per cent alluded; the current policies and programmes are not proactive, complex, and outdated to meet the challenges of water security in South Africa. It revealed that the current policies have failed to provide water for all, as stated and been bragged about by the government, and many scholarly literature. It was mentioned that till date, most rural communities in the country could not access basic water provisions because they cannot afford to pay for municipal services. This is in contrast with the Constitution, WSA and WPWSS, which were to ensure that everyone in the country, including poor households who cannot pay for water services, have access to at least basic water services. The conclusions drawn from these findings revealed fundamentally that water provision complication in South Africa, especially in rural communities, is linked to the policy framework that assigned powers, functions, and other governance structures failure to take into consideration the substantial capacity limitations of various municipalities, and many other water institutions. This has led to instances that can be described as municipal non-viability; financially, functional performance, and socioeconomic vulnerability; thus, not able to manage or run water provision effectively. These are

most prevalent in rural municipalities in the “Eastern Cape, KwaZulu Natal, and in Limpopo”, who are battling with debts, bottlenecks and cannot deliver services on a sustainable basis. The findings concluded that the policies and programmes are full of uncertainty and silent on administrative paralysis within the department, and the accompanying worsening in service provisions, policy inconsistency and outputs. Furthermore, it was acknowledged that there are challenges of severe financial mismanagement linked to over-expending, backlogs and failure to pay for service providers and consistent escalation of debt, overdraft of the water trading entity and debt owed to the Reserve Bank, irregular, fruitless and wasteful expenditure, poor revenue collection and alleged massive corruption in the sector. In summary, water service provision in many parts in South Africa is faced with several constraints ranging from lack of capacity and skills, lack of investment and poor revenue collection because the policies and regulations are weak and flawed. These constraints have hindered the process of delivering services to communities resulting in an adverse effect on people’s health and wellbeing, since the populations are exposed to disease outbreaks from consuming contaminated water.

Another theme that threaded throughout the research is the grassroots and stakeholder’s involvement in water administration and governance. It was found that public participation and engagement have been integrated into all legislative instruments and policy and strategic framework governing water management in the country. The South African Constitution, as well as the various policies, are grounded on the principles of transparency, involvement, responsiveness, and accessibility in the decision-making processes. Public participation is an essential instrument in establishing a collective understanding in the context of taking decisions which have an impact on sustainable water resource management. The need for a holistic strategy was raised several times to understand the complex and interconnected aspects of water governance and management. The findings established that water administration and governance embrace many dynamically connected components, which can only be addressed adequately by recognising their interconnectedness.

However, the conclusion drawn from this research was that, despite the public participation strategy being formulated in the country to give structure and

guidance on how to build public involvement in the management and governance of water assets, it is apparent that there are constraints with how this principle is being executed in the country. The obstacles to pragmatic public engagement include inadequate resources to do effective participation, lack of public awareness and understanding, poor communication structures, inadequate participation stages, lack of response from the public officials, and disconnection between public engagements and the policy decisions. Other limitations include lack of consistency between participation policy and implementation strategies as well as limited ability of civil participation due to inadequate understanding and information.

Another issue of concern was the mode through which water governance issues are communicated. The findings concluded that the traditional community forums ("imbizos") which were used by the local communities to air their opinions, deliberate on challenges and reach agreement affecting them, and have been instrumental for communities accountability, have been defused and replaced by "so-called' formal administrative structure at local levels. Nevertheless, these "so-called" formal administrative structures are just political organs propagating political messages for political parties relegating water administration and governance problems to the background. The lack of knowledge around the channel and structure of communication has led to an unwillingness by most residents to participate in water governance and management. The most significant setback with the public participation and engagement process, identified by this study, is the lack of clarity regarding the specific tasks and accountabilities of the stakeholders involved in water administration and governance. In most cases, stakeholders are confused about their responsibilities and the channel of communication. The lack of clarity has quenched the motivation to participate as stakeholders as they are doubtful if their input will make any difference. Based on these observations, it was concluded that the right communication channels enhance the effectiveness of water governance at local levels. More importantly, a better flow of information among different actors would increase communities' understanding of the management issues that are at stake, as well as encourage better coordination of activities by the different actors. These would inspire a better and stricter follow-up on issues, or inputs received during meetings or workshops.

Structural and systematic constraints impeding policy implementation were analysed, and the conclusion drawn. It was established that significant challenges are hindering any meaningful progress of implementing policies and programmes to achieve the water security that the country urgently needs. The challenges range from the fragmentation of policies and overlapping of responsibilities, capacity constraints, insufficient and inefficient use of funds, ageing and broken infrastructure, lack of data on operation and maintenance plans to political interference and corruption.

It was established that the water sector in the country is fragmented across the three spheres of government, private institutions and NGOs raising questions of vertical and horizontal coordination for effective and efficient execution of water policies and strategies. The water resource governance is characterised with multiple stakeholders with competing needs and objectives. The diversity of participants in the water sector makes it susceptible to politicisation, and the threat of capture, which often freeze policymaking. In addition, it was observed that some of these stakeholders exist without any clear-cut responsibilities, and no clear mandates. They are merely taking stock of who is doing what and "mapping" the programmes and policies that already exist. This often occurred because the lines of responsibilities between various organisations and institutions are very blurred.

Capacity challenges, in terms of human skills and expertise, remains a significant constraint in formulating and executing policies in the sector. Various reasons were established as caused for these constraints. Chiefly, among them were: low salaries and remuneration, absence of career structures and progression, lack of training institutions for personal development. Most of these constraints and setbacks could be traced to a lack of funding in the sector, but often they are due to structural uncertainties and lack of strong leadership at national institutions, or water experts at local levels to promote new ideas of water governance. There is a complete and absolute lack of retention strategy on how to sustain critical employees such as the engineers, water scientists, plumbers, and artisans in the sector, as well as no planning of guiding the undeveloped and new staff for the transfer of skills. The lack of skills and expertise means there is no effective planning and adequate attention for the sustenance of infrastructure until

something breaks down, and by then, the infrastructure is usually ruined. Most of the water institutions, including the municipalities, do not have maintenance plans, and generally do not conduct a regular assessment on the condition of their infrastructure to plan for them properly. Without planning and budgeting, the water sector is vulnerable and, without the skills, and planning, the funding that is transferred by the national government into the sector ends up being under-spent and sent back to the national fiscus, or redirected into other non-infrastructure expenditure. Where projects have started, this development often results in poor workmanship, along with unmet targets and delays that eventually lead to poor infrastructure with regular breakdowns. It was established that the department currently loses almost a third of their water supplies on what is termed "non-revenue water. This is defined as water that is lost through physical leaks, commercial losses such as billing errors or theft, and what is termed unbilled authorised consumption such as firefighting". This again means a third of the money that is supposed to be going into the water sector coffers, does not.

It was established that the lack of funding and investment had compounded the structural challenges of water management and governance. Insufficient funding was singled out as one of the significant contributors to weak governance and administration of water assets. The lack of funds hinders the execution of policies and programmes of maintaining infrastructure and supplying quality water to the population, as funds are not accessible to purchase spare-parts, effectively train the workforce and provide attractive remuneration to entice high qualified and competent skills. The budget allotted for water administration is often insufficient for its operations and replacement of ageing infrastructure. Moreover, national administration is habitually stressed for money, especially hard currency, which is needed to maintain the infrastructure and supply agencies. As Ruiters (2015) alluded; the water sector is severely underfunded, revenue generation and management are weak with a highly inefficient use of funds and squandering of resources, all attributed to common problems of unskilled, weak logistical and organisational structures. Based on these circumstances, most of the infrastructure programmes have been abandoned, deteriorated and have eventually collapsed, especially at the municipal levels, which has resulted in extreme levels of unaccounted for water, either through illicit connections, leakage, free water supply, or the result of insufficient commercial operations, resulting in

substantial financial losses to the sector and consequent poor service performance of the department.

Political interference and corruption were also identified as contributors to the poor performance of the water sector South Africa. Political interference was noted to occur in the daily operations in the sector. It was established that the interference in this sector operates mostly in choice technologies and infrastructure to be employed in an activity. Again, it further collaborated that this practice often occurred in employee's appointments, especially at the senior levels, where appointments are influenced on a political basis instead of qualifications and competence. These tendencies have, and continue to affect policy formulation and execution in the water sector negatively.

Based on informing literature review in Chapter 2, and the pragmatic outcomes of Chapter 4 and 5, it can be concluded that South Africa water policies and programmes have mixed perspectives in terms of addressing water security challenges. While acknowledging that a lot has been accomplished in terms of water provision through the policy of Free Basic Water Access, which is enshrined in the constitution, it was nevertheless widely acknowledged that the policies and strategies are weak and ineffective in distributing water resources equitably among the rich and poor, rural, and urban dwellers, as well as balancing the demand and supply of the resource. In addition, there is no clear direction in addressing climate change, in solving water pollution and degradation problems originating from mining, industries and municipalities, raising funds to tackle the ageing and broken infrastructure, tackling political interference and corruption, and weak monitoring and evaluation structures in the water industry.

The conclusion that could be drawn from this study was, the policies and programmes existing currently have failed to recognise that the country is currently consuming water within its natural capacity limits (thus consuming 98 per cent of their predicted total reserves) without effective regulations and guidelines to ensure these scare resources are used efficiently. As it stands now, the country is wasting more than 1.5 billion cubic meters of water annually due to broken infrastructure that has outlived its lifetime. Ideally, broken infrastructure must be replaced and modernised as a matter of urgency. Nevertheless, inadequate funding, deferred execution of the "Waste Discharge Charge System", as well as the low cost of a

"Water Use Licence Administration" charges, lack of a sustainable financial model for local government to sustain infrastructure works, and inefficiencies in bureaucracy systems, are some of the reasons for these anomalies. Climate change is posing significant threats to the country's water resources. The country is experiencing rising in weather conditions, and a declining winter duration. Temperature intensifications, in turn, have impacted the rate at which water evaporates and have led to fluctuating rainfall trends. It has also affected the soil moistness and the quantity of overflow into rivers and groundwater reserves. Consequently, there is growing uncertainty regarding surface and groundwater availability, water contamination increases and water distractions, pose a threat to social, economic, and environmental development in many provinces within the country. In light of these threats, the current legislation, policies, and strategies, as well as the law enforcement institutions, remain silent, not only in the area of exploitation of this resource but also in salient on issues such as overconsumption and dwindling of the reserves.

6.3 Recommendations

Based on the findings as presented in the study and summarised under conclusions, several recommendations are proposed:

i. The findings show that though much has been accomplished regarding access to water in South Africa, nevertheless, the distribution and allocation are unequal. The poor and most rural communities have been disadvantaged for so long. Furthermore, there is a significant challenge of meeting the increasing demand from agriculture, manufacturing, municipalities, and other sectors of the economy, while satisfying the demands of aquatic ecosystems and the ecological reserve. To address this challenge, it is recommended that legislation and policies of water accessibility and usage be redesigned to accommodate everyone adequately, regardless of racial background, poor or rich, educated, or uneducated. The water distribution monitoring task force must be reviewed and resourced to contribute more meaningfully in enforcing the policies and regulations that ensure all South Africans get equal access to safe water. Furthermore, institutions such as policy designers, legal boards, community leaders and representatives should actively be involved in the designing and

implementing phases. This will ensure that every sector of society is represented in the allocation and distribution of water. In addition, since economic development, as well as population growth, are the main contributors to water scarcity in the country, it would be prudent for constant review of the policies and programmes based on population growth and the country's developments.

ii. One of the key conclusions drawn from this research was, multi-level governance in water policy promotes a holistic and broad understanding of strategies that coordinate and collaborate with one another. This, because the policies and programmes are interconnected and interdependent. Nevertheless, it was revealed that the South African water sector is confronted with sectoral and fragmented roles and responsibilities across different departments, public institutions as well as the private organisation, which has resulted in a policy gap. The sector is further challenged with different objectives and goals among the different stakeholders and institutions that have resulted to objective gap, again, due to the silo manner in which these institutions operate information, are not willingly share that have led to information gap. These developments have weakened capacity-building, especially at the local level, which has also resulted in a capacity gap. To address this problem, it is recommended to identify the mutual interdependencies between various institutions involved in water policy formulation at the local, provincial, and national levels. This means to identify the barriers to effective coordination and collaboration of key stakeholders at the levels of administrative, funding, capacity-building, and infrastructure planning. Greater policy coherence should therefore be developed to link both horizontal and vertical institutions. This does not mean homogeneity, but synergies among customised approaches, that necessitates mutually strengthening activities across government, departments, businesses, and communities to achieve the objective, defining long-term strategies, and applying them to different frameworks and circumstances.

iii. It was also unearthed that though the current policies and programmes do well in delineating tactical activities of IWRM, climate change adaptation, draw vision from international, continental, and national developmental programmes and is steered by globally acknowledged water management

theories, values and principles such as the "Dublin Principles and the Rio Declaration". Nevertheless, the policies and the programmes have neglected key generic and country-specific water management and governance challenges. It was noted that the organisational framework for execution did not take into consideration the institutions accountable for the administration of land and mining. Timelines for policy appraisal and update are non-existing, and there are no indicators for measuring progress towards the policy objectives. Furthermore, it was identified that the legislation and policies, by principle, are contradictory and inconsistent. This is because some of them, such as NWRS of 2004 and 2013, are pushing for privatisation while, the Constitution, the WSA of 1997 and the NWA of 1998 supporting equitable access to water resources. These contradictive ideologies and principles cannot coexist at the same time. To address these anomalies, it is recommended that monitoring and evaluation of policies and programmes be grounded on measurable and quantifiable objectives with indicators. The tactical policy operations should not be ambiguously defined or delineated but should be allocated to institutions who would be accountable for such activities. This will necessitate, among others, coordinating the activities the monitoring water coverage nation-wide. Future policies should stipulate timelines for the appraisal so that they can be revised to meet looming challenges. Traditional leaders, land and mining institutions should be acknowledged as critical and important players in the water resource management.

iv. The government, through the DWS, should concentrate in regulating demand and supply by devoting resource to maintain the infrastructure that minimises water lost. This can be achieved by fixing leakages as soon as they are detected, promote the culture of maintenance, while, at the same time, encourage effective use of water resources and conservation practices. This must include improving water storage through water harvesting, applying conjuncture water consumption, encouraging wastewater processing, recycling, and reuse as well as minimising wastage in the supply chain. In addition, the government should create a conducive environment to implement policies and strategies by promoting "public-private-partnerships", and local communities at every level of implementation.

v. Findings from the study unearthed that stakeholder's participation is an important component in the water reform strategy, and bedrock to the legislation, policies, and strategies post 1994. However, it was acknowledged that there are gaps in creating awareness, get the stakeholders informed, arouse their interest, and understand their roles in water management. To rectify the situation requires coordinated efforts from various stakeholders. First, it is crucial to recognise the issues that matter most to each community, and to adapt the participation strategy that is appropriate to each specific community requirements. Hence, participation managers focus should be preceded by identifying the shared needs of the inhabitants for them to engage actively. Where management actions target issues that affect directly with the livelihoods of the people, the participation of the people is enhanced. Second, the department should promote the principle that "everyone is a stakeholder in water resource management", and this must be practical participation at all levels. The participation should be integrated into the government water management plan, ranging from planning and decision-making to law, execution to enforcement. It should be emphasised that public participation in water governance should be in line with South Africa's long-term development goal of a more democratic and harmonious society.

vi. Participants and focus audiences have diverse influential power on the progress of the water sector and the accomplishment of its strategic guidelines. It is vital for the policy formulators and practitioners to appreciate and understand the status of each of the participant in terms of its capacity to influence and contribute to water resource management. Therefore, the selection of communication tools should be influenced by factors such as the efficiency of the instrument in reaching the focus group, cost, timing, and age. It is recommended to integrate these factors into the instruments to communicate effectively to the targeted audience. The regional, national, and global media houses should be brought in to be active communication liaisons on water matters. With sufficient capacity, the media will be able to reach wider audiences and influence their opinions favourably. They also have the ability to shake distressed water sector organisations and other focus groups into functionality. The media must be a crucial focus, due to the fact that they are a vital communication network for reaching any audience.

vii. One of the structural constraints picked up by the study as a significant obstacle to policy effectiveness towards achieving water security, was lack of funding and investment. The conclusion drawn was that government alone could not provide all the financial resources needed to operate and maintain the water systems efficiently. It is therefore recommended that there should be policy reforms which must be based on public-private partnership. In that policy reform, the government should focus on mobilising private sector investment from internal markets for the sector for expansion and upgrade. Furthermore, the government should put in place favourable guidelines and regulations and establish financing mechanisms, such as "pooled financing facilities, revolving funds, and urban infrastructure funds" which must serve as financial intermediations and broaden funding sources. Again, the government should reinforce the capacity, processes and financial the institutions that offer water services by reorganising their processes to operate as independent water regulator (IWR), with a special purpose vehicle (SPV's) and independent private producers (IPP's) to generate enough revenue, attract the investment required to improve the performance, achieve full cost recovery, become financially sustainable and a water resilient country.

viii. The findings further revealed that capacity in terms of qualified, skilled personnel is also a significant hindrance to effective water management in the country. It was concluded that currently, there are no available data of the actual number of skilled personnel in the department and the human resource capacity required to tackle the challenges related to the water sector. Neither is there any structure for recruitment of new employees, nor upgrading of existing skills. It is therefore recommended that the government strengthen the evidence base by having reliable and up to date data and profiles of skilled personnel available to the department, as well as a recruitment and staff development policy. Furthermore, there should be an urgent need for an over-all appraisal of the available skills base in the sector, grounded on the strengths and weaknesses of each employee, which should serve as a foundation for an effective capacity building policy. Again, capacity building programmes should be undertaken within the subsectors, such as water conservation, supply and demand management, pollution and climate change,

reclamation, and reuse of wastewater. The attention of the national, provincial, as well as local governments, should be on building a world-class, or centre of skilled excellence base, with well-qualified trainers, facilitators, researchers and professionals in water management, with diverse skills such as engineers, architects, technicians, plumbers, and water scientists who should be equipped to face the present and future water management challenges. Addressing these challenges means there should be sound policies and building institutional capacities with well-equipped facilities to train and develop professionals for the water sector.

ix. One of the fundamental weaknesses identified in this research on the current policies and programmes was its lack of clarity on how to deal with pollution, which is a primary threat to South Africa's water security. It is recommended that policies and regulations governing water pollution should be redesigned with the government ensuring that all available means, legal, institutional and educational manoeuvres, to mobilise the public against pollution and to ensure that the main polluters, the mining companies, industries and municipalities comply fully with all pollution control requirements. The polluter pay principle must not only exist theoretically, but should be fully enforced. Again, water contamination management and planning in the catchment areas should be enhanced, with strong enactment of more pragmatic and concrete objectives. Pollution regulation should not be considered as the ultimate targets, but the mean to accomplish clean and conducive water reserves. This necessitates a long-term, cohesive, and progressive focus on strategy to preserve water quality. The funding, execution, supervision, and assessment strategies must be well-incorporated into the policy.

x. Regarding climate change, the study revealed that climate change is inextricably linked to the existing water crisis. It is recommended that the government should increase capital and investment in enhancing hydrological information, develop institutions and governance, improve training and capacity building, carry out a risk assessment and knowledge sharing among institutions involved in climate change mitigation. Furthermore, policy formulators must redesign strategies that ensure interpretation, involvement and behavioural change by every citizen, including private and civil institutions

as well as community organisations. This means that mitigation measures must incorporate targeted strategies that help lower-income groups that are disproportionately affected by this phenomenon. In addition, national climate policies and strategies should take a comprehensive approach to tackle climate change and water management. Increasing water supply to meet potential demand will necessitate more stringent and punitive measures, these may include suspending licenses of corporations or institutions that disregard climate change regulations. If a viable, sustainable future is to be achieved, proceeding along a "business as usual" approach is no more an alternative, this means water administration should be seen through a "climate-resilience lens". This suggests that the governments should put in place innovative, or examine the current tactics, and procedures to counter the effect of global warming and climate change on water reserves and integrate climate change adaptation approaches in their development plans and programmes.

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APPENDICES

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF SCIENCE

SCHOOL OF GEOGRAPHY, ARCHAEOLOGY AND ENVIRONMENTAL STUDIES

TITLE OF RESEARCH: —Analysis of Public Policies and Programmes towards Water Security in Post-Apartheid South Africa

APPENDIX A

Department of Water and Sanitation National and Provincial Officials Questionnaire and Interview Guides on South Africa's Water Governance and Management

This interview guide aims at collecting empirical data in partial fulfilment of the requirements for a PhD Degree in Geography and Environmental Studies. It seeks to investigate systematic and structural constraints that hinders sustainable water resource management, and to help develop an integrated water resource management framework to attain water security in South Africa. The study will specifically be interested in understanding the factors that make it difficult to implement public policies and programmes to achieve sustainable water resource management and what can be done to promote sustainable water use in South Africa. All responses are treated in the strictest confidence as required by the law. Your cooperation is highly appreciated.

THESE QUESTIONS ARE DESTINED FOR EMPLOYEES AND MANAGEMENT AT NATIONAL DEPARTMENT OF WATER AND SANITATION AS WELL AS PROVINCIAL DEPARTMENTS EARMARKED FOR THE STUDY. THE MAIN GOAL OF THESE QUESTIONS IS TO UNDERSTAND THE VIEWS OF RESPONDENTS ON CURRENT CHALLENGES ON WATER POLICIES AND PROGRAMMES AIMED AT ADDREESSING WATER SECURITY IN SOUTH AFRICA.

1. Are you in a position to introduce yourself and your current responsibilities in the Department of Water and Sanitation?

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2. Would you be in a position to broadly outline the responsibilities your office in the current order?

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3. How long have you been focusing on South Africa water management and governance?

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4. Are you in a position to share with me how the water authority functions? Where lies the strength of the institutions, where lies its weaknesses?

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5. What would be your perspective on the current national water policies and programmes fulfilling its mandate of addressing water challenges in South Africa?

(0 not good at all; 10 perfect.)

…….....

5.1. Would you be in a position to justify your choice briefly?

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6. Would you be able to share with me the water management and development reforms passed by your Department and Parliament post independent?

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7. Would you be in a position to identify factors that might slow down or even stop the process of implementing new water management and development policies post 1994?

……

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8. Are you in a position to identify the programmes that exist in the Department of Water and Sanitation regarding water management? You may choose more than one if applicable

   - An active water management program
   - A water management taskforce on water issues

- Academic program focused on water issues
- Research group/lab focused on water
- Extension/outreach services addressing water issues
- An active energy management program
- Others

9. Are you in a position to identify the water resource management issues that are explicitly and actively addressed in the Department as sustainable programmes? You may choose more than one if applicable
   - Water Conservation
   - Water Quality Management
   - Watershed Management
   - Storm Water Management
   - Wastewater Management
   - Others
10. Would you be in a position to share with me if there is the need to review the current policies and programmes regarding water management in South Africa or your province?

    …….
    ……..
    …….
11. What in your perspective are the four most important issues with respect to water in South Africa or your province?

    1. …… 2. ……...
    3. ……4. ……..

12. What would you consider as the greatest constraints and threats to the country's water Security?

    ……
    ……
    ……
13. To what extend would you consider these constraints and threats affecting water provision in South Africa or your province?

    ……..
    ……..
    ……....
14. Would you be in a position to share your opinion on changes if any that you would like to see on the following:

- Water legislation

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- Economic regulation of water

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- Environmental regulation of water

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- Water supply

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- Water pollution control

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- Water allocation mechanism

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- Financing of water infrastructure

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- Cost recovery mechanism

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  ……

- Management of catchment area

  ……

  ……

  ……

- ❖ Institutional arrangements

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15. What would be your perspective on sectoral or cross-sectoral issue? And would you be in a position to share with me sectors where corporation do occur? E.g. Tourism and Agriculture

…….....

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…….

15. Are you in a position to indicate the various stakeholders in water resource management in South Africa or province?

Government Departments and agencies	**Civil society & community groups**	**Non-governmental organisation and pressure groups**	**International organisations**

16. How would you characterise the following between stakeholders in the water sector management?

	Very Good	**Good**	**Fair**	**Poor**	**Very Poor**
Coordination of activities					
Information sharing					
Harmonisation of policies					
Joint working					
Collaborating with multiple sectors in managing water resources in national, provincial, and local levels					
Consider and apply solutions and management practices from multiple disciplines (Science, Economics, and engineering)					
Applying an interactive management approach involving planning, executing, monitoring, evaluation and revising.					

17. What is your perspectives on the mechanisms in place for interaction between stakeholders at the national and provincial levels?

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18. What would be your opinions on the mechanisms in place for public participation in water matters at local and community level?

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19. To what extend would you consider awareness of the public on policies and programmes towards water management nationally, provincially and at the local levels?

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20. Would you be in a position to share your opinion on how you ensure a greater representation is achieve in terms of demographics, water sector, socio-economic groups, gender, and various water-use purposes?

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21. Would you be in a position to share your opinions on how political parties, civil societies, and other pressure groups take water management essential in South Africa and in your province?

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22. Would you be in a position to share your opinion on how the concept of sustainable use of water and fair use of the resources is embedded in water policies and governance in South Africa post-independence in 1994?

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23. Are you in a position to share with me if policymakers in your department take into consideration techno-scientific knowledge, historical, cultural, socio-political aspect when drafting policies and programmes involving water governance and management? **YES/ NO**.

23.1. If your answer is **YES** would you be in position to elaborate on the subject matter with me?

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24. What would be your perspective on the overall water management and governance in South Africa post-independence in 1994?

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25. Would you be in position to propose some recommendations on how the gaps can be closed, if there are any within the water sector with regards to policies, governance and management of water resources in South Africa or your province?

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26. Based on what we have discussed, is there anything you would like to add?

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……. ……..

UNIVERSITY OF THE WITWATERSRAND

FACULTY OF SCIENCE

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TITLE OF RESEARCH: —Analysis of Public Policies and Programmes towards Water Security in Post-Apartheid South Africa

APPENDIX B.

Questionnaire Guide for External Stakeholders on South Africa's Water Policies, Programmes and Management

This interview guide aims at collecting empirical data in partial fulfilment of the requirements for a PhD Degree in Geography and Environmental Studies. It seeks to investigate systematic and structural constraints in achieving water security in Post-Apartheid South Africa. The study is specifically interested in understanding the factors that make it difficult to implement public policies and programmes to achieve sustainable water resource management and what can be done to promote sustainable water use in South Africa. All responses are treated in the strictest confidence as required by the law. Your cooperation is highly appreciated.

THIS SET OF QUESTIONS IS DESTINED FOR EXTERNAL STAKEHOLDERS, POLITICAL ORGANISATION, ACADEMICIANS, WATER BOARDS AND NGOs IN WATER SECTOR. THE MAIN GOAL OF THESE QUESTIONS IS TO UNDERSTAND THE VIEWS OF RESPONDENTS ON CURRENT CHALLENGES ON WATER POLICIES AND PROGRAMMES AIMED AT ADDREESSING WATER SECURITY IN SOUTH AFRICA.

1. Are you in a position to tell me about yourself, your function and how you carry out your function at your institution? Please elaborate.

   …….

   …….

…….

2. Are you in a position to tell me what connects you to South Africa's water management and governance?

……

……

3. How long have you been focusing on South Africa's water management? Please give response in years……

4. How will you rate the national water policies and programmes addressing water security post independent? **0 not good at all; 10 perfect** ……

4.1. Would you be in a position to share your opinion on the above question briefly?

……

……

5. In your opinion do South Africa has appropriate water policies and programmes to address water security? **YES / NO**

5.1. Would you be in a position to elaborate on your answer to the above question briefly?

……

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…….....

6. Are you in a position to share your opinion with me the sustainability management structure/style in water governance and management in South Africa or your province?

- Top-Down (Vertical)
- Bottom-Up (Horizontal)
- Integrated (Both Vertical and Horizontal)
- Other

6.1. Would you be able to share with me your opinion on your choice above briefly?

……

……

7. What would be your perspective as most appropriate structure of managing water resources to achieve water security in South Africa or your province?

…….....

……

8. Are you in a position share your opinion on stakeholder's involvement in drafting and implementing water policies and programmes in South Africa or your province?

……

……

9. Would you be in a position to share with me which groups of the society are included in the decision-making process regarding water management? What percentage of the population does this cover?

……

……

10. What would be your perspective on the mode of involvement by stakeholders presently? E.g. expert panels, public hearings, written statements of via follow-up from the commission etc

……

……

11. To what degree would you consider stakeholders influencing the outcome/ changing of water policies and programmes nationally or provincially

……

……

12. Would you be in a position to share with me some of the aim and objectives of stakeholder involvement? E.g. Building knowledge? Involvement in water management? Other?

……

……

13. Would you be able to share with me some of the constraints institutions or organisations are facing implementing policies and programmes regarding water management? Please elaborate

……

……

14. Would you be in a position to indicate where applicable the constraints towards water management? Please use the numbers at their appropriate spaces

CHALLENGES AND CONSTRAINTS TO POLIES AND PROGRAMMES TOWARDS WATER SECURITY	**Rating (Checking the rating that best applies. Use (x) to indicate.**			
Challenges / Constraints **Rate the following challenges /constraints using the following:** **0 = Not relevant; 1 = Not severe; 2 = Severe; 3 = Very severe**	**0**	**1**	**2**	**3**
Lack of Appropriate Water Policies and Programmes				
Fragmented Approaches to Policies and programmes				
➢ Multiple institutions, each with their own piece of legislation often with overlapping, unclear allocation of responsibilities				
➢ Lack of coordination among multiple players and resources				
➢ Poor working relationship among partners.				
➢ Fragmentation of water related tasks				
Lack of Effective Integration and Coordination Hampered by:				

➢ Poor programme planning and design intervention programme				
➢ Poor information management system that does not provide/poor quality of data and information for decision making				
➢ Absence of sound and comprehensive national policies on water resources				
➢ The multiplicity of laws, each dealing with separate aspects of the management of the resources, thus encouraging compartmentalisation				
➢ Poor management of the dynamics of water supply and demand.				
➢ Lack of strategic vision across water related sector				
➢ The absence of a credible framework for involving civil society in the management process				
➢ Institutional arrangements for integrated water resources management are weak/ non-existent.				
➢ Poor governance and leadership structure that work in water resource management				
Lack/inadequate institutional resources				
➢ Lack/inadequate human resources in the water sector				
➢ Inadequate of equipment and proper infrastructure network				
➢ Inadequate financing				
➢ Weak technical capabilities/lack of a critical mass for water resources Management				
➢ Inadequate Research and Technology				
Lack of correlation between water supply and demand				
Improper land use planning and soil management in catchment areas				
Lack of clear-cut strategies on pollution prevention, control, and regulations				
Lack of/poor Stakeholder Participation and engagement				
Limited/No Public Awareness and Education				
Lack of/ Weak Promotion of economic, social, and ecological values link to water resources				

15. Would you be in a position to indicate where applicable the levels of engagement on policies and programmes towards water security.

NATIONAL POLICIES AND PROGRAMMES VISION ON WATER SECURITY				
	Rating (Please indicate where applicable with (x)			
What is the level of commitment and support to the National policy and Programmes	**Very High**	**High**	**Medium**	**Little**

Vision for South Africa's Water Security by the following?				
➢ **Policy developers/Decision making bodies**				
➢ **Key Stakeholders**				
➢ **Technical Experts**				
➢ **Political or Government Appointees**				
➢ **General Population**				
What is the level of awareness on National Policies and Programmes towards the Vision Water Security by the following:				
➢ **Policy developers/Decision making bodies**				
➢ **Key Stakeholders**				
➢ **Technical Experts**				
➢ **Political or Government Appointees**				
➢ **General Population**				

16. Would you be in a position to indicate the capacity challenges hindering the performance of water management in South Africa and your provinces?

Gaps	**Major obstacle**	**Important obstacle**	**Somewhat obstacle**	**Not obstacle**
Lack of staff and managerial capacities				
Lack of knowledge on water (technical, finance etc)				
Poor planning and not articulate with provinces and at local levels				
Difficulties in doing ex ante evaluation				
Difficulties in ex post monitoring and evaluation				
Other, please specify……				

17. Are you in a position to share with me the mechanisms in place for interaction with stakeholders at both national and provincial levels?

……

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…….....

18. What would be your perspective on the level of commitment by the government in ratifying and implementing regional and international obligation and treaties regarding water resource management?

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…….....

19. In the quest to improve access to water in households post-independent in 1994, the main water sources and infrastructure were overstretched. Would you be in a position to share your opinion on this matter? What must the government do to rectify the situation?

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20. The interrelationship between food production, industry, households, and energy sectors have impacted on water security in South Africa and most provinces. Are you in a position to share your opinion on the right balance between these sectors to ensure water security in your province and the country?

……

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21. Would you be in a position to share your opinion on what government and various stakeholders in the water sector can contribute to improve water security in South Africa and your province?

……

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…….....

Based on what we have discussed, is there anything you would like to add?

……

……

…….....

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

FACULTY OF SCIENCE

SCHOOL OF GEOGRAPHY, ARCHAEOLOGY, AND ENVIRONMENTAL STUDIES

TITLE OF RESEARCH: —Analysis of Public Policies and Programmes towards Water Security in Post-Apartheid South Africa

APPENDIX C.

Interview Guide for Households and Communities on South Africa's Water Policies, Programmes and Management

This interview and questionnaire guide aims at collecting empirical data in partial fulfilment of the requirements for a PhD Degree in Geography and Environmental Studies. It seeks to investigate systematic and structural constraints in achieving water security in Post-Apartheid South Africa. The study is specifically interested in understanding the factors that make it difficult to implement public policies and programmes aim at achieving sustainable water resource management and what can be done to promote sustainable water use in South Africa. All responses are treated in the strictest confidence as required by the law. Your cooperation is highly appreciated.

THIS SET OF QUESTIONS ARE DESTINED FOR HOUSEHOLDS AND COMMUNITIES SELECTED FOR THIS STUDY. THE MAIN GOAL OF THESE QUESTIONS IS TO UNDERSTAND THE VIEWS OF HOUSEHOLDS AND COMMUNITIES REGARDING CHALLENGES IN ACCESSING WATER AND THEIR RESPONSIBILITIES IN IMPROVING WATER SECURITY IN SOUTH AFRICA.

BIOGRAPHIC INFORMATION

The following personal information is necessary for statistical purposes and to reflect the opinions of employees on all post-levels, ages, and gender in a community. Please thick where applicable

1. Gender	Male		**1**	Female		2					
2. Age	20 - 29		30 - 39		40 - 49		50 - 59		60+		

3. Highest Qualification(s)	Grade 12	1	Technical Diploma	2	B-Degree	3	Postgraduate Degree	4	Other	5

4. Occupation	Employed	Unemployed	Casual Labour	Self Employed	Others

5. Average Income	Below R100000	R100000 - R300000	R300000 – R500000	Above R500000

6. Years of occupancy in the community	3yrs	3yrs – 5yrs	5yrs – 10yrs	10yrs -20yrs	Above 20yrs

7. Household Population	3 - 5 People	5 – 10 People	10 - 15 People	Above 15 people.

8. Are you in a position to share with me the level of access to water in your household?

   0 = Very bad; 10 = Perfect

8.1. Would you be in a position to justify your rating briefly?

……

……

…….....

9. Are you in a position to share with me how your household and the community access water daily? (You may choose more than one source)
   - o through community taps
   - o from yard taps
   - o from in-house connection
   - o from borehole equipped with handpump
   - o from a spring/well
   - o from rivers
   - o others

10. Are you in a position to say if there are challenges with the above sources?

Yes		**No**		Do not Know	

10.1. If your answer is **Yes,** are you in a position to disclose the main challenges in accessing water in the community? You may select more the one constraint if applicable

- insufficient water
- broken taps/handpumps
- water is not safe to drink
- broken infrastructure
- others

10.2. Would you be in a position to elaborate the challenges you are facing above briefly?

……

……

11. In your opinion has there been problems of disease outbreaks due to consuming unsafe water in your households and your community?

Yes		No		Do not Know	

11.1. If your answer is **Yes,** would you be in a position to briefly elaborate the types of disease outbreaks and their effect on the social and economic outputs in your community?

……

……

12. Would you be in a position to share your opinion on the state on water service provision in your community?

Good		Very Good		Bad		Very Bad	

12.1. Are you in a position to elaborate your choice to the above question briefly?

…….

……..

13. Are you in a position to rate the effects of the current water policies and programmes to your households and community on the following: (**Please use x to indicate where appropriate**)?

Practices	**Good**	**Bad**	**Neutral**
Availability of water			
Accessibility of water			

Affordability of water			
Quality/safety of water			
Acceptability of water			
Non-discrimination of water provision			
Active, free, and active meaningful participation in water programmes			
Take accountability and responsibility of water resources			
Sustainable use of water resources			

14. Are you in the position to elaborate your choice in the above question briefly?

……

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…….....

15. Would you be in the position to share your opinion on the factors that hinders transparency and accountability of water management and supply in your community?

Transparency and accountability gap	**Major obstacle**	**Important obstacle**	**Somewhat an obstacle**	**Not an obstacle**
Lack of publicly available data on drinking water quality				
Lack of publicly available data on economic and financial performance, included costs of service				
Lack of accounting control through regular financial audits				
Lack of benchmarking to evaluate water quality, quantity, and service providers' performance				
Lack of competitive procurement processes				
Weak judicial system for conflict resolution				
Limited information sharing across local authorities				
Limited monitoring / evaluation guiding decision-making				
Weak stakeholder engagement in water policy and projects				
Other, please specify				

16. What is your opinion on obstacles that hinder effective use of information to guide decision-making in water management and supply in your community?

Information gap	**Major obstacle**	**Important obstacle**	**Somewhat an obstacle**	**Not an obstacle**
Absence or incomplete water users' registry				
Lack of data on the water balance and quality				
Incomplete and irregular data collection (e.g. missing statistical units, missing values, no update etc.)				
Over technical information which does not allow non-water experts to understand the meaning of the indicators				
Lack of independent data				
Other, please specify				

17. Are you in the position to share your opinion on the forward-looking adaptive governance strategies to cope with water challenges in your community?

Strategies of improving water security management and governance in communities	**RANKING**			
	Top priority	**Middle priority**	**Low priority**	**N/A**
Fostering co-operation across levels of governments				
Enhancing synergies with other policy areas				
Improving stakeholder engagement				
Raising awareness on water availability, risks, quality, costs				
Developing new laws or regulations				
Building/Operating/Maintaining water infrastructure				
Ensuring value for money (higher quality at lower cost)				
Increasing the willingness to pay of water users				
Fostering capacity building, training, qualifications				
Developing technical and non-technical innovation				
Sharing information, commitments, actions (e.g. advertising campaign) for building trust and confidence				
Other please specify				

18. What is your perspective on the strategies that best suit the constraints listed below in your community? Please explain briefly

    A. Inadequate supply safe drinking water

    B. Leakages and broken infrastructure

    C. Wastewater treatment

    D. Flood, drought, and protection in catchment areas

    E. Water quality and safety

19. Based on what we have discussed, is there anything you would like to add?

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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

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ARCHAEOLOGY: TEL: +27117176045. FAX: +270866516366

20 January 2019

A REQUEST TO PARTICIPATE IN AN INTERVIEW FOR RESEARCH STUDIES

To whom it may concerned

My name is Richard Adom with a student number of 1645009; I am a PhD student at the University of Witwatersrand. I am currently conducting a research dissertation which aimed at investigating public policies and programmes towards water security in Post-Apartheid South. The study intends to identify the structural and systematic factors restricting implementation of policies and programmes to attain water security.

This letter, therefore, seek to request your participation in the research process. Participation will require you to be engaged in an interview which will be about 30 to 40 minutes. I will engage you on face to face interview and will possibly request follow up interviews in possible.

Please be informed that there will be no remuneration for participating in the research process. Participation is voluntary process, and should you wish to withdraw from the interview, you are welcome to do so. If in the process of the interview you wish not to answer a question you are welcome to decline it. You will remain anonymous throughout the whole process as your personal details will not be required. In the process of the interview I may require the use of tape recorder or a cell phone to capture the information properly and for analysis purposes only however, its use will be subject to your approval. The information given will be for

academic purposes only also will be store securely with a protected password computer and all hard copies will be properly safe in a well-secured cabinet.

My supervisor Prof. Mulala Danny Simatele is the only personality that will have access to the information given. Should you wish to have a copy of the final dissertation, you may request for it and will be delivered to you.

Should you have any queries about the research, you are welcome to contact me on 0717117214 or 1645009@students.wits.ac.za. Alternatively, you may contact my supervisor Prof. Danny Simatele on 0117176516 or Mulala.Simatele@wits.ac.za

Thanks for your cooperation

Yours faithfully



Richard Adom

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

School of Geography, Archaeology, and Environmental Studies

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27 August 2019

PARTICIPANT INFORMATION SHEET (INTERVIEW) FOR EMPLOYEES AT NATIONA, PROVINCIAL DWS AND OTHER WATER INSTITUTIONS

Dear Sir/Madam

My name is Richard Adom and I am a PhD student in Geography, Archaeology, and Environmental studies at the University of Witwatersrand in Johannesburg. As part of my studies, I have to undertake a research project, and I am investigating "Analysis of public policies and programmes towards water security in post-Apartheid South Africa. The aim of this research is to investigate structural and systematic factors restricting implementation of policies and programmes aimed at achieving water security in South Africa.

As part of this research, I would like to invite you to take part in an interview. The interview will involve you answering some questions and will take around 45 minutes. With your permission I would like to record the interview using a cell-phone.

You will not receive any direct benefits for participating in this research, and there are no penalties for not participating. You may withdraw at any time or not answer any question if you do not want to. The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym to represent your

participation in my final research report. If you experience any distress or discomfort at any point in the process, we will stop the interview and resume in another time.

If you have any question during or after this research, feel free to contact me on the detail below: Cell Number: 0717117214 , Email: richardquame1@gmail.com or 1645009@students.wits.ac.za

This study will be written up as a thesis which will be available online through the university library website. If you wish to receive a summary of this thesis, I will be happy to send it to you. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), Telephone +27(0)117171408, Email: Shaun.Schoeman@wits.ac.za

Yours sincerely,

Richard Adom

Richardquame1@gmail.com

(0717117214)

Supervisor:

Prof. Mulala Danny Simatele

Mulala.Simatele@wits.ac.za

(0117176516/08338368884)

CONSENT FORM FOR EMPLOYEES AT NATIONAL DEPARTMENT OF WATER AND SANITATION IN PRETORIA

Title of the research: **Analysis of public policies and programmes towards water security in post-Apartheid South Africa**

Name of the researcher: **Richard Adom**

I……, agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. Please tick the relevant options below.

- I agree to participate in this research project, and I understand the purpose of this research

YES		**NO**	

- I agree that my participation will remain anonymous

YES		**NO**	

- I agree that the researcher may use anonymous quotes in the final research report

YES		**NO**	

- I agree that I will not benefit directly for participating in this research

YES		**NO**	

- I agree that my participation is voluntary and I am free to withdraw my participation in the research process or skip any question I may find offensive without any penalty

YES		**NO**	

- I agree that the interview may be audio recorded

YES		**NO**	

- I agree that the information I provide may be used anonymously by other researchers following this project

YES		**NO**	

…… **Signature of participant**

…… **Name of participant**

…… **Date.**

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Adom

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H19/07/02**
PROJECT TITLE	Analysis of public policies and programmes towards water security in Post-Apartheid South Africa
INVESTIGATOR(S)	Mr R Adom
SCHOOL/DEPARTMENT	Geography Archaeology and Environmental Studies/
DATE CONSIDERED	19 July 2019
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	03 September 2022

DATE 04 September 2019 **CHAIRPERSON** J. Knight
(Professor J Knight)

cc: Supervisor : Prof M Simatele

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ Signature

____/____/____ Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

BRUCE WESSON - NMMU Language Editor

8 Quay One
Mitchell Street
SOUTH END 6001

Email bruce@wesson.co.za
Mobile 082 555 5204

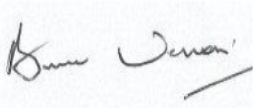
08 September 2020

TO WHOM IT MAY CONCERN

I, Bruce Wesson, hereby declare that I have proof read and copy edited the thesis given to me by Richard Kwame Adom Student Number : 1645009

I declare that the content remains solely that of the student, and that any changes made, were only to language and grammar errors.

Yours faithfully,



BRUCE WESSON
NMMU Language Editor

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ORIGINALITY REPORT

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