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WATER RESOURCE MANAGEMENT IN SOUTH AFRICA: PERSPECTIVES ON GOVERNANCE FRAMEWORKS IN SUSTAINABLE POLICY DEVELOPMENT

A dissertation submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science.

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Date of Submission:	01 December 2016

DECLARATION

I declare that this research is my own, unaided work. It is being submitted for the Degree of Master of Science at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

_____

Vanessa Pillay

Signed on this _____day of_____2016, at_____ .

ABSTRACT

Pressure on water as a resource is increasingly becoming inherent and unavoidable as economies continue to expand globally. The challenges experienced in water resource management inspired the need to understand institutional frameworks holistically. This lead to the primary purpose of this study: to explore perspectives of governance in sustainable policy development. The study intended to increase understandings of the strengths and weaknesses within governance structures in relation to contextual institutional operations and mandates. A comparative analysis of various governmental tiers in South Africa, with particular interest in Gauteng, was examined. Within Gauteng, the study focussed on district and local municipalities. Respondents comprised of participants operating at national, provincial and local level; and included institutions associated with water resource management. The participants were selected using a purposive sampling technique: snowball sampling. In assessing the identified institutions, data was gathered through the use of a questionnaire and interview questions. Together with content analysis, data was used to supplement the Institutional Analysis and Development framework; which provided a platform to incorporate actors into the research enhancing the researchers understanding of actors involved in the policy arena, including their features and functions.

Areas contributing to institutional fragmentation and poor institutional linkages were indicated as management functionality in terms of the top-down management approach. This includes management styles, lack of funds, capacity and skills relevant to the implementation of IWRM. Emphasis on the development of the NWRS2 was noted to be a major driver of sustainable water resource management, rather than the IWRM. Control and coordination of cooperative governance is strongly emphatic of management functionality. Overall, key findings highlight the importance placed toward economic development, moreover than social and environmental development. Integration of institutional structures is highly recommended for successful policy implementation.

Key Words: Water resource management, governance, IAD, institutional framework

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LIST OF ACRONYMS

CMA	Catchment Management Agency
COGTA	Department of Cooperative Governance and Traditional Affairs
CPR	Common Pool Resources
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
GDARD	Gauteng Department of Agriculture and Rural Development
HREC	Human Research Ethics Committee
IAD	Institutional Analysis and Development
IWRM	Integrated Water Resource Management
NWA	National Water Act
NWRS2	National Water Resource Strategy (second edition)
SAM	Strategic Adaptive Management
SDG	Sustainable Development Goal
SPSS	Statistical Package for the Social Science
TIPS	Tools for Institutional, Political and Social Analysis
UN	United Nations
WMA	Water Management Area
WRC	Water Research Commission
WRM	Water Resource Management
WSA_1	Water Services Act
WSA_2	Water Services Authorities
WSP	Water Service Provider
WUA	Water User Authority
WWAP	World Water Assessment Programme

CHAPTER I
FRAMES OF REFERENCE

1.1 Background to the Study

Water is the world's most critical resource, sustaining life while enabling economic and social development (Van der Gun, 2012; Vorosmarty et.al., 2013; Hassing, 2009). The necessity of water for human development is highlighted by the copious amounts of water used on a daily basis in agricultural practices and in order to manufacture consumables, process and extract minerals, generate power, as well as process food and beverages (Coleman et.al., 2007; Vorosmarty et.al., 2013). Many countries however, face challenges of growing water demands as a result of not only increased economic growth, but also population increases (Mukheibir and Sparks, 2003; Van der Gun, 2012; Vorosmarty et.al., 2013; Hassing, 2009; Coleman et.al., 2007). The increasing global demand for water is exacerbated by population dynamics and urbanization (World Water Assessment Programme (WWAP), 2015). As a result of the growing demand for water, management of water resources has been widely driven to accommodate the growth of the human population. Based on current statistics, global water demand is expected to increase by 40 % by 2030 under the "business-as-usual" approach, while the world's population is predicted to reach 9.1 billion people by 2050 (WWAP, 2015). In conjunction with population increases, land use and climate change are placing pressure on existing water resources worldwide and it is not certain that the supply is adequate to meet the increasing demand for water (Mukheibir and Sparks, 2003). According to the WWAP (2015), 748 million people around the globe still lack access to clean water, which in turn emphasizes greater pressures on water supply. It is also estimated that water demand for manufacturing is expected to increase by 400 percent between 2000 and 2050 (WWAP, 2015). According to WWAP (2015), the unpredictability of current freshwater resources needed to sustain water demand at a global level is very high.

Globally, it has been recognised that inadequate design mechanisms have led to failures in current systems that are meant to be ensuring natural resource

preservation and sustainable use for future generations (WWAP, 2015). As a result, water related issues led to the need to understand how effective management can bring about change. Water is recognised as a rare commodity and as such gives rise to the need to improve and integrate different institutions and policy measures in water resource management (Paris, 2010; Gonzalez-Villarreal and Solanes, 1999). This resulted in the development of the Integrated Water Resource Management (IWRM) framework, which translates into a policy and programme principal for implementation in order to bring about more sustainable systems of water resource management (Haigh et al., 2010; Pollard and du Toit, 2011; Walter et al., 2011; Paris, 2010; Gonzalez-Villarreal and Solanes, 1999).

Within the Sub-Saharan Africa context the greatest challenge is access to safe water, which is needed to support a population of 2.4 billion people by the year 2050 (Jankielsohn, 2011; WWAP, 2015; van Koppen and Schreiner, 2014). The situation is worsened by rapid urbanisation in Sub-Saharan Africa, where many cities experience regular water shortages (Anderson et.al, 2015; WWAP, 2015). Van Koppen and Schreiner (2014) points out that in Sub-Saharan Africa, 94 % of water resources are underdeveloped, stating that investment in water infrastructure is a key issue. Supporting this notion, WWAP (2015) highlights a 23.3 % rate of return for infrastructure projects by investing in water supply. Exacerbating existing challenges, Jankielsohn (2011) indicates that by 2025 two thirds of arable land will be lost due to climatic changes.

Issues within the global and Sub-Saharan Africa context are also pronounced within the South African context. South Africa as indicated in Figure 1 is a water stressed country (WWAP, 2015; Jankielsohn, 2012; van Koppen and Schreiner, 2014; Pienaar and van der Schyff, 2007; Colvin et.al., 2008; Pollard and du Toit, 2011; Muller, 2012). South Africa is located in a semi-arid part of the world where the temperature has been noted to fluctuate (Pitman, 2011; Molobela and Sinha, 2011). This, coupled with rainfall variability indicates the extremes relating to climate change (Pitman, 2011; Molobela and Sinha, 2011; Galvin et.al., 2015). Another big concern, as seen in the global and Sub-Saharan Africa context, is population increases. Turok (2012) indicates that the human population is projected to

increase exponentially in South Africa. Turok (2012) further points out that the population in South Africa will be 70 million by the year 2050.

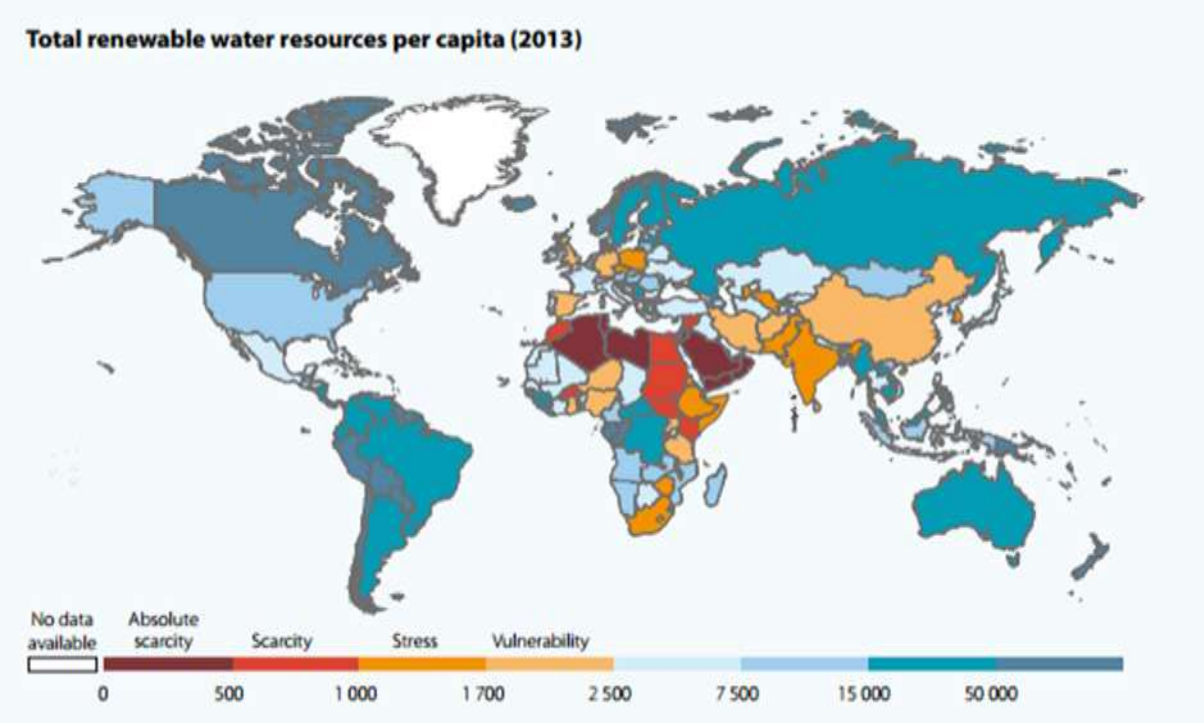


Figure 1. Water scarcity in the global context

(Source: WWAP (United Nations World Water Assessment Programme). 2015. The United Nations World Water Development Report 2015: Water for a Sustainable World. Paris, UNESCO.)

Furthermore, South Africa is a country with vast richness in its mineral resources (Turok, 2012). The inherent productivity of the mining industry has played an integral part in the advancement of the South African economy (Turok, 2012). As a result of mining business models being externalised, environmental concerns were avoided along with the cost implication thereof (Durand, 2012). The mining industry begins to move into an era of dwindling resources and costly environmental damages which will take many years to subside (Manders *et al,* 2009).

Additional concerns relating to water are delivery and treatment infrastructure, which is aging (Molobela and Sinha, 2011; Thompson et.al., 2011). Essentially, water is a fundamental natural resource for which the human need goes beyond basic drinking requirements in an industrially driven economy (Naidoo, 2014).

Using a top-down analysis approach, scholarly studies show that the world's water problems to meet basic human needs highlight a systemic failure at strategic institutional management level (Meissner, 2014; Haigh et.al., 2010; Meissner et.al., 2013; van Koppen and Schreiner, 2013; Pollard and du Toit, 2011). However, from the statistics presented above, it is evident that the arena in which water is managed is multi-faceted and therefore requires a deeper understanding of one aspect of water resource management, this being governance in sustainable policy development.

1.2 Research Statement

As pointed out above, South Africa is recognised as a water scarce country, exacerbated by water-related challenges (Siebrits and Winter, 2013). In consideration of climate change, increased populations, human migratory patterns, aging infrastructure, increased urbanisation and increased industrialisation, the water crisis in South Africa becomes more visible and problematic (Molobela and Sinha, 2011; Thompson et.al., 2011; Walter et.al., 2011). Within the context of these challenges, it is important to understand how South Africa can then manage policies and formal institutions to bring about more sustainable water resource management. In view of this, this study is particularly interested in understanding the current institutional and policy frameworks around water resource management.

South Africa is one of the countries within the Sub-Saharan region that responded to the water crisis by introducing the National Water Act (NWA) Act No. 36 of 1998 to promote an integrated and decentralised management approach (Walter et.al., 2011). Despite the introduction of a decentralised management approach, institutional and policy frameworks persist to exhibit challenges (Molobela, 2011). In view of the issues discussed above, this study seeks to understand fragmentation within institutional and policy frameworks in the South African context.

Water resource management is a complex arena in which there are many actors, anthropogenic interests and environmental challenges, in the form of climate change. South Africa continues to be subjected to frequent droughts resulting in

water dwindling. Within the context of water scarcity, South Arica has emerging challenges in the form of governance. A study conducted by Meissner et.al. (2013) suggested that future studies should focus on informal aspects of formal institutions, rather than conducting studies at operational level. Meissner et.al. (2013) further suggested that studies in water resource management and politics be ventured. While this study engages with water resource management at institutional level, another aspect looks at how South Africa can seek to improve sustainable water resource management. In view of this, the study is interested in understanding the current institutional and policy frameworks and how these institutions contribute to the formulation of sustainable water resource management. This study is particularly interested in investigating the challenges and opportunities that exist in achieving sustainable development. A fundamental aspect in understanding fragmentation is to answer if IWRM implementation through the National Water Resource Strategy, second edition (NWRS2) creates sustainable institutional design.

This study, therefore investigates the implications of disaggregation in South Africa's institutional and policy frameworks within the context of water resource management. Of paramount importance is that this study attempts to understand how the fragmentation in institutional setup and policy frameworks affect the governance of sustainable water resource management.

1.3 Research Questions

In view of the above considerations, the following questions guided the research process:

i. What gaps exist in institutional and policy frameworks relating to water resource management?
ii. What institutional frameworks exist within which sustainable water resource management can be pursued?
iii. In what ways can effective water governance be achieved in order to promote sustainable water resource management?

1.4 Aims and Objectives

The aim of this study was to investigate and understand how effective governance could contribute to the formulation of water resource management, in South Africa, in order to bring about sustainable development. The objectives of the study were as follows:

i. To identify the strengths and weaknesses of current water resource management institutions;
ii. Identify sustainable best practices within institutional frameworks;
iii. To contribute to the body of knowledge relating to aspects of governance in water resource management.

1.5 Theoretical considerations

As previously emphasised, water resources are dwindling due to a culmination of reasons that are interconnected, such as the growing human population and climate change (Ziervogel et.al., 2014; Mukheibir and Sparks, 2003; Galvin et.al., 2015). As a result of water scarcity, South Africa uncomfortably walks a tightrope between socio-economic development and the protection of its water resources (Walter et.al., 2011). As an industrialised country, water risks in South Africa are taken into consideration by few corporations (Pegram and Eaglin, 2011). The effect of water concerns is far reaching and therefore effective governance in water resource management leading to sustainable development is critical. Effective management of water resources is vital in maintaining adequate water supply and demand. While there are many aspects contributing toward water resource management, this study primarily focuses on governance.

Literature speaks to the various views that contribute to governance in water resource management in South Africa. Supporting one aspect of governance, Meissner et.al. (2013) suggests that much research is focussed on Catchment Management Agencies (CMAs) whereas more research needs to be conducted on water resource management institutions themselves. Haigh et.al. (2010) however,

observed that considerable change can be brought about through gradual training at local governmental level using the IWRM as a guiding framework. The United Nations (UN) have identified that water is vitally important in sustainable development, because this arrangement of thinking will not only support human communities, but will also maintain functions of ecosystems and ensure economic development (United Nations General Assembly, 2015c). As such, the UN Sustainable Development Summit was instrumental in developing the "*2030 Agenda for Sustainable Development*" which includes a set of 17 Sustainable Development Goals (SDGs) (Figure 2) to end poverty, fight inequality and injustice and tackle climate change by 2030 (UN General Assembly, 2015c). Achieving the SDGs, however, does require significant improvements in water resource management initiatives and linking these to IWRM may be challenging at the implementation level (Water Integrity Network, 2016). In contrast to Haigh et.al. (2010), Molobela and Sinha (2011) emphasises stakeholder participation as a key aspect toward ensuring effective governance. In view of these interlinked and contrasting views on aspects of governance in water resource management, Jankielsohn (2012) prescribes a holistic approach to water resource management that takes various aspects into consideration. Jankielsohn (2012) further adds that political will and lifestyle changes can contribute toward a more sustainable development. Similar to Jankielsohn (2012), Meissner (2013) also supports a move toward understanding water resource management and politics.



Figure 2: Sustainable Development Goals

(Source: http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda.html)

Within the Sub-Saharan Africa context, countries such as Malawi have been reported to have experienced corruption relating to public funds as well as a lack of access to safe water (Water Integrity Network, 2016). Following Malawi's "cash gate" scandal, initiatives were undertaken to capture successes and failures, in 2014 (Water Integrity Network, 2016). Ultimately, this aims to measure progress against overall strategic objectives while adapting to change. Nigeria, too, has been reported as having corruption during the awarding of contracts, where contracts were often awarded to non-professionals (Water Integrity Network, 2016). South Africa is not without its petty corruption, having reported water losses as a result of illegal connections and vandalism (eThekwini Municipality, 2015; Water Integrity Network, 2016). South Africa, in comparison to Malawi and Nigeria has been reported by the Water Integrity Network (2016) to be transparent in its procurement processes as well as being one of the five countries in the top category for "extensive" openness, as reported by the International Budget Partnership. Although South Africa is transparent, there have been reporting's of corruption and favouritism at Lapelle's water authority (Water Integrity Network, 2016). It was important to contextualise political agendas in the realm of water resource management, highlighting the premise that the action arena is complex and an issue of dwindling resources is not a sole contributor.

1.6 Methodological considerations

In evaluating institutional and policy frameworks that govern water resource management, a qualitative approach was adopted and was conducted in two ways. The first allowed for the rapid review of existing policies around water resource management and institutions to understand the dynamics within the water resource management arena. The second allowed for interviews with different actors for the analysis of perceptions for actors operating within institutions. The intention of the qualitative study was to obtain an understanding of the perceptions and perspectives regarding water resource management between institutions. Key participants were identified from the Department of Water and Sanitation (DWS), Department of Environmental Affairs (DEA), Department of Agriculture, Forestry and Fisheries (DAFF), Department of Mineral Resources (DMR), Rand Water and district and local municipalities within Gauteng.

In view of the qualitative approach adopted, a number of data collection tools were applied. This includes the use of content analysis, semi-structured interviews and questionnaires. Literature reviewed included the NWA, Water Services Act (WSA_1), NWRS2 and IWRM. Qualitative data, collected from the questionnaire and semi-structured interviews, was analysed using Statistical Package for the Social Sciences (SPSS). A detailed look into the methodological considerations is presented in Chapter 3.

1.7 Scope of the Study

Thematically, the study was interested in understanding the relationship between governance and the impact that governance has on water resource management and how it contributes toward sustainable water resource management in South Africa. In order to achieve this, the study adopted a case study approach of Gauteng. National departments identified for this study are all located in Gauteng which increased ease of engagements. Most importantly, Gauteng experiences heightened water pressures due to a number of factors. Firstly, Gauteng is South Africa's economic hub, which means increased industrialisation as well as

urbanisation. Secondly, as a result of Gauteng being the economic hub, migratory patterns indicate an influx of people into the province. Over and above the issues of climate change, the issues presented make Gauteng unique amongst the nine provinces. The study therefore used Gauteng as a worst-case scenario benchmark for understanding governance in water resource management.

Although many water related issues exist, the study did not engage with delving into understanding water quality issues, regulation or roles and responsibilities, but rather focussed on governance in water resource management.

1.8 Ethical Considerations

The application for ethical clearance for human research (non-medical) was presented to the Human Research Ethics Committee (HREC) for approval by the University of Witwatersrand. The application entailed the development of the participant information sheet and receipt of consent from each of the heads of institutions requesting permission to conduct research at their institutions (Appendix A and B). Ethical clearance (Appendix C) was received from the University of Witwatersrand and the researcher conducted research in a manner so as not to jeopardise the researcher, the participants and the University of Witwatersrand. The topic of water resource management at the institutional level is a highly contemporary perspective on water governance issues leading to gap identification. Due to the nature of this research, ethical clearance provided the researcher and the university with safeguards. The privacy of information relating to each participant was respected and maintained.

1.9 Dissertation Outline

In view of the above, there is a need to study governance in water resource management. This can be seen in the issues that South Africa faces as a water scarce country and as such requires some attention for the way in which water as a natural resource is managed. To give light to the research statement and setting the scene for the study, the structure of this dissertation is organised into 6 chapters.

Chapter one provides the design of the dissertation where the research statement, research questions, research methodology and overall contribution of the study is discussed. Chapter two presents the literature review; exploring the objectives through a document review. Chapter three presents the overall methodology. It is here that a detailed description of the research design, research materials and data sources, study population and sampling procedure, data collection tools and data analysis is presented. Chapters four and five reflect on key findings arising from the previous chapters, understanding meanings associated with the issues raised in the study. Chapter six concludes the research and provides recommendations for future researchers. It summarises findings, suggests extrapolations and makes recommendations.

CHAPTER II
THEORETICAL CONSIDERATIONS AND LITERATURE REVIEW

2.1 Introduction

It was necessary for this research to first present a broader understanding of the terminologies and linkages in water resource management to provide a greater understanding of key concepts. The literature review then set the platform for the remaining chapters by setting the scene for governance in water resource management. This was structured around three broad sections, namely water resource management and policy frameworks in the global, Sub-Saharan African and South African context. By identifying with these broad categories, South Africa is contextualised in the greater picture to understand current arguments in literature relating to the global and Sub-Saharan Africa context.

2.2 Definitions of key concepts and terms

Before discussing the literature, it is important to define key concepts that are presented throughout the dissertation. Certain concepts and terms are commonly used and are generally accepted as the norm where as other concepts and terms may require clarification.

2.2.1 Water Resource Management and Governance

Although there is no clearly defined definition for water resource management, literature does present definitions for certain aspects of water resource management. One definition provided by the Global Water Partnership (2000) defines water resource management as the prevention and resolution of conflicts. This definition takes cognisance of the growing population and economy, which increases the demand for water, while increasing pollution and further accommodates for increased competition for scarce water (Global Water Partnership, 2000). Integrated water resource management (IWRM), however, is highly topical and as such a clear definition is provided. IWRM is defined as the coordinated development and management of water and land, such that economic

and social welfare is maximised without compromising sustainable development (Haigh et.al. 2010; Global Water Partnership and International Network of Basin Organisations, 2009). The Global Water Partnership and International Network of Basin Organisations (2009) further add that this integrated approach of water resource management emphasises the role of policy and law making to establish good governance.

The UNEP (2012) and UNDP (2013) refer to governance as the political, administrative, legislative and institutional system for the development and management of water resources. The UNDP (2013) also refers to water governance as a complex arena consisting of social, economic, political and environmental dimensions and hence associates water governance with IWRM. Within the global context, however, United Nations (2006) provides an overview of various definitions for global governance. One definition describes global governance as formal and informal institutions, mechanisms, relationships and processes amongst government, citizens and organisations, through which collective interests are articulated, and where rights and obligations are established and differences mediated (United Nations, 2006). Another definition presented by the United Nations (2006) refers to global governance as the activities and processes of government and governing located at several levels of government such as local, provincial and national. While there have been many variations for the term governance over the years (United Nations, 2006), Fukuyama (2013) defined governance as "*government's ability to make and enforce rules, and to deliver services, regardless of whether that government is democratic or not*".

Within the South African context Gumede and Dipholo (2014) define elements of good governance as political and economic principles. While the study conducted by Gumede and Dipholo (2014) looked at governance in New Public Management, governance principles is a term that should have the capability of application in any arena. Vyas-Doorgapersad and Ababio (2010) define governance in the form of ten principles for ethical local governance. These principles are participation, rule of law, transparency, equality, responsiveness, vision, accountability, oversight, efficiency and effectiveness and professionalism.

Since the concept of governance is not well established and different researchers intend for different things, this study will adopt the terminology referred to by the United Nations (2006) where governance is applicable at several levels of government. The study will also include the principles for governance provided by Vyas-Doorgapersad and Ababio (2010) which describe the depth to which the term governance can be applied.

2.2.2 Institutions

Institutions are vaguely variable by definition. The World Bank (2007) presents "social analysis" as encompassing institutional, political and social analysis. Accordingly, institutional analysis is the applied rules of a society and political analysis is the structure of power relations, while social analysis is the social relationships that influence institutional structures (World Bank, 2007). Various tools exist that are adopted by social science experts in understanding institutional frameworks. As such, it is important to take into consideration the complexities that exist in water resource management, it is important to understand sustainability relating to water resource governance, within the realm of institutional, political and social analysis.

It is necessary to clarify exactly what is meant by the term institutions. In sociology, an institution is defined as "an organised, established, procedure" (Jepperson, 1991), which may imply constituent rules of a society. Early definitions of sociology by Durkheim (1982) proposed that sociology is the science of institutions. This theory is understood as beliefs and modes of behaviour instituted by the collective (Durkheim, 1982) and sets the scene to research structural social facts. These social facts "*consist of manners of acting, thinking and feeling external to the individual, which are invested with a coercive power by virtue of which they exercise control*" (Durkheim, 1982). In essence, an institution is a social entity that has attained a certain state which suggests that it serves to regulate social behaviours.

In institutional economics, M´enard and Mary (2011) explained that Douglass and Davies (1970) defined institutions as rules in a society or humanly devised constraints that shape social behaviour. Essentially, this relates to the previous

definition in the sense that institution's set rules for resource use and institutions organise the mechanisms for governance.

Bandaragoda (2000) explains that institutions are contextualised as being both formal and informal. Written laws, rules and procedures provide the formal framework for which institutions are established while norms, practices and patterns of behaviour form part of an informal framework. Bandaragoda (2000) further explains that institutions have the ability to shape the behavioural patterns of individuals in groups. Challenges in developing countries are seen where informal rules are adopted as normative rules in institutions and can therefore affect performance and decision-making in planning (Bandaragoda and Firdousi, 1992).

Generally accepted, rules create the construct that forms the basis for the institutions. These rules specify in detail all systems laws, regulations, procedures, informal conventions, customs or norms that govern behaviours. Bandaragoda (2000) collectively defines institutions as "policies and objectives, laws, rules and regulations, organisations (their bylaws and core values), operational plans and procedures, incentive mechanisms, accountability mechanisms and norms, traditions, practices and customs". Ostrom and Polski (1999) adopt similar ideas when defining institutions; however, do caution that during policy analysis one must consider how participants conduct themselves in the institution. Polski and Ostrom (1999) describe institutions as man-made systems consisting of multiple levels and that policies overlap with other situations and activities. Subsequently, Ostrom (2010) developed the Institutional Analysis and Development (IAD) framework. The basis of the IAD framework is the characterisation of institutions related to rules: constitutional choice rules, collective choice rules and operational rules (Saleth and Dinar, 2004) and has created a platform for many researchers to analyse institutions (Saleth and Dinar, 2004; Bandaragoda, 2000; M´enard and Mary, 2011). The framework is distinct in that it allows for two important motivations. Firstly, it allows the analyst to separate rules from their social, physical and economic environment and secondly, the rules cover elements of laws and policies as well as institutional arrangements such as organisations.

Based on the above-mentioned definitions, the interpretation of institutions for this study consisted of established rules, norms, practices and organisations that provide a structure of human behaviour for water resource management.

2.2.3 Hydropolitics

Politics within the realm of water is defined as “hydropolitics”. The term hydropolitics refers to a multidisciplinary science which investigates political and judicial issues relating to water (Jankielsohn, 2012). Within the realm of hydropolitics, Jankielsohn (2012) highlighted three key components of sustainable development; these being political will, engineering design capacity and institutional capacity. Attributing factors of institutional failure was found to be brought about by the inability of local authorities, water boards and non-governmental organisations to provide governance (Jankielsohn, 2012). Meissner (2014), however, adds that hydropolitics is an ever-changing arena. According to Meissner (2014), the types of actors are more dominant within complexities during certain periods, and are also based on the nature and extent of relationships over time. For the purpose of this study, the concept hydropolitics will follow the understanding provided by Meissner (2014).

2.2.4 Sustainable Development

Many definitions of sustainability exist, the most notable often referred to as the first definition, was coined at the World Commission on Environmental and Development, also known as “the Brundtland Commission” in the “Our Common Future” report (Kuhlman and Farrington, 2010). Aspiring to provide a holistic ideology the Brundtland Commission hoped to reconcile a better life with dwindling natural resources and high risk environmental impacts (Kuhlman and Farrington, 2010). Hence, sustainable development was defined as, by the Bruntland Commission (Kuhlman and Farrington, 2010):

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

This definition contains two key concepts within it. The concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (Kuhlman and Farrington, 2010). The core of sustainability is more extensive than just the environmental dimension since there is also a need to ensure a strong, healthy and fair society. This means meeting the diverse needs of all people in existing and future communities, promoting personal wellbeing, social cohesion and inclusion, and creating equal opportunity (Tetratech, 2010). These explanations clarify that effective management of the environment, the economy, and society is required to achieve sustainable development (Claasen et.al. 2011). As such the environmental, economic and social dimensions are inextricably linked and widely adopted as a conceptual model. The economic dimension accommodates the growth and development of a country and in the case of water resources, examines water demand projections comparatively, while taking into consideration factors such as drought (Claasen et.al. 2011). The environmental dimension touches on environmental protection being an integral part of ensuring sustainable development. The economic dimension has a high status as it is supported in many countries. The social dimension focuses on the well-being of the human aspect, which recognises the links between the environmental and economic dimensions (Claasen et.al. 2011). This dimension addresses issues such as poverty and underdevelopment.

Sustainability is a popular term applied in policy development as an expression of what policies should achieve. Although sustainability is a widely adopted concept Kuhlman and Farrington (2010) argue that its meaning has been obscured:

"(a) Obscures the real contradiction between the aims of welfare for all and environmental conservation;
(b) Risks diminishing the importance of the environmental dimension; and
(c) Separates social from economic aspects, which in reality are one and the same."

This study adopted the concept that idealises the three pillars of sustainability, namely social, environmental and economic dimensions (Kuhlman and Farrington, 2010). The study also takes cognisance of the challenges encountered when speaking to sustainable development.

2.3 Water Resource Management and Policy Frameworks

2.3.1 Global Context

Global concerns over water have increased considerably, presenting challenges to humans from local to global scales (Pahl-Wostl et.al. 2013). Water is therefore expected to increase in position on the global agenda (Hayes and Knox-Hayes, 2014;Vorosmarty et.al., 2013). As it stands global dependence of water is high, 2.5 billion people depend on water for general use (WWAP, 2015). Dependency on water by the growing population is not the only challenge. Lall et.al., 2008 argue that water concerns are particularly severe in the developing world, where increased populations and climate change are expected to be especially challenging. One key aspect derived from UNDP (2006) is that people who are at the forefront of the water crisis lack the political will to act. For Vorsomarty et.al. (2013) increased attention to the global water research agenda had improved developments, however, found that the global perspective is still a highly contested arena. Although global governance is contested by a few; Vorosmarty et.al. (2013) does report that the broader vision for global governance has increased. Pahl-Wostl et.al. (2013) illustrated that collaborations between environmental flows and governance issues is lacking; adding that there is a disconnect between science and policy that is essential for tackling complex issues in sustainable water resource management.

Lall et.al. (2008) reported that understandings of the global water crisis could be increased by examining safe drinking water, pollution, degradation and water scarcity. Despite safe drinking water, pollution, degradation and water scarcity falling within water resource management, there are other aspects that could be examined to enhance understandings in the global water crisis. While governance is not the only aspect of water resource management, many studies promote the

study of governance in water resource management (Zelli and Asselt, 2013; Vorosmarty et.al. 2013; Moore, 2013). Moore (2013) demonstrated that challenges in governance at a global scale vary considerably to challenges at local scale. In both instances, Moore (2013) noted fragmentation and highlighted that challenges at local scale are a complexity in itself.

This leads to the movement of sustainable development. Globally, sustainable development has become a practice that people want to be associated with (Lucci et.al. 2015). This concept has gained attention in global forums with particular interest in poverty alleviation in developing countries (Lucci et.al. 2015). The idea has assumed a central place in environmental and developmental discussions. Global development initiatives saw the introduction of the Millennium Development Goals, which were replaced by the Sustainable Development Goals (SDGs). Lucci et.al., 2015 reported that while sustainable development is progressive, there is a big risk that it may not be implemented. IWRM implementation too presents itself to be a challenge globally (United Nations-Water, 2015). Water Governance Facility (2012) adds that implementation of the IWRM has been inclined toward the economic dimension and more emphasis needs to be placed on equity and environmental sustainability.

2.3.2 Sub-Saharan Africa Context

As mentioned in chapter 1, the human population in Sub-Saharan Africa is expected to increase; the increase is anticipated to worsen with increased urbanisation. Despite urbanisation, poverty is very much rife in Sub-Saharan Africa (Soussan, 2006, Braune, 2014). Over and above social challenges such as poverty, infrastructure development is provided for more readily in urban areas than in rural areas (Salami et.al. 2014). Poverty has been and still continues to be a focus under the SDGs. According to WWAP (2015), demand for fresh water is growing and this has major impacts, such as inaccessibility of water in regions where extreme poverty dominates.

Salami et.al. (2014) reported that in Madagascar 17 million people live in rural areas and these communities are heavily reliant on agriculture. Agriculture

contributes a significant portion to Madagascar's Gross Domestic Profit (Salami et.al. 2014). Salami et.al. (2014) reported that in Burkina Faso agriculture is the main water consumer and that many small communities are also reliant on water. Agricultural activities serve as the primary source of income in poverty stricken countries.

Politics within Sub-Saharan Africa is also reported to be a contributing factor in poor governance of water resource management. Salami et.al. (2014) describes politics between national and local government, in complying with institutional arrangements as a difficulty in Kenya. Kenya however, has an informal water service sector and as such is non-transparent in its operations and interactions between actors (UNDP, 2013). Table 1 represents a peek at a few Sub-Saharan Africa countries relating to governance in water resource management. If one looks at Kenya, you will see that financial constraints also contribute to issues in governance.

Within the Ugandan and Kenyan context, multi-stakeholder engagements are seen as a key for success (UNDP, 2013). The Water Partnership Program (WPP) of the African Development Bank (2010) corroborates this statement, identifying involving community management as an element for success. De Cecco (2012) conducted a study between Uganda and Tanzania and reported major differences in governance mechanisms. The study conducted by De Cecco (2012) suggests that Uganda has a successful water resource management system as a result of management's commitment in providing basic services to the poor.

Largely, there are many concerns relating to governance in water resource management in the Sub-Saharan Africa context. There are, however, success stories and plans that could lead to success. Looking at the aims and objectives of this study, it was necessary to gain perspective of governance in Sub-Saharan Africa countries to identify if certain challenges are a common feature or if the findings of this study are localised to South Africa.

Table 1. Governance in Water Resource Management: Sub-Saharan Africa Peek

Country	Main Findings	Conditions for Success
Kenya: Citizens Report Cards	Monitoring at the grass-roots level needs to continue; more regular interaction is needed within utilities; strengthened mechanisms are also needed to foster engagement between utilities and citizens.	Political will is necessary to take up the findings of the assessment. Suitable local conditions are required: a political context that allows for citizen participation in decision- making processes and a level of safety for researchers and citizens to conduct the survey. A reliable, independent institution is required to lead the effort. The findings need to be publicly distributed and followed up by local actors.
Kenya: National Water Integrity	Financial constraints, weak corporate governance, weak participation by citizens and illegal water connections have been identified as major concerns undermining performance in the sector. With regards to the actor analysis, several challenges were underscored by the study. Accountability is weak because sanctions and anti-corruption measures are not applied, and incentive systems to facilitate the development of good governance are weak. Poor	None listed

Country	Main Findings	Conditions for Success
	access to information is a major problem hampering public participation	
Ethiopia: Rural Water Supply Corruption	Ethiopia has made significant strides in policy development, financing, governance and management, resulting in generally low levels of corruption and perceptions of corruption along the value chain. The study highlights a number of remaining vulnerable areas, particularly at the lower (procurement and construction) end of the value chain. Stakeholder perceptions of corruption vary significantly in some instances	None listed
Uganda: National Water Integrity	Inadequate integrity in the Ugandan water sector has resulted in: loss of investments, exploitation of contractors, compromised professionalism, contracts issued for personal gain, resources lost through poor quality and incomplete works, and political interference. Services and investments have been targeted towards affluent communities at the expense of poor people.	A collaborative multi-stakeholder design and oversight are required to create a shared sense of ownership of the research and action programme. A comprehensive communication and media strategy should be made publicly available

(Source: UNDP, 2013. User's Guide on Assessing Water Governance., pp.1–116)

2.3.3 South African Context

Certain parts of South Africa are faced with growing water demands and insufficient potable water sources (Pegram and Eaglin, 2011; Haigh et.al. 2010). In addition to drought that leads to water shortages, provinces such as Gauteng have incurred water contamination as a result of abandoned mines (Knuppe, 2011). Apart from water demand, industrial practices are applying enormous pressure on dwindling resources and South Africa has exceeded its natural availability of water (Mukheibir and Sparks, 2003; Pitman, 2011). Over-and-above this there are growing concerns that climate change presents further challenges in rainfall patterns (Mukheibir and Sparks, 2003; Galvin et.al. 2015). Water resource management is therefore a very critical area for many researchers.

Water resource management in South Africa has a historical journey of importance. Initial reform initiatives supported a transformation of management structures from a centralised to a decentralised mode of operation (van Koppen and Schreiner, 2014). Since the decentralisation of governance in 1996, local government has been responsible for a wide range of services, including legislative compliance (Meissner, 2013). Despite the uncertainty of a decentralised system, it is widely accepted to ensure better governance and performance (Stanton, 2009). Policy making power has subsequently been distributed to mandated institutions, where financial, political and administrative challenges are noted, even at local level (Stanton, 2009, Haigh et.al. 2010).

Siebrits and Winter (2013) reported that more effort must be applied toward policy aspects such as development, which include supporting evidence of policy creation, implementation and monitoring. Only when governance issues are understood in water resource management can South Africa progress to a sustainable water situation (Meissner, 2014; Siebrits et.al. 2014). Gumede and Dipholo (2014) identified major governance issues in a study that looked at New Public Management in South Africa. Sectoral boundaries, lack of coordination, fragmented responsibilities and inconsistencies between regulatory frameworks have been noted as complexities in water resource management (Haigh et.al. 2010; Meissner et.al. 2013). The challenges emphasised in water management have brought to

surface a great need for water governance reform as poor governance is recognised as one of the causes of the current water crisis (Siebrits et al., 2014; Jankielsohn, 2012; Meissner, 2014). This is underlined by Siebrits et al. (2014) whose research identified priority questions for key themes in South Africa. Using an integrated and Strategic Adaptive Management (SAM) approach Siebrits et al. (2014) presented eleven topical questions for the key theme "*governance*". Although these ideas build a platform for further research, issues such as mismanagement highlight a hydropolitical agenda in water resource governance (Jankielsohn, 2012; Meissner, 2014).

Manders et al. (2009) identified two problems within the policy framework, related to water quality in South Africa, that require attention. The first is that the delegation of powers at various levels within the government does not clearly identify roles and responsibilities and the second is that current frameworks treat the problem rather than identifying the root cause and preventing a recurrence (Manders et al. 2009). Meissner et al. (2013) suggests that despite the implementation of IWRM, institutional structures are still faced with disjointed management, alignment is therefore highly important to achieve a collaborated output and sustainable water management system. Alternatively, a study by Colvin et al. (2008) indicated that a progressive system of water laws and policies should be considered for effective water resource management.

2.4 Gaps in Water Resource Management

From the literature presented above it is evident that within the global, Sub-Saharan and South African context challenges arise from vast complexities in the water resource management arena (Pahl-Wostl et al., 2013; Munnik and Burt, 2014; Meissner, 2014; Ziervogel et al. 2014). The disconnect between the science and politics alluded to by Pahl-Wostl et al. (2013) is also represented in the way in which literature conducts studies; presenting these as separate challenges. The science community is driven by climate change and attributes complexities such as seasonal availability of water to climate variations (Ziervogel et al. 2014), while the focus by Meissner (2011) is on the water politics and governance. As previously mentioned, water resource management constitutes various aspects, one of which

is the IWRM. Despite the IWRM being driven as a concept of sustainable development, understanding governance in water resource management to promote sustainable development is yet to be ventured.

The multi-layered structure of water resource management also presents challenges in the form of varying objectives and the nature of management (Meissner et al., 2003). Breaking down management, Stanton (2009) highlights policy planning, development and governance to as challenges (Stanton, 2009).

To summarise, the management of water exists in a complex action arena, consisting of pressures such as population growth, economic development, trade, urbanisation and climate change. Taking all of these factors into consideration, the need to explore governance of water resource management is important.

CHAPTER III
METHODOLOGICAL CONSIDERATION

3.1 Introduction

The objective of this chapter is to discuss the methodology that has been applied. In order to produce answers to the research questions, it is necessary to plan and design a research strategy. In order to unpack governance complexities in institutional frameworks this research strategy adopts diverse types of methods and tools that are relevant to obtain suitable information. To assess governance in institutional frameworks, a mixed approach was adopted to generate qualitative and quantitative data. The approach aligned with the principles of triangulation to provide a stronger sense of validity of the research outcomes. An advantage of using triangulation in a case where interviews and questionnaires are adopted is that there is added depth to results that is not necessarily possible when applying a single strategy method, thereby increasing the validity of any findings (Bhattacherjee, 2012).

This chapter begins by discussing the research philosophy giving rise to the approach that has guided this research process. Following the research philosophy, the subsequent section provides details relating to the research design. The study identified institutions with particular interest in water resource management. Next, the researcher explains the process undertaken to identify the policies and strategies that forms an integral part of governance in water resource management. An important task in strengthening water resource management is to examine policy frameworks governing the water sector and identifying sustainable frameworks. To this extent grounded theory was applied to provide in depth insight into the policy development and implementation within institutional frameworks. This allowed the researcher to further analyse data holistically in relation to governance in institutional frameworks thereby promoting sustainable water resource management.

3.2 Research Philosophy

This research employed a multi-paradigmatic approach, incorporating data gathered from both qualitative and quantitative methodologies. A multi-paradigmatic study can have many advantages over a strict single-method qualitative or quantitative study, such as allowing the researcher to analyse policy implementation, goals, objectives to clearly identify the extent to which they are achieved, estimating the effects of proposed policies and weighing the shortcomings and benefits of policies within the institutional frameworks (Bhattacherjee, 2012). By employing a multi-paradigmatic approach, data was collected and analysed using the post-positivism and interpretivist methods:

i. **Principles of Post-Positivism**: According to Bhattacherjee (2012), a post-positivism paradigm amends positivism by proposing that it is impossible to verify the truth, though it retains the positivist paradigm of an objective truth and its emphasis on scientific method. This view argues that one can make rational suggestions regarding research by combining empirical observations with logical reasoning (Mack, 2010). Post-positivism affirms that there are limitations and considers that there are other means of factual knowledge determination. This consideration incorporates the interrelationship of individuals in the society in which the individual belongs (Ponterotto, 2005). In essence, post-positivism provides a good tool since departmental institutions operate within a complex system, within which outcomes support factual knowledge.

   According to Mack (2010) post-positivists take a more realistic approach, allowing political issues to also be studied to gain knowledge. Post-positivism accommodates a complex platform for analysing policies which allows for non-traditional methods of study, thereby contributing to the knowledge of politics. For a policy analyst using the post-positivist approach, stakeholder engagement is vital to ascertaining alternative courses of action as well as

determining limitations within the current perspective. Here the semi-structured interview questions present alternative ideologies in analysis.

ii. **Principles of Interpretivism**: The interpretivist paradigm beliefs are that social reality is seen by multiple people, and this is then interpreted differently leaving many versions of situations (Mack, 2010), therefore, to view research objectively it must be observed from the inside through direct experiences from the people. Through interaction the interpretivist seeks deeper meaning of the subject relative to the situation. Although the research provides an overview of governance, it is also important to understand the functionality within institutions.

iii. **Strengths and Limitations of Post-positivism and Interpretivism**: Strengths of post-positivism includes the recognition that not all knowledge is gained from one single method (Ponterotto, 2005). Qualitative methods are criticised for being inexact; however, do provide in-depth insight into explaining what happens at institutional levels. The progression of post-positivism has improved policy analysis methods by taking a more comprehensive and inclusive approach (Morris, 2009). Post-positivism is relatively in its infant stages and therefore poses unanswered questions, however, does have the ability to move beyond inflexibility. Another limitation of post-positivism is that there may be difficulty separating one's own perspective from the research (Mack, 2010).

In an interpretivist paradigm, the main limitation is that the verification of results and data cannot be generalized or assumed at any institutional level (Mack, 2010). This, however, is only relative since knowledge enhancement provokes alternative thought processes, thereby achieving change and improvement, nullifying generalizable findings. Local theories can create a platform for practice. It is also said that an interpretivist view is rather more subjective than objective (Mack, 2010). Here too, this criticism can be nullified by bracketing assumptions, and analysing data without the researchers own perceptions (Mack, 2010). Where an interpretivist paradigm

fails to acknowledge political influences, knowledge and social reality, post-positivism will strengthen research analysis.

3.3 Research design

The research design makes provision for the integration of various components to study governance in water resource management in a clear and logical manner and hence constitutes the design for collection measurement and data analysis. See Figure 3 for an overview of the research design adopted.

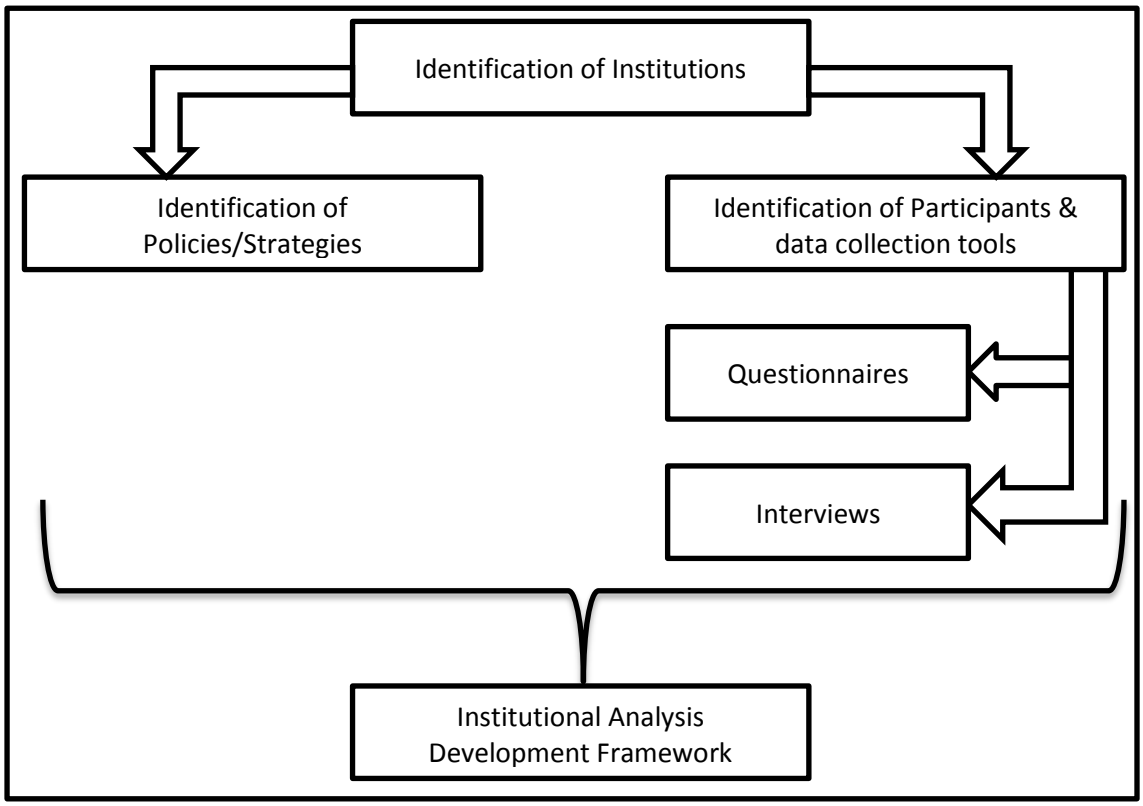


Figure 3. Research Design

(Source: Authors representation, 2016)

3.3.1 Study area description

A case study of South Africa was undertaken through the collection of data from participants operating within identified institutions as well as from specific policies and strategies. This section therefore explores the institutions that were identified and the reasoning behind selecting these institutions. The identification of

institutions was followed by the identification of policies and strategies as well as participants necessary to study governance in institutional frameworks.

To begin with, it is necessary to contextualise the South African constitutional system. South Africa's democracy is represented by a three-tier government system consisting of national, provincial and local government. Each tier has legislative and executive authority in their respective spheres (South African Government, 2016). At the national level, ministers are responsible for one or more departments mandated to provide governance. Represented in Table 5 are national departments operating in South Africa. From the list of national departments, the researcher identified five departments directly and indirectly involved in water resource management.

Table 2. Departments operating at national in South Africa

South African Departments	Involvement in Water Resource Management
Rural Development and Land Reform	No direct involvement
Science and Technology	No direct involvement
Agriculture, Forestry and Fisheries	Agriculture, forestry and fisheries activities involve direct water usage
Communications	No direct involvement
Economic Development	No direct involvement
Finance	No direct involvement
Higher Education and Training	No direct involvement
Labour	No direct involvement
Mineral Resources	Mining activities involve direct water usage.
Cooperative Governance and Traditional Affairs	No direct involvement
Environmental Affairs	Mandated to effectively manage natural resources
Transport	No direct involvement
Water and Sanitation	Mandated to effectively manage water resources
Public Works	No direct involvement
Human Settlements	No direct involvement
Energy	Energy production involves direct water usage with some energy sources
Small Business Development	No direct involvement
Public Enterprises	No direct involvement
The Presidency: Planning, Performance Monitoring and Evaluation	No direct involvement

Telecommunications and Postal Services	No direct involvement

(Source: South African Government, 2016)

Although the Department of Water and Sanitation (DWS) is mandated to provide governance in water resource management, water usage and management is inextricably linked to the Department of Agriculture, Forestry and Fisheries (DAFF), the Department of Environmental Affairs (DEA), the Department of Mineral Resources (DMR) as well as the Department of Energy. The inextricable link between these departments is exemplified in their vision and mission statements Table 3. From this table, the DWS is identified as the mandating department to manage water resources. The DEA is identified as having a mandate over the management of natural resources (see excerpt below). While the DAFF, DMR and the Department of Energy do not have direct management over water resources they do directly utilise water for agricultural use, mining activities and for the production of energy.

"Everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure sustainable development and use of natural resources while promoting justifiable economic and social development" (Section 24 of the Constitution of the Republic of South Africa, 1996)

Table 3. Institutional Vision statements

Department of Water and Sanitation
A dynamic, people centred department, leading the effective management of nation's water resources, to meet the needs of current and future generations
Department of Mineral Resources
The vision of the Department of Mineral Resources is to enable a globally competitive, sustainable and meaningfully transformed minerals and mining sector to ensure that all South Africans derive sustainable benefit from the country's mineral wealth. This is achieved within our legislative framework and as the legitimate custodian of the country's mineral wealth.
Department of Agriculture, Forestry and Fisheries

United, prosperous and transformed agricultural sector that contributes to food security for all
Department of Environmental Affairs
A prosperous and equitable society living in harmony with our natural resources.
Department of Energy
Formulate energy policies, regulatory frameworks and legislation, and oversee their implementation to ensure energy security, promotion of environmentally-friendly energy carriers and access to affordable and reliable energy for all South Africans.

(Source: Authors representation of collated visions and missions derived from DEA, DAFF, DMR, DWS and the Department of Energy).

Augmenting the identification of these departments is the introduction of the "One Environmental System" which is an effort by the DWS, DMR and DEA. It serves to implement a system where the mining industry is integrated into the environmental management system, while streamlining environmental and water authorisations. These three departments hold importance as a result of the emphasis placed on streamlining environmental and water authorisations. Furthermore, Goga and Pegram (2014) reported that 61 % of water is used for agricultural purposes while mining and energy departments use 6 % and 2 % respectively. In view of this, the study identified the DWS and the DEA as key institutions to form part of this study. With regard to the DAFF, DMR and the Department of Energy, the researcher opted to approach the DAFF and DMR based on the water usage by these sectors.

Considering South Africa follows a three-tier governance system, the next tier is province. Each province in South Africa is faced with water challenges in various degrees, however, for purpose of this study Gauteng was chosen from the nine provinces. Supporting this decision, Gauteng accounts for 32 % of the national economic output and is the economic hub of South Africa (Turok, 2012). Mining activities account for the vast majority of economic output in Gauteng and has led to the industrialisation of the province. As a result Gauteng continues to support an influx of humans to the province. Subsequently, the growth rate of the population is far greater than that of the other provinces (Turok, 2012). As previously mentioned in chapter 1 and 2, there are many concerns contributing to the current water situation. Some of which is increased populations, industrialisation and urbanisation. These factors make Gauteng the ideal study area. In view of this, the Gauteng Department of Agriculture and Rural Development (GDARD) was

identified as a key provincial institution. The vision outlined by the GDARD is to economically transform the agricultural sector and provide sustainable environmental management to ensure a healthy, food secure community (Gauteng Department of Agriculture and Rural Development, n.d). It is important to note that provincial government does not play a major role in water resource management, but the outcomes of the study will represent Gauteng in the form of a case study.

To understand the level of understanding or perceptions that lie within implementing institutions, local government was approached. For this reason, municipalities in Gauteng were approached to provide insight in this study (Figure 4). This includes three metropolitans (City of Tshwane Metropolitan Municipality, City of Johannesburg Metropolitan Municipality and Ekurhuleni Metropolitan Municipality) and two district municipalities (Sedibeng District Municipality and West Rand District Municipality). Each District Municipality is further subdivided into local municipalities: three municipalities form part of the Sedibeng District Municipality (Emfuleni Local Municipality, Lesedi Local Municipality and Midvaal Local Municipality) and four municipalities form part of West Rand District Municipality (Merafong City Local Municipality, Mogale City Local Municipality, Randfontein Local Municipality and Westonaria Local Municipality).



Figure 4. Geographical context of Gauteng's District Municipalities

(Source: The Local Government Handbook: A complete guide to municipalities in South Africa. 2012 – 2016. http://www.localgovernment.co.za/provinces/view/3/gauteng)

Now that the institutions from the three-tiered system have been identified, it is important to include the water board servicing the Gauteng area: Rand Water. The vision of Rand Water is "to be a provider of sustainable, universally competitive water and sanitation solutions for Africa" (Rand Water, n.d.). Rand Water's customers include municipalities and industry. Municipalities then supply to consumers in and around Gauteng (Rand Water, n.d.).

The Water Research Commission (WRC) was established in terms of the Water Research Act (Act No. 34 of 1971). The WRC is mandated to stimulate research in water related priorities as a result of the water issues faced by the country.

3.3.2 Description of research materials and data sources

In identifying the institutions forming part of this study, the researcher was then able to identify policies, strategies and participants required for the study.

i. **Selection of Policy Documents**: Legislatively, there are two principle acts that provide governance for water resource management in South Africa: the Water Services Act (WSA_1) and the National Water Act (NWA). Both Acts provide the basis for the legislative framework within which water supply and sanitation services, water resource management and water use takes place. The WSA_1 makes provision for the social dimension through the Free Basic Water Policy, which was instituted to ensure basic access to water. Municipalities who are legally constituted as Water Service Authorities (WSA_2) are responsible for the provisions of the WSA_1. In contrast, the NWA makes provision for fair and equitable access to water resources through its "Schedule 1" water allocations and Water Allocation Reform Policy. In addition to these Acts, there are a number of associated frameworks that contribute to defining the legislative frameworks. In South Africa, the NWRS2 holds merit as a document aimed toward governance in water resource management and sustainable development. Moreover, the NWRS2 addresses various needs, such as urban and rural water dependence and industrial use.

   Looking back at the water related concerns highlighted in Chapters 1 and 2, the need to address water related concerns such as urban and rural water dependence and industrial use is quite high. This is ever so important in a province such as Gauteng where industrial water usage and increased human populations adds pressure to the water resource management arena. Van Koppen and Schreiner (2014) reported that the previous version of the NWRS2 integrated IWRM principles, whereas the current version introduces developmental water resource management as an underlying theme. For this reason it makes the selection of the NWRS2 and IWRM critical in relating governance in water resource management to sustainable development.

A rapid appraisal was undertaken of these four documents. The two Acts provide the structural understanding for governance in water resource management, while the IWRM and NWRS2 provide the governance in water resource management relating to sustainable development. These four documents, then formed the basis for the content analysis.

ii. **Selection of Research Participants**: Participants were drawn from the identified institutions above. In order to identify participants, websites for each of the institutions was consulted. Institutional structures were provided in most cases. For example, national departments such as the DWS, DEA and DAFF provided details for institutional structures, whereas the DMR did not indicate branches and contact details as transparently. These participants were identified based on their involvement in water resource management and includes individuals who roles encompass the following key words:

Technical / management / strategy / policy / operational / research / governance / water allocation / river basin planning / stakeholder participation / pollution control / monitoring / economic and financial management / information management (adapted from Cap-Net UNDP, 2008).

Using information from the structures provided from the websites and the criterion for participants, contact was made with these participants. The study also adopted a snowballing technique. In snowball sampling, participants are selected based on an initial pool of participants who could contribute to the study and through these participants social networks, other participants who are involved in water related concerns were contacted to participate. This particular sampling method works well in attaining the adequate numbers of participants to create a satisfactory understanding of governance in water resource management. According to Bhattarcherjee (2012) the advantage of this method creates a more credible data collection approach. One disadvantage though is that the findings cannot be generalised in other sectors and geographical positioning (Bhattarcherjee,

2012). Using the above-mentioned criterion and the snowballing technique, participants were able to refer the researcher. This resulted in a total number of 40 participants across all institutions. Using this number, participants from the WRC and GDARD were not included in the main analysis and therefore resulted in a total of 36 participants selected for the study.

3.3.3 Data collection tools

Using a single method does not normally provide adequate understanding in social science studies; therefore, using methodological triangulation, various aspects can be explored. Triangulation serves to validate the research outcomes from multiple perspectives. Although there are various types of triangulation, this study makes use of methodological triangulation. Here the researcher utilised structured interviews, content analysis and perception questionnaires to obtain data.

The administration of a standard questionnaire and interview was aimed at reducing time spent by institutional officials when having to respond to the data collection tools. Although the researcher was not readily available to respond to queries, none was received. Possible time constraints from the participants as well as the researcher posed significant constraints on the project time frames and deliverables. In light of this, the use of multiple sources of evidence, specifically content analysis, interviews and questionnaires entrenched the construct of validity in the research, ensuring triangulation of findings and information. This leads to a high level of accuracy between the use of the interview and questionnaire data collection tools. The semi-structured interview was administered together with the questionnaire via electronic tools such as SurveyMonkey.

i. **SurveyMonkey:** SurveyMonkey is an online survey development software company, providing free customisable surveys and simplified surveying processes. SurveyMonkey offers users the option to collect data through the use of the Likert scale and through administered questions. The request to complete the questionnaire and semi-structured interview was sent to the identified participants. Following responses, data was collated and analysed.

ii. **Semi-structured Interview:** In order to understand the governance of water resource management activities, interviews were conducted with institutional frameworks involved in policy design and maintenance. Both the closed-ended (structured) and open-ended (unstructured) research process was used during the interview. It is understandable that the institutions and their participants were busy, therefore, face-to-face interviews were not considered. Personal contact or one-on-one sessions were not viable due to time constraints; therefore, interviews were conducted using convenience and snowball strategies. Essentially, interview questions were designed to probe into participant's understanding, knowledge and perception of water-related concerns to better understand the relationship between institutions.

iii. **Questionnaire:** In order to examine governance in water resource management, a self-completion questionnaire was adopted. These were designed to provide perceptions of participants. The questionnaires were designed such that the researcher is independent of what is being observed, hence promoting the validity of data collected. Theoretical concepts also ensure clarity of definition to enable quantitative analysis of data obtained (See appendix B). The questionnaire was first designed using the six categories to engage with participant perceptions. This includes IWRM, management commitment, stakeholder involvement, policy design evaluation, implementation and policy evaluation. According to Maxwell (2008), this approach of categorisation may lead to "*neglect of contextual relationships*", therefore the research adopted the questionnaire as a simple perception survey. This has been used to represent the perception around governance in water resource management promoting sustainable development. The creation of the Likert scaling questionnaire involved the following steps (Boynton and Greenhalgh, 2004):

    i. Understanding and identifying key subcategories for sustainable measures taken: IWRM, management commitment, stakeholder involvement, policy design evaluation, implementation and policy evaluation;

ii. Devising statements to measure strengths and weaknesses as well as the degree of sustainability during policy-making;
iii. Appropriately categorising the questions into the 1-5 Likert scale into words expressing the degree of opinions (1=Strongly disagree; 2=Disagree; 3=Neutral; 4=Agree; and 5=Strongly agree).

3.3.4 Data analysis

On completion of gathering data, the data was analysed with the purpose to interpret and identify common trends. This chapter illustrated the methods and procedures employed in order to capture and analyse the results such that reliable and valid results are obtained. The chosen mixed method approach combined a method of triangulation and therefore follows a three pronged analysis approach. The first is outlined below, followed by the introduction of the Institutional Analysis and Development (IAD) framework.

i. **Content Analysis:** Content analysis was used to analyse the documents previously identified. Content analysis was used mainly to understand the contexts of the institutional features. By using content analysis, data was collected by systematically analysing policy content and legislative mandate in the various institutions. Documents were analysed to primarily determine the extent of alignment between institutions. Although content analysis is a valid research tool, triangulation using questionnaires and interviews served to validate findings due to limitations of content analysis. Content analysis is very descriptive and does not necessarily highlight underlying issues for observed patterns, however does support observed patterns. Ultimately, by examining the NWA, WSA_1, IWRM and NWRS2, the researcher is able to look at trends, patterns and consistency related to governance in water resource management as well as to observed patterns outlined by participant perceptions.

Semi-structured Interview: Semi-structured interview responses were examined using open coding, an aspect of the grounded theory approach. All

data received was recorded and transcribed. Open coding allowed the researcher to breakdown, examine, conceptualise and categorise raw data. Using this approach, categories were developed based on the participant's perceptions which built on a multi-dimensional preliminary framework for further analysis.

ii. **Questionnaire:** The Likert scale uses anchored points of coding (Nel, 2004). According to Boynton and Greenhalgh (2004) this form of rating scale is best for participants who can conceptualise linear scales and numerical values, while generating data for non-parametric statistical analysis.

Qualitative research methods include a categorising strategy, a connecting strategy and a memos and display strategy. In a categorising strategy, data is broken down and rearranged into themes (Strauss, 1987). A connecting strategy approach is an attempt to understand relationships without breaking it down. A memos and display approach presents data in a holistic manner (Maxwell, 2008). For the purpose of this study a connecting strategy was adopted and data was analysed using Microsoft Excel.

Delivery of questionnaires was via email and although a higher response rate was expected due to ease of administration, fewer responses than anticipated were received. The questionnaire results of participants' perceptions in the following sub-categories were coded onto an Excel spread sheet and analysed using descriptive analysis tools:

i. IWRM;
ii. Management commitment;
iii. Stakeholder involvement;
iv. Policy design evaluation;
v. Implementation; and
vi. Policy evaluation.

The quantitative data was analysed using SPSS. Likert scale data was represented in the form of percentage bar graphs. Neutral responses were anticipated and this can be expressed for a number of reasons. Participants

may show hesitance over expressing positive or negative opinions. A study conducted by Bishop (1987) suggests that participants responses gravitate toward neutral because they want to avoid negative feelings associated with conflicting issues. Alternatively, it could be 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 (Krosnik et al. 2002). Krosnik et al. (2002) also suggest that neutral responses are influenced by social desirability where participants may be reluctant to voice undesirable opinions. Arguing the neutral response option, Alwin and Krosnik (1991) and Bradburn et al. (2004) suggests that it enables respondents to express neutrality, preventing random responses where a participant may express no attitude.

iii. **Institutional Analysis and Development Framework:** In understanding institutional and policy frameworks, it is important to note that there are various tools that can be adopted for analysis. World Bank (2007) presents this variety in the form of Tools for Institutional, Political and Social Analysis (TIPS). There are three basic levels of analysis that is applied in TIPS. The first level is the macro-level which is designed for analysis within the context of the country as well as reform. The second level is the meso-level which is designed for analysis of policy implementation and operates within the realm of stakeholder and institutional analysis. The third level of analysis is the micro-level, which identifies the impact of policy reform by looking at analytical frameworks at implementation level and entails physical data collection. While this research does analyse elements of behaviour at national level, exploration of the how, why and what conditions are sought. For this reason, this study operates in the meso-level to provide greater understanding of the underlying features in policy implementation. In essence, this contributes toward detailing perspectives on governance frameworks in sustainable policy development. At meso-level, analysis is further subdivided into meso-stakeholder analysis and meso-institutional analysis. Both levels are designed to test assumptions; however the meso-stakeholder analysis tests interests of social actors while the meso-institutional level tests social rules governing implementation of policy.

To effectively analyse relationships at meso-institutional level the IAD framework has been applied. The framework was used to depict governance in water resource management using Common Pool Resourcing (CPR) (Polski and Ostrom, 1999). This approach explains how actors interact with an array of factors from political, social, physical and environmental issues. Before adopting the IAD framework as an analysis tool, the researcher first presents the IAD framework depicting its origin and application.

Due to the inherent difficulty of examining institutions and the invisible elements of policy making, Ostrom (2007; 2010; 2011) developed the IAD framework. It is used to provide an understanding of institutional arrangements by organising policy analysis activities and allows analysts to comprehend complex social situations and by providing foresight to issues that would lead to policy failures (Polski and Ostrom, 1999).

Figure 5 provides a schematic of the framework. The action arena is where most of the analysis takes place and is where the situation and actors/participants are examined (Polski and Ostrom, 1999). Firstly, behavioural influences from the physical and material conditions, community attributes and rules-in-use are identified. Thereafter, patterns of interactions are evaluated and the outcomes are assessed. The following provides an outline for the three principles analysed in the action arena:

i. Physical conditions refer to issues identified within the management of the institution. Issues in water resource management are intertwined with governance; it is, therefore, important to understand the core operations of each institution;

ii. Community attributes provides the socio-economic overview by incorporating local situations; and

iii. Rules in use incorporate norms, strategies and frameworks to understand co-governance amongst institutions (Ostrom, 2011).

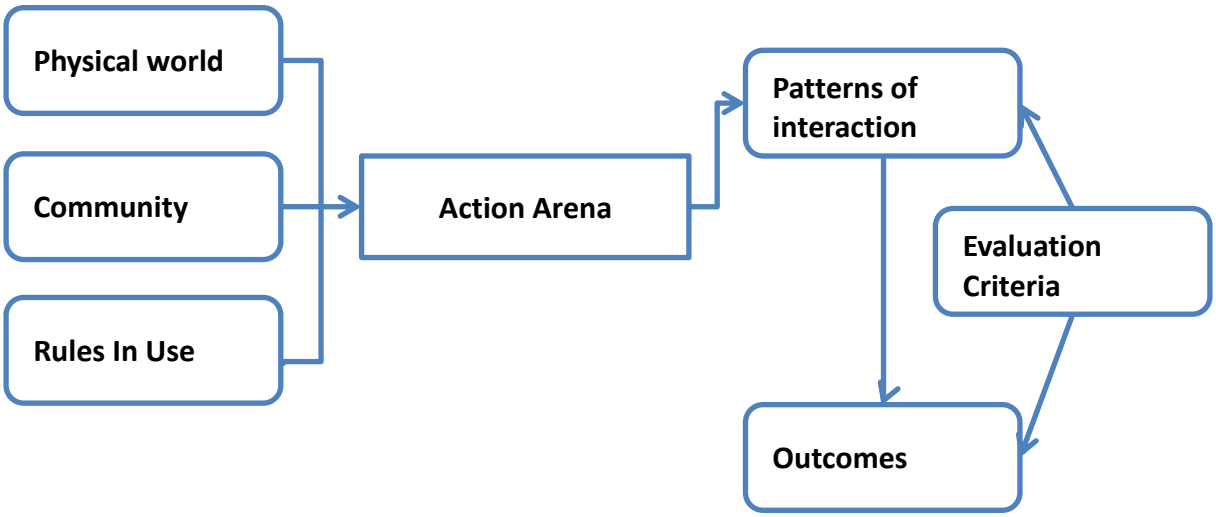


Figure 5: Institutional Analysis and Development Framework

(Source: Adapted from Ostrom, 2011)

Due to the complexity of responsibilities within institutional arrangements, this approach allows for the investigation of embedded cultural, political and economic interests comfortably (Ostrom, 2007; Muller, 2012). Muller (2012) added that in the South African context, CPR should be managed in terms of "common property regimes" for analysts with an interest in sustaining water. This refers to a particular social arrangement regulating the preservation, maintenance and consumption of a CPR. The governance of CPR is notably coordinated by common property regimes, in which Muller (2012) supports Ostrom's approach, idealising it as one that can develop countries onto sustainable water resource management paths.

The IAD framework is particularly useful for analysing complicated procedures such as the interconnectedness of an institutional structure. It is important that the research process allows for the analysis of the interrelationship and interconnectedness or interdependency. It does this through depicting the interactive development between the participants and the conditions within the action arena (Ostrom, 2011). The CPR has

informed many studies of self-governing institutions and contributed to understanding alternative institutions beyond institutional policy.

It is important to understand how this form of institutional analysis relates to water resource management. As such, institutional design consists of the constitutional, collective-action and operational levels, relating to an interconnected hierarchy (Ostom, 2007). Muller (2009) argues that water resource management boundaries do not overlap with political boundaries and water is, therefore managed through polycentric governance. Although various levels within one institution have control over the governance of water, and though there are many tiers in government, water is still a CPR utilised by industries managed by their respective institutions. The IAD framework is suitable for the study because it has the capability to analyse multiple actors and the behavioural influences (physical, community and rules-in-use) prompts analysis in sustainable elements such as social and physical environments.

A significant focus of this study is to understand the contextual operations during policy development between the institutions; the seven rules-in-use have been unpacked to assess the outcomes comparatively (Table 4).

Table 4: Applying rules-in-use

Rules-in-use (theoretical)	Rules-in-use (in action arena)
Boundary	The set of participants
Position	The specific positions to be filled by participants
Scope	The set of allowable actions and their linkages to outcomes
Aggregation	The level of control
Authority	The potential outcomes
Information	Information rules
Payoff	Payoff rules

(Source: Adapted from Ostrom, 2007)

3.4 Methodological Reflections

Various methodological reflections existed which will be discussed here. The first is the constraints placed on the study due to the nature of work. It was expected that institutions may not make themselves available due to the nature of the research and if participants are available, the resultant data may be biased toward institutions. Cleverly structured questionnaires and interviews were developed in the hope to eliminate any biased inclinations. Although outcomes may produce variable results between participants, Boynton and Greenhalgh (2004) argue that reliable questionnaires produce consistent results through repeated samples or use by different researchers, while variability arises from differences in participants. The study necessitated engaging with these individuals, however, it should be noted that these types of participants are typically characterised by lower response rates (Baruch, 1999).

The second is that, the researcher was faced with time constraints and balanced working while studying. Work entails late and long hours that led to time constraints, making persistent follow-ups with participants difficult. Moreover, when follow-ups were made, it was met with annoyance and delays. Time constraints were encountered when analysing the data as the volume of data is generally high in qualitative research methods. A challenge incurred at the start of this research was encountered when seeking ethical clearance from institutions. Firstly, national institutions were apprehensive and secondly, ethical clearance was only received after months of persistent calls and emails (Table 5).

Table 5. Number of Days taken to provide permission

Department	Delay in permission
Department of Environmental Affairs	15 days
Department of Water and Sanitation	26 days
Department of Agriculture, Forestry and Fisheries	69 days
Department of Mineral Resources	115 days

(Source: Authors representation, 2016).

Response times by the different institutions varied considerably. While the DEA responded before the institution mandated with water governance (DWS) both the DEA and DWS provided ethical clearance within a month as compared to the DAFF and the DMR. Obtaining ethical clearance from the departments introduced time constraints on the project as data collection could only commence once ethical clearance was obtained. Despite numerous calls and electronic correspondence ethical clearance added major time constraints.

The third methodological reflection is that participant's responses could not be completely assumed as representative of the institution they belonged to. Varying responses were received from participants in the DWS and is highly distinguishable between management and technical staff.

The fourth and most significant methodological reflection arose when the researcher only received 13 responses in the initial data collection. Following this, more persistent and rigorous effort was made to increase the number of responses received. This meant increasing the sample population in terms of institutions and focus was removed from national and extended to other tiers of the South African government as well as Rand Water.

CHAPTER IV
EMPIRICAL EVIDENCE

4.1 Introduction

This chapter is dedicated to the presentation of empirical data collected. Empirical evidence in this case means data that has emerged from the research. It is structured in two main sections. The first of which is the evaluation of policies relating to governance in water resource management. This is represented in the form of trends, contrasts and ideologies arising from these documents. The second section represents the views of participants in the form of data gathered from the questionnaire and semi-structured interviews.

4.2 Review of documentary policies and strategies

The water sector is primarily governed by the Department of Water and Sanitation (DWS), which in turn is informed by the National Water Act (NWA) and the Water Services Act (WSA_1). The DWS is also governed by national strategic objectives, governance and regulatory frameworks that provide an environment for effective governance. The DWS operates at a national, provincial and local level across the various stages of the water cycle from water resource management to the distribution of potable water to the collection and treatment of waste water. The DWS, however, does not execute these functions and assigns the functions to the appropriate water sector partners. South Africa's large dams and related infrastructure are owned by the DWS and it is also the responsibility of the DWS to plan and implement future water resource development projects.

The dynamic arrangement of partnerships includes the management of water by water boards and municipalities. Provisioning of potable water is the responsibility of Water Services Authorities (WSA_2) and Water Service Providers (WSP) operating in their jurisdiction. Within each catchment area, water resource management functions have been delegated to Catchment Management Agencies (CMAs). Regulation of water resources is conducted through appropriate policy implementation and is monitored accordingly through the nine provinces.

Management of water resources is currently divided into CMAs. The NWA designates water as a national resource when there are inter-linking catchments. Two Water Management Areas (WMAs) are not linked to another management area and therefore poses difficulties in alignment of water resource management.

4.2.1 Water Policies and Frameworks

In this section, the National Water Resource Strategy (NWRS2) was analysed together with key and relevant acts, such as the NWA and WSA_1. This entailed a comprehensive review of these documents, identifying strengths and weaknesses as well as relating these to the Integrated Water Resource Management (IWRM). The overall understanding that was sought in this section was to understand how issues of management and governance are structured. Within the South African context, there are a number of policies that exist that could be applied, however, as previously mentioned the IWRM, NWRS2, NWA and WSA_1 were engaged with to provide understanding.

The first document engaged with was the IWRM. The IWRM framework is recognised as a strategy that promotes the coordinated development and management of water, land and related resources in an equitable manner to ensure the resultant economic and social welfare, without compromising the sustainability of vital ecosystems (Anzaldi et.al, 2014; Bindra et.al., 2014; Hassing et.al, 2009; Higa Eda and Chen, 2010). The IWRM framework is a process of development and implementation of planning and management strategies. Development is founded on three principles: social equity, economic efficiency and ecological sustainability, while implementation involves participation from various disciplines and knowledge from stakeholders to devise and implement efficient, equitable and sustainable solutions to water resource management issues. As a resource, water has a multitude of uses and users; therefore the IWRM adopts a cross-sectoral approach. In essence, the IWRM focuses on avoiding fragmented water resource management through ensuring the efficiency of the enabling environment, effective management of roles and responsibilities and through management instruments. The IWRM presents opportunities to provide long-term solutions in seeking a paradigmatic shift in water resource management systems.

As a consequence of conflicting views of water resource management an IWRM framework was adopted to accommodate sustainable social, economic and environmental development (van Koppen and Schreiner, 2013). Despite embracing the IWRM, governance and implementation of the system is still progressive (van Koppen and Schreiner, 2014; Colvin et.al., 2008). Galvin et.al. (2015) argues that capacity building and institutional development in the IWRM is lacking.

The IWRM is ultimately a process of managing resources in a manner that is environmentally sustainable while ensuring a participatory approach. The concept of the IWRM is based on principles that incorporate the three pillars of sustainability. In addition, it is a concept that encourages a holistic approach while considering a bottom-up and top-down approach on issues.

The second document reviewed was the NWRS2. The NWRS2 was developed by the DWS to ensure that water resources are protected, used, developed, conserved, managed and controlled in a sustainable manner that provides equitable growth. Accordingly, the NWRS2 reflects principles of the IWRM such as equity, environmental sustainability and efficiency (van Koppen and Schreiner, 2014). The NWRS2 states that South Africa is a water-stressed country and is facing water challenges which include supply and demand, environmental degradation, resource pollution and inefficient water usage. The NWRS2 also alludes to potential water sources, which include water reuse, desalination, groundwater utilisation, water conservation and water demand management measures, rain water harvesting and water recovery from polluted water. The strategy aims to achieve its objectives through the use of various programmes, one of which is the water allocation reform programme.

Water policy management, implementation and maintenance require competent and accountable governance structures. To this extent the NWRS2 outlines institutional arrangements which serve to provide a developmental management style that considers stakeholders. Since the development of the first NWRS (2004) and the NWRS2 (2013), little progress had been made in terms of water conservation and demand, appropriate institutional arrangements and regulation.

There are two separate legal frameworks that govern the water sector; these are the WSA[1] and the NWA. These acts have established a dual structure of water resource management. The WSA[1] makes provision for the supply and sanitation of water and is vested with local government, while the management and protection of water resources falls within the domain of the DWS. Table 6 and Table 7 depict sections extrapolated from the WSA[1] and NWA, respectively, where the term sustainable and sustainability was used. Although sustainability is widely used terminology, a definition is not provided for in both the WSA[1] and NWA.

Table 6: Contextualising the use of "sustainable" and "sustainability" in the WSA[1]

	Sustainab-le/ility
Water Services Act, Act No. 108 of 1997	**Preamble -** Acknowledges: Duty on all spheres of government to ensure that water supply and sanitation services are provided in a manner that is efficient, equitable and sustainable
	Preamble - Acknowledges: Duty on all spheres of government to strive to provide water supply and sanitation services sufficient for subsistence and sustainable economic activity
	Section 9(1)(c) - Standards: the ministry may prescribe compulsory national standards relating to the effective and sustainable use of water resources for water services
	Section 9(1)(d) - Standards: The ministry may prescribe compulsory national standards relating to the nature, operation, sustainability, operational efficiency and economic viability of water services
	Section 10(3)(c) - Norms and Standards for tariffs: The ministry may prescribe compulsory norms and standards in respect of tariffs and must consider financial sustainability of water services in the geographic area in question
	Section 11(1) - Water Service Authorities (Duty to provide access to water services):Role of WSA[1] to consumers is to progressively ensure efficient, affordable, economical and sustainable access to water services
	Section 19(5)(c)(i) - Contracts and joint ventures with water service providers: Joint ventures between the WSA[1] and water service institutions should ensure that water services are provided on an efficient, equitable, cost-effective and sustainable basis
	Section 25(1)- Duties of water service intermediaries: Water service intermediaries

	Sustainab-le/ility
	are to comply with minimum standards prescribed by the minister and the WSA[1] with regard to quality, quantity and sustainability of water services provided.
	Section 24(1)(a) -Parameters for functions of water boards: Water boards should achieve a balance between striving to provide efficient, reliable and sustainable water services

(Source: Authors representation using information derived from the Water Services Act, Act 108 of 1997)

The NWA makes provision for water to be protected, utilised, developed, conserved, managed and controlled in a sustainable and equitable manner.

Table 7: Contextualising the use of "sustainable" and "sustainability" in the NWA

	Sustainab-le/ility
National Water Act, Act No.36 of 1998	**Preamble -** Recognises: Aim of water resource management is to achieve the sustainable use of water for the benefit of all users
	Preamble - Recognises: The protection of the quality of water resources is necessary to ensure sustainability of water resources in the interest of all end users
	Chapter 1 - Interpretation and fundamental principles: Sustainability and equity are identified as central guiding principles in the protection, use, development, conservation, management and control of water resources
	Definitions - Protection: One aspect includes the maintenance of water quality such that it can be used in an ecologically sustainable way
	Definitions - Reserve: means the quantity and quality of water required to protect aquatic systems in order to secure ecologically sustainable development and the use of the relevant water resource
	2(d) - Purpose of the act: Promotion of efficient, sustainable and beneficial use of water in the public interest
	3(1) - Public trusteeship of nations water resources: National government through the minister must ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner
	26(4)(a) - Regulations on use of water: During policy development the minister must consider the promotion of economic and sustainable use of water
	140(a) – Objectives of national information systems: To store and provide data and

	Sustainab-le/ility
	information for the protection, sustainable use and management of water resources
	1(2)(b)Part 1: Governing board – Governing board: To ensure that the institution exercise its powers and performs it duties in a proper, efficient, economical and sustainable manner

(Source: Authors representation using information derived from the National Water Act, Act No. 36 of 1998)

Despite the ambiguity in defining sustainability, the NWA does however declare the need for integrated management of water resources (Bauer and Scholz, 2015).

4.2.2 Synthesis of policy frameworks

In terms of the Constitution the management of water resources is an exclusive national competency. As such the NWA mandates the Minister of Water and Sanitation to ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons (De la Harpe and Ramsden, 2006). A key principle envisaged with this act is that it strives to ensure the right mix between economic growth, social equity and environmental sustainability (Walter et.al.2011).

In order to understand the legislative procedures that govern sustainable water resource management, it is important to begin with the root of the South African law, the Constitution. The constitution is well recognised, however, legislation is also open to interpretation. According to Galvin et al. (2015) implementation has been 'uneven, inconsistent and often inadequate'. Legislation and subsequently well-developed policies do not necessarily ensure compliance as well as maintenance of sustainable water resource management plans. The Constitution reflects the foundation for which subsequent water policies and legislation is developed. The NWA is based on the principles ensuring sustainability, however, since the World Summit on Sustainable Development held in 2002, South Africa is still faced with governance issues (Siebrits et al. 2014; Meissner, 2013; Ewarts, 2011). It is often assumed that if legislations are strictly enforced, a well governed water sector would be distinguished. However, stricter legislation does not

contribute to compliant and sustainable policy frameworks across institutional sectors. Conversely, it can be said that progressive policy thinking demands strategic approaches to implementation.

In light of the above, it can be deduced that South Africa has an impressive constitutional framework; however, since the implementation of the IWRM improvements toward a sustainable water resource management systems have not been successful (Galvin et.al., 2015). By investigating the current policy frameworks applied within institutional operating systems the study ascertains current gaps in policy implementation and maintenance. Insight is gained into the operations between the identified institutions through communications and policy implementation.

4.3 Review of participant perceptions

In order to understand the perceptions of participants employed at the various institutions, a self-completion questionnaire and semi-structured interview was adopted. One of the key issues important for this study was studying the interconnectedness of institutions involved with governance of water resource management. To this extent, the structural functionalist perspective was adopted as this concept illuminates the understanding that an operating system contains an array of interconnected parts that work together to maintain a state of sustainable functioning (Mooney et.al., 2013). Using this concept alludes to how each part influences and is influenced by other parts.

Table 8 and Figure 6 represent the overall response rate by participants from their respective participating institutions. National government contributed to 58 % of the response rate with the DMR, DAFF, DEA and DWS contributing to 13 %, 17 %, 35 % and 52 % of the total national response rate, respectively.

Please see appendix D for the questionnaire and semi-structured interview. The questionnaire consisted of 40 statements which participants were required to

choose an answer between strongly agree, agree, neutral, disagree and strongly disagree.

Table 8. Overall Response Rate

Institution	Number Responses
National Government	23
Local Government	9
Rand Water	4
Supplementary Institutions	**Number Responses**
Water Research Commission	3
Provincial Government	1
TOTAL	**40**

(Source: Authors representation, 2016)

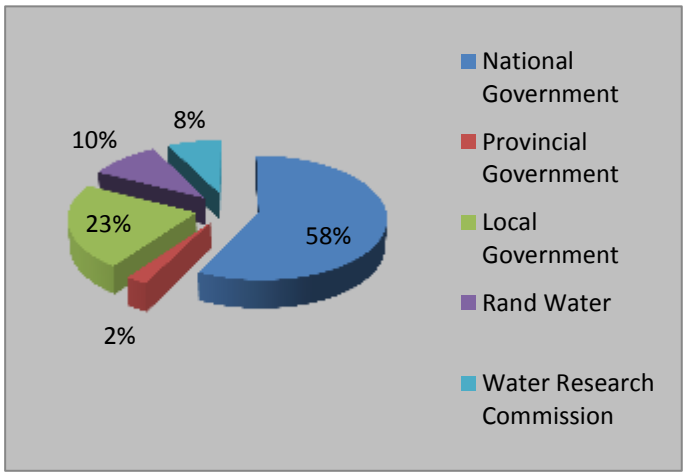


Figure 6: Summary of Institutional Responses

(Source: Authors representation, 2016)

Results, from these institutions were transcribed to portray feedback on understanding the gaps that may exist in institutional and policy frameworks, understanding positive mechanisms that could be pursued and finally understanding governance mechanisms that could be adopted to promote sustainable water resource management.

As discussed in chapter 3, descriptive analysis was conducted for the coded Likert questionnaire (see Appendix E and F). Each sub-category was further analysed to understand alignment between participants and institutions in water resource management. The validated percentage is calculated for each question and was tabulated for each sub-category. Validated percentages provide an overall understanding of where on the Likert scale dominant answers feature. For each question, a total of forty (40) respondents provided feedback. Using the following calculation a validation percentage was achieved:

$$\frac{Total\ number\ of\ responses\ per\ Likert\ Class}{Total\ responses\ per\ question} * 100$$

where, Likert class refers to strongly agree, agree, neutral, disagree and strongly disagree.

The neutrality of participants was calculated using the average percentage for each sub-category (See Appendix F for coded data) using the following formula:

$$\frac{(Sum\ of\ Validated\ Percentages\ per\ subcategory)/}{(Total\ number\ of\ questions\ per\ subcategory)}$$

A considerable amount of neutrality was shown in responses representing all spheres and institutions approached (Table 9). This could be resultant from participants hesitance to objectively express their perceptions regarding the topic or lack of knowledge or accessibility to the level of information handling management commitment and policy design evaluation.

Table 9. Neutrality between sub-categories (%)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
IWRM	52	22	**11**	10	4
Management Commitment	17	45	**21**	14	3
Stakeholder Relationships	19	40	**19**	20	2
Policy Design Evaluation	17	39	**29**	13	2
Implementation	6	41	**22**	25	7
Policy Evaluation	16	42	**23**	18	1

(Source: Survey results)

The highest degree of neutrality was seen with the sub-category policy design evaluation, indicating that 30 % of participants were either unsure or had a lack of knowledge in answering this sub-category. High degrees of neutrality were also

seen in the management commitment, stakeholder relationships, implementation and policy evaluation sub-categories. For the sub-category looking at the IWRM principles, participants showed the least amount of neutrality. By providing a neutral response option, this allowed participants with little or no subject matter on a particular statement to provide a response rather than skewing the responses for strongly agree or strongly disagree.

Responses resulting from the semi-structured interview questions were consolidated and grouped (see Figure 7). Participants expressed strong feedback when providing answers for improving policy implementation and enforcement as well as promoting effective governance to achieve water resource management.

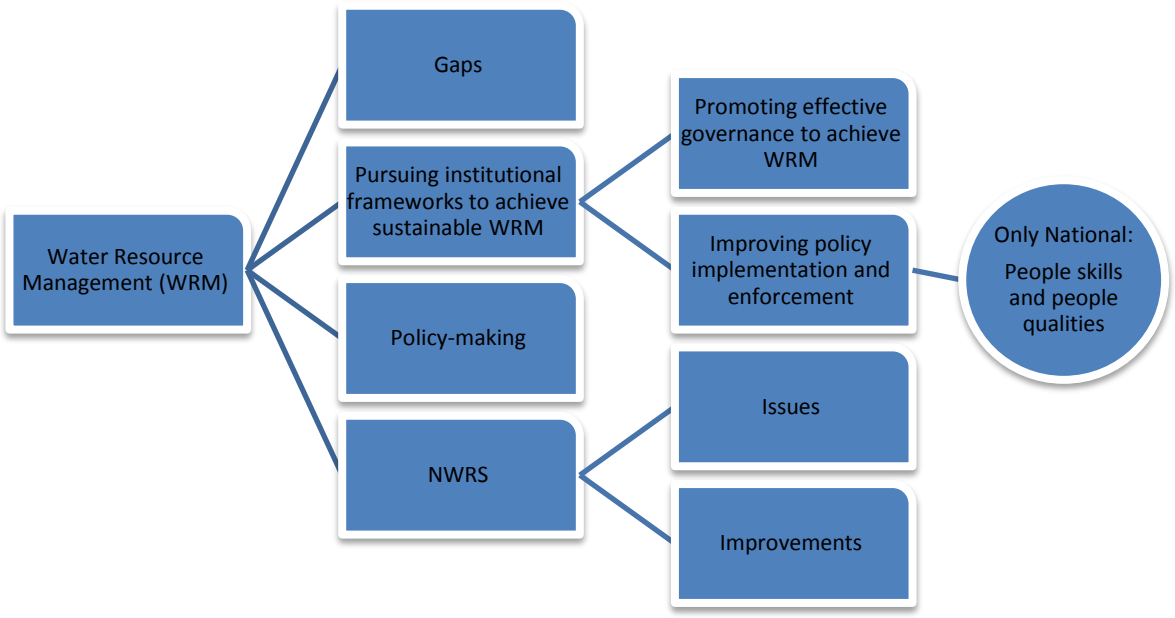


Figure 7. Groupings for coding interview responses

(Source: Authors representation, 2016)

The subsequent sections explore the responses made by participants in relation to the main sub-categories of the questionnaire. Also integrated in the presentation of data arising from the questionnaire are responses to the semi-structured interviews.

4.3.1 Awareness of the IWRM Principles

To engage with participant perceptions relating to IWRM principles, statement as seen in Table 10 were posed.

Table 10. Questionnaire statement engaging IWRM principles

	IWRM Principles
Q1	Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
Q2	Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
Q3	Women play a central part in the provision, management and safeguarding of water
Q4	Water has an economic value in all its competing uses and should be recognised as an economic good
Q5	All people have a basic right of access to water that is of adequate quantity and quality
Q6	Current water resource management plans undermine environmental and ecological sustainability
Q7	Economic allocations considers water scarcity

(Source: Survey results)

According to participants at national, local and water board (Rand Water) level, the overall perception was that water resource management should be based on a participatory approach (Q2). The consensus regarding water resource management being a participatory approach was unanimous as seen Figure 8. Participants perceive the two major areas of concern in this theme. For the first area of concern, participant's perceptions regarding water resource management plans undermining environmental and ecological sustainability resulted in a sample variance of 1.4 (See Table 11). For the second area of concern, participant's perceptions resulted in a negative response when responding to the statement "economic allocations consider water scarcity". Despite water being documented to be a scarce resource,

national government, local government and Rand Water all allude to concerns in economic allocations to combat water scarcity with the majority of participants falling into either the remaining neutral percentile or falling in the in the disagree percentile (Table 11).

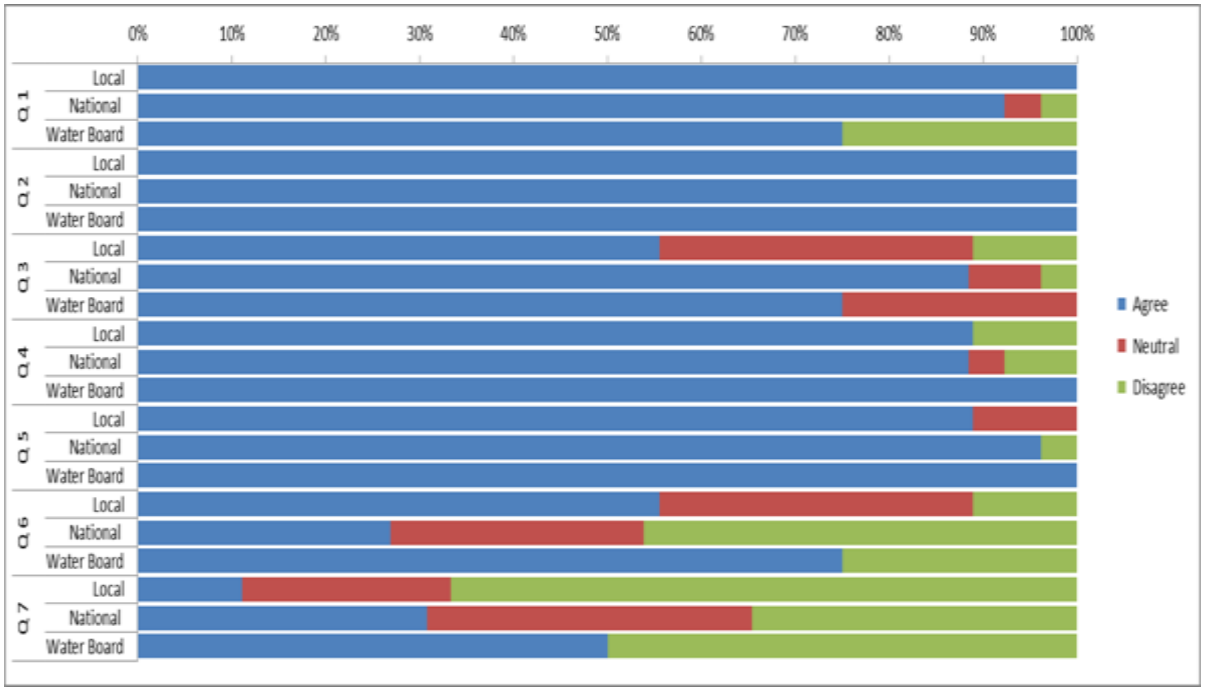


Figure 8. Perceptions summary of IWRM

(Source: Survey results)

Table 11. SPSS representation of participant perception across tiers (IWRM principles)

	Mean	Standard Error	Median	Mode	Standard Deviation	Sample Variance	Kurtosis	Skewness
Q1	4.7	0.1	5.0	5.0	0.7	0.5	8.1	-2.9
Q2	4.7	0.1	5.0	5.0	0.4	0.2	-0.7	-1.2
Q3	4.1	0.2	4.0	4.0	1.0	1.0	2.6	-1.4
Q4	4.6	0.1	5.0	5.0	0.8	0.7	4.5	-2.3
Q5	4.7	0.1	5.0	5.0	0.9	0.9	10.6	-3.2
Q6	3.1	0.2	3.0	4.0	1.2	1.4	-0.8	-0.1
Q7	2.7	0.1	3.0	2.0	1.0	0.9	-1.1	0.0

(Source: Survey results)

As represented in Figure 8 (Q1) participants acknowledge that water is a finite and vulnerable resource. Interestingly, participants expressed mixed responses when responding to “Women play a central part in the provision, management and safeguarding of water”, as well as when responding to “Current water resource management plans undermine environmental and ecological sustainability”, represented with standard deviations of 1.0 and 1.2, respectively.

4.3.2 Institutional Commitment and Relationships

To engage with participant perceptions relating to management commitment and stakeholder relationships, statement as seen in Table 12Table 10 were posed.

Table 12. Questionnaire statement engaging management commitment and stakeholder relationships

	Management Commitment
Q8	Management drives and supports water resource management initiatives
Q9	My institution promotes sustainable best practices
Q10	My institution has policies that adopts sustainable development
Q11	Management budgets for incorporation of sustainable best practices
Q12	Management involves relevant stakeholders during policy development
Q13	Regulatory compliance is always maintained
Q14	We seek objectives for continuous sustainable water resource management
Q15	Management incorporates environmental performance in reports
Q16	Audits are frequently conducted on implementation and maintenance of policies
Q17	There is investment on water issues
	Stakeholder Relationships
Q18	We actively communicate policies with all spheres of government and public
Q19	Policies regarding sustainable water resource management are aligned to

	legislation
Q20	Policies regarding sustainable water resource management are aligned at all spheres of government
Q21	Training has been provided for all policies
Q22	Mandated stakeholders are regularly audited
Q23	Sustainable development has been clearly outlined in my institution
Q24	Sustainable water resource management is a priority
Q25	We have the necessary expertise to implement and maintain policies
Q26	I understand my role in policy development

(Source: Survey results)

Overall, a high degree of variability is seen regarding management commitments at all institutions (Figure 9). A number of neutral and negative responses were received across all tiers. The most frequently occurring response for all management commitment statements was agree and not strongly agree. However, participants from Rand Water responded positively to “My institution promotes sustainable best practices” (Q9), “Management involves relevant stakeholders during policy development” (Q12), “Management incorporates environmental performance in reports” (Q15) and “Audits are frequently conducted on implementation and maintenance of policies” (Q16). Contrary to Rand Water’s response, only a few participants responded negatively, at national and local levels. Participants at local level demonstrated higher negative responses to Q9, Q12, Q15 and Q16, representing 33 %, 22 %, 11 % and 33 % of negative responses, respectively. A number of these were also neutral responses, making the total of neutral and disagree for Q9, Q12, Q15 and Q16, 44 %, 66 %, 33 % and 44 %.

Of significant importance is the statement “Regulatory compliance is always maintained” which is represented negatively by participants (See Table 13, Q13).



Figure 9. Perceptions summary of management commitment

(Source: Survey results)

Table 13. SPSS representation of participant perception across tiers (management commitment and stakeholder relationships)

	Mean	Standard Error	Median	Mode	Standard Deviation	Sample Variance	Kurtosis	Skewness
	Management Commitment							
Q8	3.2	0.2	4.0	4.0	1.2	1.3	-0.9	-0.4
Q9	3.9	0.2	4.0	4.0	1.0	1.0	2.1	-1.3
Q10	4.0	0.1	4.0	4.0	0.9	0.8	-0.5	-0.5
Q11	3.4	0.1	4.0	4.0	0.9	0.8	-0.8	-0.2
Q12	3.9	0.1	4.0	4.0	0.9	0.8	0.1	-0.7
Q13	3.0	0.2	3.0	2.0	1.1	1.3	-0.9	0.0
Q14	3.9	0.1	4.0	4.0	0.8	0.7	-0.3	-0.4
Q15	3.8	0.1	4.0	4.0	0.9	0.8	1.0	-0.7
Q16	3.5	0.2	4.0	4.0	1.0	1.1	-0.7	-0.5
Q17	3.6	0.1	4.0	4.0	0.9	0.8	-0.3	-0.6
	Stakeholder Relationships							
Q18	3.7	0.1	4.0	4.0	0.9	0.9	-0.4	-0.6
Q19	4.0	0.1	4.0	4.0	0.8	0.6	0.1	-0.5
Q20	3.3	0.2	4.0	4.0	1.1	1.3	-1.1	-0.2
Q21	2.7	0.1	2.0	2.0	0.9	0.9	-0.5	0.5

Q22	2.9	0.1	3.0	3.0	0.9	0.9	-0.5	0.3
Q23	3.5	0.2	4.0	4.0	1.0	1.0	-1.0	-0.3
Q24	4.1	0.1	4.0	4.0	0.9	0.8	-0.1	-0.8
Q25	3.6	0.2	4.0	4.0	1.2	1.4	-0.5	-0.7
Q26	4.4	0.1	4.0	5.0	0.6	0.4	-0.5	-0.6

(Source: Survey results)

Some participants expressed the belief that training has not been provided for all policies developed (See Table 13, Q21). Responses for Q21 were mostly negative and the same response is viewed across all tiers (see Figure 10, Q21). Another frequently occurring response of significance was when answering the statement "Mandated stakeholders are regularly audited". Responses across all tiers were found to be mostly neutral for Q22.

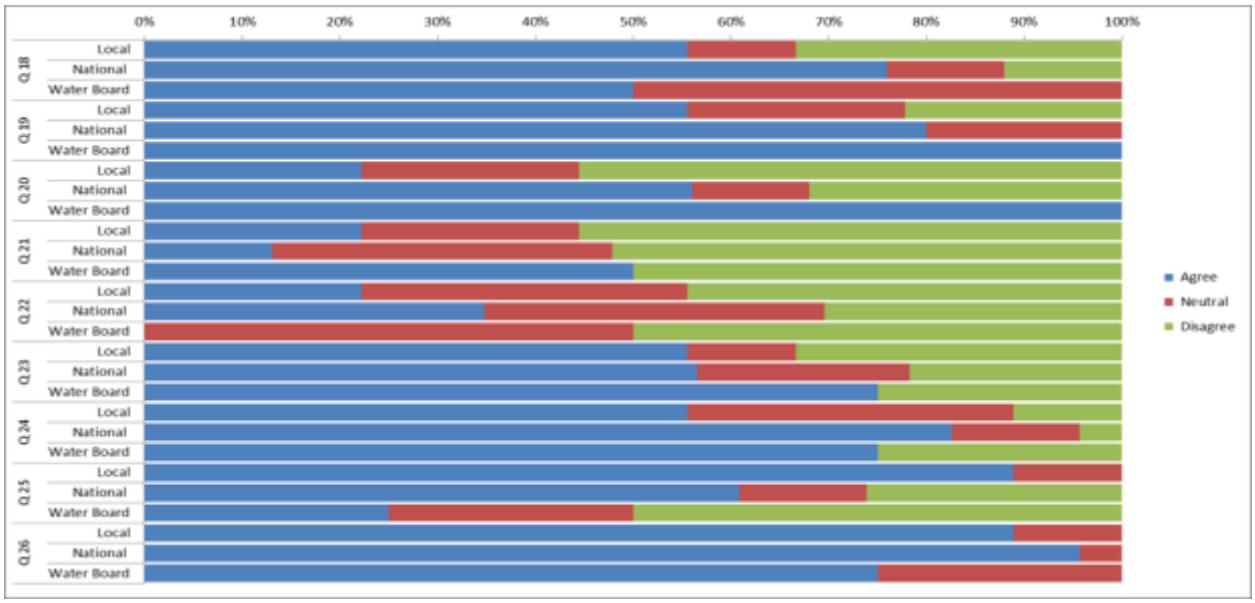


Figure 10. Perceptions summary of stakeholder relationships

(Source: Survey results)

4.3.3 Policy Design, Implementation and Policy Evaluation

To engage with participant perceptions relating to policy design, implementation and policy evaluation, statements as seen in Table 14 were posed.

Table 14. Questionnaire statement engaging policy design, implementation and policy evaluation

	Policy Design
Q27	There is willingness to design environmental/water resource policies
Q28	A committee was established for policy-making
Q29	A situation analysis was conducted during policy-making
Q30	Access to information was readily available to make informed decisions
Q31	There are minuted discussions around policy-making
Q32	Representatives from all spheres of government were present during environmental/water resource policy-making
	Implementation
Q33	Policies are easy to interpret
Q34	Dedicated resources ensure policy implementation
Q35	There is sufficient human and financial resources to coordinate policy implementation
Q36	Policies are appropriately communicated to stakeholders
	Policy Evaluation
Q37	Environmental/water resource policies show stability and reliability
Q38	Environmental/water resource policies are relevant and significant to my job
Q39	Environmental/water resource policies are effective and efficient in maintaining sustainability
Q40	Environmental/water resource policies consider all aspects I feel are relevant

(Source: Survey results)

Participants across all tiers expressed positivity when responding to the statement "There is willingness to design environmental/water resource policies" (Q27). This positive response is represented by 78 %, 67 % and 75 % at national, local and water board levels, respectively.

When responding to "Representatives from all spheres of government were present during environmental/water resource policy-making" (Q32), a great deal of neutrality was expressed by respondents across all tiers.

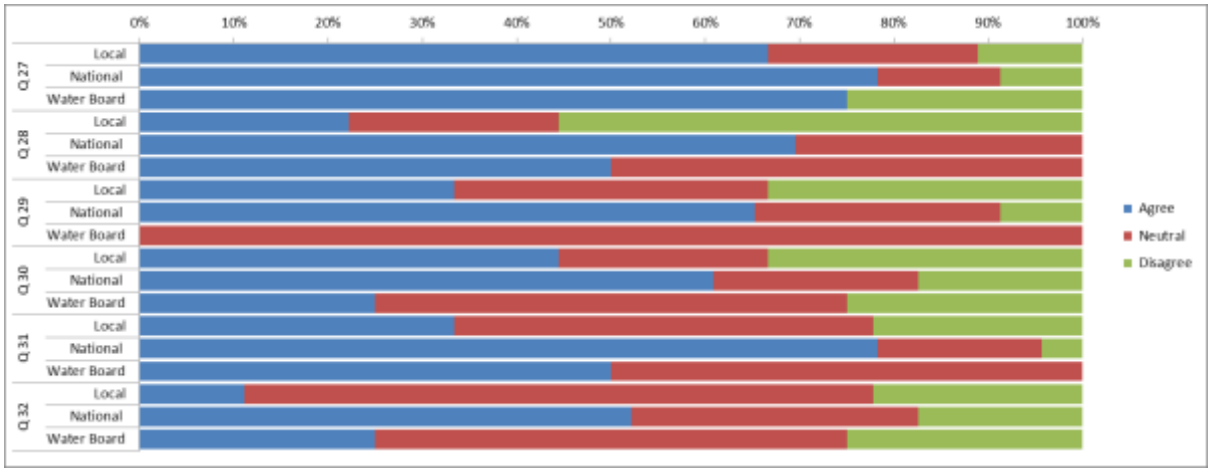


Figure 11. Perception summary of policy design

(Source: Survey results)

Table 15. SPSS representation of participant perception across tiers (policy design, implementation and policy evaluation)

	Mean	Standard Error	Median	Mode	Standard Deviation	Sample Variance	Kurtosis	Skewness
	Policy Design							
Q27	3.8	0.1	4.0	4.0	0.9	0.8	1.5	-1.1
Q28	3.5	0.2	4.0	4.0	1.0	1.0	-0.2	-0.4
Q29	3.5	0.2	3.5	4.0	1.0	1.0	-0.2	-0.3
Q30	3.5	0.2	4.0	4.0	1.0	1.0	-0.4	-0.5
Q3	3.8	0.1	4.0	4.0	0.9	0.9	-0.7	-0.3

1								
Q32	3.4	0.2	3.0	3.0	1.0	1.1	-0.5	0.1
	Implementation							
Q33	3.5	0.1	4.0	4.0	0.8	0.7	-0.4	-0.3
Q34	3.5	0.2	4.0	4.0	1.0	1.1	-0.5	-0.4
Q35	2.4	0.2	2.0	2.0	1.0	1.0	-0.9	0.4
Q36	3.2	0.2	4.0	4.0	1.0	1.0	-0.6	-0.8
	Policy evaluation							
Q37	3.4	0.1	3.5	4.0	0.7	0.6	-0.5	-0.4
Q38	4.3	0.1	4.0	4.0	0.6	0.4	-0.6	-0.4
Q39	3.4	0.2	4.0	4.0	1.1	1.1	-0.9	-0.3
Q40	3.3	0.2	3.0	4.0	1.0	1.0	-1.1	0.0

(Source: Survey results)

Implementation of policies is a neutral activity, undertaken through effective management and administration. As such, participants indicate a degree of concern in policy implementation. In view of this, it is expected that without a policy being effectively implemented, there will not be any policy to monitor and evaluate. Monitoring and evaluation of policies is suggested by Roux (2002) as the final step in a systematic assessment of policy relevant information. Policy evaluation however indicates a substantial degree of variability (Figure 12) in participant responses. In particular, participants across all tiers disagreed with the statement "There is sufficient human and financial resources to coordinate policy implementation" (Q35), portraying this statement as a negative response. Moreover, when responding to Q34, "Dedicated resources ensure policy implementation", participants at Rand Water were mostly neutral (50 %) or disagreed (25 %).

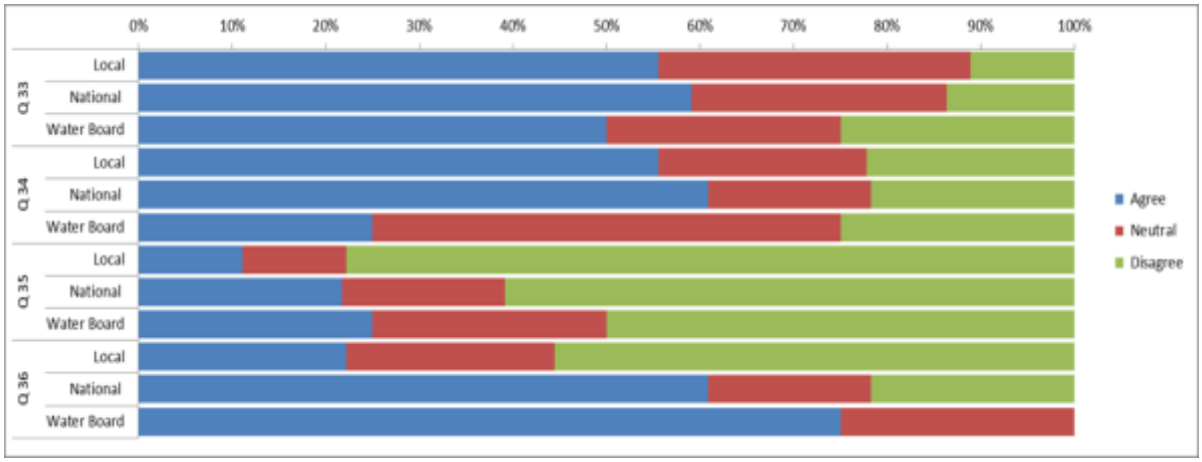


Figure 12. Perception summary of policy implementation

(Source: Survey results)

One of the aspects that this study pursued was to find out what challenges exist in the governance of water resource management. Participants indicated that although policy design has challenges during stakeholder participation, implementation proves to be a major area of concern. Key findings involved in implementation are

- High degree of variability pertaining to dedicated resources to ensure implementation of policies;
- High degree of variability pertaining to human and financial resources being sufficient; and
- High degree of variability pertaining to policies being appropriately communicated to stakeholders.

When reviewing policy evaluation, there is a general positive consensus amongst institutions (See Figure 13). Significantly, national, local and water board levels are in agreement when responding to “Environmental/water resource policies are relevant and significant to my job” (Q38), however, a number of participants showed neutral or negative responses to “Environmental/water resource policies show stability and reliability” (Q37). Participants, therefore, agree that environmental policies are significant, however, do not feel that policies are stable or reliable.

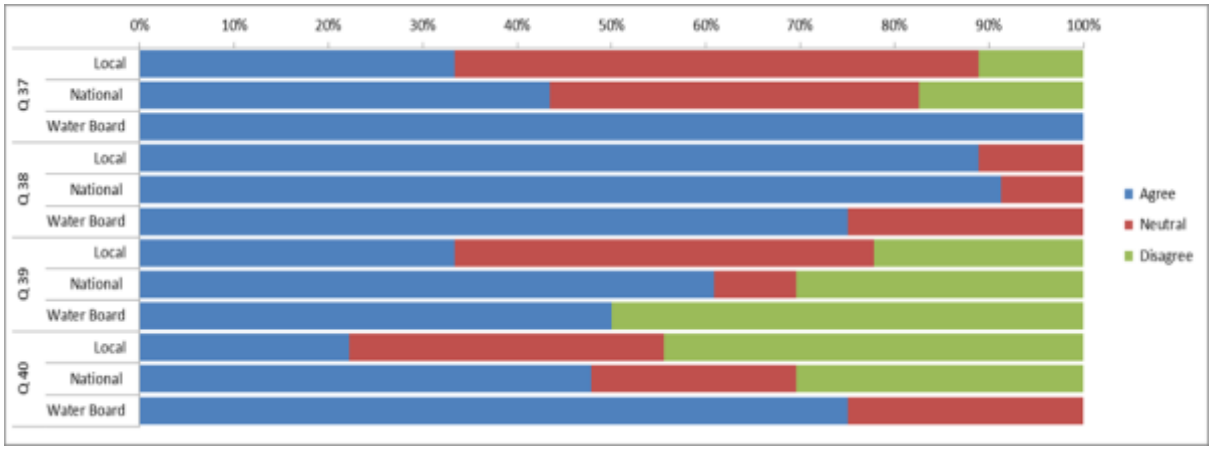


Figure 13. Perception summary of policy evaluation

(Source: Survey results)

4.3.4 Governance in Water Resource Management

In answering questions relating to governance in water resource management, a number of issues were picked up. The information presented here is presented in the form of Personal Communication (Pers.Comm.) responses and is based on information derived from raw data resulting from the semi-structured interview questions.

Instituting clearly defined and mandated structures was found to be challenging at national level where participants express concerns that structures have more width than depth (Pers.Comm. 2015g). Pers.Comm. (2015g) and Pers.Comm. (2015i) also express concern with the number of management level employees compared to operational level employees. Many senior management positions are filled by inexperienced individuals, which in turn prevents the transfer of knowledge to implementable level, as quoted "*The replacement of experience, technical knowledge and ability with inexperience, little knowledge and inability seems to be becoming the norm*" (Pers.Comm., 2015g). Despite the vast number of scientists within institutions capable of implementation, there appears to be a lack of empowerment from management levels (Pers.Comm. 2015g, Pers.Comm. 2016b). Without the necessary skilled personnel, thorough auditing of deliverables is not conducted as suggested by one participant: "*Officials should be empowered and*

capacitated to excel in delivering services. In reality, in many instances, the opposite is being achieved!" (Pers.Comm. 2015g).

A number of principles need to be factored when ensuring successful management. These will include effective planning and implementation processes and facilitated communication channels between institutions to support information exchange and end-user understanding (Pers.Comm. (2015i), Pers. Comm. 2015o).

An effective stakeholder engagement is expressed deeply by many participants. It is important that institutions involved directly and indirectly collaborate (Pers.Comm. 2016d, Pers.Comm. 2016h, Pers.Comm. 2016i, Pers.comm. 2016k, Pers.Comm. 2016m, Pers.Comm. 2016n, Pers.Comm. 2016q, Pers.Comm. 2016s, Pers.Comm. 2016u, Pers.Comm. 2016w, Pers.Comm. 2016x). The sustainable management of water depends on numerous actors who have their own mandates and goals related to economic development, social aspects and ecological conservation. For example, certain institutions may have socio-economic benefits that require water resources and will therefore present complexities. Supporting this statement, Pers.Comm. (2015i) expressed a disconnect saying that "*most often other Departments are invited but absent when important policy issues are discussed*".

Over and above concerns with institutional structures and stakeholders, participants allude to political interference (Pers.Comm. 2016b, Pers.Comm. 2016u, Pers. Comm. 2015i, Pers. Comm. 2015g). Interestingly, participants who allude to political interference are all from the DWS. More significantly few participants identified the operations of institutions working in silos, lacking intergovernmental coordination, communication and commitment (Pers.Comm. 2015b, Pers.Comm. 2016a, Pers.Comm. 2016r, Pers. Comm. 2016u).

For implementation at operational level, participants suggest clearly defined strategies that are translated into different languages and conveyed in the form of awareness campaigns (Pers.Comm. 2016h, Pers. Comm. 2016r). Funding, skilled personnel and capacity appear to be a key concept lacking in improving policy implementation and enforcement (Pers.Comm. 2016d, Pers. Comm. 2015e).

One participant suggested that more-effective decision-making be taken at higher management levels and also supports a concisely structured institution of less management and more staff functioning at the operational level: “*Better integration of functional mandates would be possible in a streamlined establishment, having less width and possessing greater depth in the organisational structures*” (Pers.Comm., 2015g).

CHAPTER V
ANALYSIS AND DISCUSSION

5.1 Introduction

In consideration of the empirical evidence outlined in chapter four, chapter five discusses what the findings mean within the context of this study. Given that a significant focus of this study is to understand the governance in water resource management at institutional level with regard to a best possible scenario, the Institutional Analysis and Development (IAD) framework has been adopted as a means to compartmentalise findings.

As previously discussed the rules-in-use exist at all levels and tiers of organisational structures, including constitutional levels. These are portrayed through the government in the structure of the various institutions. Most importantly, in line with the research aims, rules exist at top-level institutional structures where policy-making is collectively managed to set aside standards. It is important to understand this to set the background.

According to Ostrom's theory "governing the commons", a resource system that is sustainable has to have defined boundaries and rules about who has access to the Common Pool Resource (CPR). If institutions outside the group are operating within the realm of water resource management and benefit from it, behaviour of misuse or mismanagement will expand. These boundaries and rules ensure that each institutions contributions and benefits are in balance and serve to promote sustainable management of water. Equity is also important if a resource is to be managed in a sustainable manner. Keeping this in mind, chapter 5 begins with evaluating institutions, which analyses the material conditions, the community attributes and the action arena. Following this, the outcomes are discussed in conjunction with the patterns of interaction.

5.2 Evaluation of Institutions

Supporting data represented in chapter four forms the basis for which the institutional, political and social dimensions are explored. Outcomes are discussed within the context of the IAD framework. The institutional analysis involved identifying exogenous factors which influence the action arena and in turn patterns of interactions and outcomes. The evaluation of institutions covers the detail for these exogenous factors using the principles governed by the IAD framework.

5.2.1 Material Conditions: Sustainability in Water Resource Management

Chapter 1 and 2 touched on factors affecting water resource management, thereby painting a picture of the urgency or need to understand governance in water resource management. Sustainability, being a key theme was therefore assessed in relation to governance in water resource management. Sustainability encompasses a multi-dimensional approach in governance of water resource management and is therefore discussed as a theme with many facets. In this section, participants' interview responses were coded and portrayed for each institutional level as well as by common aspects.

Literature alluded to the increasing water demand of Gauteng's growing population and industrial growth presenting challenges of governance in water resource management. While demand is increasing, the study found that other aspects such as multi-sectoral water usage also present challenges on governance of water resource management. The analysis of sustainability in water resource management reveals that relations between the studied actors have been in constant change since the beginning of the decentralisation in the water sector. The actual system of governance, however, was organised according to a centralised state of decision-making and economy planning. The national system of water resource management was extended from centrality to a local level of administration. Decentralisation is not a focus of this study; however it does frame water resource management in context to sustainable development. Accordingly, accountability is central to a democratic governance system (Stanton, 2009), which

however, appears to be lacking. This could be, as highlighted by participants, partly owing to a lack of resources and financial allocations.

An area of concern is that current plans and initiatives are detailed around short-term sustainable development and most importantly, there seems to be a struggle between understanding sustainability and dimensions of water as an economic good. Here, the hydropolitical agenda discussed by Jankielsohn (2012) and Meissner (2014) is evident where there is a noticeable imbalance toward the economic dimension. One, however, cannot negate political interference as a constraint in water resource management. This was captured by national level participants. The interaction between water resources and economics is important within institutions. Financial allocations within the action arena however, are noted to be inadequate in addressing water related issues.

Corroborating findings in this research, Molobela and Sinha (2011) highlight the need for increased stakeholder participation and new approaches to water resource management. Participation involving all direct and indirect water users is important since the end-users have a better understanding and knowledge of their situation and environment. Though a participatory approach is widely recognised as a major constituent of effective and sustainable water resource management, integration between departments and sectors may first need to be understood. As seen within the Sub-Saharan Africa context, a great deal of water is required for functions. Although participatory approaches are mostly driven at local level in the Sub-Saharan Africa, the participatory approach within the South African context is expressed at institutional levels. Expanding on the need for research in water resource management in the South African context, Siebrits and Winter (2013), identified priority research questions through extensive horizon scanning. These questions were placed into overarching themes, one of which is governance (translated as integrated, strategic adaptive management). One question posed by Siebrits and Winter (2013) is of particular interest: *"How do we ensure effective implementation of co-operative governance and regulation specially inter-departmental communication?".* This question centres on integration.

Successful coordination of multiple actors in water resource usage and governance proves to be perplexing, however, it is essential that land, water management and economic growth through industry are achieved to harmonise land management in a comprehensive manner that covers water usage. Of paramount importance, it must be understood that although there is interconnectedness between departments, each department is pursuing their own interests or mandates while at the same time influencing one another. An example of where integration at institutional level across and within all tiers is lacking is seen where participants speak of silo-effects. Moreover, institutions function within their mandate, such as the Department of Agriculture, Forestry and Fisheries (DAFF) whose mandate lies within the domain of agriculture, forestry and fisheries.

A part of this study was to understand management of water resources and its constraint (Table 16). Gaps identified in institutional and policy frameworks, interestingly highlighted 3 common themes. These are lack of implementation, lack of compliance and lack of alignment. This could be indicative that policies are sufficient, however, once finalised are not implemented, nor are institutions aligned when adopting policies and hence there is a lack of compliance.

Table 16. Gaps identified in institutional and policy frameworks

	National	**Local**	**Rand Water**	**Common Theme**
Gaps	• No coping mechanism for drought or contaminated water • Impractical targets • Constant changes in mandate and leadership • Lack of attention to CMAs • The NDP is steeped with supply-side thinking	• Secluded reporting structures for WSA_2 • By-law enforcement • Institutional set up not aligned to policy imperatives	• Lack of interaction	• Lack of implementation • Lack of compliance • Lack of alignment

(Source: Authors representation, 2016)

The common theme for institutional frameworks that could be pursued to achieve sustainable water resource management resulted in the National Water Resource

Strategy (NWRS2) (Table 17). Institutions acknowledge the NWRS2, however, also add that integration or participatory approaches are also instrumental in pursuing institutional frameworks to achieve sustainable water resource management.

Table 17. Pursuing institutional frameworks

	National	Local	Rand Water	Common Theme
Pursuing Institutional Frameworks to Achieve Sustainable WRM	• National climate change white paper • Near-term priority flagship programmes • Statutory instruments • Cooperative governance (inland water ecosystem committee) • Focus on committees, working groups and councils • Coordination between government spheres • Linking to international bodies • NWRS2, IWRM, Reconciliation Strategies	• CMA's • Line of reporting of water boards to local government • By-law enforcement Use of SALGA to liaise with the water board • Old Mvula Trust Model • Water affairs • Water boards • Municipal service authorities	• NWRS2, NWA, NEMA	• NWRS2

(Source: Authors representation, 2016)

The topic “promoting effective water governance” resulted in several common themes across institutions (Table 18). These include creating awareness, maintenance of infrastructure, implementation, demonstration of commitment, recognising water as an economic good and stakeholder engagements. Hereto, integration, or a participatory approach is strongly driven. Economic drivers push agendas where water demand in the form of service delivery is emphasised moreover than conservation. Meissner (2014) describes water as an economic good under the economic power of agential power determinants and as such actors can identify recognising water as an economic good. Infrastructure too, is described by Meissner (2014) under economic power and must be in a suitable form for all users (industrial and home).

Table 18. Promoting effective governance

	National	Local	Rand Water	Common Theme
Promoting effective governance to achieve WRM	• Clear strategies • Clear champions • Impact monitoring • Eliminate political interference • Smaller directorates (more production staff, less senior staff) • Increase government partnerships • Water conservation infrastructure • Strengthening WRC • Good governance to People, Planet and Profit • Respectful discussions • Administrative systems for WRM • Focus on committees, working groups and councils	• Eliminate silo effects • Enforcement at local government • Alignment of structures (boards and WSU) • Policy only • Resource allocation • Polluter pays principles	• Encourage sustainable water use • Monitoring of compliance	• Create awareness • Maintenance of infrastructure • Implementation • Demonstration of commitment • Recognise water as an economic good • Stakeholder engagements

(Source: Authors representation, 2016)

There is consensus that policy implementation and enforcement can be achieved through ensuring that policies are practical and appropriate, that there is sufficient resource allocation for implementation and enforcement, through education at all levels, through effective stakeholder engagements and adequate enforcement at implementation level (Table 19). National and local level participants, who are directly involved in policy-making provided extensive and detailed answers which were coded as seen in Table 19. Bindra et.al. (2014) attribute issues in compliance and enforcement to a lack of holistic perspective regarding governance in water resource management.

Table 19. Improving policy implementation and enforcement

	National	Local	Rand Water	Common Theme
Improving policy implementation and enforcement	• National champion with support team • Detailed implementation plans • Clear roles and responsibilities, allowing accountability • Promote integration • Work with a holistic view in mind across sectors • Less focus on short-term sustainable development • Focus on committees to deal with priority deals • Alignment of city development with water resource availability • Better coordination • Continuous improvement • Financial investment • Transboundary strategic cooperation • Industry tariffs • Focus on relevant topics • Continuous awareness • Alignment of government • Interdepartmental collaborations • Implementation task teams • Accountability for enforcers • Track progress and challenges • Operationalise WGDF • Identify what is necessary for sustainability • Set targets and goals • Empowerment of officials • Centralised decision making within the department • Eliminate political interference	• Eliminate the silo effect (reduces duplications and financial implications thereof) • Programme linked partnerships • By-law alignment • Streamline reporting • Capacity building • Capacitate local authority • Communication • Water conservation and water demand • Water compliance certificates • Reduce the number of staff in departments • Effective management at department level • Appropriate qualifications • Risk aversion	• Less ambiguity in policies • End user enforcement • Strict monitoring and implementation	• Appropriate policies • Sufficient resources • Education • Effective stakeholder engagements • Enforcement at local government

(Source: Authors representation, 2016)

After gaining perspective holistically, the study focussed on governance in water resource management by looking at the NWRS2. The NWRS2 is perceived to be a well written strategy that incorporates sustainable water resource management (Table 20). Short term goals are identified plentifully across all tiers; however, only one long term goals is identified: integrate all water systems. Mechanisms for accomplishing these short term and long term goals are not mentioned. The

greatest concern with the NWRS2 is lack of implementation, while no common themes were identified for improvements. Interestingly, responses for each institutional level identify improvements relating to each particular institution respectively. For example, implementing agents are at the local level as well as Rand Water. Both institutions highlight NWRS2 improvements within the capacity and capability of local government and Rand Water.

Table 20. NWRS issues and improvements

	National	Local	Rand Water	Common Theme
NWRS Issues	None identified	• Lack of effective partnerships/stakeholder management • Lack of alignment at local level • Lack of monitoring and evaluation • Does not suitably cover sustainable WRM	• Lack of training for end users • Lack of reporting back to government	• Lack of implementation
NWRS Improvements	• Integrate water systems • NWRS2 should be adaptable • Improve coordination and communication	• Improved resourcing	• Requires monitoring compliance	• None

(Source: Authors representation, 2016)

Understanding the relationship between the institutions provides insight relating to gaps and opportunities within water resource management (Table 21). Responses provided sufficient insight to deduce that although there may be alignment in certain instances, other areas contributing toward effective alignment such as communication is severely lacking. There is a general agreement that alignment does support effective water resource management on all spheres of government, through lessons and best practices. There is also an acknowledgment that this alone does not ensure compliance or sustainable water resource management.

Currently, institutions are comprised of many branches. Moellenkamp *et.al.* (2010) add that fewer hierarchies and the formation of informal organisational structures can improve relationships and transparency, as well as be able to adopt a scientific and practical approach through collaboration.

Table 21.Policy making

	National	Local	Rand Water	Common Theme
Policy making	• Integration with the institution is cumbersome • Improvement required across government • Structures exist for intergovernmental cooperation • High value on supply with little value on conservation • Economic dimensions valued over sustainability • One Environmental System (DEA, DWS, DMR) • Effective decision making • Acknowledging the technical nature of challenges • Less width within the department and greater depth • Forums relating to water quality are not attended by departments	• Clarity between revenue collection and sustainable use • Lack of resources for implementation • Review of resource allocation • Responsibility is only for municipalities who are WSA_2s (not DM)	• Policies are produced effectively • Regular audits	• Alignment • Local government does not play an adequate role • Production areas

(Source: Authors representation, 2016)

Responses to alignment suggest that policies and strategies are in place; however, institutional communication is a challenge. Departments work in silos, albeit the fact that there are intergovernmental coordination workshops and meetings. It is evident that cooperation between institutions is not taken seriously, where economic or politically driven agendas may exist. As with any effectively operating system, there is a degree of complexity and various aspects relating to the operation of the system; one of these aspects includes a hydropolitical agenda (Meissner, 2014; Jankielsohn, 2012). The hydropolitical agenda highlights a failure in overall development, implementation and maintenance of water resource management.

Despite policy development inefficiencies such as effective stakeholder engagements, capacity at all hierarchies of water research management presents a set of challenges that are highlighted by the participants. Figure 14 represents the ideas derived from the participant's coded responses. Intergovernmental cooperation relating to the implementation of developed instruments remains an obstacle. Capacity and performance of implementers has been perceived to be

ineffective in the implementation of policies. According to several personal communications, experienced personnel are lacking to effectively implement the policies and interdepartmental stakeholder engagement is inefficient. Limiting factors are in part due to the lack of financial input required to carry out management plans at operational levels.

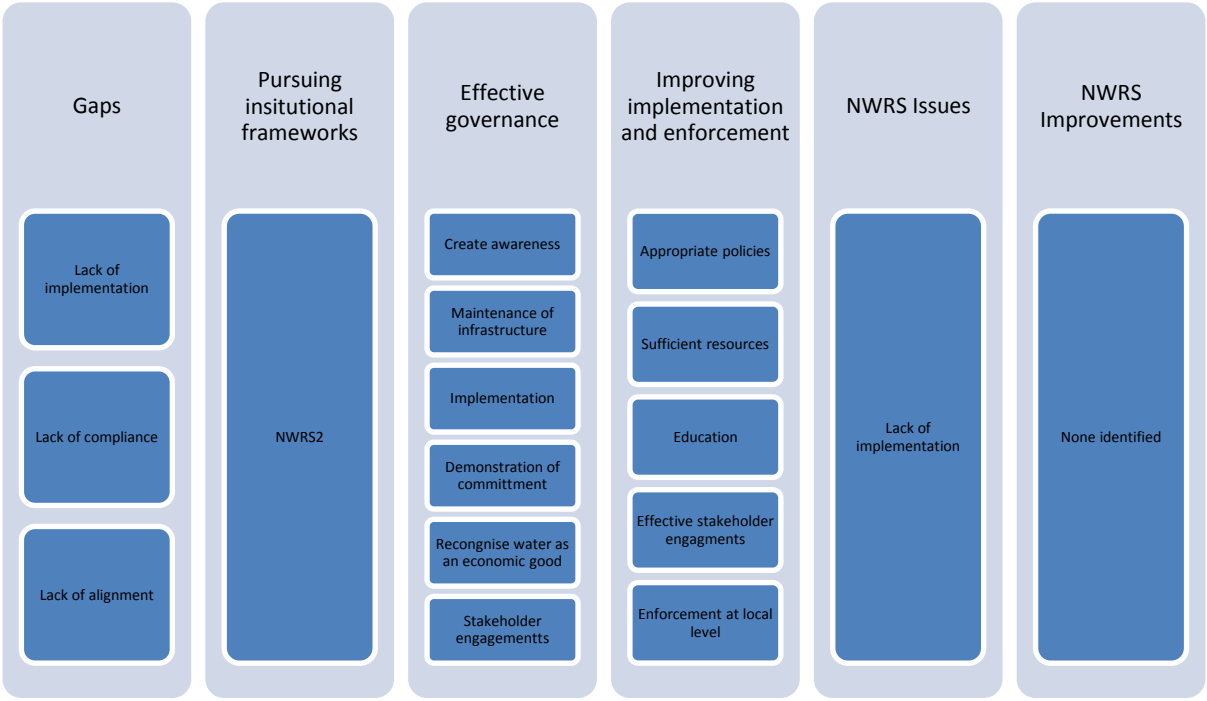


Figure 14. Common themes derived across institutions

(Source: Authors representation, 2016)

In summarising, sustainability in water resource management is achieved using a unilateral approach. Here we see that the relationships between water, economic growth, poverty alleviation and health and sanitation are not governed holistically. Emphasis on delivery is stressed in legislation and policies, negating conservation of water.

Creating a sustainable water resource management system will necessitate all institutional frameworks working on an agreed management framework or the adoption of a strategic adaptive framework. Coordination and collaborative efforts between institutions are required to enable synergies in sustainable environmental, economic and social challenges, eliminating compartmentalisation.

5.2.2 Community Attributes: Attitudes affecting formal rules

Institutional frameworks set the rules-in-use, which forms a focus for this study. Therefore, community attributes existing within institutional frameworks are explored together with rules-in-use. Subsequently, this section is devoted to the analysis of individual perceptions and attitudes towards the regulatory frameworks. An inherent difficulty associated with institutions, though is that they have dual facilities that constrain and liberate group actions. In water resource management, rules are meant to enable governance of socially unacceptable behaviour regarding water use. Essentially, institutional frameworks aim to reduce human error, thereby regulating societal behaviour. This can be seen by institutions such as the UN who produces standard expectations globally, which in turn attempts to stabilise international governance.

Overall, there are several consensus statements shared by the institutions in relation to sustainability. An underlying message confirms one of a hydropolitical agenda (Meissner, 2014; Jankielsohn, 2012). Current water resource issues require stronger implementation by all spheres of government. Though implementation and enforcement is a concern, a great deal of capacity and skills is required. This necessitates the need for integration across all spheres. All spheres of government will inevitably need to show greater commitment.

Although this study explored the interactions between actors, the political power, economic power and ideological power does feature as dominating areas of concern. These dominating areas of concern show similarities in research conducted by Meissner (2014) who used analysis tools of ideological power, economic power and political power. This study supports the framework provided by Meissner (2014), understanding that the economic, political and ideological powers work in synergistic mutualisms, similar to the pillars of sustainability.

Cave et.al. (2013) identify communication among actors, transparency, accountability and long-term sustainable development plans as key principles for effective water governance. Many public utilities operate a top-down service provision model that is neither transparent nor responsive to the needs of users.

Though this is one aspect required to ensure effective water resource management, the findings of this study indicate that the principles alluded to by Cave et.al. (2013) are major concerns in South Africa's water sector.

The above community attributes as mentioned are dictated by rules-in-use. To this extent, the IWRM, NWRS2, NWA and WSA[1] form the basis of understanding the actors in relation to these documents. To begin with, we look at the global perspective and the adoption of the IWRM. A study conducted by Anzaldi et.al. (2014) indicate a number of gaps in management tools such as:

i. "lack of integrative tools to support planning and management decisions;
ii. segmentation of institutions responsible for water resources planning and management;
iii. limited participation of stakeholders in decision-making process; and
iv. lack of interested self-assessment and improved mechanisms for water resource management and economic impacts measurements".

Higa Eda and Chen (2010) conducted a study in the Peruvian context and indicate similar gaps to Anzaldi et.al. (2014); emphasising the importance of clear institutional roles and responsibilities as well as participation. Within the South African context Braid and Gorgens (2010) concluded that even at municipal level participation is lacking, however, did not indicate the degree of implementation and compliance monitoring. Hassing et.al (2009) identified key development issues, determined by drivers that put pressure on water resources. These were used to determine the linkages between the IWRM and the NWRS2 comparatively (Table 22).

Table 22: Key development issues and linkages to IWRM and NWRS2

Key Development Issues	Examples of how IWRM links to the key development issue	Examples of how NWRS2 links to the key development issue
Adapting to climate change	Assists appropriate planning of water use, conservation, and the protection of surface-water and ground-water with better resilience and/or larger safety margin	• Identifies climate change as a threat, and includes strategic actions to develop vulnerability assessments as well as for reconciliation strategies to address climate change • Climate change is an underlying theme throughout the NWRS2
Mitigating disaster risks (e.g. floods and droughts)	Assists disaster preparedness	• The DWS has developed a Disaster Management Plan and Guideline for Flood Management • Links disaster reduction to extreme climate change events • Coordination of disaster management is the responsibility of the CMA • Considered a strategic action
Securing food production	Assists the efficient production of food crops in irrigated agriculture	• Highlights the need for agricultural support as it assures food security and contributes to job creation • Promotes irrigation schemes that develop water management plans
Reducing health risks	Reduces health risks in particular through the management of water quality	• Recognises eleven water quality issues which contribute to health risks
Sustaining a healthy aquatic environment	Supports the maintenance of environmental flows and ecological reserves	• Developed outcomes, themes and principles for water resource protection relating to aquatic ecosystems • Resource management and protection is considered as a strategic action

Key Development Issues	Examples of how IWRM links to the key development issue	Examples of how NWRS2 links to the key development issue
Collaboration in the management of freshwater and coastal water	Advances the management of freshwater and the coastal zone as a continuum	• Desalination is considered as an option to increase water supply • Wastewater reuse is suggested in coastal cities
Ensuring sustainable water infrastructure	Assists in giving a cross-sectoral view of water development and a multipurpose infrastructure	• The vision 2030 theme establishes a water infrastructure investment framework • Challenges include economic allocations, maintenance and rehabilitation • Social Assessment and Development Framework integrate social needs into the planning of new infrastructure, such that it is also used as multi-purpose facilities • Planning is aligned to Urban Development Framework in terms of sustainability
Collaboration in the management of land and water	Advances the management of land and water by considering their mutual impacts	• Groundwater development and management for irrigation • Mining activities reduce water quality • Highlights natural resource management programmes in the DEA and Land Care in the DAFF • Intent to formalise and accelerate implementation through integration at national, provincial and municipal levels
Planning transboundary collaboration	Assists water management with the catchment as the management unit, irrespective of whether it is within national boundaries or shared	• Shared water basins as per international agreements • Lesotho Highlands Water Project

Key Development Issues	Examples of how IWRM links to the key development issue	Examples of how NWRS2 links to the key development issue
	between two	
Managing the water-energy relationship	Addresses the link between water and energy	• Water and energy is recognised as an integral link for sustainable development

(Source: Key Development Issues and Examples of how IWRM links to the key development issues are derived from Hassing et.al, 2009)

Despite underlying commonalities between the NWRS2 and the IWRM, the NWRS2 diverges from the IWRM in certain aspects. One aspect is that the NWRS2 describes water management as a developmental democratic state (van Koppen and Schreiner, 2014). Another aspect is seen as placing emphasis on water being a basic right by means of service delivery (van Koppen and Schreiner, 2014).

The use of well-written policies serve as a guiding tool that should ideally be adopted, managed rolled over to operational institutions. Literature does indicate that IWRM has been progressive and lacking (Siebrits and Winter, 2013) There are a numerous factors that have been identified that constrain the development of the IWRM. These include overarching themes of equity, efficiency and sustainability.

As discussed earlier, there are various challenges relating to legislative and policy confines within institutional frameworks. One of which is the dualism of policy frameworks that are linked to water resource management. A key concern with the implementation of the IWRM is linked to the dualism of legislation where jurisdiction of land issues falls within a different law and different mandated institution. Within the South African context the water resource management arena is governed by two separate frameworks which create dualism in legislation. Van Koppen and Schreiner (2013) support an integrated approach to sustainable water resource management as a means to tackle dualism.

Despite Braid and Gorgens (2010) highlighting that no other department is given parallel authority for water governance, alongside the DWS, it is important to

recognise that the water sector is a complex arena and that other departments are indirectly involved in water resource management.

Policies such as the IWRM accounts for management of natural resources holistically while ensuring sustainable development. This is especially important as land and ecosystems are affected alongside social concerns. Consequently, the Water for Growth and Development Framework is recognised as carrying IWRM concepts more than the NWRS2 as it gives considerable weight to water as an economic good. Pollard and du Toit (2011) support the use of the IWRM recognising that the IWRM has the capability have providing governance in a complex system. Conflicting with this, however, is the NWA which does not provide for the integration of water resource management with other natural resources. Although sustainability and equity are identified as central guiding principles in the NWA, it could be argued that sustainability and equity alone cannot provide a holistic mechanism of "*protection, use, development, conservation, management and control of water resource"* as this does not consider water as an economic good.

5.2.3 Action Arena: key actors in the water sector

Within the action arena, rules-in-use and patterns of interaction are discussed in relation to key actors. The study produced several key findings about water institutions and how they are influencing water governance:

i. Multiple actors involved in water governance and management are amplifying issues of accountability and transparency in the community;
ii. Maintaining formal institutions have strengthened the capacity of technical staff to deal with water related issues.

The findings indicate a myriad of issues, which contribute to ineffective water resource management. Though an effort is being made to increase access to water for many communities, access to adequate water still presents challenges. Access issues are compounded by the narrow focus of water policies on allocations of water for basic needs and industrial use. Of paramount importance is the fact that

South Africa has expressed commitment toward the SDG's which is reflected by the NWRS2 commitment toward basic access to water. More importantly, a key theme throughout the NWRS2 is the management of water resources in a sustainable manner. Sustainable water resource management, however, does need to consider conservation as well as demand.

Various formal water policies, strategies and management frameworks have been developed to shape or influence actors involved in governing and managing water resources. Although formal policies are developed to incorporate sustainable development, it was found implementation through different formal institutions is a major concern. Fundamental principles for effective water governance also include communication among actors, transparency, accountability, equitability and views toward long-term sustainability. Power relations and the due distribution of rights reveal that silo behaviours exist where institutions are actively involved in adopting sustainable development principles.

Ultimately, key actors here involved here is a complex array of policies themselves and all institutional level actors. In applying the IAD framework, the following steps in institutional analysis involved patterns of interaction which is a focal point of this study through describing the relationships between actors influencing water issues and decisions. Key findings for patterns of interaction include the jurisdictional division of responsibilities influencing water resource management and communication deficiencies between institutions.

5.3 Outcomes

In this section, the researcher explores the outcomes of the study. The results from the study were organised according to relationships between actors involved in the institutions management.

There is a clear absence or underdevelopment of connections between institutions in terms of common interests such as water resource management, alluding to the presence of institutional fragmentation. Corroborating this, are the results emanating from the IAD framework. Although this research did not focus on all

aspects of fragmentation, it focused on sustainable water resource management. According to Zelli and van Asselt (2013), fragmentation exists even between international relations. Furthermore, legislative frameworks tend to result in functional overlaps between institutions. Alternatively, Zurn and Faude (2013) argued that differentiation is the "rational response to the increasing complexity of society". In light of the current water situation, this study argues that though complexities exist within institutional frameworks, a systematic means of approaching complexities can be adopted. Consequently, this study showed contentious issues across institutional operations, supporting the argument posed by Zelli and van Asselt (2013) that overlaps exist between institutions. The degree of fragmentation is dependent on framing the area or problem structure, in other words inefficiencies in water resource management which operates across institutions. In relation to water governance, defining fragmentation ultimately provides an understanding to institutional complexities. Though this study aimed to assess fragmentation between institutional linkages, complexities were found within each institutional setting. Distinct structural features are framed as areas of great concern to scientists. Drawing on the tenets of interpretivism and post-positivism, this research provided an examination of fragmentation in governmental departments. However, similar to Zelli and van Asselt (2013) questions arise in response to fragmentation:

i. "What are options for, and limits to, the management of fragmentation?
ii. Do they necessarily imply de-fragmentation, or are other forms of management possible? Who are the driving actors in managing fragmentation?
iii. When and why are such approaches undertaken?"

In addressing concerns related to institutional fragmentation and fragmentation at institutional linkages, these questions can further be explored as a solution based outcome. A key finding is that both types of fragmentation exist, however, alternative management styles could provide a possible solution. A cause and approach study of fragmentation within water resource management requires much theoretical and empirical support. Fragmentation is not necessarily negative in light of the optional improvements that can be applied, through structural opportunities

and intergovernmental coordination (Zelli and van Asselt, 2013; Zurn and Faude, 2013). The urgency is rather with the looming water crisis. The IAD framework did prove to be a useful tool to provide insight into complex governance systems such as water resource management, especially where fragmentation exists. These findings indicate that a higher degree of management may lead to improvements in the collaborative efforts of water resource governance. However, there were gaps between anticipated and actual outcomes. It was difficult to achieve the objective using the scope of water resource management. This was even more difficult because only the DWS is mandated to govern water resources and local government is tasked with operation, while the DEA, DAFF and DMR have an indirect role to play.

Given the understanding that water resource management is complex, operating in a poly-centric governance system increases challenges to the extent where roles and responsibilities are not clearly defined. In addition, overlaps, or inadequacies with policy on water quality issues are indicative of the water pollution. Effective consultations laterally are needed to ensure the development of efforts at a holistic level to address issues and that decisions are taken as an integrated and long-term strategy.

Although public awareness is a key aspect of governance processes, this research focussed on the participatory approach within and between institutions. Overall, participants highlight non-attendance by key institutions as an area of concern when decision-making regarding environmental resources is taking place. Fragmentation also exists within institutions, between the levels of management. The analysis conducted perpetuates the introduction of awareness campaigns, skills development, and education programmes for institutions to be better equipped to manage water related concerns. In saying so, the role and value of water must be emphasised by the scientists within institutions.

Though intergovernmental workshops/meetings are held, it is necessary to solidify cooperation within these networks to interact and holistically apply themselves in combating challenges. However, due to the fact that water is used at a cross-sectorial level, these participatory meetings should not only include representatives

of the DWS, CMAs, Water User Authority (WUA) and local municipalities but also include members of the DAFF, DMR and DEA. The participatory meetings need to plan programmes that consider long-term goals rather than a prescriptive goal that supports immediate concerns.

Building capacities and skills development at the institutional and implementable level are key concepts lacking within water resource management. Capacity building is even more critical at local level where basic water conservation and demand strategies are most needed. Reflecting on the interview responses, mechanisms identified as lacking in institutional structures are participation, expertise within institutions and an imbalance in the bottom-up/top-down approach. This section conceptualises these into a positive practice mechanism that can be adopted in relation to SAM. A critical element to ensure the economic development and natural resource preservation is to ensure that strategies are implementable, practical and are enforceable.

In light of the significant findings, the applied methodology could be vastly improved. The qualitative approach adopted for this study provided a holistic view, but had limitations in measuring the institutional linkages. A quantitative methodology may be more appropriate to idealise the outcomes of institutional relationships. A quantitative methodology would necessitate the need for a larger sample size, which would ultimately provide in-depth detail of institutional fragmentation and linkages.

In water resource management, a higher degree of value is placed on economic growth tipping scales of environmental and social dimensions to one where water resources are dwindling. The IWRM has the potential to ensure collaborative governance of water, however, is not the primary policy framework driven in South Africa. The NWRS2 does present a great degree of sustainability; however, collaborative cooperation between institutions is required.

Meissner et al. (2014) suggested that although water resource management is governed through various frameworks, institutions deal with water resource management separately. Over and above this, Coleman *et al.* (2007) state that

water resource management requires collaboration at all institutional levels. Therefore, to fully understand the water resource management, this research endeavours to interrogate patterns of interaction between the various institutions that are involved in governance and management of water.

A critical issue forming the basis of any institutional analysis is defining the nature of the resource involved in the action situation. Taking into consideration the element of the physical world, a common feature is that the physical world affects the actions that are physically possible in an action situation and the information contained in information sets (Ostrom, 2011). Consequently, the water crisis, in the form of sustainable water conservation and demand is a significant driver toward the internal dynamics in the action situation. The physical attributes of water resources are challenging for sustainable management due to seasonal differences and water availability.

Access to potable water is a fundamental and basic right according to the constitution, yet many people still lack access to basic service delivery. Although regions are faced with service delivery challenges, factors such as aging infrastructure and water scarcity present a cumulative impact (Mukheibir and Sparks, 2003; Walter et.al.2011). Subsequent to the constitutional right that everyone has a basic right to water that is not harmful, the NWA created a management system where the government is the custodian of all water resources.

Institutional frameworks are developed to ensure good governance and improved management in water resource management. The NWRS2 is one such strategy that sets out core objectives where water strategies support the development and elimination of poverty and inequality contributes to the economy and ensures that water is protected, used, developed, conserved, managed and controlled sustainably and equitably (Department of Water and Sanitation, 2013). A major focus is equitable and sustainable water use. Equity and redistribution is achieved through the authorisation process and other programmes, such as water allocation reform, financial support to farmers and rural and local economic growth (Department of Water and Sanitation, 2013).

5.4 Ideologies of Sustainability in Water Resource Management

Sustainable development models have previously indicated differing beliefs (Bocken et.al., 2014). One describes an anthropocentrically driven system, while the other describes an ecocentric system. The ecocentric system dictates the views that morality and ethics form part of sustainable development and informs it as a view of nature (Bocken et.al., 2014). The anthropocentric view, on the other hand, is a more dominating approach to nature and can be related to the industrial, economic and technological growth (Bocken et.al., 2014).

Various models emphasised the use of the natural environment to support economic systems, to the extent that production and growth is maximised. A major limitation is that the focus is on an economic dimension and does not consider the environmental dimension. This form of sustainable development has been highly criticised for the lack of concern toward environmental issues. Anthropocentric views are very often considered with high regard when understanding sustainable development models and best practices to be adopted. The ideal model of sustainable development, constructs a paradigm that incorporates social, environmental and economic dimensions.

At the implementation level, there are very contrasting outcomes between the dimensions of sustainability. It is evident that although industrialisation has contributed to economic growth, challenges have arisen in the form of pollution (Mukheibir and Sparks, 2003). The eradication of poverty has also been a primary goal of sustainable development and is also based on the concern in which poverty affects the environment. Attention to environmental pollution, however, only arose when economic growth and rapid industrialisation was generated. In developing countries this reality has been especially difficult for policy-makers who are conflicted because economic growth inadvertently poses environmental threats, while poverty can also be calamitous.

Improvements to human welfare and tackling poverty are undoubtedly an imperative that has received considerable discussions in achieving the path to sustainable development. Although globalisation has spread, many people still

suffer in poverty amidst progressive development. Dissatisfaction about the underlying principles of development has led to the universalization of the model sustainable development. In the late nineties “sustainability” received much criticism as being practically irrelevant, paradigmatically bankrupt, narrowly focused and lacking multidisciplinary perspectives (Kuhlman and Farrington, 2010). In light of this, the NWA identifies sustainability and equity as core principles.

As an integration model, stakeholders have realised the importance of sustainability. It is recognised in various issues of development, environment and poverty alleviation programmes. Currently, sustainable development is recognised and incorporated in most policies, frameworks and planning tools.

Although the definition of water sustainability is indistinct, one can almost define it as referring to the sufficient availability of water over periods for all who require the natural resource. Water resources and services are one avenue of achieving global sustainability in water resource management. Kuhlman and Farrington (2010) expand on sustainability stating that it is the social, economic and environmental dimensions arose only for use by the corporate world. The dynamics of water, socio-economics, development and growth are, however, complex due to the reliance of the human population on water. Water resource management is, therefore, important to achieve sustainable development and growth. Without water, development and growth is difficult. Consequently sustainability in water resource management should be incorporated in planning, financing and governance frameworks.

CHAPTER VI
CONCLUSION AND RECOMMENDATIONS

6.1 Summary and Conclusion

This chapter provides the conclusion and recommendations of the study. From the findings the researcher points out recommendations that could be applied for future researchers when analysing institutions in relation to water resource management. High rainfall variability and drought are being experienced in various parts of the province as a result of climate change. The water situation, as a result of water demand will soon reach a dire point. In light of this, it is imperative that effective management principles are integrated into current governance systems. Although, the constitution and policy frameworks account for sustainable water resource management, institutional constraints exist, such as implementation.

Many of the challenges exist within the domain of institutional structures and operations. Although there is a dualism within constitutional mandates, policies such as the National Water Resource Strategy (NWRS2) and Integrated Water Resource Management (IWRM) take cognisance of sustainable water resource management. Additionally, the following areas of governance require attention:

- Implementation and skills development is characterised as improvement areas for the successful progression for IWRM;
- Government needs to undertake coordinated and participatory action to mitigate anthropogenic activities in a sustainable manner; and
- The bottom-up management approach needs to be further investigated within each institution to ascertain whether it is a feasible option for management.

The issue is not with compliance with legislation or policies, but in a general misconception that in merely abiding with the law allows for sustainable natural resource management. A mind change shift needs to be adopted in each institution to understand that water is a finite resource that is dwindling. Therefore, practical measures to ensure sustainable water reform are to be undertaken.

It can be concluded that policy makers need to consider the adaptive water management approach to overcome internal institutional structures in the policy arena and water-related concerns. It is strongly recommended that the three dimensions constituting sustainability are incorporated with the technical and physical dimension to ensure evolution and implementation of management approaches.

Working in silos was indicated by participants, indicating that there is a lack of alignment and coordination between relevant stakeholders. The impact of silo-based thinking is that although concerns should be dealt with in an integrated manner and that all institutions should be linked, the opposite is occurring resulting in the pressures on existing water resources. This is further seen by the lack of progression of the IWRM and the issues faced with current water issues. The identified gaps are in no way seen as limitations, but rather as a precursor for opportunities for developing an enhanced knowledge base of water management institutions.

6.2 Recommendations

The aim of this research was to investigate and understand how effective governance can contribute to the formulation of sustainable water resource management. The study demonstrated the importance of intergovernmental cooperation and coordination while also ensuring that bottom-up and top-down participation is an important aspect to ensuring involvement of relevant departments.

Another major finding is that institutions operate in silos, rather than approaching water resource management in a collaborative manner. Stakeholder engagement or intergovernmental meetings where involvement and implementation is discussed and agreed on is a necessary step toward eliminating the silo effect. The IWRM is a suitable policy, however, as seen in by Bindra *et. al.* (2014) and Higa Eda and Chen (2010), IWRM is not easily implementable. Within the context of this study, the researcher eludes to the pressures placed on the economic dimension rather than a

sustainable approach that includes environmental and social dimensions of water resource management.

The primary lesson learnt is that Strategic Adaptive Management (SAM) plans should be further analysed by institutions for implementation. However, plans require strong coordination and clear roles and responsibilities amongst departments within departments. Unclear roles and responsibilities create situations where long-term water resource management does not receive sufficient attention. A strategic adaptive approach should incorporate a degree of preparedness to ensure water conservation and demand needs are met. Ideally, these should be developed in conjunction with all departments and should include procedures that plan for services, allocation of resources and effective prevention and mitigation measures.

Financial allocations have been raised as possibly preventing the implementation of IWRM; therefore the researcher proposes a strategy that will ensure financial support for sustainability measures. A well-structured financial strategy would also increase resource capacity as well as introduce the correct expertise to ensure IWRM implementation. This will create a ripple effect, improving efficiency and effectiveness of institutional management.

6.3 Areas for further research

Grounded on the results of this research, there are a number of research topics that can be ensued to improve institutional relationships in a complex system. Though a hydropolitical agenda exists, various avenues of improvement can be undertaken that could improve relationships, communications and overall operation. Despite its theoretical and empirical contributions, this dissertation has limitations, one of which is the scope of the research. While research has been conducted on the theory of institutional analysis, little is available on looking at the relationships between institutions. Furthermore, although this research placed emphasis on the IWRM, the NWRS2 is a strategy that is primarily adopted by the Department of Water and Sanitation (DWS).

Time constraints did not permit the researcher to delve deeper and explore the issues discussed by the participants. Although quite a large task, future research endeavours should explore the relationships between departments in finer detail, contributing toward the alignment of internal processing between departments.

The term sustainability is commonly and loosely used, for example; despite the DMR being mandated to sustainably mine for minerals, the term “sustainably” is relating to its operations without necessarily placing too much focus on natural resources holistically and in conjunction with the mandates of other departments (Jankielsohn, 2012).

In the future, a study utilising a quantitative approach will better provide the detailed outcomes of interdepartmental governance. Future studies could also include the operational values of the Department of Cooperative Governance and Traditional Affairs (COGTA) and observations of actual or theoretical intergovernmental meetings. Considering the time delays when dealing with departments, it is also vital that future researchers plan enough time and resources to accommodate for possible conflicts and obstacles in data collection. Central to the future stability of water resource management, is that both capacity and skills are required at all spheres of government to secure long term sustainability

Institutional strengths and weaknesses bring about a need to improve. The researcher has thus identified possible avenues that could be explored in strengthening sustainability within institutions. These are sustainable business models and adaptive management.

6.3.1 Sustainable business models

Sustainable business modelling is often used to define eco-innovations and eco-efficiency practices within institutions (Bocken *et.al.*, 2014). The application of these models incorporates the involvement of stakeholders, environment and society, however, does not provide a long-term solution. In essence, it is a modelling tool that has the potential to reduce impacts and prolong water availability

for the implementing institution. In line with identifying best practices, sustainable business models are one such avenue that can be explored by the institutions. Sustainable business models further have the capability of supporting the planning and implementation of policies.

The theory of sustainable business modelling is a concept that is gaining momentum at international level, where building sustainable practices from the onset of business operations is paramount. Despite the need for expertise suitably qualified to initiate and implement business models, it is believed that this has the potential to support the planning and implementation of policies. It's applicability at departmental level serves to introduce an arena of sustainable mechanisms in the corporate world. This could greatly reduce the costs and water usage by manufacturing industries. Government plays an important role in the implementation and regulation of sustainable business modelling (Bocken *et.al.*, 2014).

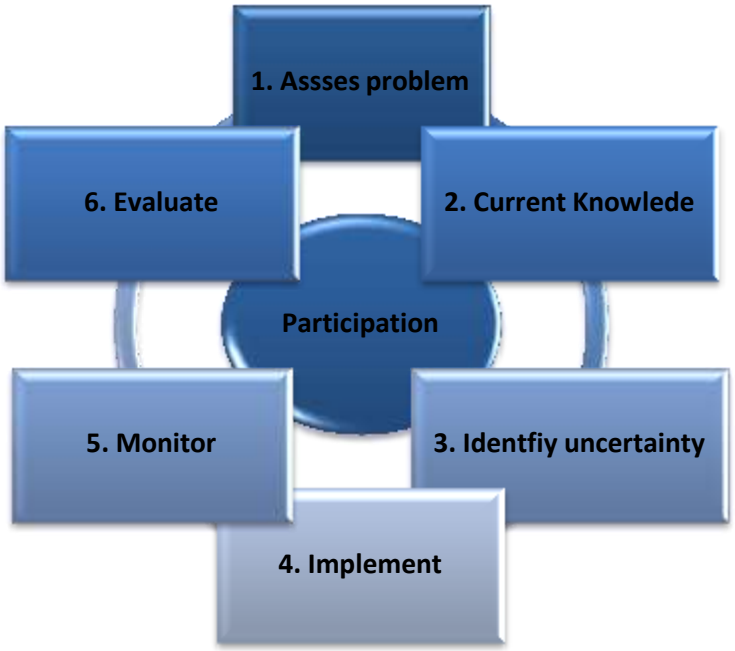
6.3.2 Adaptive Management

The environment is an ever-changing arena, where existing challenges in water resource management are compounded by new challenges. The first step in adaptive management is recognising the fact that the environment and its surroundings is complex, adaptive and a self-organising system that must be managed in a way that it is possible to adjust to changes (Figure 15). A broader definition of adaptive management is provided by Moellenkamp *et.al.* (2010): "systematic process for improving management policies and practices by learning from the outcomes of implemented management strategies". Moellenkamp *et.al.* (2010) further identifies the institutional prescriptions, such as collaboration, experimentation and a bio-regional approach, as well as adopting a learning and action-based approach. Adaptive management does depend on structural conditions to achieve its mandate. This does require a paradigm shift and can be achieved through (Moellenkamp *et.al.* 2010):

i. Extensive participatory management meetings and collaborative decision-making at government and non-government levels;
ii. Adjustable management approaches that can account for unexpected challenges; and
iii. The reduction of dualism in policies and strategies governing water resource management.

The South African water governance regime has lacked the capacity for adaptive management, and is still met with challenges of conventional bureaucracies. Current practices highlight a more reactive than preventative approach. It is therefore critical that water resource management is recognised as management of the social, environmental and economic dimensions. While these dimensions work in synergy, ethical attitudes within institutions require change. To successfully achieve SAM short term and long term change concepts must be considered to make improvements in the institutional arena, thereby overcoming constraints outlined in the interview questions. Meissner (2013) suggests that in order for SAM to adapt, an understanding that water resources is a complex system is required.

Figure 15. Adaptive Management Process



(Source: Adapted from Rist et.al., 2013).

Accordingly the principles of adaptive management (Rist *et.al.*, 2013) will ideally support policies such as the NWRS2 and IWRM. This comprises building of a more participatory approach and formally grounded management structures (Moellenkamp *et.al.* 2010; Rist *et.al.*, 2013, Meissner, 2013). Moreover, the interview questions allude to a top-down institutional management style, whereas the adaptive management approach requires a bottom-up approach through its participatory process (Moellenkamp *et.al.* 2010; Rist *et.al.*, 2013). Another important aspect of SAM is knowledge in the form of correct skills which is paramount to identifying and ensuring its concepts; which was identified by participants as lacking.

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APPENDIX A PARTICIPANT INFORMATION SHEET

School of Geography, Archaeology and Environmental Studies

Private Bag 3, Wits 2050, South Africa Enquiries: **GEOGRAPHY:** TEL: +27 11 717-6503 •
ARCHAEOLOGY: TEL: +27 11 717-6045 •
http://www.wits.ac.za/geography/

Dear Sir/Madam,

PARTICIPANT INFORMATION SHEET

Purpose of Study
I am currently conducting research on perspectives of governance frameworks in sustainable policy development with the Water Resource Management system in South Africa. The attached Questionnaire and Interview is part of a research project which is partial fulfilment of a Master of Science degree at the Department of Geographical, Archaeological and Environmental Studies (University of Witwatersrand). The information you supply will assist in better understanding sustainable policy development within institutional frameworks.

Participation
In order to create a complete data collection base, you have been selected as a participant in this project. Participants were selected from offices within institutions to understand the relationship during and after policy development.

Structure
The study will only be for the duration of 2015; therefore, your urgent response will be grateful. The option to participate is solely yours and should you be willing to participate, please sign the consent form. Do note you are free to withdraw at any time.

I would greatly appreciate your time and effort in completing the research questionnaire. The questionnaire and interview questions should take approximately ten (10) minutes your time.

Confidentiality
Please note that your response will be kept strictly confidential. To ensure confidentiality, the questions have been coded and only your response will be analysed. Your details are only required for quick referencing during data analysis and data will only be accessible to the research team. All data will be stored securely.

Should you have any questions or enquiries regarding the research, please contact me or my supervisor, Dr. Danny Simatele (please see contact details below). Thank you for your time and assistance in furthering this research endeavour.

Yours sincerely,



Vanessa Pillay
Research Student
Email: 937663@students.wits.ac.za
Cell: 083 226 9467

APPENDIX B PERMISSION FROM INSTITUTIONS

School of Geography, Archaeology and Environmental Studies
Private Bag 3, Wits 2050, South Africa Enquiries: GEOGRAPHY: ARCHAEOLOGY: TEL: +27 11 717-6603 TEL: +27 11 717-6545 http://www.wits.ac.za/geography/

14 July 2015

Department of Environmental Affairs
Environment House
471 Steve Biko
Arcadia, Pretoria
0083, South Africa

Dear Director-General

Permission to Conduct Research

My name is Vanessa Pillay and I am a MSc. Environmental Management student at the University of Witwatersrand. The research I wish to conduct involves perspectives of governance frameworks in policy development in sustainable water resource management in South Africa. I would, therefore like to approach selected individuals to complete an online questionnaire. In saying so, I am seeking the Director-Generals consent to approach individuals within the Department of Environmental Affairs to conduct my research in fulfilment of my post-graduate degree.

The study will only be for the duration of 2015; therefore, your urgent response will be grateful. My research objectives are to:

- To identify the strengths and weaknesses of current water resource management institutions in Gauteng, South Africa;
- Measuring the degree of sustainability during the policy development process and governance thereof, within the water resource management institutional framework;
- Identify sustainable best practice by institutional frameworks.

Strict confidentiality will be maintained for all responses. To ensure confidentiality, the questions will be coded and only responses will be analysed. Participant details are only required for quick referencing during data analysis and data will only be accessible to the research team.

Thank you for your time and assistance in furthering this research endeavour.

Yours sincerely,

Vanessa Pillay
Research Student
Email: 937663@students.wits.ac.za
Cell: 083 226 9467

DEA Director-General Approval

GUY PRESTON
Name and Surname

Signature

mineral resources
Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DMR 16

For enquires; contact no. (012) 444 3004; Email address: Makisang.dlamini@dmr.gov.za

Ms Vanessa Pillay
Research Student
Department of Geography, Archaeology and Environmental Studies
Private Bag 3
Wits
2020

Dear Ms Pillay

RE: PARTICIPANT INFORMATION SHEET

This serves to confirm receipt of your letter with regard to the above mentioned subject.

The Department of Mineral Resources (DMR) is willing to assist you on matters relevant to its mandate. The contact persons from the DMR will be Ms Sibongile Malie; email address: Sibongile.malie@dmr.gov.za and Mr Sibusiso Kobese, email address Sibusiso.kobese@dmr.gov.za.

For other government departments you are kindly advised to approach those relevant departments.

I hope you will find this in order.

Kind Regards

Dr Thibedi Ramontja
Director-General
Date: 02 November 2015

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Director-General, Department of Agriculture, Forestry and Fisheries
Private Bag X250, Pretoria, 0001
Tel: 012 319 7300. Fax: 012 319 7135. E-mail: DGoffice@DAFF.gov.za

Ms V Pillay
Research Student
Private Bag 3
WITS. 2050

Dear Ms Pillay

APPROVAL TO CONDUCT RESEARCH IN THE DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES IN FULFILLMENT OF A POST-GRADUATE DEGREE

Your request to conduct research in the Department of Agriculture, Forestry and Fisheries dated 25 August 2015 refers.

The department supports and approves your request for conducting research in the department. You are requested that upon completion of the research, a copy of the outcomes be submitted to the Department's Knowledge Management component for use by the department. Your contact in this regard would be Ms Mary- Jean Gabriel on 012 846 8567 or Mary-Jean@daff.gov.za

Good luck with your studies.

Kind regards

EDITH VRIES
DIRECTOR GENERAL
DATE: 14 SEP 15

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Private Bag X313, Pretoria 0001 / Sedibeng Building, 185 Schoeman Street, Pretoria
Tel: 012 336 7500 / Fax: 012 323 4470 or 012 326 2715

Eng: Miriam Moagi Tel: (012) 336 7447 Fax: 086650 6241 Email: jiq@dwa.gov.za Ref: 12355305

Ms Vanessa Pillay
University of Witwatersrand
Private Bag X 3
WITS
2050

Dear Ms Pillay

APPROVAL TO CONDUCT RESEARCH IN THE DEPARTMENT OF WATER AND SANITATION IN FULFILLMENT OF A POST- GRADUATE DEGREE

Your request to conduct research in the Department of Water and Sanitation dated 18 May 2015 refers.

The department supports and approves your request for conducting the research in the department. You are requested that upon completion of the research, a copy of the outcomes be submitted to the Department's Knowledge Management component for use by the department.

Good luck with your studies.

Yours sincerely

Margaret-Ann Diedricks
DIRECTOR-GENERAL
DATE: 2015/07/16

APPENDIX C ETHICAL CLEARANCE

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Pillay

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H15/06/73**
PROJECT TITLE	Water resource management in South Africa: Perspectives on governance frameworks in sustainable policy development
INVESTIGATOR(S)	Ms V Pillay
SCHOOL/DEPARTMENT	GAES/
DATE CONSIDERED	26 June 2015
DECISION OF THE COMMITTEE	Approved unconditionally
EXPIRY DATE	26 July 2018
DATE 27 July 2015	**CHAIRPERSON** (Professor J Knight)

cc: Supervisor : Dr D Simatele

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor, Senate House, University.

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

30 / 07 / 2015
Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

APPENDIX D QUESTIONNAIRE AND INTERVIEW QUESTIONS

Completion and submission of the questionnaire is taken to mean consensus **Strictly Confidential (only for researchers statistical analysis)**			
Job Title			
Male (M) /Female (F)		**Number of Years in Your Current Industry**	
Institution			

	CIRCLE YOUR CHOICE	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
	IWRM					
1	Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment	1	2	3	4	5
2	Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels	1	2	3	4	5
3	Women play a central part in the provision, management and safeguarding of water	1	2	3	4	5
4	Water has an economic value in all its competing uses and should be recognised as an economic good	1	2	3	4	5
5	All people have a basic right of access to water that is of adequate quantity and quality	1	2	3	4	5
6	Current water resource management plans undermine environmental and ecological sustainability	1	2	3	4	5
7	Economic allocations considers water scarcity	1	2	3	4	5
	Management Commitment					
8	Economic allocations considers water scarcity	1	2	3	4	5
9	Management drives and supports water resource management initiatives	1	2	3	4	5
10	My institution promotes sustainable best practices	1	2	3	4	5
11	My institution has policies that adopts sustainable	1	2	3	4	5

	development					
12	Management budgets for incorporation of sustainable best practices	1	2	3	4	5
13	Management involves relevant stakeholders during policy development	1	2	3	4	5
14	Regulatory compliance is always maintained	1	2	3	4	5
15	We seek objectives for continuous sustainable water resource management	1	2	3	4	5
16	Management incorporates environmental performance in reports	1	2	3	4	5
17	Audits are frequently conducted on implementation and maintenance of policies	1	2	3	4	5
	Stakeholder Relationships					
18	We actively communicate policies with all spheres of government and public	1	2	3	4	5
19	Policies regarding sustainable water resource management are aligned to legislation	1	2	3	4	5
20	Policies regarding sustainable water resource management are aligned at all spheres of government	1	2	3	4	5
21	Training has been provided for all policies	1	2	3	4	5
22	Mandated stakeholders are regularly audited	1	2	3	4	5
23	Sustainable development has been clearly outlined in my institution	1	2	3	4	5
24	Sustainable water resource management is a priority	1	2	3	4	5
25	We have the necessary expertise to implement and maintain policies	1	2	3	4	5
26	I understand my role in policy development	1	2	3	4	5
	Policy Design	1	2	3	4	5
27	There is a willingness to design environmental/water resource policies	1	2	3	4	5
28	A committee was established for policy-making	1	2	3	4	5
29	A situation analysis was conducted during policy-making	1	2	3	4	5

30	Access to information was readily available to make informed decisions	1	2	3	4	5
31	There are minuted discussions around policy-making	1	2	3	4	5
32	Representatives from all spheres of government were present during environmental/water resource policy-making	1	2	3	4	5
	Implementation					
33	Policies are easy to interpret	1	2	3	4	5
34	Dedicated resources ensure policy implementation	1	2	3	4	5
35	There is sufficient human and financial resources to coordinate policy implementation	1	2	3	4	5
36	Policies are appropriately communicated to stakeholders	1	2	3	4	5
	Policy Evaluation					
37	Environmental/water resource policies show stability and reliability	1	2	3	4	5
38	Environmental/water resource policies are relevant and significant to my job	1	2	3	4	5
39	Environmental/water resource policies are effective and efficient in maintaining sustainability	1	2	3	4	5
40	Environmental/water resource policies consider all aspects I feel are relevant	1	2	3	4	5

i. In your opinion, does alignment between departments during policy making ensure effective water resource management, please elaborate?

_____

_____

ii. Does the NWRS suitably cover sustainable water resource management? If yes, has the NWRS been sufficiently implemented? If no, what improvements can be made?

_____

_____

iii. Are there gaps in institutional and policy frameworks relating to water resource management? If yes, what are they?

iv. What institutional frameworks exist within which sustainable water resource management can be pursued?

v. In what ways can effective water governance be achieved in order to promote sustainable water resource management?

vi. What do you suggest could be done to improve policy implementation and enforcement?

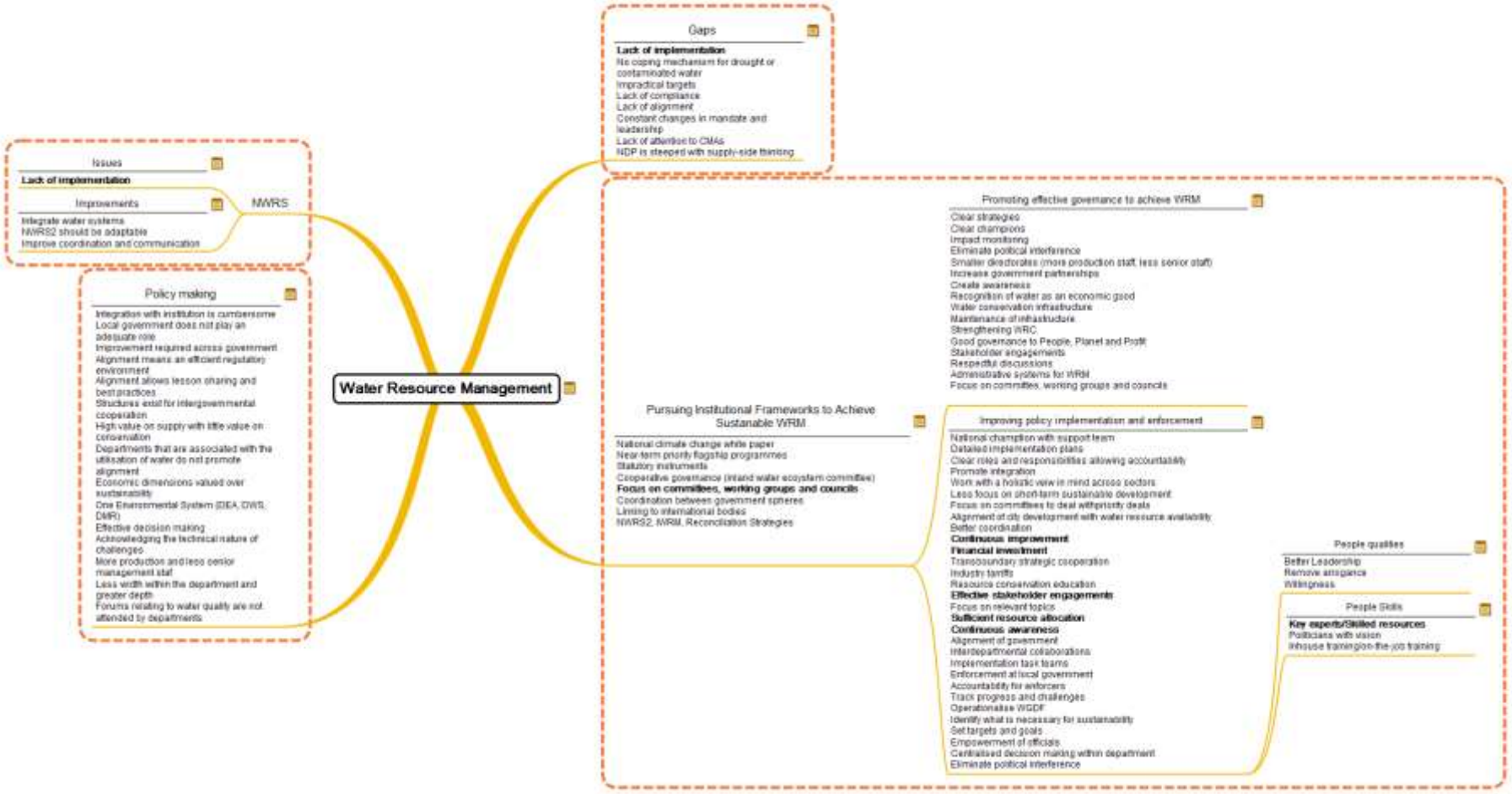
APPENDIX E CODED QUESTIONNAIRE DATA

	Strongly Agree			Agree			Newtral			Disagree			Strongly Disagree		
	National	Local	Water Bo	National	Local	Water Bo	National	Local	Water Bo	National	Local	Water Bo	National	Local	Water Bo
1.Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment	81	89	75	12	11	0	4	0	0	4	0	25	0	0	0
2.Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels	77	67	75	23	33	25	0	0	0	0	0	0	0	0	0
3.Women play a central part in the provision, management and safeguarding of water	38	33	50	50	22	25	8	33	25	0	0	0	4	11	0
4.Water has an economic value in all its competing uses and should be recognised as an economic good	69	78	100	19	11	0	4	0	0	8	11	0	0	0	0
5.All people have a basic right of access to water that is of adequate quantity and quality	85	89	75	12	0	25	0	11	0	0	0	0	4	0	0
6.Current water resource management plans undermine environmental and ecological sustainability	4	22	50	23	33	25	27	33	0	27	11	25	19	0	0
7.Economic allocations considers water scarcity	0	0	0	31	11	50	35	22	0	27	67	25	8	0	25
8.Management drives and supports water resource management initiatives	4	0	25	38	56	50	19	11	0	23	33	25	15	0	0
9. My institution promotes sustainable best practices	23	22	50	54	33	50	23	11	0	0	11	0	0	22	0
10. My institution has policies that adopts sustainable development	35	22	50	42	33	25	19	33	25	4	11	0	0	0	0
11. Management budgets for incorporation of sustainable best practices	12	0	25	48	33	25	28	33	25	12	33	25	0	0	0
12. Management involves relevant stakeholders during policy development	32	0	25	56	33	75	4	44	0	8	22	0	0	0	0
13. Regulatory compliance is always maintained	4	0	50	28	22	25	36	22	0	20	56	25	12	0	0
14. We seek objectives for continuous sustainable water resource management	20	11	50	60	44	0	20	33	25	0	11	25	0	0	0
15. Management incorporates environmental performance in reports	20	0	75	40	67	25	36	22	0	0	11	0	4	0	0
16. Audits are frequently conducted on implementation and maintenance of policies	12	0	50	48	56	50	16	11	0	20	33	0	4	0	0
17. There is investment on water issues	8	0	50	60	67	25	20	11	0	12	22	25	0	0	0
18. We actively communicate policies with all spheres of government and public	24	0	0	52	56	50	12	11	50	12	33	0	0	0	0
19. Policies regarding sustainable water resource management are aligned to legislation	16	22	75	64	33	25	20	22	0	0	22	0	0	0	0
20. Policies regarding sustainable water resource management are aligned at all spheres of government	12	11	0	44	11	100	12	22	0	28	44	0	4	11	0
21. Training has been provided for all policies	0	0	25	13	22	25	35	22	0	52	33	50	0	22	0
22. Mandated stakeholders are regularly audited	9	0	0	26	22	0	35	33	50	30	44	25	0	0	25
23. Sustainable development has been clearly outlined in my institution	22	0	0	35	56	75	22	11	0	22	33	25	0	0	0
24. Sustainable water resource management is a priority	39	33	25	43	22	50	13	33	0	4	11	25	0	0	0
25. We have the necessary expertise to implement and maintain policies	17	11	25	43	78	0	13	11	25	17	0	50	9	0	0
26. I understand my role in policy development	57	22	50	39	67	25	4	11	25	0	0	0	0	0	0
27. There is a willingness to design environmental/water resource policies	26	11	0	52	56	75	13	22	0	4	11	25	4	0	0
28. A committee was established for policy-making	22	0	25	48	22	25	30	22	50	0	44	0	0	11	0
29.A situation analysis was conducted during policy-making	22	0	0	43	33	0	26	33	100	9	22	0	0	11	0
30. Access to information was readily available to make informed decisions	17	0	0	43	44	25	22	22	50	13	33	25	4	0	0
31. There are minuted discussions around policy-making	30	0	50	48	33	0	17	44	50	4	22	0	0	0	0
32. Representatives from all spheres of government were present during environmental/water resource policy-making	17	0	25	35	11	0	30	67	50	17	22	0	0	0	25
33. Policies are easy to interpret	14	0	0	45	56	50	27	33	25	14	11	25	0	0	0
34. Dedicated resources ensure policy implementation	9	33	0	52	22	25	17	22	50	17	22	25	4	0	0
35. There is sufficient human and financial resources to coordinate policy implementation	0	0	0	22	11	25	17	11	25	48	56	25	13	22	25
36. Policies are appropriately communicated to stakeholders	0	0	0	61	22	75	17	22	25	13	44	0	9	11	0
37. Environmental/water resource policies show stability and reliability	4	0	0	39	33	100	39	56	0	17	11	0	0	0	0
38. Environmental/water resource policies are relevant and significant to my job	43	33	50	48	56	25	9	11	25	0	0	0	0	0	0
39. Environmental/water resource policies are effective and efficient in maintaining sustainability	13	0	0	48	33	50	9	44	0	26	22	50	4	0	0
40. Environmental/water resource policies consider all aspects I feel are relevant	13	0	25	35	22	50	22	33	25	30	44	0	0	0	0

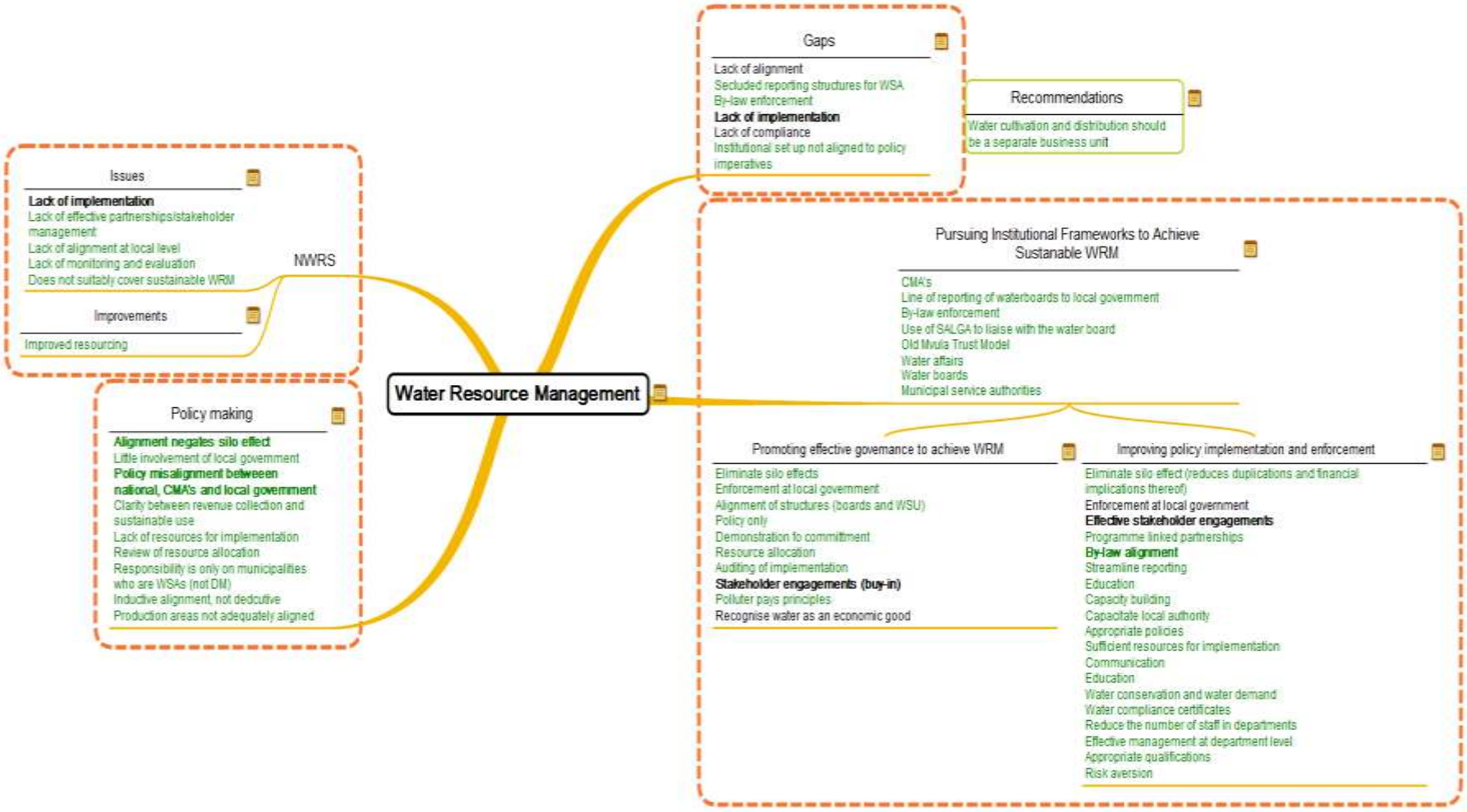
APPENDIX F DESCRIPTIVE ANALYSIS OF QUESTIONNAIRE DATA

	Mean	Standard Error	Median	Mode	Standard Deviation	Sample Variance	Kurtosis	Skewness
1	4.7	0.1	5.0	5.0	0.7	0.5	8.1	-2.9
2	4.7	0.1	5.0	5.0	0.4	0.2	-0.7	-1.2
3	4.1	0.2	4.0	4.0	1.0	1.0	2.6	-1.4
4	4.6	0.1	5.0	5.0	0.8	0.7	4.5	-2.3
5	4.7	0.1	5.0	5.0	0.9	0.9	10.6	-3.2
6	3.1	0.2	3.0	4.0	1.2	1.4	-0.8	-0.1
7	2.7	0.1	3.0	2.0	1.0	0.9	-1.1	0.0
8	3.2	0.2	4.0	4.0	1.2	1.3	-0.9	-0.4
9	3.9	0.2	4.0	4.0	1.0	1.0	2.1	-1.3
10	4.0	0.1	4.0	4.0	0.9	0.8	-0.5	-0.5
11	3.4	0.1	4.0	4.0	0.9	0.8	-0.8	-0.2
12	3.9	0.1	4.0	4.0	0.9	0.8	0.1	-0.7
13	3.0	0.2	3.0	2.0	1.1	1.3	-0.9	0.0
14	3.9	0.1	4.0	4.0	0.8	0.7	-0.3	-0.4
15	3.8	0.1	4.0	4.0	0.9	0.8	1.0	-0.7
16	3.5	0.2	4.0	4.0	1.0	1.1	-0.7	-0.5
17	3.6	0.1	4.0	4.0	0.9	0.8	-0.3	-0.6
18	3.7	0.1	4.0	4.0	0.9	0.9	-0.4	-0.6
19	4.0	0.1	4.0	4.0	0.8	0.6	0.1	-0.5
20	3.3	0.2	4.0	4.0	1.1	1.3	-1.1	-0.2
21	2.7	0.1	2.0	2.0	0.9	0.9	-0.5	0.5
22	2.9	0.1	3.0	3.0	0.9	0.9	-0.5	0.3
23	3.5	0.2	4.0	4.0	1.0	1.0	-1.0	-0.3
24	4.1	0.1	4.0	4.0	0.9	0.8	-0.1	-0.8
25	3.6	0.2	4.0	4.0	1.2	1.4	-0.5	-0.7
26	4.4	0.1	4.0	5.0	0.6	0.4	-0.5	-0.6
27	3.8	0.1	4.0	4.0	0.9	0.8	1.5	-1.1
28	3.5	0.2	4.0	4.0	1.0	1.0	-0.2	-0.4
29	3.5	0.2	3.5	4.0	1.0	1.0	-0.2	-0.3
30	3.5	0.2	4.0	4.0	1.0	1.0	-0.4	-0.5
31	3.8	0.1	4.0	4.0	0.9	0.9	-0.7	-0.3
32	3.4	0.2	3.0	3.0	1.0	1.1	-0.5	0.1
33	3.5	0.1	4.0	4.0	0.8	0.7	-0.4	-0.3
34	3.5	0.2	4.0	4.0	1.0	1.1	-0.5	-0.4
35	2.4	0.2	2.0	2.0	1.0	1.0	-0.9	0.4
36	3.2	0.2	4.0	4.0	1.0	1.0	-0.6	-0.8
37	3.4	0.1	3.5	4.0	0.7	0.6	-0.5	-0.4
38	4.3	0.1	4.0	4.0	0.6	0.4	-0.6	-0.4
39	3.4	0.2	4.0	4.0	1.1	1.1	-0.9	-0.3
40	3.3	0.2	3.0	4.0	1.0	1.0	-1.1	0.0

APPENDIX G INTERVIEW RESPONSES (NATIONAL)



APPENDIX H INTERVIEW RESPONSES (LOCAL)



APPENDIX I INTERVIEW RESPONSES (RAND WATER)

