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Performance Measurements on Concession Periods to Forecast Water Infrastructure Investment Returns

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Walden University
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Abstract

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M.Phil. Fin. Mgmt, Walden University, 2019

MSc.PM, Liverpool University, 2013

MBA, Milpark Business School, 2012

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Public-private-partnership stakeholders in South Africa are inconsistent in applying performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. The purpose of this qualitative e-Delphi study was to assess consensus among 17 public-private-partnership experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. The research question pertained to their level of consensus. Determination and analysis of the concession period conceptual model that illustrates how to achieve benefits of the concession period when the distribution of risk is equal among parties, and equity in benefit distribution formed the conceptual framework. The study had three rounds of online surveys. The first was an open-ended questionnaire, analyzed with open coding, followed by items rated for desirability (Round 2) and desirability and feasibility (Round 3) and analyzed with descriptive statistics. Consensus emerged on 23 strategies items in five categories: technical skills, budget constraints, performance measurements, negotiation best practice strategies, and performance monitoring measures. Performance measurement incorporation on concession period model can balance investment returns over the economic life cycle of the infrastructure asset, leading to positive social change.

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Dedication

The work is a blue-print of past-generation who strove for meaningful justice and dedicated their sweltering sweats to a society equal for all. I dedicate my work to the child who endeavors to till the land for another day. The work is for all the women and the children of the world who goes to sleep without food. I dedicate my work to my late mother, my late father, my late sisters, and my grandmother whom I owe my success to her struggles. Let all who read my work ponder and think about what their role is in this world. The research study was designed by the University of Walden, to whom I want to also dedicate my special thanks for giving me the opportunity to conduct the research study to completion.

Acknowledgments

At the completion of my study, the re-configuration of my scholarly journey is already at pace. The knowledge gained in the study reshaped my future and redesign my perspective about the financial sector.

Let me start by acknowledging the team-work, colleagues from the University at different levels of responsibility, astounding dinosaurs, whom I owe my success. Dr. Keri Heitner, Dr. David Bouvin, Dr. Daphne Halkias, and Dr. Barbara Turner, you gave it all until the end. I'm sincerely humbled and grateful by your unreserved dedication. The study also benefited from your unconditional contributions. Dr. Solan Bvuma, thanks for your guidance through the project, even when the journey looked dark to comprehend. Let me also thank the great minds, to whom I borrowed the future….through the journey of my project. Essie Ntombana Nkuna, my native mother, who left us in 2012 at the height of future undetermined. She gave it all to lead us into the future that begins now…My late father, France Mathuthu Khoza, an African soul. I couldn't be what I am without you….May you Live Longer in our hearts! Lastly, special thanks to my children, Adimba Perez Magudu Khoza, Kgopotso Rajiv Khoza, Mathuthu Rey Khoza, Melusi Rey Khoza, and Latoya Essie Ntombana Khoza, who led me the time to dedicate effort to the study completion. I sincerely appreciate your patience…waiting in cold-winds to finally witness this moment of glory. To all the mothers of my children…you gave the best that you can…I'm deeply indebted to you. May you live longer….and always hold the future that is!

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Chapter 1: Introduction to the Study

South Africa's government is meeting challenges in financing much-needed water infrastructure expenses that measure beyond the national budget capacity (Khatleli & Mukuvari, 2019). As elsewhere in the developing world, many South Africans do not have "acceptable access" to potable water (Department Statistics South Africa, 2020; Fintel & Orthofer, 2020). The lack of financial capacity and budgetary constraints compelled the South African government to use PPP concession period models as alternative funding instruments to develop new water infrastructure (McCallum et al., 2019; Khatleli et al., 2017). PPP (PPPs) concession period models have become a significant scheme for governments in delivering public infrastructure projects due to public budget constrictions and the urgent need for new or rehabilitated infrastructure in developing nations (Carbonara & Pellegrino, 2020). A concession period refers to a period starting from the infrastructure project's breakeven point until the end of infrastructure asset economic life, taking into account the transition period of infrastructure to government and public (Feng et al., 2019).

Despite scholars documenting that PPP concession period models provide a variety of benefits to the government, several critical aspects related to a concession period-based infrastructure projects need to be managed, among them the determination of an optimal concession period and the risks associated with it (Carbonara et al., 2017). The optimal concession period allows a fair risk-sharing between PPP stakeholders. In other words, the concession period should protect the parties' rights by guaranteeing that profits and risk allocation between parties are balanced and rational (Hadi & Erzaij,

2019). The concession period model application is critical to funding water infrastructure in South Africa and demonstrates that infrastructure assets can become significantly inefficient and unreliable both technically and operationally postconcession termination (Khatleli & Mukuvari, 2019; Matey, 2019). Accordingly, Ramirez et al. (2019), and notably Albertus (2019), cited inconsistencies caused by the lack of symmetrical data for planning and the incapacity to incorporate performance measures specifying water infrastructure project financial value at the preconcession stage.

South African government stakeholders have encountered additional inconsistencies of water infrastructure assets' return on investment, such as numerous obligations being poorly articulated and defined, including incomplete and inconsistent long-term costs, inconsistent governance legislation, and undue risk allocation between parties to the concession agreement (Albertus, 2019; Ramirez & Sanudo-Fontaneda, 2018; Ruiters & Matji, 2016). Accordingly, to address inconsistencies, the concession period structures need to have standard approaches that incorporate all performance measurements consistent with long-term investment returns that balance social value and profit generation for both public and private sectors, respectively (Dithebe et al., 2019a; L. Zhang et al., 2019). The concession period is a crucial decision to arrange a successful partnership contract because its value decides when the ownership of the infrastructure assets should be transferred from the private sector to the public one, thereby demarcating the influence, and responsibility, between the private party and the government (Hadi & Erzaij, 2019; Ma et al., 2018; Yinghua et al., 2016). The South African government must apply a concession period model strategy because possibilities exist to achieve social

benefits and financial value postconcession termination from a well-designed and adequately structured water infrastructure concession period (McCallum et al., 2019; Khatleli et al., 2017).

The concession period approach emerges as an alternative investment instrument best suited for the South African government because of the investment opportunities the model provides to build large-scale infrastructure projects needed to improve quality service delivery and infrastructure assets' financial value (Halstein, 2020; Khatleli et al., 2017; Ruiters & Matji, 2016). Sections of this chapter include the study background and the problem the study addresses. It also includes the study's purpose, research question, subquestions, and a conceptual framework for the study. Furthermore, it includes the study's nature, definitions of key terms, and discussion of assumptions, scope and delimitations, and limitations. The chapter also includes a section on the study's significance related to practice, theory, and social change.

Background of the Study

Water infrastructure efficiency and reliability are critical to providing water for domestic use, such as for mining, agriculture, residential use, and filtration, and are costly to construct and maintain (Seeletse, 2016). According to Mudombi and Montmasson-Clair (2020), a focus on building water infrastructure in South Africa can ensure water security, and equally, reductions in poverty and inequality. To achieve water infrastructure sustainability, South Africa needs an estimated $103 billion (Ruiters & Matji, 2016) to rebuild its infrastructure capacity. Water infrastructure alone requires an estimated $55.5 billion to align water demand and supply with the National Development

Plan's goals aiming at industrial development and employment creation (Mudombi & Montmasson-Clair, 2020; Khatleli et al., 2017). The concession period is the main element of the PPP model critical for infrastructure projects' life cycle (Ma et al., 2018). The concession period defines partnership agreements and outlines rights and obligations between public and private sectors in infrastructure projects development (Ullah et al., 2018; Zhang et al., 2016). According to Ma et al. (2018), the empirical estimation determines the concession period length rather than quantitative analysis.

Since empirical estimates determine the concession period, there is a likelihood that decision on concession period timing may result in personal judgments unlikely to protect the rights and interest of parties and compromise infrastructure projects financial value at postconcession termination (Nabawy & Khodeir, 2020; Ullah et al., 2018). The prolonged concession period of water infrastructure assets may lead to a social profitability loss that governments often pursue to achieve postconcession termination (Dithebe et al., 2019a; Hadi & Erzaij, 2019). In contrast, a short concession period usually leads to two scenarios: either the concessionaire offers to increase prices of the service charges or fees that provide financial constraints to the public, or the investor would reject the partnership (Seeletse, 2016; Yinghua et al., 2016). Several studies in developing countries, including South Africa, show a high success rate of concession period contracts considering appropriate risk-sharing, benefits, technology transfer, shared investment costs, and balanced financing structures (Dordevic & Rakic, 2020; Khatleli & Mukuvari, 2019). Other studies lack conclusive evidence that concession period-based PPPs offered infrastructure assets financial value postconcession

termination (Halstein, 2020; Mohamad et al., 2017; Ramirez et al., 2019; Ruiters & Matji, 2016). Opawole et al. (2018) wrote that a comparable level of better PPPs reported in South Africa results from a well-streamlined approval process, strong local financial institutions, and well-structured legal mechanism.

The above evidence with differing research findings demonstrates a need for further research to determine the concession period influence in water infrastructure assets financial value postconcession termination (Ahmadabadi & Heravi, 2019; F. Wang et al., 2018) and developing countries (Hadi & Erzaij, 2019). Undertaking further research ensured that future practitioners in concession period models develop financing structures appropriate to deliver infrastructure assets in developing countries that generate revenue certainties and maintain financial value postconcession period (Cui et al., 2018; Feng et al., 2019). F. Wang et al. (2018) pointed out that a mutually beneficial concession period reduced infrastructure projects' implementation failures, uncertainties, and risks in postconcession termination. McCallum et al. (2019) supported F. Wang et al.'s (2018) notion of a mutually beneficial concession period between governments and impact investors concerning building adequate water infrastructure in South Africa. A concession period model must allow for public and private sectors to equal risk-sharing to ensure equity in benefit distribution and leverage concession period improvements to safeguard stakeholders' equal benefits and profits (Yan et al., 2020).

Cui et al. (2018) further found that asset infrastructure development potentially increases economic value and benefits society through improved infrastructure performance measurements. Zeng and Chen (2019) noted that the concession period

model as a tool to develop assets infrastructure through PPPs could also be used to create infrastructure financing options, financing theories, contract theories, and transaction costs theories, and or partnerships theories. Since the financial value of infrastructure assets differs from country to country, scholars recommend a need for more studies within the South African context on developing a well-designed concession period model to drive social benefits and financial value after the postconcession termination (McCallum et al., 2019; Khatleli et al., 2017).

Problem Statement

South Africa's water infrastructure improvement is central to economic activity and human health (McCallum et al., 2019). The disease burden caused by insufficient water and sanitation infrastructure is estimated to result in approximately 2 million mortalities caused by the lack of potable water. The South African Financial and Fiscal Commission (FFC) noted that in order for South Africa to get its water and sanitation infrastructure to suitable standards, an additional R4 billion ($300 million) would be required annually for 5 years (Makhathini et al., 2020). The lack of financial capacity and budgetary constraints compelled the South African government to opt for the PPP concession period model as an alternative funding model to develop water infrastructure across localized communities (McCallum et al., 2019; Khatleli et al., 2017). Y. Zhang et al. (2017) pointed out that for a government to implement the concession period model and source funding against fiscal funding, it is critical to use rigorous and consistent performance measures on PPP to access capital investments for infrastructure development. The general social problem in South Africa's concession period-based

PPP' inability to balance their goals of social value and profit generation within local water infrastructure development may be due to inconsistent application of performance measurements to forecast long-term investment returns at postconcession termination (Arimoro, 2020; Dithebe et al., 2019a).

Determining the timing of concession period agreements impacts valuation, and valuations differ from market to market due to different interest rates and financing structures (equity, bonds, capital markets, government subsidies; Bayat et al., 2020). Water security is critical for South Africa's economic recovery, making reliable water infrastructure a significant source to stimulate quality livelihoods and public service delivery (Khatleli et al., 2017). South African government stakeholders that initiate PPPs to build much-needed water infrastructure must assume contingent liabilities relating, for example, to early contract termination or debt and revenue guarantees (Ruiters & Matji, 2016). Challenges affecting the success of water infrastructure projects in South Africa include corruption, hostility towards private participation, cost recovery constraints, unreliable planning and procurement processes, and a lack of technical and administrative capacity to maintain infrastructure financial value (Dithebe et al., 2019c). Inconsistent measurements for reliability, efficiency, and value for money (VfM) of performance measurements to optimize concession period agreements have left emerging economy governments with revenue uncertainties and financial value loss of water infrastructure assets (Petersen, 2019). Without applying rigorous performance monitoring measures to optimize concession period agreements, the South African government risks the capacity to achieve water supply sustainability, resulting from inefficient water infrastructure

performance postconcession termination (Dithebe et al., 2019a; Mabuza, 2019). The specific management problem is PPP stakeholders in South Africa are inconsistent in applying performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination (Dithebe et al., 2019c; Khatleli, 2020b).

Purpose of the Study

The purpose of this qualitative, e-Delphi study was to determine the level of consensus among 17 PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. The concession period is a crucial decision to arrange a successful partnership contract because its value decides when the ownership of the infrastructure asset should be transferred from the private sector to the public one, thereby demarcating the influence, and responsibility, between the private party and the government (Hadi & Erzaij, 2019; Pagoni & Georgiadis, 2020). Without using rigorous performance measures to optimize concession period agreements, the South African government risks the potential to sustain water supply due to inefficient water infrastructure performance postconcession termination (Dithebe et al., 2019a; Mabuza, 2019). Accordingly, to address this literature gap, an e-Delphi study design (Cole et al., 2013) application to answer the research question was essential to meet the study's purpose through a panel of experts. I selected a panel of PPP experts across South Africa. I recruited 20 participants in Round 1 through purposive sampling to form a panel with experience in the

underlining study constructs (Strasser, 2017). I evaluated the data's trustworthiness resulting from this e-Delphi study using credibility, transferability, dependability, and confirmability criteria (Staykova, 2019).

Research Question

The primary research question was: What is the level of consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure assets' financial value at postconcession termination? The study had three research subquestions, as well.

First, for a government to implement the concession period model and source funding against fiscal funding, it is critical to use rigorous and consistent performance measurements on PPP concession models. As such, the first research subquestion was: What are desirable and feasible strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development?

Second, project cash flows during the concession period and cash flows postconcession period until the end of infrastructure project economic life are critical to realizing. The second research subquestion was: What are desirable and feasible strategies during the negotiation period between public and private partners, so both parties come to a consensus on a project completion schedule?

Last, inconsistent measurements for reliability, efficiency, and value for money to optimize concession period agreements have left emerging economy governments with

revenue uncertainties. The third research subquestion was: What are desirable and feasible strategies for the South African government to apply rigorous performance monitoring measures to optimize concession period agreements, and drive infrastructure financial value at postconcession termination?

Conceptual Framework

This study was grounded in Hadi and Erzaij's (2019) determination and Analysis of the concession period conceptual model that illustrated how to achieve benefits of the concession period when the distribution of risk is equal among parties, and there is equity in benefit distribution. More importantly, the infrastructure project cashflows during the concession period and cash flows postconcession until the end of the infrastructure asset's economic life are critical to realize. In their seminal research on determining a concession period in PPP, Hadi and Erzaij (2019) defined the concession period as a negotiation process between public bodies and private sector entities acting as parties to adopt a partnerships deal. Hadi and Erzaij (2019) wrote that their underlying concept is the negotiation period, where both parties agree to a project's completion time. The successful outcome of such negotiations is to allow a competent contractor to complete the project on schedule. The operation period should be long enough to enable the concessionaire to achieve a reasonable return but not too long such that the concessionaire's return is excessive and the public sector's interests consequently sacrificed.

Hadi and Erzaij (2019) have grounded their conceptual model in Hanaoka and Palapus' (2012) use of the Monte Carlo simulation and bargaining game theory to design

a methodology to determine the reasonable concession period that would benefit both the public and the private sector with the impact of risks taken into consideration in the financial evaluation. The Monte Carlo Simulation in finance is a mathematical technique that generates random variables for modeling the risk or uncertainty of a specific system. According to Bayat et al. (2020), drawing on Nash (1950), game theory, a bargaining situation describes a situation in which (a) individuals or players have the possibility of concluding a mutually beneficial agreement, (b) when there is a conflict of interests about which agreement to conclude, and (c) no agreement may be imposed on any individual without the approval of the other (Carraro et al., 2005).

Bayat et al. (2020) and Feng et al. (2019) investigated developing an optimal concession period for infrastructure construction by PPP applying Monte Carlo simulation and bargaining game theory, generating a period interval within which a specific concession period could be agreed upon by the government and the private sector (Carbonara et al., 2014). Ahmadabadi and Heravi (2019) and Zhang et al. (2017) pointed out that for a government to implement the concession period model and source funding against fiscal funding, it is critical to use rigorous and consistent performance measures on PPP to access capital investments for infrastructure development. Carmichael (2020) recommends that an optimal concession period is critical when supported by sound management of performance measurements to monitor the infrastructure project during its economic life span. In chapter 2, the researcher presents the Conceptual Framework in greater detail in Chapter 2.

Nature of the Study

The study's nature was qualitative with an e-Delphi design (Cole et al., 2013; Meshkat et al., 2014). An e-Delphi technique is applied in qualitative research as a forecasting technique to investigate a topic that lacks evidence and goes far beyond to explore an area of what is currently known or believed (Hsu & Sandford, 2007; Murphy et al., 2018). Qualitative research allows naturalistic and fieldwork engagement, which provides a basis for a clear understanding of how people make sense of their experience, the research phenomenon, and subsequently shape their research process that entails shaping data collection and findings (Ravitch & Carl, 2016). The quantitative research method was not relevant to this study because exploratory studies are not appropriate to investigate any statistical relationship or manipulate experimental variables. Qualitative research is suitable when field observations of reality are analyzed using numerical methods or where the intention is to conclude coded data. As such, the qualitative method was the most flexible approach to collecting and analyzing data to determine the consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development.

Other qualitative research methods, such as phenomenology and case studies, would not be appropriate for this study. In phenomenological research, a researcher holds presuppositions, assumptions, biases, and previous experience to describe the study (Ravitch & Carl, 2016; van Manen, 2017). The case study method involves studying a case of real-life experiences and is a method that, if applied, aims to improve a theory

instead of approving or rejecting it (Babbie, 2017). The e-Delphi method is a systematic research approach and was most appropriate for achieving consensus based on expert judgments by completing rounds of questionnaires (Price et al., 2020). The controlled feedback can potentially influence experts' responses in each round of questionnaires influenced by controlled feedback resulting in a convergence of opinion and subsequent expert-consensus (Karampatakis et al., 2019; Price et al., 2020).

The Delphi design originated from the RAND Corporation in the 1950s (Murphy et al., 2020). The Delphi technique allows researchers to gather data from experts' assessments of a research phenomenon through a series of questionnaires (Hsu & Sandford, 2007). The Delphi design involves an iterative process owing to independent and anonymous participation critical to reducing extrinsic factors that are likely to create a subject bias (Price et al., 2020). According to Green (2014) and Meshkat et al. (2014), the Delphi technique consists of a structured communication process that ensures an interactive forecasting procedure. Donohoe et al. (2012) expressed that the e-Delphi design represented an updated Delphi computerization process, critical to optimizing widespread and diverse thinking while ensuring organization, control, and the facilitation of communication between the expert panel and the researcher (Karampatakis et al., 2019). Consequently, Hsu and Sandford (2007) viewed the Delphi method as suitable for research problems that are not consistent with linear or precise analytical approaches and where subjectivity judgment based on a collective basis is likely to illuminate new perspectives. Qualitative researchers in the finance sector use the e-Delphi technique when the objective is to gather consensus and generate a level of agreement among a

panel of organizational managers on a situation that is not well understood (Velez et al., 2020).

The e-Delphi delivers sequential questionnaires on an electronic platform removing geographical limitations while ensuring the data collection process provides the researcher with the advantage of the convenience of time and resource savings and data management platform (Davidson, 2013; Price et al., 2020). Donohoe et al. (2012) indicated that the e-Delphi technique is a convenient and efficient design alternative compared to the traditional paper-based technique of the classical Delphi research method. Because I conducted the research online, the e-Delphi research technique was a viable alternative compared to the traditional paper-based method to coordinate experts' data collection from different locations within South Africa (Davidson, 2013; Murphy et al., 2020). Given this study's purpose, the e-Delphi design was appropriate for the study's overall purpose which was to gain knowledge from experts using e-Delphi techniques to determine the level of consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements. Using the e-Delphi approach was therefore considered relevant to meet the purpose of the study since:

- The research problem was likely not to be resolved through analytical methods but required collective expert judgment;
- The experts were independent and anonymous participants in the research, and;
- The researcher achieved validity by maintaining diverse group thinking (Green, 2014; Murphy et al., 2020; Price et al., 2020).

I used a social media recruitment strategy that included emails, purposive and snowball sampling, and online communication with potential participants to recruit panelists. I used purposive sampling to identify experts in the PPP concession period. The experts identified satisfied the following inclusion criteria:

- Had a minimum of at least 5 years of experience in PPP water infrastructure development;
- Possessed a Masters' Degree in Finance, Engineering, and Project Management;
- Were employed at the time of the study in the Development Bank of Southern Africa (DBSA);
- Had been employed for over 5 years at the National Treasury in the PPP unit; and
- Were an adult over the age of 18.

As noted by Peterson (2018), there is no set of universal guidelines for qualifying an expert for a Delphi panel. I used various criteria to assess expert qualifications focusing on "education, years of work experience, professional affiliation, project involvement, licensures, and professional publications" (Peterson, 2018). Accordingly, to achieve consensus-based outcomes from experts and realize trustworthiness, I worked diligently to achieve credibility, dependability, transferability, and confirmability. The data collection tools included three rounds of multiple questionnaires to gain a level of agreement.

The instrument for Round 1 was an open-ended questionnaire. The data produced through the panelists' descriptive responses were coded and analyzed using an open coding technique to label and focus responses on a strategic construct that assisted to

create categories. In Rounds 2 and 3, the panelists rated strategic constructs from Round 1 using a 5-point Likert scale for desirability in Round 2, and desirability and feasibility in Round 3 (Murphy et al., 2020; Prince et al., 2020).

I provided participants with the opportunity to review and comment on their individual collected data. I applied coding memos to detail and document data collected and subsequent analysis, including code descriptions, theme development, code definition, and development of specific codes (Ravitch & Carl, 2016). The coding of memos and detailed descriptions of data allowed the research audience to appraise the findings and their applicability to broader contexts and settings while maintaining their context-specific richness (see Ravitch & Carl, 2016; Velez et al., 2020).

Definitions

Concession period: Concession period refers to a period or period starting from the infrastructure project's breakeven point until the end of infrastructure asset economic life, taking into account the transition period of infrastructure to government and public (Feng et al., 2019).

Preconcession period: In the preconcession period, the private sector design, build, operates, and maintain infrastructure to maximize profits and transition infrastructure asset to government ownership (Yan et al., 2020).

Postconcession period: Postconcession period is when the government operates and maintains infrastructure assets to maximize revenue, social welfare and sustain the infrastructure's economic life (F. Wang et al., 2018).

Economic life: Economic life refers to an infrastructure asset life cycle wherein the asset infrastructure generates profits and net gains until it reaches its design life (Hadi & Erzaij, 2019).

Financial value: Financial value or value for money for infrastructure projects is the total present value cost of private sector investors less the net present value of the baseline cost of public delivery services, adjusted for risk costs to be retained by the government (Cui et al., 2018).

Performance measures: Performance measures of concession period-based PPP are evaluated based on time, costs, and quality saved through the concession model (Cui et al., 2019).

Performance measurements: Performance measurements of the concession period is an active process that ensures concession period infrastructure projects achieve economic, environmental, and social sustainable performance postconcession termination (Liang & Wang, 2019).

Private sector: Private sector in a concession period-based PPP refers to the party in the agreement provided with an obligation to design, finance, construct, and operate a public facility for a fixed duration of the concession period, until transitioning of asset infrastructure to government and public use (Nguyen & Notteboom, 2017).

Public sector: Public sector in a concession period-based PPP refers to a government that provides a subsidy scheme, land, and or enabling an environment that allows the private sector or investors to invest their capital, resources, and competencies

in developing public social infrastructure with sustainable financial value for service delivery (Shi et al., 2018).

PPP: PPP refers to agreements between public and private sectors entering into a long-term contractual relationship with private sector entities to finance, construct, manage, and transfer public infrastructure facilities to government and public (Hadi & Erzaij, 2019).

Socioeconomic infrastructure: Socioeconomic infrastructure refers to infrastructure with social and economic benefits to help deliver public services while improving national economic opportunities (L. Zhang et al., 2019).

Risk management: Risk management in the context of a concession period-based PPP covers government-related risks, specific infrastructure risk allocation, project financing risks, construction risks, and uncertainties concerning infrastructure asset future value (Opawole et al., 2018; Shi et al., 2018; L. Zhang et al., 2019).

Win-win concession period: Win-win concession period is a model at which the estimated concession period value expected provides protection and safeguard all stakeholders' interests and ensure that interests are satisfied in a balanced way (Carbonara et al., 2014; Yan et al., 2020).

Assumptions

Assumptions are fundamental beliefs that cannot be proven (Tracy, 2019). The study included a range of assumptions. The first assumption was that recruited experts viewed the research problem as significant and agreed to participate in the Delphi panel. A second assumption was that recruited experts felt qualified to participate in the study.

The third assumption was that even with the absence of formal training in the selection criteria, the other selection criteria requirements placed the participants selected as experts in the study field. The recruitment processes were vital in enabling the participant's information to be accurate and data-rich for this study (Toronto, 2017). The fourth assumption was that the study participants would provide honest answers to the questionnaires. Expert participants attempted to reply to survey questions in a socially acceptable manner by understating or overstating their responses. There can be social acceptability bias present in the e-Delphi study (Msibi et al., 2018). An honest response to best practices strategies in reply to the research question strengthened the study data's trustworthiness.

The fifth assumption was that participant attrition was likely to be limited by providing explicit instruction, formatted questionnaires, and the short time lag between e-Delphi rounds. The lack of clear instructions and formatted questionnaires and excessive time duration between rounds in an e-Delphi study contributed to the participant drop-out rate (Toronto, 2017). The sixth assumption was that reaching a consensus required assembling a panel of experts on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development. There are numerous consensus measures in a Delphi study, such as percentage agreement and median score (Linstone & Turoff, 2011). A consensus amongst experts can provide information rich data to meet the purpose of the study. For the study, I followed Shorter et al.'s (2019) recommendations for scoring a multi-stakeholder e-Delphi study, with defining consensus achieved as 70% or more of the

respondents rating a given item at 4 or 5 on a 5-point Likert-type scale in Round 2 and 3, using the anchors of 1 to 5 for desirability in Round 2 and for desirability and feasibility in Round 3. The scoring method illustrates an outcome agreed upon critically by the majority and little or no importance by a small minority (Efstathiou et al., 2007; Shorter et al., 2019).

While Rowe and Wright (2001) estimated a panel of 5 to 20 experts would be appropriate for a classical Delphi study, I selected a minimum of 20 participants, as there was some expected drop-out during the rounds to compensate for expected participants' loss. All assumptions above demonstrated methodology challenges when conducting an e-Delphi study. Prevalent strategies applied to mitigate identified risks included constant use of electronic technologies such as teleconference, SurveyMonkey, skype, email, etcetera, which were crucial to data storage and transmission (Cole et al., 2013; Halim et al., 2018; Miles et al., 2014).

Scope and Delimitations

The study's scope was limited to the location and context of South Africa and focused on the concession period. This e-Delphi study's scope was limited to identifying best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development. I only focused on the data collection process on the concession period's topic to focus and align the research scope with and avoid answering questions outside the concession period model. Building consensus among PPP experts on approaches to improve the concession period model in infrastructure development could lead to sustainable positive social

change through assets infrastructure developments in communities. I never intended to cover infrastructure development outside water infrastructures, such as information technology, telecommunications, software development, research and development, and mega seaports concessions.

However, the study may not be generalizable in other parts of the world because its conclusions were limited to the South African context. I used purposeful sampling to select 20 participants in Round 1 to form a panel of experts from the public and private sector representative of stakeholders within the financial market of South Africa, such as commercial banks, government agencies, legal fraternities, engineering, and construction. The participant recruitment strategy in this e-Delphi remained within the scope of previously identified inclusion criteria.

I used questionnaires through the online survey, teleconference, email, SurveyMonkey, and Skype to maintain participants' confidentiality (Halim et al., 2018). In this qualitative e-Delphi study, the conclusions might be subject to other interpretations. I followed processes detailed in previous e-Delphi studies (Hasson et al., 2000; Msibi et al., 2018; Shorter et al., 2019). The design detailed processes for participants selection included expert knowledge, judgments, and experts' experience in the subject matter under investigation to guarantee an expert knowledge-base and ensure the trustworthiness of results while reducing data distortions. The e-Delphi technique identifies the initial scope of constructs grounded within the study's conceptual framework with the goal of theory extension (Efstathiou et al., 2007; Velez et al., 2020).

Limitations

A study's limitations concern potential weaknesses usually outside of a researcher's control and are associated with selected research design, resource and time allocation constraints, or factors beyond a researcher's control (Hasson et al., 2000; Hsu & Sandford, 2007; Theofanidis & Fountouki, 2018). The qualitative, e-Delphi technique imposes a certain degree of restrictions on the research process and might constrain the research outcome. Some of the limitations included internet access challenges, technical difficulties, and inconveniences to enter data in a computer-based screen compared to hard copies (Donohoe et al., 2012). Other than internet infrastructure availability, unreliable Internet access can also pose a challenge to both participants and researchers (Donohoe et al., 2012), and this is likely to cause experts' low response rates on questionnaires sent via emails.

Another limitation relates to time requirements and the possibility of participants dropping out from the research process due to resources and time constraints (Hsu & Sandford, 2007). All Delphi techniques are portions of an iterative process, therefore taking a large block of time for data collection is unavoidable (Hsu & Sandford, 2007; Murphy et al., 2020). The e-Delphi technique limitations are that the questionnaire method potentially slows down data collection and analysis processes considerably due to time cost and potentially driving participant drop-out. To help mitigate this limitation, I recruited 20 participants in Round 1, anticipating drop-out throughout the study so I could finalize the study with a sample of at least 10 participants, a minimum sample size standard for e-Delphi studies. Further limitations related to researcher bias resulting from

my experience and exposure in concession period-based PPP infrastructure projects development. These challenges can also compromise sample panel representation to achieve maximum consensus in a research study. Although there may be a relative limitation in recruiting PPP experts with subject knowledge to solicit an e-Delphi panel member size of 20 experts and complete the three rounds with 17 panelists, meeting the study inclusion criteria through a rigorous sampling strategy was practical to achieve.

Significance of the Study

The study results supported practitioners, policymakers, and scholars within the public and private infrastructure development in emerging economies to incorporate rigorous performance measurements to retain the financial value of assets pre- and postconcession termination. Incorporating design performance measurements in a concession period model is critical to establishing a win-win concession model (F. Wang et al., 2018; Y. Zhang et al., 2017).

Significance to Practice

The study might be significant to knowledge contribution in the PPP field of research within the South African context. More specifically, the concession period's remodeling against current concession models might contribute to concession periods research pertinent to developing countries focused on socio-economic infrastructure development opportunities (Mouraviev & Kakabadse, 2016; Song et al., 2015). The research aimed at providing essential benefits to scholars, practitioners, government agencies, legal agencies, project managers, engineers, and, to no small extent, academics involved in PPP practice (Mouraviev & Kakabadse, 2016; Y. Zhang et al., 2017). The

lack of balance between South Africa's PPP' social value contribution and profit generation within local water infrastructure development may be due to inconsistent use of performance measurements to forecast long-term investment returns (Arimoro, 2020). For a government to implement the concession period model and source funding against fiscal funding, it is critical to use rigorous and consistent performance measures on PPP to access capital investments for infrastructure development (Y. Zhang et al., 2017).

The results of this study may be significant to business and management practices by contributing towards a rigorous process of practitioner-based knowledge production generated from within the South African context to inconsistent use of performance measurements to forecast long-term investment returns at postconcession termination (Dithebe et al., 2019a). Furthermore, the study results may be crucial to design concession period-based models that are fair and crucial to increase equal investment returns to benefit all investors pre-and-postconcession termination (Pivatto et al., 2017). Concession period-based infrastructure development is critical in revenue generations and reduces government budget burden (Nguyen & Notteboom, 2017). Executing concession period-based infrastructure development for the country subsequently contribute towards social development, both from an income generation and skills development perspective (Zeng & Chen, 2019), and these elements are critical to sustaining positive social change in societies (Liebenberg, 2018).

Significance to Theory

Due to fiscal constraints to build infrastructure assets required for growing national economies and increasing societal demand for immediate service delivery, South

Africa opted for concession period models as an innovative funding tool to address infrastructure deficiencies. The application of concession models in developing African economies with PPP shows a certain level of inefficiencies to achieve infrastructure assets return and benefit from investments in water infrastructure (Opawole & Jagboro, 2016a). Consequently, the above is likely to be attributed to concession period challenges reported in emerging economies such as an inadequate definition of obligations, lack of skills to execute concession contracts, and failures to incorporate standards and measures safeguarding benefits and public sectors' investments interests in concession period contracts pre-and-posts concession period termination (Opawole et al., 2018; Pivatto et al., 2017).

The fact that governments adopt a concession period is fundamental in PPP contracts and consistently applied as an alternative funding model to develop large-scale infrastructure projects for service delivery and improve national economies (Feng et al., 2019; F. Wang et al., 2018; Y. Zhang et al., 2017). This research is likely to contribute to the body of knowledge to broaden the theoretical knowledge perspective based on experts' panel opinions and consensus. Furthermore, research results based on best practices in financing infrastructure projects are likely to provide helpful knowledge for concession period-based PPP in defining clearly, parties' obligations and equities aiming to benefit all party's concession period PPP contracts (Feng et al., 2019). Incorporation of the e-Delphi method to extend Hadi and Erzaij's (2019) conceptual framework supports the study's overall purpose of developing a set of best practices based on experts' level of consensus on using performance measurements to optimize concession period

agreements and further extend the bargaining game theory (Bayat et al., 2020; Carbonara et al., 2014; Nash, 1950).

Significance to Social Change

Infrastructure development is essential for achieving sustainable, socio-economic development across Africa. Building resilient infrastructure and promoting sustainable industrialization has long been featured on the multilateral agenda and was first recognized in the United Nation's Millennium Development Goals (MDGs) as an essential requirement for improving living standards (Khatleli, 2020a). The challenge for South Africa is to maintain and expand its electricity, water, transport, and communications infrastructure in order to support economic growth and social development goals through meeting its commitment to the United Nations Sustainable Development Goals 6 (ensure availability and sustainable management of water and sanitation for all), and 9 (build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation). The issue is that the South Africa government is probably focused more on economic development through infrastructure in urban areas and leaving the rural areas behind (Makhathini et al., 2020).

South Africa leads this avenue of sustainable infrastructure development among developing Southern African nations only in MDG 9: building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. South Africa is a country generally regarded to have relatively high levels of success in PPP, such that comprehensive PPP frameworks and legislation in contrast to its neighbors, which has served as necessary best practices for implementing PPP within the region.

South Africa has also begun to undertake cross-border infrastructure PPPs that could also offer valuable lessons for developing and implementing regional infrastructure projects if successfully implemented. While in recent years, several countries have begun to develop legislation and dedicated PPP capacity, mirroring South African best practice as well as frameworks and toolkits developed by multilateral institutions such as the World Bank, more progress on these MGs 6, 7, 8, and 9 need to be made (Khatleli, 2020b).

By conducting further research in implementing PPPs in South Africa, positive social change can be driven by providing practitioner-based information to regional and national governments with much more attractive conditions for private-sector investments. In return, the government can gain many advantages from the private investor, such as improvements in operational efficiency, management capacity, technology, and innovation –ultimately leading to better quality public services and coming closer to meeting the Millennium Development Goals (MDGs) in improving living standards in developing nations through modern infrastructure development (Haywood et al., 2019; Khatleli, 2020a).

Summary and Transition

South Africa's water infrastructure is primarily deficient, and it creates water supply instabilities in various communities (McCallum & Viviers, 2020; Mudombi & Montmasson-Clair, 2020). South Africa government stakeholders that use PPPs to build much-needed water infrastructure must assume contingent liabilities relating, for example, to early contract termination or debt and revenue guarantees (Ruiters & Matji, 2016). Challenges affecting the success of water infrastructure projects in South Africa

include a lack of technical and administrative capacity to maintain infrastructure financial value (Dithebe et al., 2019c). South African PPP' inability to balance the government's social value and profit generation goals within local water infrastructure development may be due to inconsistent use of performance measurements to forecast long-term investment returns postconcession termination (Arimoro, 2020; Dithebe et al., 2019c). The problem to be addressed in this study is that PPP' stakeholders in South Africa are inconsistent in using performance measurements to optimize concession period agreements for water infrastructure development (Dithebe et al., 2019b; Khatleli, 2020b).

The purpose of this qualitative, e-Delphi study was to determine the level of consensus among PPP experts on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. Without using rigorous performance measures to optimize concession period agreements, the South African government risks achieving sustainable water infrastructure postconcession termination (Dithebe et al., 2019c; Mabuza, 2019). Practically, to address this literature gap, an e-Delphi study design (Cole et al., 2013) was applied to meet the study's purpose by convening a panel of experts to answer the research question. The selection of PPP experts across South Africa through purposive sampling remains critical. As a result, I recruited 20 study participants in Round 1 to form a panel with experience in the underlining study constructs (Strasser, 2017). I evaluated data's trustworthiness resulting from this e-Delphi study using credibility, transferability, dependability, and confirmability criteria (Staykova, 2019).

An e-Delphi design was the appropriate research instrument critical to extending Hadi and Erzaij's (2019) determination and analysis of the concession period conceptual model that primarily supported the purpose of study for developing best practice strategies based on experts' level of consensus on using performance measurements to optimize concession period agreements, and further extending bargaining game theory. The e-Delphi technique limitations are that the questionnaire method potentially slows down data collection and analysis processes considerably due to time cost and potentially driving participant drop-out. To help mitigate this limitation, I convened 20 participants, anticipating drop-out throughout the study to finalize the study with a sample of 17 participants, exceeding the minimum sample size of 10 panelists standard for e-Delphi studies.

The significance of the practice, theory, and social change effectively assumed that infrastructure assets preserve value for money and provide quality public services critical to sustaining social change through efficient water infrastructure. The literature review in Chapter 2 focused on scholarly authority concerning the research study. Chapter 2 details the study's rationale and, through various citations based on scholarly literature, supports the assertions to undertake the research. The study's literature review section contains themes essential to identify the knowledge gap and relate to the study's purpose. Chapter 2 provided background and detailed the study context to establish academic authority in concession period models. The literature review is consistent with the research scope, and the section provides detailed discussions of the study's strengths and weaknesses and the rationale to select the research methodology.

Chapter 2: Literature Review

South Africa's water infrastructure improvement is central to economic activity and human health (McCallum & Viviers, 2020). The lack of financial capacity and budgetary constraints compelled the South Africa government to use PPP concession period-based model as an alternative funding instrument for developing water infrastructure across localized communities (McCallum et al., 2019; Khatleli et al., 2017). Inconsistent measurements for reliability, efficiency, and value for money of performance measurements to optimize concession period agreements have left emerging economy governments with revenue and profit uncertainties and financial value loss of water infrastructure assets (Petersen, 2019). The general social problem is South Africa's PPP inability to balance their goals of social value and profit generation within local water infrastructure development may be due to inconsistent application of performance measurements to forecast long-term investment returns at postconcession termination (Arimoro, 2018; Dithebe et al., 2019b).

The specific management problem is PPP stakeholders in South Africa are inconsistent in using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination (Dithebe et al., 2019a; Khatleli, 2020b). The purpose of this qualitative e-Delphi study was to determine the level of consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination.

Chapter 2 provides the literature search strategy, conceptual framework, synthesis of knowledge, and critical analysis of the scholarly literature related to the study's problem and purpose.

Literature Search Strategy

Peer-reviewed journal articles from the past 5 years were the primary source of knowledge in the literature review. Primary databases accessed through the Walden University Library included ScienceDirect, Elsevier, Academic Search Complete, Dissertations & Theses @ Walden University, EBSCOHost, Emerald Insight, ProQuest Central, SAGE Journals, Springer e-books, Taylor and Francis Online, Thoreau Multi-Database Search Research Gate and ProQuest. I also used Google Scholar, the South Africa government treasury archives, and The World Bank databases. Keywords and combinations of keywords searched were *PPP, PPP stakeholders in South Africa, concession period models, concession period, concession period design, infrastructure assets, financial value, value for money, and pre-and-postconcession termination, South Africa water infrastructure,* and *concession period performance measurements*. While I primarily focused on literature from 2015 to 2021, on a few occasions I identified relevant earlier research from 2001, 2002, 2007, and 2013. Due to a lack of academic research present on the study's specific topic, some seminal sources older than 5 years were necessary to employ. Concerning best practice strategies within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development, I found a lack of original and seminal research on the topic due to its recent emergence as a topic of discussion in academia (Dithebe et al.,

2019b; Khatleli, 2020b). I used the key search terms and phrases mentioned above on their own, and in combination with each other, I also added the qualifier of "systematic review" to yield complementary results. To be apprised of newly published articles on the topic throughout the dissertation process, I created Google alerts for *PPPs in South Africa, South Africa water infrastructure, concession period,* and *performance measurements*. I used additional keywords throughout the dissertation to substantiate the conceptual framework and the methodological research process such as *determining a concession period in PPP, negotiating a concession period,* and *bargaining game theory* in different databases and search engines to identify germane scholarship. I used different combinations of these keywords during searches through Google Scholar and databases hosted by the online Walden Library that contained peer-reviewed articles.

Conceptual Framework

This study is grounded in Hadi and Erzaij's (2019) determination and analysis of the concession period conceptual model that illustrates that the concession period's benefit is achieved when risk is shared among parties and there is equity in benefit distribution. More significantly, the project cash flows during the concession period, and cash flows postconcession period until the end of the infrastructure project's economic life is critical to realize. In their seminal research on determining a concession period in PPP, Hadi and Erzaij's (2019) defined the concession period as a negotiation process between public institutions and private sector entities acting as parties to adopt a partnerships deal. Hadi and Erzaij (2019) wrote that the concept's core perception was the negotiation period, where both parties agree to a project's completion time. The

successful outcome of such negotiations was to allow a competent contractor to complete the project on schedule. The operation period should be long enough to enable the concessionaire to achieve a reasonable return. The operational period should not be too long, so the concessionaire's return was excessive, and the public sector's interests were sacrificed. Incorporation of the e-Delphi method to extend Hadi and Erzaij's (2019) conceptual framework supports the study's overall purpose of building a consensus-based outcome among experts aimed at developing a set of best practices based on experts' level of consensus on using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination within the South African context.

Hadi and Erzaij grounded their conceptual model in Hanaoka and Palapus' (2012) use of the Monte Carlo simulation and bargaining game theory to design a methodology to determine the reasonable concession period that would benefit both the public and the private sectors with the impact of risks taken into consideration in the financial evaluation. The Monte Carlo Simulation in finance is a mathematical technique that generates random variables for modeling the risk or uncertainty of a specific system. According to Nash's game theory (1950), a bargaining situation can be described as a situation in which (a) individuals or players have the possibility of concluding a mutually beneficial agreement, (b) when there is a conflict of interests about which agreement to conclude, and (c) no agreement may be imposed on any individual without the approval of the other (Carraro et al., 2005). Bargaining game theory was used by Feng et al. (2019) and Bayat et al. (2020), who concluded that an optical concession period for

infrastructure construction through PPPs using Monte Carlo simulation and bargaining game theory methodology generates a concession period interval within which a specific concession period could be agreed upon by the government and the private sector respectively (Carbonara et al., 2014)

To demonstrate the methodology's applicability, Hanaoka and Palapus (2012) used two build-operate-transfer (BOT) road infrastructure projects in the Philippines as case studies. The outcome of their research was that the resulting concession period was found to be longer than the actual concession period granted to the private sector, indicating the impact of risks in the cash flow. With the methodology of Hanaoka and Palapus (2012), a government could further enhance its infrastructure development policies by fairly negotiating increased private sector participation for finance support (Hadi & Erzaij, 2019). Hanaoka and Palapus (2012) recommended that their methodology be tested on other BOT infrastructure projects in different national contexts, which may have different cash flow structures (Hanaoka & Palapus, 2012). The methodology can be used by both parties to develop the renegotiable concession period. The renegotiable concession period usually deals with many aspects such as the uncertainty inherent in the construction industry, the scope of the project has not been clearly defined, the construction activities of infrastructure project usually are very intricate with substantial risks (e.g., overruns of the cost and duration), and the operating cash flows are usually challenging to be forecasted in future.

Feng et al. (2019) and Cui et al. (2018) undertook studies to determine concession period influences over the PPP model for infrastructure development. The findings of

both Cui et al. (2018) and Feng et al. (2019) were too broad, focusing on various concession period critical factors such as price correlations, return, and risk-sharing benefits. Other findings that were also extensive included that of Ma et al. (2018) and F. Wang et al. (2018); these authors focused their studies on pricing and gaming models that can be applied to determine concession period optimization and financial value to consideration of infrastructure assets future benefit uncertainties. In studying complexities associated with the concession period model application, Bayat et al. (2020) extended Hanaoka and Palapus (2012) methodology by concluding that the concession period length and capital structure (equity: debt ratio) were the most important financial key decision variables in a BOT scheme.

Y. Zhang et al. (2017) pointed out that for a government to implement the concession period model and source funding against fiscal funding, it was critical to use rigorous and consistent performance measures on PPPs to access capital investments for infrastructure development. Hadi and Erzaij (2019) recommended that future scholars further extend their conceptual model by gathering more information on key variables to formulate a concession period that protects the parties' rights by guaranteeing both a fairly allocate of profit and risks between parties. Carmichael (2020) recommended that an optimal concession period be supported by sound management of performance measurements to monitor the project during its whole life span.

Literature Review

South Africa's Financial Challenge in Expanding National Infrastructure

The population growth in countries of the world increasingly necessitates significant demand for infrastructure assets development to benefit communities. Infrastructure assets are necessary for quality service provision and contribution to countries' economic growth (McCallum et al., 2019). South Africa is one of Africa's economic development leaders and has a relatively good core network of national economic infrastructure. The challenge for South Africa is to maintain and expand its national infrastructure in order to support economic growth and social development goals through a commitment to the United Nations Sustainable Development Goals 6 (*ensure availability and sustainable management of water and sanitation for all*) and 9 (*build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation*).

The issue stands that the South African government was probably focused more on economic development through infrastructure in urban areas and compromising large-scale social infrastructure development in rural areas (Makhathini et al., 2020). South African infrastructure projects operate within a PPP framework that accommodates concession period-based infrastructure assets development (Makhathini et al., 2020). The concession period-based infrastructure assets development application allows private sectors and investors to deposit project funds for the long term to finance and build large-scale infrastructure projects. The government aims to create value from the concession period-based infrastructure assets built through private sector investment initiatives.

South Africa considers the concession period application a viable economic option and an exceptional financial instrument to attract funds to benefits infrastructure projects development that ensures social value and profit maximization (Titman & Martin, 2016).

Applying the Concession Period Model in Emerging Economies

Empirical evidence on acceptance of concession period application as a viable economic option and an excellent financial instrument to attract funds to benefits infrastructure projects development that ensures social value and profit maximization includes the work of Feng et al. (2019), Ma et al. (2018), and Z. Wang et al. (2015) with the conceptual assumptions of Carbonara et al. (2014), Y. Zhang et al. (2017), and F. Wang et al. (2018) wherein the authors focused primarily on emerging economies. The win-win concession model, according to Carbonara et al. (2014), Y. Zhang et al. (2017), and F. Wang et al. (2018), calculates the instant of time that the concession period terminates and considers the effects of revenue generation uncertainty. From their findings, the authors expressed that the win-win concession period model satisfies both public and private sectors and guarantees both parties to benefit minimum profit based on a fair risk allocation between parties. Some of the performance measurements incorporated on the concession period model include reliability, efficiency, and financial value measures. Incorporating the performance measurement tools is critical to successfully implementing infrastructure assets development to help the concession period model achieve financial value postconcession termination (Emeghara et al., 2018).

The studies by Carbonara et al. (2014), Hadi and Erzaij (2019), S. Liu et al. (2018), F. Wang et al. (2018), X. Zhang et al. (2016), and Y. Zhang et al. (2017) have, as

a result of their findings, exposed the need for further investigation on how concession period can influence infrastructure assets financial value especially postconcession termination in emerging economies. In their findings, all the authors mentioned above agreed that the concession period model could be validly applied to support public authority in decision-making about concession period length. The concession period model can, according to S. Liu et al. (2018), J. Liu et al. (2015), but notable, Y. Zhang et al. (2017) provided authorities with baseline knowledge to develop appropriate guidelines for concession negotiations and concession period structure design. The guidelines were necessarily critical to ensure that parties to the concession period agree to achieve minimum value for investments and adequately safeguard investors' net benefits equally (Carbonara et al., 2014; Y. Zhang et al., 2017).

Similarly, Hadi and Erzaij (2019) and S. Liu et al. (2018), in their studies, formulated and adapted an extended net present value function, which demonstrates Extended net present value as an increasing function with maximum value-add to infrastructure project financial value postconcession termination. Eventually, the concession period design is critical for investors in infrastructure assets development, particularly the public and private sectors. Because parties to the agreement need to adapt a concession period model that integrates extended net present value to performance measurements so that infrastructure assets can generate revenue and maximize profits at postconcession termination (F. Wang et al., 2018). More importantly, the public sector can improve service quality provision and increasingly provide large-scale infrastructure

projects development that preserves infrastructure asset financial value during the postconcession termination (F. Wang et al., 2018; Yan et al., 2019).

Accordingly, Z. Liu et al. (2015), and especially K. Wang and Ke (2018), confirmed that the incorporation of performance measurements in the concession period application was critical because it provides an economic rationale to invest long-term project funds to develop infrastructure assets that ensure social and financial values. Nevertheless, according to Yan et al. (2019), other studies on the concession period have not focused on performance measurements on PPPs to forecast investment returns on water infrastructure projects postconcession termination, but rather private sector revenue and profit maximization. Governments in emerging economies are expected to assume ownership of infrastructure assets, especially the postconcession period, and ensure that assets infrastructure remains economically viable for public use and sustainable to guarantee financial value (Feng et al., 2019; Opawole et al., 2018).

Other evidence by various authors, such as Z. Wang et al. (2015) and L. Zhang et al. (2019), demonstrated that concession period implementation brings about significant challenges, particularly concerning partnership design and structures. At the center of the concession period, performance challenges include that: the nature of risks exposures of partners to the concession agreements differs, the regulatory and operating frameworks differs, and tax incentives, as well as revenue and profit structures, differs (Madura & Fox, 2014; J. Liu et al., 2015). According to Guasch et al. (2016) and F. Wang et al. (2018), there was further evidence that significantly demonstrates that the current concession period model design requires incorporating performance measurements to

monitor assets infrastructure future financial value to ensure net social benefits postconcession termination. The nature of the concession period challenges stated above may be creating a certain degree of partnership imbalances (Emeghara et al., 2018). According to Liang and Wang (2019), to minimize the risk of infrastructure projects investments exposure as a result of concession period agreements imbalances, performance measurements need to be incorporated into the concession period model to ensure that infrastructure assets are financially viable, efficient, and reliable during and postconcession termination (Emeghara et al., 2018; Liang & Wang, 2019). Unpredictable concession period model conditions in emerging economies present a unique opportunity requiring concession period remodeling to ensure infrastructure assets preserve financial value postconcession termination. In South Africa, infrastructure projects developed through the concession period are an 80%-85% success rate (National Treasury, 2019).

The influence of the concession period over infrastructure assets' financial value postconcession termination remains elusive for private sector investors, but more specifically, government agencies and the public sector (F. Wang et al., 2018; L. Zhang et al., 2019). Infrastructure assets operation and maintenance throughout the concession period need to be measured against performance measurements as baselines to ensure that asset infrastructure retains efficiency, reliability, social value, and value for money postconcession termination (J. Liu et al., 2015; S. Liu et al., 2018). In essence, the concession period represents infrastructure financing modeling and strategy to build massive infrastructure projects on behalf of multinationals and governments (L. Zhang et al., 2019). The concession period is not a regularly applied mechanism by small and

medium-sized enterprises; instead, it focuses on primary and complex schemes (Ma et al., 2018). Feng et al. (2019) pointed out that the concession period represents a form of debt funding to finance identified infrastructure projects that carry defined revenue claims, risks, and assets infrastructure financial value. As noted earlier, this study focused on bulk water infrastructure projects and bulk-water infrastructure networks in South Africa (Khatleli et al., 2017). I sought the concession period as a subject of this research because the model is critical for positive social change. Primarily because infrastructure asset development mainly influences national economies, critically, the assets have social and economic value stimulus over society's living conditions (Y. Zhang et al., 2017). Time always impacts valuation, and valuations differ from market to market due to different interest rates and financing structures (equity, bonds, capital markets, government subsidies). The concession period's influence over infrastructure assets in South Africa needs zone-specific contextual research since infrastructure assets' financial value differs from country to country (The World Bank, 2020).

South Africa's Implementation of the 2030 National Agenda to meet United Nations Sustainable Development Goals 6 and 9

The undertaking and subsequent implementation of the sustainable development agenda for South Africa is an imperative and appropriate mechanism to reduce poverty, create quality livelihood, and improve employment opportunities (Mabuza, 2019). South Africa's challenge is to maintain and expand its national infrastructure to maintain economic growth and social development goals (Makhathini et al., 2020). The accelerated and Shared Growth Initiative (ASGI-SA) distinguished infrastructure as one

of the macro-economic constraints towards the growth of South Africa's economy (Mudombi & Montmasson-Clair, 2020). South Africa's 2030 agenda adopted in 2019 also highlighted that poor access to essential social services such as water further complicates and impacts its economic growth potential (Mabuza, 2019). South Africa needs to meet the United Nations' commitment, such as Sustainable Development Goals 6 (ensure availability and sustainable water and sanitation management for all), and 9 (build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation). The 2030 national agenda implementation requires South Africa to undertake extensive-scale water infrastructure. Infrastructure development to motivate local economic development (LED) and create social welfare value against the struggling economy may ensure the reduction of poverty, inequality, and a sustainable environment (Makhathini et al., 2020). Chetty and Luiz (2014), but notably Dithebe et al. (2019a), thought that the current state of water administrative readiness in South Africa lacks the skills and capacity to provide appropriate technical, operational efficiencies, and social welfare benefits to society. For optimal success in implementing the 2030 United National Agenda for sustainable development against poor skills development at various government levels to monitor, evaluate, and finance required infrastructure to sustain development (Mabuza, 2019).

South Africa needs private sector intervention and a well-structured partnership to improve service delivery (Chetty & Luiz, 2014). McCallum et al. (2019) noted no standards applicable to implement concession-based infrastructure development at various government levels in South Africa. There is also a lack of strong institutional

capacity to analyze and address water infrastructure technical challenges effectively. Access to affordable water and other essential infrastructure services is critically important and is a prerequisite for South Africa's economic development (Makhathini et al., 2020). For South Africa, the route to achieving the 2030 National Agenda of Sustainable Development Goals relies on the PPP capacity innovations for funding and technical efficiencies to evaluate, monitor, and implement concession period-based infrastructure development (Chetty & Luiz, 2014; Mabuza, 2019). The Sustainable Development Goals implementation requires a more robust and efficient concession period partnership of multi-stakeholders (Hadi & Erzaij, 2019; Haywood et al., 2019). The encouraging stake-holder partnership that is efficient is a baseline to effectively implement the structure and function of infrastructure projects such as water, energy, roads, and or telecommunications (Mabuza, 2019).

Haywood et al. (2019), but notably Mabuza (2019), pointed out that an opportunity exists to leverage infrastructure development to the 2030 Agenda and mainly ensure water management and sustainability as well-built resilient infrastructure. The South African government is focused more on economic development through infrastructure in urban areas and leaving the possibilities of large-scale infrastructure development in the rural areas behind (Makhathini et al., 2020). Implementing the 2030 Nations Agenda to meet United Nations Sustainable Development Goals 6 and 9 is crucial to help reverse other water infrastructure deficiencies, which is essential to improve economic growth and better citizens' lives (Mabuza, 2019).

Mudombi and Montmasson-Clair (2020) have pointed to confronting non-revenue water (NRW) and water-saving promotions through efficient water infrastructure development as a means likely to contribute towards unemployment reductions and increases socio-economic development. As pointed through the United Nations Agenda, addressing water-related sustainable development goals requires water infrastructure investments, primarily to improve direct access to water quality, re-use, and increase water-ecosystems (Hemson, 2016; Makhathini et al., 2020). Water infrastructure should not only exist to provide essential water services (Hemson, 2016) but also supports health services and ensure society has the means to achieve self-development and self-sustainability (Makhathini et al., 2020).

Challenges Delaying Water Infrastructure Assets in South Africa

The development of water infrastructure is critical for South Africa's socio-economic sustainability, and there is a need to expand water infrastructure development beyond urban areas to underdeveloped populations (McCallum et al., 2019). The financing and development of water infrastructure are primarily critical and aligned to achieving South Africa's Sustainable Development Goals (SDGs) (Makhathini et al., 2020). Recent studies have raised the reality that South Africa is not on track to achieve the water and sanitation targets as expected in SDG 6 & 9 (Dithebe et al., 2019a). Fundamentally, Dithebe et al. (2019c) pointed to the funding challenges as the constraints to achieving the development of water infrastructure assets in South Africa essential to help meet the country's socio-economic objectives and goals. Dithebe et al. (2019c) pointed to ineffective infrastructure planning at various government levels due to limited

capacity to identify technically feasible and economically viable water infrastructure projects as a significant challenge to secure private funding to deliver efficient service. South Africa lacks the capacity and skills to prepare project feasibilities, and the lack of procurement process transparency and sound governance practices reduces investor appetite (McCallum et al., 2019).

Accordingly, Dithebe et al. (2019a), but notably Makhathini et al. (2020), identified other challenges that negatively impact water infrastructure implementation, including lack of capacity to identify, prioritize, and prepare water infrastructure projects for efficient development. Haywood et al. (2019) also identified specific challenging areas such as insufficient long-term capital planning, appropriate tariff setting, and human resources water management challenges. The delay in water infrastructure asset development in South Africa is mainly caused by limited to inflexible government policies, high budget deficits, and inadequate debt reductions strategies, lack of skills to design and plan for water infrastructure projects, and poor planning for water infrastructure projects implementation (Dithebe et al., 2019c). Feyzbakhsh et al. (2017) noted that water management's technical and financial capacity is critical for successfully developing and delivering sustainable water infrastructure for the water sector to function effectively and efficiently.

Feyzbakhsh et al. (2017) articulated that the engineering functions are critical to designing and planning long-term water infrastructure performance efficiencies. Equally, the finance function is increasingly significant for designing and planning long-term water infrastructure assets implementation. According to Haywood et al. (2019), but

notably, Dithebe et al. (2019c) noted that financial governance requires considering alternative procurement and financial structuring options that effectively support water infrastructure assets development based on sustainable financial value. As a result, the water infrastructure project identification and prioritization need to consider long-term planning scenarios based on the technical and financial capabilities of water management human resources (Dithebe et al., 2019b; Makhathini et al., 2020; McCallum & Viviers, 2020).

The other critical aspect is that investments in public infrastructure and financing processes require stakeholder-interest with an aligned focus to achieve economic efficiency and social benefits (Dithebe et al., 2019a; Z. Wang et al., 2015). The focus on water infrastructure asset development has a great potential to improve South Africa's economic growth, impacts poverty reduction positively, helps improve health systems, ensure to create of employment opportunities, and build water administrative capacity development (Dithebe et al., 2019a; Mudombi & Montmasson-Clair, 2020). Makhathini et al. (2020) identified infrastructure development as critical concerning the economy's production potential and can act as a direct input to increase South Africa's economic output. Dithebe et al. (2019b) articulated the view that innovative financing mechanisms and innovative integrated strategies could essentially help overcome South Africa's water infrastructure development challenges. Makhathini et al. (2020), but notably McCallum and Viviers (2020), pointed that unlocking barrier to providing sustainable financing solutions for water infrastructure in South Africa would critically improve social welfare and increase sustainable water infrastructure assets financial value.

Water Infrastructure Projects' Financing Challenges in South Africa

Traditional approaches to water infrastructure development continue to generate the pace and scale of infrastructure services, failing to match the demand for South Africa water infrastructure development (Wentworth & Makokera, 2015). With traditional approaches where government water projects initiative based on time and budgets capacities to implement significant water infrastructure projects at a scale implied by population growth, there is a potential evolution of South Africa government applying a significant PPP concession period-based model for financing infrastructure development (McCallum et al., 2019). The South African government's innovative approaches such as the PPP concession period models were applied undertakings for water infrastructure development to increase quality service provisioning in a scale and context to achieve water service delivery through world-class water infrastructure.

Such water service delivery in rural South Africa is often slowed down due to corruption and hostility towards the private sector involvement (Dithebe et al., 2019c). Furthermore, a lack of cost recovery plans, high levels of fiscal deficits, unreliable planning, and inconsistent procurement processes (Dithebe et al., 2019b). Ramirez et al. (2019) revealed in their study that most of the challenges facing South Africa water infrastructure development could be institutional, lack of technical and financing capacities to develop, and expedient socio-economical viable water infrastructure projects. Matji and Ruiters (2015) pointed further to fiscal policies of budget surplus and debt reduction to reinforce water infrastructure development challenges. From the above, it is evident that private sector participation in significant water infrastructure

development in South Africa, given these circumstances, creates complex requirements to access the numerous water infrastructure project opportunities (Wentworth & Makokera, 2015). The challenges for financing water infrastructure in South Africa stand as bottlenecks between government and quality service delivery (Ramirez et al., 2019). Nevertheless, the challenges to water infrastructure financing more significantly illustrate that South Africa does not offer a competitive risk-adjusted return on investments. No models exist that ensure that private sector investors are likely to receive modest investment returns and benefits (Dithebe et al., 2019a). Effectively, efficient approaches and or models are needed in this context to help fund water infrastructure projects in South Africa (Matji & Ruiters, 2015).

The approaches need to offer private sector investors the adequate assurance of cost recoveries from investments on the water infrastructure projects, provide appropriate planning processes for project implementation and maintenance. The South African government must offer leadership to guide water sector services administration and have municipalities' capacity to carry out technical and financial responsibilities to develop viable economic and bankable projects (Dithebe et al., 2019c). Besides, for private sector involvement in the financing of water infrastructure, both public and private sector need to ensure to manage transactional costs, develop regulatory framework and performance measurements capable of providing benefits to all stakeholder, and ensure to achieve efficient services for water postconcession period (Dithebe et al., 2019b). South Africa's urban and rural populations continue to grow (Fintel & Orthofer, 2020; Department Statistics SA, 2020), which requires water project planning and implementation to

undertake delivery of public required services. The development of water infrastructure assets is achieved (McCallum et al., 2019). Simultaneously, integrating informal settlements to the urban population within the rest of the cities reduces non-water revenue impacts and guarantees investment recoveries in South Africa (Ramirez et al., 2019). Dithebe et al. (2019a), but notably McCallum et al. (2019) articulated that the provision of adequate and quality water services to local communities is likely to create products in various economic sectors like agriculture, mining, manufacturing, and or production, which essentially improve South Africa Gross Domestic Products (GDP). The challenge for the South Africa government and private sector in water infrastructure financing is critical to shaping new models that ensure delivery of quality water services in both urban and rural economic areas and, subsequently create jobs and add to a dynamic economic activity (Makhathini et al., 2020; McCallum et al., 2019).

Development Bank of Southern Africa

The Development Bank of Southern Africa, commonly known as DBSA, is a national bank established in 1983 to perform socio-economic development for the South African government. In the socio-economic development function, the bank mainly focuses on infrastructure projects developed in South Africa and Africa (National Treasury, 2019). The bank's asset register released by National Treasury shows that the bank has an estimated total asset value of $5.8 billion and belongs to the South Africa government. With diverse expertise in concession period-based PPP, the bank offers transactional advising and funding for emerging or developing economies such as the South African government and governments of South African Development Corporation

(SADC). The bank advises governments on funding structures of massive infrastructure projects development essential for public sector benefits and national economies (Cui et al., 2019). The advisory services include but are not limited to the evaluation of risks inherent in infrastructure projects.

It also includes the preparation of contracts and business plans, taking into account legal, technical, and fiscal specifications that influence infrastructure projects cash flows, profitability, and equity structure of the concession period partners (Feng et al., 2019). The bank also plays a significant role in the concession period application. Significantly, the bank is essential for the construction of concession period-based PPP agreements for infrastructure development (DBSA, 2020). After concession period agreements for public and private sectors, partners can execute the majority of complex infrastructure projects so that society can benefit from bulk infrastructure projects such as water and sanitation, roads, electricity, buildings, etcetera. The social value and financial benefits are primarily dependent on the completion of all valuation criteria meeting the positive net present value of infrastructure projects, which is the basis for infrastructure project development (Z. Wang et al., 2015).

The bank is financing large-scale infrastructure projects such as water and sanitation, roads, electricity, etcetera, requires financial engineering knowledge, equivalent financial skills, and technical capacities to achieve infrastructure projects development (Finnerty, 2013; Hu & Zhu, 2015). Development Bank of Southern Africa has broker-dealers, financial advisors, legal advisors, and project engineers to provide financial engineering services and arrange project financing for infrastructure project

execution (National Treasury, 2019). Through Development Bank of Southern Africa adopted the concession period funding model for large infrastructure projects, the bank showed that by March 2019, 79% of its gross loans concentrated in South Africa, and 21% of gross loan exposed to the Sub-Saharan Africa region in particular Angola, Ghana, Zambia, and Zimbabwe (DBSA, 2020). The bank is critical and a significant factor in helping governments, particularly South Africa's government, improve economic growth through infrastructure development. From the year 2018 to 2019, the bank benefited significantly from government disbursements. A total of $4 billion of capital was allocated to the bank to accelerate funding for municipalities.

The concession period method of funding is a strategy that the bank uses to support infrastructure project development related to bulk water and sanitation and green energy infrastructure projects (DBSA, 2020). Bulk water and sanitation infrastructure projects account for an increasing percentage in developing social infrastructure projects. The Development Bank of Southern Africa expects pressures on its asset quality metrics resulting from increases in social infrastructure project development demand due to increased infrastructure deficiencies (DBSA, 2020; National Treasury, 2019). For 2019 and 2020, the bank forecast increasing concession contracts by 30% of investments in infrastructure assets development to increase job creation and economic development opportunities (DBSA, 2020). The bank demonstrates a stable capacity to fund and maintain a diversified funding profile for various infrastructure projects. For most infrastructure projects, the Development Bank of South Africa intends to invest much

into local municipalities across the country to spread various concession period infrastructure projects to increase and improve bulk services.

PPP Model Application

The notion of PPP model definition and application framework differs from country to country. For instance, S. Liu et al. (2018) associated PPP models with a collaborative and strategic management approach that creates relations between public and private sectors in a mid-to-long-term investment partnership to deliver public services in a blended skills approach. Nguyen and Notteboom (2017) and Zeng and Chen (2019) also viewed the PPP model as a collaborative relationship between public and private sector investors through an agreed concession period with the public sector wherein the private sector undertakes to invest funds for infrastructure development. Significantly, in concession period-based PPP agreements, the private sector leads in concession period initiative taking advantage of concession period contracts scope (Z. Wang et al., 2015).

In exchange for a significant private-sector role in concession period contracts government pursued actual risk transfer and showed primary interest in infrastructure projects' financial value postconcession period (L. Zhang et al., 2019). At the center of the concession period agreement, the operation and maintenance of developed infrastructure assets and or facilities could be a fixed contract. On the other hand, the concession period contract could be flexible (Hadi & Erzaij, 2019). Usually, the infrastructure asset and or facility postconcession period transitioned to public sector ownership in good condition (Nguyen & Notteboom, 2017; Ouenniche et al., 2016). S.

Liu et al. (2018) highlighted that the transition of infrastructure assets to the public sector does not guarantee efficiency, reliability, and value for money postconcession period.

According to the PPP in Infrastructure Resources Center (PPPIRC) of the World Bank Group, there is an expectation that the PPP model application could allow both concessionaire and public sector investment to share risks and responsibility to assume investments and subsequent infrastructure projects development (Nguyen & Notteboom, 2017). Stakeholders in PPP concession model investments contribute and examine the minimum return on investments based on risk exposures and expected net profit (Feng et al., 2019). Investing in concession period parties to PPP agreements choose between risks as measured against expected infrastructure asset performance and generated a return on infrastructure asset investment measured over a while economic life cycle of an asset (Madura & Fox, 2014).

According to Cui et al. (2019), when concession period models are efficient, PPP stakeholders usually would prefer to choose between higher returns and higher risks or lower returns and lower risks. In South Africa, a significant part of large infrastructure projects such as water, rail, roads, transport, seaport project, telecommunications, energy, and other bulk infrastructure projects use concession period-based PPP models for implementation of infrastructure projects to realize a higher return on investments (Dithebe et al., 2019c). As studies have shown, the South African government applies the concession period to accelerate economic growth through public infrastructure asset service delivery (Mohamad et al., 2017). In the same light, other studies, notably those of Nguyen and Notteboom (2017) and Opawole et al. (2017), have shown that concession

period-based infrastructure projects development governments have shown the use of concession period-based infrastructure projects intends to reduce fiscal expenditures, but equally benefit from the private sector funding initiative. By applying a reasonable concession period, S. Liu et al. (2018) also found that concession period application is core to providing infrastructure projects funding to develop public facilities and improve public services, including sustained living standards for communities. Attarzadeh et al. (2017) also found that parties in concession period agreements focused on generating a high return on investments and improving public sector performance in delivering quality services to the communities.

F. Wang et al. (2018) have found that none of the studies appeared to have focused on developing sustainable infrastructure assets that preserve financial value or value for money postconcession period. According to Mohamad et al. (2017), parties to the PPP concession period, especially the private sector partner, appear to have always focused mainly on investment returns, but equivalently on recovering profits through allowing the government to reduce risks and pressures on capital expenditures. Z. Wang et al. (2015) articulated that public sector failures to forecast net social benefits generation and ascertain infrastructure assets financial value postconcession period presents infrastructure assets financial value uncertainties. The author asserted that the uncertainties in infrastructure asset revenue generation threaten the public sector to invest in infrastructure project development. At the same time, this has a considerable repercussion over service delivery and infrastructure asset future developments. Mohamad et al. (2017) contended that long-term operating concession period, poorly

forecasted planning, monitoring, and lack of performance measurements to evaluate infrastructure assets' financial value resulted in poorly constructed concession period-based infrastructure project development.

In retrospect, Feng et al. (2019) articulated that an appropriate technique is needed to monitor concession period infrastructure projects' performance to ensure infrastructure achieves value for money postconcession termination. Necessarily, to ensure the concession period develops infrastructure assets to achieve value for money, further studies are critical to determining concession period influence over infrastructure assets' financial value. A vital aspect of concession period-based infrastructure projects' successful execution guarantees investment returns for public and private sectors while ensuring that certain infrastructure assets preserve the financial value postconcession period (S. Liu et al., 2018).

Preconcession Period

A preconcession period is primarily the stage at which stakeholders intend to invest in infrastructure projects and subsequent identification of infrastructure project scope (Opawole et al., 2018). The benchmark for preconcession period completion takes effect when infrastructure project financing, designing, constructing, and operating infrastructure assets are achieved (Nasirzadeh et al., 2014; Yan et al., 2020). Accordingly, Sun and Zhang (2015) presented that preconcession period attributes are critical to ensure the stability of investment returns that subsequently increase infrastructure asset financial value postconcession period. At this stage, preconcession period parties define agreements such as value-sharing forecasts based on expected return from infrastructure

projects investments if concession period implementation was successful (Nasirzadeh et al., 2014; Titman & Martin, 2016). Ullah et al. (2016) reiterated that the preconcession period is crucial to estimate optimum return value for concession period-based infrastructure project investments and development. According to Ullah et al. (2016), the preconcession period's benefit is that the government, especially the more considerable public, needs to utilize the preconcession stage to clearly define investment expectations social benefit at transfer against levels of satisfaction and quality of public service.

Equity returns, revenue sharing, user charges, contract flexibility, and competition form part of preconcession period attributes and are critical elements of concession period performance measurements (Gatti, 2013; Yescombe, 2014). The performance measurements are essential to ensure that the concession period application help safeguard public and private sector investment based on the level of risk exposures and expectations (Cui et al., 2019; Nasirzadeh et al., 2014). Determining performance measures at the preconcession period is crucial for the public and private sectors. Primarily, concession period contracts are long-term (Ma et al., 2018); consequently, the preconcession period could significantly reduce the concession period uncertainties inherent in infrastructure project development (Hadi & Erzaij, 2019).

While preconcession is critical to determine forecasting revenue from infrastructure projects and minimum revenue guarantees, the revenue and profit generation forecasted at the preconcession period are often inaccurate. They may contain significant revenue generation uncertainties (Nasirzadeh et al., 2014; Sun & Zhang, 2015). The incorporation of performance measurement in the preconcession period as

compound options substantially reduces revenue uncertainties and guarantees a reasonable return on concessionaire investments in infrastructure projects (Yan et al., 2020). Besides, Cui et al. (2019) found that fair risk allocation is critical. They should have to be incorporated in the preconcession period stage to ensure postconcession period revenues and social benefits in infrastructure assets are achieved and guaranteed based on the considered and quantified risk allocation structure. Accordingly, maximizing the economic benefit of public and private sector investors in concession period infrastructure projects is mainly dependent on the investment utility-risk ratios both parties are willing to undertake during preconcession period contracts finalization (Yan et al., 2019).

X. Zhang et al. (2016) and Yan et al. (2019) underlined that the introduction of risk allocation fairness into preconcession period decision-making ensures infrastructure assets achieve financial value performance postconcession period is still infrequent at present. F. Wang et al. (2018) articulated that the benefit of the preconcession period sharing fair risks is that it reduces revenue and profits generation uncertainties. A fair risk-sharing model increases prospects to achieve infrastructure assets' financial value postconcession termination. Yan et al. (2019) stressed that fair allocation of risk needs to be considered at preconcession stages of infrastructure project development, taking into account that parties to the concession period are both bounded by rationality that of minimum expectation of benefits and pursue fairness of benefits.

Infrastructure Financial Value or Value for Money

The concept of financial value in infrastructure assets and or value for money is a deterministic mechanism used to examine infrastructure asset standard performance according to performance measurements (Mohamad et al., 2017). In line with Cui et al. (2018), Value for money demonstrates when asset infrastructure's total present value of private sector supply is lower than the net present value of the base costs of public services delivery rendered, adjusted for risks retained by the government. Value for money in the concession period is a baseline for evaluating infrastructure projects in terms of economic viability and social efficiency and could determine infrastructure asset financial value postconcession period (Cui et al., 2018). Infrastructure asset downfall in financial performance, decreased profitability, reduced technical efficiencies, and income unsustainability occurs because current concession period models do not incorporate performance measurements to determine infrastructure assets earnings and efficiency in the postconcession period (L. Zhang et al., 2019).

Accordingly, Cui et al. (2019) expressly posited that concession period models should only be used to achieve value for money than traditional procurement processes. Value for money or infrastructure financial value is a critical component to achieve infrastructure asset user expectations, infrastructure asset performance objectives, technical reliability, and post-transfer economic viability (Cui et al., 2018), especially for the public sector.

The key to a valid concession period lies in infrastructure assets' capability to carry all senior debts, secure operational costs, maintenance costs, and provide social net

value to public sector investors (Feng et al., 2019). Performance measurement strategies such as reliability, efficiency, and value for money are crucial to employ in the PPP concession period as deterministic instruments to measure and forecast the financial and technical performance of infrastructure assets. Research studies have found that infrastructure assets performance measurements are reliable indicators of concession period infrastructure assets' financial value performance, especially postconcession termination (Liang & Wang, 2019). Emeghara et al. (2018) recommended that the concession period incorporates value for money performance measurement at initial stages to ascertain the economic and financial viability of infrastructure assets is confirmed. The concession period needed to incorporate value for money and financial value performance measurement to ensure postconcession period activities of infrastructure projects such as development, operational and transitioning stages. In contrast, infrastructure assets' financial value is sustained without compromise.

Typically, financial value performance measurement considers infrastructure project development's economic infrastructure viability and equally determines a net present value of infrastructure assets postconcession period (Emeghara et al., 2018). If the net present value is definite, the certainty of investment return for public and private sectors is demonstrated and stated to ensure that the infrastructure project is likely to preserve the financial value postconcession period (Titman & Martin, 2016). Expected return on concession period investments needs to cover average capital costs of both debt and equity, but at the same time generate sustainable revenues and profit to increase the ability of infrastructure assets to maintain financial value postconcession period. To

achieve successful concession period implementation that generates value for money, public and private sectors need to invest in skills, knowledge, and management capabilities to increase infrastructure assets scope to preserve financial value postconcession termination (Opawole et al., 2018). Incorporating financial value and or value for money performance measurement in concession period-based infrastructure assets is critical to delivering investment return, but more significantly, delivering infrastructure assets financial value postconcession period (Opawole et al., 2018; L. Zhang et al., 2019).

Ma et al. (2018) further elaborated that infrastructure assets need to generate funds sufficient to cover all costs, such as operating and maintenance costs, debt services, and an acceptable return on invested equities in infrastructure projects. Buafua (2015) also argued that concession period-based infrastructure assets need to reflect measured revenue increases in investments pre-and-postconcession termination to guarantee a fair distribution of benefits and revenue in infrastructure assets. S. Liu et al. (2018) indicated a reasonable expectation for infrastructure assets to offer financial value and technical efficiencies and the reliability to perform according to design standards. The author above, particularly S. Liu et al. (2018), argued that infrastructure asset especially postconcession period supposedly needs to continue to preserve economic life and financial value adequacies that have a net social benefit to both public and private sectors.

According to Zeng and Chen (2019), infrastructure financial value implies that the concession period design needs to be in such a way that infrastructure assets developed to

perform according to design performance standards technically and offer expected return on investments. At the same time, L. Zhang et al. (2019) confirmed that revenue generation adequacy enhances the infrastructure asset economic life cycle and delivers quality services to benefit the community. Various authors, especially Z. Liu et al. (2015), viewed infrastructure financial value as the critical component and primary benchmark for the concession period strategic objective. Key to the authors' emphasis was that infrastructure financial value is associated with service quality, reduced public sector risks, social value, maintainability, asset economic life, and sustainability at the postconcession termination. Titman and Martin (2016) proclaimed that infrastructure asset financial value could be sustained pre-and-postconcession period pending undertakings to incorporate financial value performance measurement that creates the basis to safeguard public and private sectors' investment interests and social benefits.

It is essential to ensure that parties to a concession period endeavour to have a long-term view that allows for competitive neutrality, risk assessments, and systematic risk mechanisms to maximize measures of infrastructure asset financial value performances (Mohamad et al., 2017). Cui et al. (2019) found efficient risk sharing, productivity-based specification, competitive tendering, competitive skills, technical innovation, and project profitability were crucial factors that increased infrastructure financial value pre- and postconcession termination.

Concession Period Risks

Concession period risk identification is fundamental to provide the basis for establishing an appropriate agreement between public and private sector partnerships

(Hadi & Erzaij, 2019; J. Liu et al., 2015). According to Poulose and Mahalingam (2019), various risks such as completion, economic, financial, political, force majeure, and demand and revenue risks are there to determine the type of concession period structure that can be applied to develop infrastructure assets. The fact is that concession period-based PPP models inherently create uncertainties and risks associated with the costs of capital raising through private sector investment initiatives (Shi et al., 2018). Infrastructure projects construction, operations, maintenance costs, and transactional costs are critical risks in concession period models (J. Liu et al., 201a; Mohamad et al., 2017). According to L. Zhang et al. (2019), concession period risks substantially augment critical risks that potentially add to revenue and profit uncertainties and negatively impact infrastructure life cycle and contribute towards negative infrastructure asset financial value pre-and-postconcession period.

Balanced risk in the PPP concession period provides a starting point that could be applied to mitigate concession period risks (Nguyen & Notteboom, 2017; Z. Liu et al., 2015). Simultaneously, lower operations and maintenance costs, increase infrastructure asset financial value and improve quality service delivery pre-and-postconcession termination (Z. Wang et al., 2015). In various studies, authors including Ma et al. (2018), F. Wang et al. (2018), J. Liu et al. (2015), and especially Y. Zhang et al. (2017) have supported the view that it might be impractical for a single party in a concession period contract to endure all the risks unaided because risks exposures impact on equity and debt structures. If such an event were to occur, it was unlikely that the concession period contract to be executed has the likelihood of debt repayment ability and capacity to

provide adequate security to support infrastructure project funding (L. Zhang et al., 2019). Cui et al. (2018) have argued that the concession period needs to permit risk-sharing by all parties to execute the concession period for infrastructure projects development successfully. According to the authors, especially Cui et al. (2018), the fair allocation of risks is desirable if all parties in the concession period share the risk equally.

Ma et al. (2018) indicated that risk-sharing achieves possibilities of economies of scale. Nevertheless, equally, it allows prospects to provide security and creditworthy guarantees to execute infrastructure projects so that benefits accrue to all parties after infrastructure asset completion and subsequently transitioned to public sector ownership (Hadi & Erzaij, 2019). Again L. Zhang et al. (2019), with concession period risks, the author alluded that risk sharing is not beneficial if technical, environmental, economic, and monitoring risks are of such a scale that it would be imprudent for parties to undertake such risks. Various risks, including completion, economic, technical, financial, and operating risks, all have implications over concession period implementation (Hadi & Erzaij, 2019). During the concession period implantation, if an infrastructure project fails to meet the completion period, project risks increase capital expenditures, and on the contrary, reduces expected returns on investments (Finnerty, 2013). Finnerty (2013) stated that parties to the concession period need to apply proven technologies essential to ensure projects completed on time, within budget, and mitigation of completion risks impact the creation of uncertainties on concession period revenue and profit generation, as well as quality constraints. Hadi and Erzaij (2019) maintained that using sound project implementation technologies to complete and operate projects satisfactorily does not

resolve economic risks. However, instead, it minimizes delays to complete infrastructure project execution.

In the same view, Finnerty (2013) and Shi et al. (2018) believe that incompletion risks negatively impact infrastructure projects and might significantly reduce capacity to sufficiently generate revenues and profit to provide generous benefits to equity investors in the concession period. Hadi and Erzaij (2019) identified political risks involving authorities' interference with modern infrastructure project constructions, which, if not mitigated, is likely to make it challenging to predict infrastructure value, mainly postconcession period. Accordingly, L. Zhang et al. (2019) asserted that parties in the concession period need to devote time and effort to obtain the security of their investments and improve infrastructure financial value postconcession termination.

They need to establish a legal framework that enforces contracts, defines relationships clearly, outlines the roles and responsibilities of parties, and states cooperation areas. The existence of defined and appropriate legal frameworks potentially reduces political interferences and eventually allows infrastructure projects to proceed to completion, operation, and later transition to public sector use without challenges (L. Zhang et al., 2019). The other concession period risk is the environmental risks that usually occur when infrastructure project development necessitates a stage of a costly redesign, either resulting from changes to environmental laws or environmental objections voiced through political processes (Finnerty, 2013). If such a risk is exceedingly higher than budget projections, project output bears fewer income generation streams. There is an expectation that parties to concession period contracts either

abandon the project or seek third-party lending to cover such related risks (Titman & Martin, 2016). Force majeure risks in concession period implementation are the risks beyond the investors' control or power (L. Zhang et al., 2019).

Such risks have the capabilities to force project operations to be stopped. The circumstance surrounding force majeure is that concession period parties insist on appropriate management of the event and protection from losses that force majeure causes (L. Zhang et al., 2019). According to Hadi and Erzaij (2019), traditional risk management frameworks provide force majeure risk management guidelines. L. Zhang et al. (2019) suggested that insurance covers assurance for debt service or rebuild or repair project damages through force majeure. All risks mentioned above represent large-scale business risks. The risks are such that they can affect concession period implementation. L. Zhang et al. (2019) affirmed that guarantees, contractual obligations, credit support arrangements, and other supporting arrangements are critical to providing indirect support for infrastructure project initiation to attract project development funding. Nguyen and Notteboom (2017) concluded that costs such as initial investment capital costs, project construction complexities, and inflation rate could probably increase infrastructure assets' financial value risks and uncertainties postconcession. Risk mitigating factors alone are not a guarantee to safeguard the interest of the public sector and cannot guarantee infrastructure revenue and profits generations for current and future markets unless performance measurements are incorporated in concession period models (S. Liu et al., 2018).

Concession Period Benefits

Governments in emerging economies, including the South Africa government, mobilize infrastructure funding to develop large-scale infrastructure projects. The concession period is an alternative investment instrument that provides considerable benefits throughout the world during significant infrastructure project development (Z. Wang et al., 2015). Empirical data corroborates that concession period application efficiency is based on that the model needs to continue to demonstrate its ability to contribute substantially to national economies through revenue and profits generations and, to a lesser extent, social infrastructure benefits postconcession termination (Z. Wang et al., 2015). According to Hadi and Erzaij (2019), PPP infrastructure assets development provides many benefits to government and private sector partnerships. Nguyen and Notteboom (2017) and Feng et al. (2019) attributed public sector access to capital, technology and expertise, quality of services, market access, and or direct revenue generation as some of the critical benefits of concession period agreements. Other benefits, such as socio-economic development derived from concession period implementation, increase employment opportunities, help develop an active economic population (Nikitenko & Goosen, 2017).

These factors, such as quality service provision, direct revenue, and profit generation through infrastructure projects development, according to F. Wang et al. (2018), are fundamental to improving income growth, but equally better society living standards and conditions. In concession period research, trends also found that equal distribution of risk attracts infrastructure funding to develop massive infrastructure assets

through the concession period model (Ma et al., 2018). Infrastructure projects developed in the South African government depended primarily on concession period-based PPP models, which ultimately increased economic growth (Matji & Ruiters, 2015). Accordingly, Ullah et al. (2016) presented that a concession period is a model modernizing service delivery through alternative funding strategies to improve efficiency and service quality and deliver infrastructure assets financial value. On the contrary, L. Zhang et al. (2019) argued that the concession period could present challenges. Related concession period challenges include contract suspension due to long-term revenue uncertainties, concession period cancellation, and failure to demonstrate that infrastructure assets could achieve infrastructure financial value.

Opawole et al. (2018) attributed such concession period failures to conflicting goals and responsibilities of concession period-based PPP, as well as misinterpretation of their performance metrics and associated concession period risks. The concession period is critical towards PPP investment undertakings to build massive infrastructure assets (Ma et al., 2018). Nevertheless, according to Yan et al. (2020), a good design and structured concession period could often broaden benefits such as infrastructure assets quality, efficiency, and better revenues for public and private sectors postconcession period. Although the concession period presents a positive outlook, according to Ullah et al. (2016), uncertainties about model complexities in long-term costs, service quality consequences, and multiple agreements impair model application success. S. Liu et al. (2018) cited high costs to land, high costs to capital borrowing, public and private sector

capacity deficiencies, and poor economic conditions to be barriers that make the concession period model less attractive for project funding.

Continuous aging infrastructure and demand for quality public services persist in influencing the South Africa government's assertion that the use of concession period to undertake infrastructure project development provides social benefits and financial value postconcession period (Matji & Ruiters, 2015). Hu and Zhu (2015) asserted that the government perceives infrastructure assets as a service and a facility that society needs to improve their social well-being and increase social and financial values. Concession period contracts need to safeguard all parties' interests, such as revenue and profit generation and infrastructure financial value postconcession period (Feng et al., 2019; Hu & Zhu, 2015).

Fixed and Flexible Concession Period

Concession period contracts are such that public and private sectors participating in infrastructure projects development create and enter into agreements to develop infrastructure. The concession period contract could either be flexible or fixed depending on the terms expected to determine infrastructure assets profits and return on investments (Ma et al., 2018; Xiong & Zhang, 2014). Sun and Zhang (2015) showed the public sector preferred to grant pre-determined concession period contacts with fixed rates of return and profits to concessionaire investors based on the user-tariffs the public is willing to pay. In practice, pre-determined fixed concession period contracts potentially create conflict between parties on the expected values, especially because fixed concession

period contracts turn to originate excessive benefits for private investors while reducing public social benefits (Sun & Zhang, 2015).

In another view, Z. Wang et al. (2015) have argued that there are benefits associated with flexible and or fixed-term concession period contracts. According to Z. Wang et al. (2015), the benefits of either flexible and or fixed concession period contracts are that under fixed concession period contract public sector fixes concession prices. Additionally, according to Feng et al. (2019), fixed concession period contracts incorporate public sector equity investments and prolonged concession periods to make infrastructure projects development economically viable. Demirel et al. (2017), on the other hand, found that flexibility in concession period contracts can proactively anticipate and address possible contingencies during pre-contract phases of the project execution. Primarily, concession period flexibility ensures that changes effected in infrastructure projects scope during design and construction cope with complex environments (Demirel et al., 2017). Xiong and Zhang (2014), but notably Garg and Garg (2017), provided that concession period contract flexibility is critical to formulating, and in due process, incorporate appropriate measures to mitigate infrastructure projects execution uncertainty and complexity. In a sense, concession period contract flexibility and or fixed concession period contract provided by the government is, according to Demirel et al. (2017) and Z. Wang et al. (2015), considered a risk-mitigating method that fosters a win-win principle that reduces adverse effects on infrastructure assets investments. Feng et al. (2019) articulated that the incorporation of fixed and or flexible concession period contract terms

during the pre-phase of infrastructure projects development may guarantee the postconcession period's financial value.

Win-Win Concession Model

Yan et al. (2019) presented that a win-win principle is significant to guarantee and safeguard the interest of both public and private sectors undertaking to execute infrastructure projects development through concession period models. In support of the same view above, Carbonara and Pellegrino (2020) indicated that a win-win concession period model was structured to achieve a minimum revenue guarantee and reduce the effect of income generation uncertainties. Creating a win-win concession period means assuring that public and private sector investors not only recover from the infrastructure projects investments but equally earn profits postconcession period (Yan et al., 2019). The public and private sectors need to incorporate performance measures to pre-determine infrastructure asset financial value long before asset transitioning to public sector ownership. This action essentially, aimed to help balance investment returns in infrastructure projects to realize a win-win concession period contract (Carbonara et al., 2017). Incorporating performance measurement criteria that regulate concession period implementation ensures public and private sector investors execute concession contracts based on a win-win principle (Xiong & Zhang, 2014; Y. Zhang et al., 2017). Authors such as Ma et al. (2018) and X. Zhang et al. (2016), but notably Yan et al. (2020), added that the win-win approach integrates infrastructure assets efficiency measures, and as such, improves the sustainability of financial values during and postconcession termination. According to Z. Wang et al. (2015) and Y. Zhang et al. (2017), the model

presents the economic benefits that simultaneously ensure infrastructure asset financial values increase service efficiency and balance risks until the asset end of economic life. A win-win concession period model with balanced risk sharing provides a basis for achieving all stakeholders' revenue and profits.

Performance measurements are critical for the model and constitute an appropriate mechanism to measure infrastructure asset performance and achievements postconcession (Mohamad et al., 2017). Yan et al. (2019) indicated that successful execution of concession period-based infrastructure projects developed based on a win-win principle requires incorporating performance measurement (Z. Wang et al., 2015; Y. Zhang et al., 2017). According to Y. Zhang et al. (2017), a win-win concession model risks averse and focuses on creating risks sharing platform that equally ensures that infrastructure assets generate balanced revenues and provide for assets financial value postconcession period. Nwokedi and Emenike (2018) added that concession period-based infrastructure projects development could only sustain financial value if the concession period incorporated performance measurement guarantees present efficiencies demanded and post demand requirements. Hadi and Erzaij (2019) pointed out that the concession period should balance public and private investors' interests. Based on an appropriate sharing of risks, reducing revenue generation uncertainties and proportionate allocation of profits must be considered to maintain infrastructure asset financial value at the postconcession period (Ma et al., 2018).

Performance Measurements

Infrastructure performance measuring is part of an evaluation process used to measure infrastructure effectiveness, reliability, and efficiency (Liang & Wang, 2019). South Africa's government is currently constructing, operating, and planning a massive infrastructure project development scale (National Treasury, 2019). The government is expanding bulk infrastructure projects network in water and sanitation, roads, electricity, housing, and agriculture to improve service delivery and ultimately increase national economies (Matji & Ruiters, 2015). Mohamad et al. (2017) observed that the key to concession period success is a need to implement and enforce performance measurements to ensure sustainable infrastructure assets financial value postconcession period. Accordingly, Nwokedi and Emenike (2018) and Ismail and Haris (2014) both pointed out that establishing certainty in infrastructure asset performances that guarantees sustainable revenues and financial value is mainly dependent on performance benchmarks.

According to Mohamad et al. (2017), performance measurements are critical to quantify and appraise concession period-based infrastructure asset performance sustainability. They can be used to determine the certainty of infrastructure asset financial asset values. Infrastructure asset efficiencies sustainability fundamentally is a critical aspect that needs to satisfy concession period performance contracts maintaining infrastructure assets financial value postconcession period (Cui et al., 2018; J. Liu et al., 2014). Liang and Wang (2019) confirmed that reliability, efficiency, and value for money are crucial aspects of performance measurements that, if incorporated in the concession period, could potentially ensure infrastructure assets preserve financial value

postconcession period. As a result, concession period-based infrastructure asset sustainability performance is a benchmark achieved by meeting performance measurement benchmarks, as Liang and Wang (2019) stated. Applying traditional triangle performance measurements such as time, cost, and quality in the concession period-based infrastructure project makes it inherently complicated and riskier to achieve social benefit and infrastructure financial value (J. Liu et al., 2014; Y. Zhang et al., 2017).

The application of time, quality, and costs-based performance measurements approach to achieve infrastructure financial value in the postconcession period does not reflect complexities associated with concession period-based infrastructure assets delivery of public service and infrastructure maintenance financial value (Z. Liu et al., 2015). Appropriate selection and incorporation of performance measurement for efficiency, reliable, and value for money in the concession period, according to Mohamad et al. (2017), is required to ensure the development of efficient infrastructure assets that generate financial value and social benefit postconcession termination. Mohamad et al. (2017) indicated as well that there was a need to adequately supply resources and skills to manage infrastructure project execution to achieve infrastructure assets' future value postconcession period. To optimize infrastructure asset financial value, necessarily, there is a need for a concession period to incorporates performance measurements that increase infrastructure asset’s reliability and efficiency postconcession period (J. Liu et al., 2015). Performance measurements are preferred to drive one common strategic goal: the achievement of infrastructure financial value, reliability, and efficiencies postconcession period. The advantage of incorporating performance measurements in the concession

period is that it is consistent with income generation and equally with social value creation for all stakeholder investments, particularly the public sector (Liang & Wang, 2019; J. Liu et al., 2014).

Postconcession Period

L. Wang and Zhang (2017) identified post-transfer management, project transfer, documents and software transfer, stability, and public service continuity as key transfer elements that the government needs to consider when taking over infrastructure assets postconcession termination. At postconcession termination, the government critically examines every management mode of asset infrastructure transitioning from private sector postconcession period to public sector ownership (Nwokedi & Emenike, 2018). L. Wang and Zhang (2017) identified operation and maintenance contract options, the nomination of a new operator and renovated-operate-transfer contract as amongst management modes postconcession period essential to driving infrastructure assets sustain revenue and profit generations. A postconcession period should not only take into account measures such as infrastructure assets performance-based post-assessments at the transfer period. However, it must evaluate financial performance and employees to ensure asset infrastructure is in good operating condition and is likely to sustain financial value postconcession period (Feng et al., 2019).

Postconcession period transitioning of infrastructure assets based on quality management needs to form an essential criterion that from time to time informs concession period model capabilities to create infrastructure assets financial value postconcession termination (Correria et al., 2015; Y. Zhang et al., 2017). The basic

guidelines alluded to above are critical elements to determine a return on investments from concession period-based infrastructure assets developed (X. Zhang et al., 2016). These guidelines, if applied during the postconcession period, most measures would be critical to determine investment recoveries that need to guarantee benefits for both public and private sector investors equally (Ma et al., 2018). During the postconcession period, infrastructure assets must adequately guarantee that the public sector achieves revenues and show reasonable profit generation certainties (Feng et al., 2019). Effectively, postconcession period revenue and profit generation deterministic mechanism has to show profits and underlying cash-flow stability and ensure the public sector sustains infrastructure assets financial value postconcession period (L. Zhang et al., 2019).

According to J. Liu et al. (2015), the postconcession period accurately must maintain such infrastructure assets performance and compares expected returns with actual outcomes of infrastructure assets efficiency, reliability, social value, and financial value for money (F. Wang et al., 2018). Essentially, the postconcession period ought to assist the government in safeguarding the public interest while ensuring profit generation for the private sector through appropriate concession period-based PPP agreements that ensure balanced risk-sharing approaches are observed (Y. Zhang et al., 2017). Similarly, the postconcession period must ensure that social benefits postconcession termination should be provided at a reasonable price to public use while preserving infrastructure asset financial value (Y. Zhang et al., 2017).

In the same light, Cui et al. (2019) and Tassopoulos and Theodoropoulos (2014) noted that infrastructure assets whole-life costs, reliability and utilization, and value for

quality service delivery are all associated with an out-based specification which enhances infrastructure assets financial value sustainability. In exceptional cases, F. Wang et al. (2018) found that social welfare is independent of infrastructure asset capacity utilization, especially when the public sector initiates building and operating infrastructure assets without the private sector's involvement. According to F. Wang et al. (2018), it becomes the government's responsibility to achieve postconcession period objectives, ensuring that infrastructure assets obtain optimal social welfare and provide quality public use (Z. Liu et al., 2015). Nwokedi and Emenike (2018) articulated that to achieve a postconcession period performance of infrastructure assets, there is a need to apply the basic principle of performance forecasting and benchmarking as tools for infrastructure sustainability the postconcession period. Cui et al. (2019) and Nwokedi and Emenike (2018) argued that this was appropriate to determine post infrastructure asset financial values as key performance indicators for the financial value of infrastructure assets postconcession termination.

Concession Period Pricing Model

The concession period is the most significant factor in decision-making for PPP infrastructure projects development (Ma et al., 2018). According to Ullah et al. (2018), but notably Feng et al. (2019), infrastructure projects developed through the concession period usually have over 15 to 20 years, effectively influencing net present value calculation. The delivery of concession period-based infrastructure projects with positive net present value requires a long-term performance view that considers the sustainability of infrastructure asset benefits-based performance measurements (S. Liu et al., 2018).

Optimizing a reasonable concession period is critical for PPP infrastructure project implementation (Deng et al., 2014; Hu & Zhu, 2015).

According to Feng et al. (2019), determining an acceptable and concession period and ensuring a balance of benefits and interests between the public and private sectors requires a complete application of the net present value. S. Liu et al. (2018) proposed a net present value model that can be applied to calculate and create a concession period model beneficial to all parties in infrastructure projects investments. Titman and Martin (2016) have argued that the model is practical and can calculate the difference between the present value of the infrastructure project's expected future cash flows at concession period implementation. Y. Zhang et al. (2017) and Titman and Martin (2016) viewed the model application to focus on safeguarding the interests and benefits for public and private investments in infrastructure projects development as crucial to developing national economies through infrastructure projects development.

Hu and Zhu (2015) pointed that the net present value model is traditionally a static evaluation tool that virtually assists in estimating infrastructure project value without considering the uncertainty of the future cash flows and infrastructure assets' financial values postconcession period. Madura and Fox (2014) presented that the model applies borrowing and lending equations to infrastructure investment projects to evaluate complex scenarios of uncertain future outcomes. Below, I present Madura and Fox's (2014) net present value equation showing different components critical for applying the model. The process to calculate infrastructure project net present value is presented to

demonstrate the net present value model's critical components. Further clarity below points to the benefits of model application.

$$NPV = -IO + \left(\sum_{t=1}^{n} \frac{CF_t}{(1+k)\dot{t}} \right) + \frac{SV_n}{(1+k)t}$$

From the equation above:

NPV = net present value

IO =initial outlay (investment)

NPV = net present value

IO =initial outlay (investment)

CFt = cash flow in project t

k = required rate of return on the project

n = lifetime of the project (number of periods)

SV = Salvage Value = terminal value

Source: Madura and Fox (2014)

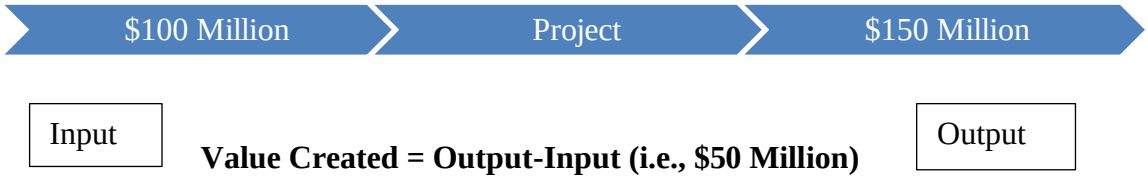
The method used to calculate investments in infrastructure projects is to determine cost against benefits. Public and private sector investors have different priorities and interests when investing in concession period-based infrastructure project development (Deng et al., 2014; F. Wang et al., 2018). As shown in the net present value equation above, the primary focus for investments in infrastructure projects, especially for the private sector, is to achieve revenues and maximize profits (X. Zhang et al., 2016). From a public sector, the perspective is government invests in infrastructure to achieve social value and infrastructure financial value postconcession period (Z. Wang et al.,

2015). Although the net present value has limitations, according to Ma et al. (2018), the model application can calculate the concession period's length.

Above computing investment total capital costs and benefits, investors can use the net present value to compute the concession period to determine each investment cost to clarify the value of the economic viability of investing in infrastructure projects (Madura & Fox, 2014). According to Titman and Martin (2016), using the net present value model helps public and private sector investors to evaluate whether the infrastructure project's return on investment is consistent with the extent of risk inherent in the investment initiative. Figure 1 below shows a typical example of value creation through an initial infrastructure project investment using net present value.

Figure 1

Investment Evaluation (Titman & Martin, 2016)



From the investment evaluation model above, an investment project's net present value is $50 million (Titman & Martin, 2016). The calculation discounted the net cash flows of $100 million during the concession period. According to Titman and Martin (2016), net present value essentially determines investment failures or successes and determines pre-and-postconcession period capabilities to provide infrastructure projects investment advantages relative to other forms of infrastructure investments and development. Sun and Zhang (2015) analyzed the private sector's infrastructure project

investment effect in the concession period. The authors discovered that a project is acceptable if a value for money or investment returns are higher or equal to zero. Hadi and Erzaij (2019) pointed that infrastructure projects incur different development profiles during life cycle as such, requires concession period methods such as net present value to determine revenues over concession period implementation and subsequent postconcession termination.

Ma et al. (2018) articulated that traditional net present value methods applied to discount cash flows cannot calculate complex and uncertain future infrastructure projects' financial values. According to Ma et al. (2018), the application of traditional models such as net present value only works for infrastructure projects where risk levels are low and deterministic conditions under which revenue and profit generation is stable. The function of the extended net present value is applied as an increasing function. It demonstrates a maximum value for both the public and private sectors (S. Liu et al., 2018). Yan et al. (2019) proposed a theoretical model of the extended net present value approach to include social value and financial value factors to create value for the public sector and society postconcession period. In their development approaches, Yan et al. (2019) considered that both public and private sectors are bounded by rationality and have different fairness preferences based on each side's minimum expected benefits.

Summary and Conclusions

Infrastructure assets are necessary for quality service provision and contribution to countries' economic growth. South Africa is one of Africa's economic development leaders and has a relatively good core network of national economic infrastructure. The

challenge for South Africa is to maintain and expand its national infrastructure in order to support economic growth and social development goals through a commitment to the United Nations Sustainable Development Goals 6 (ensure availability and sustainable management of water and sanitation for all) and 9 (build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation). The issue stands that the South African government is probably focused more on economic development through infrastructure in urban areas and compromising the possibilities of large-scale social infrastructure development in rural areas.

The current state of water administrative readiness in South Africa lacks the skills and capacity to provide appropriate technical, operational efficiencies, and social welfare benefits. For optimal success in implementing the 2030 United National Agenda for sustainable development against poor skills development at various government levels to monitor, evaluate, and finance required infrastructure to sustain development. South Africa needs private sector intervention and a well-structured partnership to improve service delivery. There are no standards applicable to implement concession-based infrastructure development at the various government levels in South Africa, and there is a lack of strong institutional capacity to analyze and address water infrastructure technical challenges effectively.

Access to affordable water and other essential infrastructure services is critically important and is a prerequisite for South Africa's economic development. For South Africa, the route to achieving the 2030 National Agenda of Sustainable Development Goals relies on the PPP capacity innovations for funding and technical efficiencies to

evaluate, monitor, and implement concession period-based infrastructure development. South African infrastructure projects operate within a PPP framework that accommodates concession period-based infrastructure assets development. The South African government aims to create value from the concession period-based infrastructure assets built through private sector investment initiatives. South Africa considers the concession period application a viable economic option and an exceptional financial instrument to attract funds to benefits infrastructure projects development that ensures social value and profit maximization.

This chapter also focused on a literature review relevant to concession period influence in infrastructure assets financial value, but more specifically, how the concession period influences the financial value of the infrastructure asset's financial value postconcession period. The literature review chapter compares and contrasts concepts and applications relevant to concession period influence in infrastructure asset financial value. I examined the conceptual framework and concession period implication in PPP implementation as well. Through the literature review, I observed how the concession period influences decisions in applying the concession period-based PPP application towards infrastructure projects execution. Additionally, I also examined concession period risks and benefits associated with PPP infrastructure project implementations.

Because developing countries continue to execute concession period-based PPP infrastructure development, infrastructure's financial value was examined and showed how such values were preserved to ensure infrastructure financial value sustainability,

postconcession period. Chapter 3 details the rationale for using an e-Delphi research design to best answer the research question. Chapter 3 includes a critical discussion on the researcher's role and a clear outline of the research methodology, which includes processes towards data collection methods, data analysis approaches, participants' selection criteria, and sampling approaches and applications. The chapter concludes by considering the necessary tools and steps to ensure the study results' trustworthiness and ethical research procedures.

Chapter 3: Research Method

In Chapter 3, the intent is to describe the research methodology for the current research and its suitability to help answer the research question. The purpose of this qualitative, e-Delphi study was to determine the level of consensus among PPP experts on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. The specific management problem is PPP stakeholders in South Africa are inconsistent in using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination (Dithebe et al., 2019b; Khatleli, 2020b).

South Africa's PPP concession period-based infrastructure development's inability to balance their goals of social value and profit generation within local water infrastructure development may be due to inconsistent use of performance measurements to forecast long-term investment returns at postconcession termination (Arimoro, 2020; Dithebe et al., 2019b). An e-Delphi method is a research approach appropriate for achieving consensus based on expert judgments by completing rounds of questionnaires (Habibi et al., 2014; Price et al., 2020). Controlled feedback usually influences experts' responses in each round of questionnaires resulting in a convergence of opinion and subsequent expert-consensus (Habibi et al., 2014; Karampatakis et al., 2019; Price et al., 2020). Using the e-Delphi method to extend Hadi and Erzaij's (2019) conceptual framework supports the study's overall purpose of developing a set of best practices

based on experts' level of consensus on using performance measurements to optimize concession period agreements. This chapter provides detailed information on the research method and rationale for using an e-Delphi approach to meet the study's purpose. The chapter information includes a rationale for the participant selection strategy, data collection strategies and data analysis, the researcher's role, evaluation methods for the trustworthiness of data, ethical considerations, and a chapter summary.

Research Design and Rationale

The central research question that guided this empirical study was: What is the level of consensus among PPP experts on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at the postconcession termination? The study included three research subquestions:

Subquestion 1 (S1): What are desirable and feasible strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development?

Subquestion 2 (S2): What are desirable and feasible strategies during the negotiation period between public and private partners, so both parties come to a consensus on a project completion schedule?

Subquestion 3 (S3): What are desirable and feasible strategies for the South African government to apply rigorous performance monitoring measures to optimize concession period agreements, and drive infrastructure financial value at postconcession termination?

The application of a qualitative Delphi study was a means to examine the level of consensus among PPP experts on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure asset financial value at postconcession termination. Using e-Delphi method to achieve expert-consensus is a desirable practice when the problem is unknown and when investigative methods are insufficient to solve the problem (Datta et al., 2021). More importantly, the e-Delphi practice allows for freedom to expression, consideration of opinion, anonymity, and logical deliberations (Datta et al., 2021).

I reviewed various research methods, including those that scholars applied in concession period model implementation, before deciding on producing data for the research question. Various evaluated methods included mixed-methods, qualitative, and quantitative methods. The objective of evaluating the various research methods was to identify the most appropriate method of the research study about the concession period, focusing on determining the level of consensus among PPP on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure asset financial value at postconcession termination.

Following vigorous processes to establish a consistent research approach in the concession period study, I elected to limit qualitative methodology research. In line with Creswell and Clark (2011), a qualitative research method is used frequently to explore one idea or the central phenomenon to achieve an in-depth perspective. The other reason

I selected the qualitative method was that, according to Creswell and Clark (2011), using the qualitative method conveys study participants' multiple perspectives. The quantitative method was not relevant to this study because exploratory studies do not involve investigating any statistical relationship and or manipulating experimental variables. Qualitative research is suitable when field observations of reality are analyzed using numerical methods or where the intention is to conclude coded data (Babbie, 2017; Creswell, 2009). A research method can be a flexible approach to collecting and analyzing data to determine the level of consensus among PPP experts on best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development.

Other qualitative research methods, such as phenomenology and case study, were not appropriate for this study. In phenomenology research, a researcher holds presuppositions, assumptions, biases, and previous experience to describe the study (Van Manen, 2017; Ravitch & Carl, 2016). The case study method involves studying a case of real-life experiences and is a method that can help improve a theory instead of approving or rejecting it (Babbie, 2017). According to De Vos et al. (2011), the phenomenology approach describes the life world and what it consists of and describes what concepts and structures of human experiences provide form and meaning. In the phenomenology approach, the researcher strives to describe the phenomenon as accurately as feasible and remain faithful to the facts while refraining from any pregiven framework (De Vos et al., 2011). The study was not meant to describe the research phenomenon of human experiences; instead, the study's goal was to establish a level of consensus among subject

matter experts. The Delphi design originated at the RAND Corporation in the 1950s and is a technique applicable to gather expert judgments of a phenomenon through rounds of questionnaires and controlled opinion feedback (Habibi et al., 2014; Linstone & Turoff, 2011; Velez et al., 2020). According to Okoli and Pawlowski (2004), the Delphi design emphasized that the resulting expert opinion's validity as an outcome of data analysis is measured based on a level of expert consensus on a topic of research.

The design's main objective was to achieve a degree of expert-consensus according to logical reasoning to examine and forecast the future of a particular problem (Jeste et al., 2010; Meshkat et al., 2014). Accordingly, Green (2014) indicated that the Delphi design consists of a structured communication technique serving as an interactive forecasting method. Grime and Wright (2016) articulated that the Delphi design for qualitative studies is critically important when the researcher aims to assess the extent of unanimity among experts on a specific critical forecasting area of interest. In such an effort by experts, the study is likely to find a level of consensus among a panel of experts on a situation that is not well understood (Grime & Wright, 2016; McPherson et al., 2018). The Delphi technique's judgmental forecasting ability is crucial as a research method because its application helps solicit opinions through carefully designed questionnaires and correctly targeted experts (Cornel & Mirela, 2008; Habibi et al., 2014; Meshkat et al., 2014). Price et al. (2020), but notably Linstone and Turoff (2011), expanded on the idea of judgmental forecasting capabilities of the Delphi technique by stating that the Delphi design possesses value in gaining convergence of opinion from experts.

The e-Delphi was an appropriate technique relevant to deliver the overall purpose of the study. The e-Delphi method's selection is systematic and appropriate for achieving consensus based on expert judgments by completing rounds of questionnaires (Price et al., 2020; Soong et al., 2016). Controlled communication feedback helps influence experts' responses in each round of questionnaires resulting in a convergence of opinion and subsequent expert-consensus (Karampatakis et al., 2019; Price et al., 2020). The study's overall purpose was to gain insights from PPP experts on best practices within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value postconcession period. Opportunities for the method arise when analytical methods are insufficient to solve the problem. Consequently, a need arises for collective judgments, primarily when expert individuals who have no knowledge and communication with each other and coming from diverse backgrounds; and more significantly, when the researcher can ensure to achieve validity through maintaining the diversity of the participants throughout the research process (Latif et al., 2016; Linstone & Turoff, 2011; Price et al., 2020). The nature of this qualitative study was to apply three rounds of e-Delphi research design (Cole et al., 2013; Karampatakis et al., 2019).

An e-Delphi technique is applied in qualitative research as a forecasting technique to investigate a topic that lacks evidence and goes far beyond to explore an area of what is currently known or believed (Hsu & Sandford, 2007; Murphy et al., 2020). The Delphi method's application via the internet to collect data represents what is widely known as an e-Delphi method. In the e-Delphi method, the researcher facilitates and communicates

with a group of experts to collect data through survey-online questionnaire methods (Donohoe et al., 2012; Murphy et al., 2020). In a critical methodological discussion of a case study where a review of advantages and disadvantages of the e-Delphi research was undertaken, Toronto (2017) suggested that before formulating an e-Delphi analysis, the researcher needs to consider the e-Delphi limitations. Some of the limitations of the approach considered in the study were the anonymity of the Internet, which prevents the researcher from carefully monitoring the research, firewalls preventing the experts from receiving the surveys, and technological and interpretation of the survey questions (Grime & Wright, 2016; Latif et al., 2016).

The e-Delphi design involves three rounds of iterations intending to reduce the responses until some form of consensus is received with 55% to a 100% agreement with the standard being 70% (Avella, 2016; Soong et al., 2016). In this e-Delphi study, I used three rounds of surveys. The first round of the survey consisted of an open-ended questionnaire; the second and third questionnaires were in the form of items and Likert-type rating scales (Jeste et al., 2010). Round 2 ratings focused on desirability and Round 3 focused on desirability and feasibility.

I used purposive, snowball, and criterion-based sampling in identifying study participants. Purposive sampling is typically critical and used when information by a specific group of people requires a certain qualitative interpretation degree. The basis of snowball sampling is on networks whereby existing participants or network contacts recommend others for their study (Tracy, 2019).

Role of the Researcher

In any qualitative research study, the researcher acts as a primary source of data collection and an instrument of study. The researcher's focus in qualitative research is to explain, understand, discover, explore, and clarify feelings, situations, perceptions, experiences, and values of a group of people (Babbie, 2017; Kumar, 2014; Ravitch & Carl, 2016). As a result, the parameters of the scope of the research and the selection of research participants for data collection and analysis was based on my years of professional experiences of almost 20 years as both a director and employee working for A D I Afrika (Pty) Ltd in infrastructure projects development. Although infrastructure project development involves professional and stakeholder inter-communication to a particular degree, the relationship gap between me as the researcher and the study population is non-linear and far broader. The most distinguishing feature in determining performance measurement concession period-based infrastructure projects capital investments is the long-time held professional code of conduct wherein contracts such as concession period contracts are concluded based on regulated procurement processes.

The credibility of qualitative research methods hinges on the person's skills and competencies undertaken in research to maintain rigorous data collection and analysis techniques (Miles et al., 2014). Accordingly, the researcher must relate to positionality, identity, experience, prior knowledge, assumptions, ideologies, and working epistemologies (Ravitch & Carl, 2016). The positionality and implicit theories used are critical to guide and direct the researcher to make professional choices and undertake reflective inquiry processes (Tracy, 2019). More significantly, applying these theories,

such as implicit theories, is crucial, which, according to Ravitch and Carl (2016), helps achieve research integrity and validity. I adopted an observer and facilitator's role by developing multiple questionnaires. I never answered the research directly on the first or second round but ran the data from each round through analysis to establish the next set of surveys. The basis for recruiting participants who fit the expert inclusion criteria followed purposive, snowball, and criterion-based sampling requirements. I sent a recruitment letter posted to a candidate pool with whom I had no personal, professional, and or supervisory relationships.

In a Delphi study, the researcher collects data and is aware of the study's biases and limitations (Hasson & Keeney, 2011). The biases surrounding the Delphi method included a possible manipulation of the results. Nevertheless, the development of criteria based on trustworthiness was significantly sufficient to mitigate partialities. Another bias in the e-Delphi approach was that experts' consensus might not be a genuine consensus because it might be exposed to manipulation. I was able to mitigate biases by carefully following the study audit trail based on the four aspects of trustworthiness: credibility, dependability, confirmability, and transferability. I used the aspects above trustworthiness: credibility, dependability, confirmability, and transferability to communicate assumptions and limitations of the study's delimitations. The study's purpose was not to display any of my personal views but to provide the best practical strategies from the study based on participants in response to the surveys.

To mitigate any risk of bias that might emerge from my previous experiences in concession infrastructure projects development, I avoided using leading questions such as

"don't you agree or disagree" about any specific issue. The reason was that such wording was unlikely to produce consensus and may support a position already identified (Babbie, 2017). To further mitigate bias risk, I used an e-Delphi research methodology appropriate and aligned to determining performance measurements on concession period model to forecast water infrastructure investments returns and ensured to present the findings accordingly to achieve validity and credibility of the research outcome, as I needed to adhere to acceptable professional practices (Kumar, 2014).

Adherence to a professional code of conduct that reduces the likelihood of a conflict of interest between researcher and study participants was critically significant (Kumar, 2014; Toma & Picioreanu, 2016; Toronto, 2017). My adherence to professional practice included ensuring consenting was obtained before research participants contributed to the research project (Babbie, 2017). Another ethical consideration was the framework for providing incentives, obtaining sensitive information, and clarity on maintaining information confidentiality needed to be well defined (Miles et al., 2014). The goal was to ensure the examination of these areas stated above to guarantee an ethical code of practice as well adhere to and subsequently observed (Kumar, 2014).

Methodology

The research methodology was critical to helping to decide how to find answers to the research question to meet its purpose to achieve the research objective (Kumar, 2014). Choosing the appropriate research methodology to construct a study question was essential for how the researcher approaches data collection and analysis methods and how the data collection methods were situated and sequenced to create validity rigor and

procedures applied to generate perceptions (Creswell, 2009; Murshed & Zhang, 2016). I used the qualitative Delphi method to meet the purpose of the study. The significant premise underlying the e-Delphi method's selection is that raw data inputs are centered and aggregated to achieve expert judgments (Hsu & Sandford, 2007). Okoli and Pawlowski (2004) emphasized that the resulting expert judgments' validity as an outcome of data analysis is measured based on a degree of expert consensus on the research topic. Turoff and Linstone (2002) articulated that the Delphi method's philosophical epitome is that the method can focus on considering a topic with no established institutional advocates and research measures, as in the case with this study.

The e-Delphi design encompasses experts' selection to serve as online study participants (Toma & Picioreanu, 2016). Experts' selection is essential in a Delphi study, and the research design is selected based on the unique knowledge and experience of participants (Strasser, 2017). The e-Delphi method is a judgmental forecasting and decision-making method and technique. Delphi studies are amenable to the Internet platform where iterative data collection is mainly more accessible and efficient to help researchers achieve the research objective and goal (Cole et al., 2013). In this e-Delphi study design for an online platform the aim was to adhere to three rounds of questionnaires. In the first-round questionnaire, I used an open-ended approach to gathering expert opinions in the form of themes garnered from the first round of data analysis. I designed the second online survey questionnaire with questions derived from the first round’s data analysis coded themes. The third-round questionnaire formed the summative data to achieve a consensus-based outcome among experts by having their

opinion rated according to the degree of desirability and feasibility (Cole et al., 2013). To achieve the goal of reaching consensus among e-Delphi study participants, three rounds of online survey questionnaires were sufficient in answering the research question (Meshkat et al., 2014). Finally, managing e-Delphi studies' practical logistics includes designing successful online communication channels, technological considerations, and proper handling of quantitative and qualitative data (Haynes & Shelton, 2018).

Participant Selection Logic

Delphi is a research method applied to evaluate future events, developments, technologies and solicit opinions through carefully designed questionnaires and targeting the correct experts to identify consensus (Cornel & Mirela, 2008; Markmann et al., 2020). Linstone and Turoff (2011), but notably Markmann et al. (2020), expressed that using the e-Delphi technique methodology possesses value in various insights, especially in the independencies of opinion than the convergence of expert judgments. Accordingly, Clibbens et al. (2012) articulated that it was important for experts in the Delphi design to maintain divergent views while the researcher challenges the participants' assumptions. Equally, Avella (2016) suggested that it was critically important that Delphi design underlining set criteria for expert selection, considered the following requirements for a panel of expert selection for the study. Ludwig (1997) argued that for Delphi studies, the number of participants could be between 15 to 20, and in this study 20 participants were selected to participate in Round 1 based on the exclusion criteria. The selection of participants using a random sampling approach is not appropriate for a Delphi study.

Clibbens et al. (2012) expressed that participant selection should occur after carefully identifying relevant experience, knowledge, qualifications, and detailed criteria.

Criterion and network sampling was applied in this Delphi qualitative method to select 20 experts from the population with the most relevant knowledge, experience, and expertise in the PPP and water infrastructure space within the South African context (Merriam & Grenier, 2019). As argued by Skulmoski et al. (2007), there are probabilities that a Delphi study sample size can vary depending on whether the researcher has a heterogenous sample or a homogenous sample. Tracy (2019) articulated that criterion-based sampling was critical and reinforced a sampling strategy that aimed at a heterogeneous group of participants to validate maximum variation sampling. Maximum variation sampling in qualitative research was mainly dependent on the participants' opinion and or researcher's judgment since it was the expert judgments upon which Delphi output was based (Skulmoski et al., 2007). As a result, selecting participants with diverse attributes was critical to ensure the utmost unpredictability within the primary data, which in this e-Delphi study was the responses to the three rounds of questionnaires (Palinkas et al., 2015; Skulmoski et al., 2007).

Instrumentation

The e-Delphi method was used to collect critical data through an online-survey process on the Internet using SurveyMonkey platform (Velez et al., 2020). The researcher aggregates data collected to formulate expert opinions to resolve a research problem and to generate new knowledge (Cole et al., 2013; Jameel & Majid, 2018). In recent years Delphi studies have been increasingly undertaken to conduct research regularly in web-

based formats and platforms, where calculations between rounds are carried out immediately (Linstone & Turoff, 2011). Such real-time Delphi studies, according to Clibbens et al. (2012), have demonstrated comparable results with traditional Delphi studies regarding validity and reliability. The e-Delphi approach involves online survey questionnaires to collect data, is administered electronically, through a platform such as SurveyMonkey, and may consist of three rounds of data collection (Gill et al., 2013; Jameel & Majid, 2018; Markmann et al., 2020).

The first round of the questionnaire had an answer limit of 150 words in all the subquestions of the first round. The framing of the questions helped to generate a set of common categories and themes. The first round of questions was grounded in the study's conceptual framework, Hadi and Erzaij's (2019) determination and analysis of the concession period conceptual model, that illustrates how to achieve benefits of the concession period when there is equity on sharing of risk among parties and balanced benefit distribution.

In the first round, online survey questions were developed and framed to enable identifying common categories and themes. The first-round questions helped to ground the study's conceptual framework. The development of the first survey questionnaire (Round 1) was open-ended soliciting participants' opinion in accordance with their experience and knowledge of the study, while subsequent questions were constructed in accordance with participants' responses, predictions, and recommendations from the first-round questionnaire (Clibbens et al., 2012). The dissemination of the second round of the survey questionnaire (Round 2) essentially indicated a collective list of responses

whereby the expert participants, after rating desirability of each idea according to an order using a 5-point Likert-type scale pertaining to desirability. As a result of the second questionnaire ratings of desirability, the third questionnaire (Round 3) was used to obtain consensus among experts by having the experts rate all ideas in order of desirability and feasibility. I collected data and analyzed responses, applying qualitative measures to track statistical knowledge of themes and patterns.

I applied a rating type of survey to elicit opinions from experts through the controlled feedback process. Each of the online-survey questions assisted in ensuring expert participants who were selected based on the inclusion criteria stipulated above helped to achieve the objective of the study (Toronto, 2017). The data collection instruments were the researcher-developed online survey questionnaires. The communication between myself and the experts was through the IRB consent form, which listed the study purpose, number of questionnaires, frequency, and ethical concerns. The links to the first, second, and third round questionnaire were sent via e-mail using a separate e-mail once participants consented to participate in the research project. The Delphi technique is associated with five terms, which are synonymous with the method and are listed below.

1. Anonymity: The process coordinated by the researcher for panel members who do not know each other.

2. Iteration: refers to the survey instrument's series where the survey instrument reflects the panel members' responses to the previous survey.

3. Controlled feedback: this emerges from the research conducting a statistical analysis of the survey results and constructing the next survey to express the aggregated responses.

4. Statistical group response: usually shows the group's responses as measures of central tendency, dispersion, and frequency distribution.

5. Stability: this refers to the consistency of responses through all surveys. (Jain, 2020, p. 89)

The Delphi study design is critical to measure consensus or dissent among expert participants on important matters, and there are various perspectives on what signifies agreement or disagreement among experts (Fletcher & Marchildon, 2014; Markmann et al., 2020). For that reason, researchers need a clear definition of consensus, and when is the consensus reached to stabilize responses across all the rounds (Clibbens et al., 2012). To achieve consensus, agreements, and stability among experts, in the second and third round I used Likert-type scales and percentage agreement (Price et al., 2020). The evaluation of consensus for the rating of desirability in Round 2, and in Round 3 for the rating of desirability and feasibility were based on questionnaires comprised of items and 5-point Likert-type scales (Gravetter & Forzano, 2016; Viladrich et al., 2017), where in Round 2, 1=*Exceedingly Undesirable* and 5=*Exceedingly Desirable,* and in Round 3 1=*Exceedingly Undesirable* and 5=*Exceedingly Desirable,* as well as 1=*Exceedingly Infeasible* and 5=*Exceedingly Feasible*.

The Delphi method's application stated above was informed essentially by guidance on conducting and reporting Delphi study recommendations to ensure rigor,

stability, and transparency (Flostrand et al., 2020; Price et al., 2020). Markmann et al. (2020) opined that a formal statistical analysis for Delphi results comes from a measure of central tendencies such as median, mode, and dispersion measures. In the final round, that is Round 3, it is essential to undertake the vital final step in Round 3 of an e-Delphi survey for all experts to grant panel members an opportunity to rate the study topics for desirability and feasibility to obtain valid responses and ultimately consensus (Toronto, 2017).

Field Test

I conducted a first-round field test of open-ended questionnaire using communications, e-mails, hyperlinks, and surveys to invite experts for the field test study. The processes involved a panel of experts who possessed the required knowledge and experience of the research to ensure shared understandings between the researcher and the panel of experts, eliminating possibilities of creating flaw-responses that could lead to challenging outcomes (Toronto, 2017; Toma & Picioreanu, 2016). The field test of the first round of data collection questionnaires comprised of four subject-matter experts who also possessed research experience in e-Delphi research projects. My objective was to assess the questionnaires for clarity, design, flow, and alignment with the study's purpose. Furthermore, the primary aim was to provide practically and critically essential answers to the study's research questions. In conducting the field test, the feedback from the four experts was aimed to solicit experts' opinion essential to help formulate and test whether the research conducted met the requirements, crucial to the Delphi study and the findings (Fletcher & Marchildon, 2014; Price et al., 2020). The responses were crucial to helping

generate subsequent rounds of questions (Clibbens et al., 2012). The field test is central to help mitigate questionnaire creation issues on desktop computers and provide accessibility to the online survey questionnaires through mobile devices such as iPads or smartphones. The field test aims to allow for revising processes and the questionnaire's design to consider how experts are likely to use mobile devices during the research project (Toronto, 2017).

The results of the field test assisted in adjusting the instrumentation for better simplicity, ensuring that the research was restricted and controlled within the ethical framework as required in the IRB guidelines. The field test critically helped to adjust the first-round questionnaire instrumentation. The approval of the first-round questionnaire came from the dissertation committee and the IRB. The approval of Round 1 allowed me to proceed with the first-round questionnaire and subsequent rounds of questionnaires of the research.

Internal Consistency Reliability

Using Cronbach's alpha to measure internal consistency reliability across the 5-point Likert-type ratings of the items in Rounds 2 and 3 of the research is traditional with Delphi studies (Yoon et al., 2020). A Cronbach's alpha greater than 0.70 would be regarded above the 0.70 predefined criteria threshold for best practice performance measures using 20 participants to respond to survey questionnaire (De Leng et al., 2017; Yoon et al., 2020). The Cronbach's alpha for Round 2 was 0.80, which was above the predefined criteria. In Round 3, the Cronbach's alpha was 0.85, which was above the criteria threshold (Mokkink et al., 2017) for both desirability and feasibility performance

measures incorporation on concession period model. However, the Cronbach's alpha was subsequently increased to 0.90 to further eliminate unwanted items and measure expert convergency on performance measures strategies execution.

Procedures for Recruitment, Participation, and Data Collection

Procedures for Recruitment

The expert panel critical for building a Delphi study comprised of: (a) defining the relevant expertise and (b) identifying individuals with the desired knowledge and experience (Hirschhorn, 2018). The Delphi method's success relies on experts' careful selection, a methodological process perfect for a researcher using the e-Delphi technique (Donohoe et al., 2012; Jameel & Majid, 2018). To collect data for this study, I selected PPP experts in South Africa. As noted by Peterson (2018), there is no set of guidelines for a Delphi panel expert selection. According to Peterson (2018), scholars apply various methods to determine expert experience, knowledge, and qualifications. Such may include the number of years in terms of work experience, professional qualifications, experience in project involvement, licensures, and professional publications in the field under-investigation (Fusch & Ness, 2015; Peterson, 2018).

Procedure for Participation

The participants' recruitment strategy in this e-Delphi study remained within the scope of previously identified inclusion criteria. The experts satisfied the following inclusion criteria:

- Had a minimum of at least 5 years of experience in PPP negotiating a concession period for water infrastructure development;

- Possessed a Masters' Degree in Finance, Engineering, and Project Management;
- Were currently employed in the Development Bank of Southern Africa (DBSA);
- Were employed for over 5 years at the National Treasury in the PPP unit; and
- Were an adult over the age of 18.

In a Delphi design, the number of panel members could range from small to large; however, the experts' knowledge to add value to the research importance brings its authenticity and provides a solution to the research question (Hasson & Keeney, 2011; Powell, 2003).

Procedure for Data Collection

The basis of the answer to the research questions depends on the multiple rounds of Delphi-styled surveys critical to help participants with an opportunity to provide a consensus-oriented outcome, with data saturation referred to in the Delphi method as a convergence of opinion amongst participants (Rayens & Hahn, 2000). To answer the research questions, I followed the methodological approaches and recommendations for applying three rounds of questionnaires (Haynes & Shelton, 2018). In the first round of the online survey questionnaire, I used an open-ended question approach to gathering data from PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. The sample size in a Delphi study varies; thus, saturation stands for a different meaning with qualitative e-Delphi methodology than other classic qualitative designs.

As noted by McPherson et al. (2018), but notably Linstone and Turoff (2011), the attrition rate in a Delphi study might present a challenge, as experts drop-out during the data collection and analysis processes, either due to engagement or other responsibilities. Such possibilities inform the participants' selection ranging at 10 to 20 of the panel of experts for the qualitative Delphi research of high attrition rates, which according to McPherson et al. (2018), is likely to compromise the validity of findings if not due care is factored in during participants selection. Because of this limitation of a high drop-out rate in Delphi studies, I began the recruitment with a list of 20 participants to form a panel of experts for Round 1. Upon agreeing to participate in the study with a response to the call for participation, the participant received an e-mail with the IRB approved consent form that briefly introduced the researcher, described the purpose of the study, and briefly explained the three rounds of questionnaires and the approximate time they needed to devote to the answers. Once participants responded with "I Consent" on the subject line to the informed consent form, I sent the first survey link to the participants. The first round of questionnaires in an e-Delphi study only allows necessary information about the subject.

After analyzing responses from the first questionnaire, I converted responses into a structured questionnaire for responses on the second round. Panelists rated strategies in Round 2 using a 5-point Likert-type scale for desirability where 1=*Exceedingly Undesirable and* 5=*Exceedingly Desirable*. At the end of each list of items of the set of Round 2 questionnaire included a voluntary box for experts to provide justification for any low-rated items. In between the rounds, I gathered the responses, statistically

summarized the answers, and presented all participants' feedback in another format. The results of the Round 2 were accordingly reported. In the third round of the questionnaires, I anticipated that the panel member-experts would reach a consensus-oriented outcome. The participants had 2 weeks after receipt of the first questionnaire to return their responses. The analysis of the first and second rounds of responses took 1 week.

I sent the third and final survey link with the expectation of receiving answers within another 2 weeks. Panelists rated strategies in Round 3 using two 5-point Likert-type scales, one for desirability where 1=*Exceedingly Undesirable and* 5=*Exceedingly Desirable,* and one for feasibility where 1=*Exceedingly Unfeasible and* 5=*Exceedingly Feasible*. The final analysis took place within 1 week, and I sent feedback to participants 5 days before each round deadline and then 2 days before the close of the survey. I recorded the survey questions in Microsoft Word format and then transferred them to SurveyMonkey. I recorded the responses to each survey into an Excel sheet. The spreadsheet was divided into six sheets and used to track responses and reminder e-mails. In the final spreadsheet, I analyzed responses based on the following categories: (a) survey number, (b) participant’s code name, (c) IP address, (d) questions with rating, (e) answers from the first survey, (f) codes, (g) categories, (h) themes, (i) and additional comments.

Debriefing Procedures for Participants

Debriefings are discrete opportunities employed in qualitative data collection processes, ideally conducted to discuss data collection tenor, flow, and resulting findings (West et al., 2018). The debriefing procedure essentially helps measure and possibly

ameliorate adverse reactions that could have resulted from research experiences by research participants (Babbie, 2017). Christensen et al. (2015) investigated the impact of debriefing and reported that only 1.3% of research participants showed adverse reactions after an extensive debriefing process. According to the authors above, particularly Christensen et al. (2015), argued that such evidence demonstrated the positive influence of debriefing in minimizing extreme harm to participants after research experiences. West et al. (2018) stated that the execution of debriefing sessions must be that participants are not left inferior based on their performance in the research project; instead, the process needs to create a base for empowerment to tackle future research. Besides, Babbie (2017) expressed that if the research effects are likely to be long-lasting, the researcher is obligated to conduct follow-up interviews and further undertake to provide counseling. Gravetter and Forzano (2016) articulated that the overall objective of debriefing is to reduce harmful effects.

Other studies, especially those conducted by Christensen et al. (2015) and Gravetter and Forzano (2016), demonstrated that debriefing was less effective and suspicious but most significantly created more harm and embarrassment to participants. Despite it being seen as counter-productive by specific authors such as Christensen et al. (2015) and Gravetter and Forzano (2016), debriefing remained critical to ensure participants were adequately safeguarded and appraised about the research experiences. The intricacies of facilitating effective debriefings include but are not limited to ensuring an open environment that focuses on crucial research objectives, participant value acceptance, and the significance of self-reflection (Babbie, 2017; Gardner, 2013).

I achieved the debriefing objective by ensuring that debriefing processes were acted upon confidentially. I conducted the debriefing session using online SurveyMonkey platform. I used the platform to send the report of the study and follow-up questionnaires to establish panelists' feedback to their participation in the research project (Straits & Singleton, Jr., 2011). The fundamental ethical justification for the research project was that it was judged satisfactory by panelists.

Data Analysis Plan

The Delphi methodology calls for simultaneously carrying out data collection and data analysis (Peterson, 2018). The e-Delphi is a relatively new technique that leverages the Internet and reduces time, costs, communication challenges, and reduces the attrition rate (Cole et al., 2013; Jameel & Majid, 2018). Delphi's first-round began with an open-ended questionnaire grounded in the study's scholarly literature, and a conceptual framework converted into a structured questionnaire in the following rounds (Hsu & Sandford, 2007). The first round enabled the experts to acquaint themselves with the study's subject matter. In the second round, the introduction of desirability appears in the questionnaire. In the event of disagreement, the evaluation of the reasons occurs in the third phase, while experts clarify their opinions. In between stages, I analyzed the results with themes and codes (Round 1) and descriptive statistics (Round 2s) to develop the next round of questionnaires. The themes and codes adjusted as answers to questionnaires arrived, entering them into an Excel spreadsheet according to questions and participant code names. I used Microsoft Excel as my primary data analysis tool. I transferred the

results from SurveyMonkey into an Excel spreadsheet and imported the Excel file for analysis.

Round 1

The first round of open-ended questionnaire generated narrative responses about best strategies for using performance measures for implementing PPP concession period water infrastructure development and drive infrastructure financial value. I analyzed the descriptive responses from panelists using the open coding technique. The analysis focused on coded data interpretation to construct item strategies. Codes are applied to transcribe field notes into categories and subsequently create units of meaning (Kumar, 2014; Straits & Singleton, Jr, 2011). The coding process involved listing and deconstructing each statement issued by the panelists to form categories (Ravitch & Carl, 2016). Similar categories such as those of performance measures and performance monitoring measures were grouped together from the research perspective. Other categories were combined with other categories because of their too infrequent occurrences (Donohoe et al., 2012; Straits & Singleton, Jr, 2011). After categories were assigned on an Excel spreadsheet, I used color coding of categories, and analyzed the narrative data. The final outcome of Round 1 coding of categories and subsequent analysis helped to develop Round 2 questionnaire.

In Round 1, I also collected panelists' demographic data. I used descriptive statistics to analyze their nominal and ordinal demographic data to align their demographic information with the e-Delphi study criteria requirements (Chou, 2012; Hsu & Sandford, 2007). The analysis included establishing aggregate descriptions of gender,

qualification, years of experience, academic background, work-sector, work-title, age, and organization where individual participants work (Varela et al., 2016; Skulmoski et al., 2007).

Round 2

In the second round of Delphi, participants received the second questionnaire based on the results of the first round (Hsu & Sandford, 2007). The experts provided their perspectives regarding the best practice strategies for using performance measurement to optimize PPP concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination as the current study content as in Round 1. For the second round the analysis was based on the experts' responses to a 5-point Likert-type scale ratings of ordinal data to ascertain the median and top two responses for each item for desirability. The measure of consensus was critical to determine the level of consensus among PPP experts on best practice within the South Africa context for using performance measurement to optimize PPP concession period agreement for water infrastructure development and drive infrastructure asset financial value at postconcession termination. The extent of consensus was subsequently determined by experts for the current study in accordance with the 5-point Likert-type scale rating the median of participants' responses and the responses percentage corresponding to the level of rating where 4 and 5 were considered highest on the scale of desirability.

The items that reached expert-consensus demonstrated the answer for the level of consensus among PPP experts for best practices within the South African context for

using performance measurement to optimize PPP concession period agreements for water infrastructure development and drive infrastructure asset financial value at postconcession termination. The extent of consensus in the second round for each question was as if any of the following calculation occurred where (a) median agreement rated ≥ 4, and or (b) percentage agreement rated > 80% for the expert-consensus for desirability. Thus, the rating demonstrated to have scored above the threshold expected e-Delphi technique requirement of 70% for expert-consensus (Avella, 2016; Soong et al., 2016). The rationale to provide analysis for Round 2 was to also ensure experts' rights to reevaluate their ratings for items that were close to reaching consensus, but achieved low expert-consensus from one measure in the following Round 3 (Price et al., 2020).

Round 3

In the third round, consensus was reached following similar approach as in Round 2 where expert-consensus model for (a) median agreement ≥ 4, and for (b) percentage agreement > 85% for the highest responses of 4 and 5 ratings for both disability and feasibility. The third-round incorporated results from the second round (using a Likert-type scale, listing the best practices with the scale rating on 1 to 5 with 1=*Exceedingly Undesirable* to 5=*Exceedingly Desirable,* and 1=*Exceedingly Infeasible* to 5=*Exceedingly Feasible* on the consensus built based around themes. The third-round results included narrative responses, which I analyzed the data using thematic coding to reveal the differences in consensus among experts for desirability and feasibility ratings. The thematic coding was also critical for future literature review. Chapter 4 as well contains the results of the study.

Issues of Trustworthiness

Credibility

Qualitative data analysis's credibility is mainly dependent on systematic, in-depth fieldwork, conscientious analysis of data, credibility to an inquirer, and a user's philosophical convection in the qualitative investigation (Merriam & Tisdell, 2015). To achieve the truthful value of research, the researcher, according to Miles et al. (2014), ought to ensure that the research findings make sense and credible to both the participants and readers and demonstrate an authentic portrait of what the researcher investigated. Necessarily, to achieve the research findings' credibility, I maintained an authentic and scientific approach to data analysis to establish generalizations. Subsequently, every aspect of data analysis was covered, and every question responded accordingly to improve credibility in research findings (Babbie, 2017; Miles et al., 2014). In the e-Delphi method, credibility relates to the degree that achieving data credibility occurs through an ongoing iteration and feedback given to experts and member checks (Hasson & Keeney, 2011; Msibi et al., 2018). The use of an iterative process in an e-Delphi study involves a chance for initial feedback, collation of feedback, and distribution of feedback to participants for review (Msibi et al., 2018). During this reviewing process, the participants' responses allow the participants to review and comment on the collected data (Msibi et al., 2018).

Transferability

Transferability can be achieved by verifying e-Delphi findings (Msibi et al., 2018) and can be compared with external validity (Creswell, 2009; Kumar, 2014). As a

researcher, I provided prudential details to data descriptions and contexts to ensure that both the readers and the research audience can compare contexts based on the available information, which helped achieve transferability. I established transferability by providing an account of each sample, settings, and study process. Developing transferability processes also ensured the full description of the research audience's research findings to evaluate their settings' potential transferability. I appropriated pronounced strategies to establish transferable research findings, including confirming concerns and predicaments raised in the final research report (Miles et al., 2014).

Dependability

The e-Delphi dependability ensures consistency of research results across researchers and time, and to achieve this is primarily through triangulation, peer examination, audit trials, and stepwise replication (De Loë et al., 2016; Fusch & Ness, 2015). To achieve dependability, a researcher included a diverse range of industry experts (Hasson & Keeney, 2011; Msibi et al., 2018). Babbie (2017) proposed an inquiry audit to determine the consistency of patterns or themes observed and the processes by which patterns or themes ensure the exact achievement of dependability. I established dependability by ensuring that research questions were straightforward, and the design of the study was consistent with the research question (Miles et al., 2014). Equally, I demonstrated integrity in research works and ensured equal provisions of participants with data collection protocols across all settings, as well that findings provide exact parallelism across all sources of data (Miles et al., 2014). Dependability simply means that the collected data are consistent with the research design and answers the research

question (Babbie, 2017). I employed triangulation and sequencing methods based on well-expressed reasoning to ensure that data collected answered the research questions to establish dependability. Data triangulation is necessary to enhance research validity and ensure researchers search for different data sources based on data analysis events (Ravitch & Carl, 2016). Accordingly, Miles et al. (2014) asserted that research findings are more dependable if compared several independent sources to the findings, but equally that more than one data collection instrument needs to be applied to measure the same data and achieve consistencies.

Confirmability

The final criterion to ensure trustworthiness is confirmability, assessed by maintaining a detailed description of the e-Delphi collection and analysis processes (Msibi et al., 2018; Shariff, 2015). Confirmability is essential to convey and maintain neutrality related to the concept of objectivity and achieved by maintaining a detailed description of the Delphi data collection and analysis process (Hasson & Keeney, 2011). Confirmability is a standard achieved when the researchers acknowledge a sense of subjectivity in research as research instruments. Qualitative researchers also endeavour to be relatively neutral, confirmable, reasonably objective, and free from researchers' unacknowledged biases (Miles et al., 2014). Confirmability achievement requires the researcher to endeavour to ensure that the methods and procedures of data collection and analysis are explicitly detailed. It also requires a vivid sequence of data collection protocols, processes, and procedures to transform data to arrive at specific research (Tracy, 2019). I demonstrated that applied research methods and data collection

procedures could be represented and audited by independent sources, such as in the pilot study. The use of the confirmability strategies aims to explore ways and means to reduce biases to map into an interpretation of data collected. I used triangulation methods, reflexivity processes, and external audits to achieve confirmability (Miles et al., 2014).

Ethical Procedures

Ethical considerations in research conduct require researchers to pay particular attention to relational, procedures, and transactional to ensure that researchers approach empirical studies that include human subjects with clear understanding, considerations, and humility in order for the research works to be ethical (Tracy, 2019). Universities, including Walden University, appointed institutional review boards (IRB). The IRB's chief responsibility is to review research proposals and oversee research projects to ensure beneficence is realized in all research aspects. Beneficence simply means the researcher needs to be mindful not to cause harm and damage to research participants and to commit to the welfare of participants involved in research projects (Babbie, 2017; Creswell, 2009). Additionally, the IRB is responsible for ensuring that research projects do not harm participants. They are also critical to point at critical matters of a research proposal and ongoing research that further establish creative insight into safeguarding against harmful factors to research participants and the researcher. Below are critical elements which the researcher needs to implement according to IRB to ensure researchers always have the welfare of participants, and should not inflict harm to research participants, but equally promote the level of accountability and researcher attentiveness to details to mitigate harm to research participants (Gravetter & Forzano, 2016).

Permissions

Soliciting permission from research participants is one of the central tenets of ethical research to the extent that research participation, according to Babbie (2017), must be voluntary and uncoercive. To ensure research works uphold research ethics, I ensured to abide by ethical considerations and procedures to recruit and sought voluntary participation of research participants, who knowingly and intelligently consented to participate in research without coercion (Babbie, 2017; Kumar, 2014).

Participant Recruitment

Research participants' recruitment should involve careful consideration of all possibilities and adherence to standard requirements stipulated in the e-Delphi method of research participant recruitment (Cone & Unni, 2020; Hsu & Sandford, 2007). I employed perspective-based triangulation to ensure the selection of research participants is systematically and intentionally inclusive of all participants' perspectives. The processes aim to ensure that the recruitment process is transparent and follows the Delphi method and procedures (Hsu & Sandford, 2007). During participants' recruitment, I considered the ethics of data collection and analysis, ethics of participants' treatment, and the ethics of responsibility to society (Straits & Singleton, Jr., 2011). The significance of taking ethical considerations to recruitment was to reduce dubious recruitment processes. I provided a complete account of the research and the rationale for using selected participants in the research project, which is essential for credibility (Babbie, 2017).

Informed Consent

Informed consent in qualitative research ensures the protection of research participants from harm or abuse during the research project. To achieve informed consent, I aligned with Thakur and Lahiry's (2019) informed consent, whereby such consent must include voluntariness, participants' competencies, and adequate information valid to elicit data from research participants. Informed consent entails circumstances at which research participants accept an invitation to participate in the research project voluntarily and be informed about the research before it commences. Informed consent must align to transparency and honesty, and researchers need to pay meaningful attention to dialogue with research participants about the research and the participants' involvement in the research works (Babbie, 2017). The objectives of informed consenting include a need to establish research participants compliance, exposure of participants to detailed information about study procedures, the intention of the study, and research purpose, including risks, if any, and benefits of the research project (Abrar & Sidik, 2019; Thakur & Lahiry, 2019). I am certified to adhere to Ravitch and Carl's (2016) guidelines regarding informed consent and establish consenting conditions to ensure ethical research.

The informed consent forms need to contain explicit language that participation is voluntary and that participants have the right to withdraw from the research at any time of the research project. Christensen et al. (2015) stated that the researcher needed to present research expectations, research time commitment, and any risks to participants' well-being through their involvement in the research project, as well as elaborate on if the treatment of data and reports will be anonymous or confidential. As a result, and if the

above requirements are correct, research participants sign informed consent and /or statements consenting to participate in the research voluntarily and without coercion (Babbie, 2017).

Anonymity, Privacy, and Confidentiality

One central doctrine that grounds the Delphi method is anonymity and confidentiality (Hsu & Sandford, 2007), which entails that the participants in a study sample undertake research and respond to online survey questionnaires anonymously (Rowe & Wright, 2001). True anonymity is not possible in a Delphi study given the iterative nature of multiple surveys; the only anonymity is among the panelists. The fundamental reason is that the e-Delphi method aggregates data and reports of the research instead of individualizing or presenting anonymous data to the research audience or readers (Cone & Unni, 2020). I used the SurveyMonkey technique for online-survey because the tool's application essentially helps produce anonymity of the panelists to one another.

According to Kumar (2014), but notably Varela et al. (2016), the SurveyMonkey technique removes information identity from all study material, including removing transcripts and coding sheets to eliminate associating responses to participants. I achieved participants' anonymity to one another and maintained confidentiality of the participants. The fact is using SurveyMonkey online-survey questionnaire essentially provides an excellent basis to guard and protect the research participants' well-being and interest, including their identity, and safeguard the anonymity of the panelists from authorities

who might want to know the names of research participants (Babbie, 2017; Gill et al., 2013; Varela et al., 2016).

Summary

In Chapter 3, I endeavoured to describe and provide appropriate justification of the research design, research method, and methodology for the e-Delphi research about the level of consensus among PPP experts on best practice within the South African context for using performance measurement to optimize PPP concession period agreements for water infrastructure and drive infrastructure asset financial value at postconcession termination. The chapter comprised as well of the description and rationalization of recruitment and sampling approach applied, data collection and analysis procedures, instrumentation, data analysis plan, trustworthiness and ethical procedures. Chapter 4 include member panel attributes and the results of the study.

Chapter 4: Results

The purpose of this qualitative, e-Delphi study was to determine the level of consensus among PPP experts on best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. For this study, the e-Delphi design was suitable as I intended to benefit through consensus significantly beneficial for private and public sector aimed at ensuring that a PPP concession period model is optimized to drive infrastructure asset financial value at postconcession termination (Dordevic & Rakic, 2020; Mukuvari & Kathleli, 2019). PPP concession period model practitioners and scholars, if they were to implement performance measurement strategies that met consensus, could essentially help optimize concession period agreements and drive infrastructure financial value at postconcession termination. The expert-consensus accomplished in this research may contribute towards the body of knowledge consequently decrease the literature gap of desirable and feasible approaches for executing lopsided concession period contracts (Feng et al., 2019).

The main research question and subquestions that guided this e-Delphi study were: What is the level of consensus among PPP experts on best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession period?

S1: What are desirable and feasible strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development?

S2: What are desirable and feasible strategies during the negotiation period between public and private partners, so both parties come to a consensus on a project completion schedule?

S3. What are desirable and feasible strategies for the South African government to apply rigorous performance monitoring measures to optimize concession period agreements, and drive infrastructure financial value at postconcession termination?

This chapter presents the research findings but also includes the research setting, participant demographics, data collection procedures, evidence of trustworthiness, and the results of the data analysis. The findings presented in this chapter result from the three rounds of data collection and analysis. In Round 1, experts were presented with five open-ended questions on an online SurveyMonkey platform. From the analysis of narrative responses in Round 1, aggregated data produced a list of varied approaches to execute best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. In Round 2 experts rated items constructed as a result of the outcome of Round 1 on a 5-point Likert-type scale for desirability. In Round 3, experts rated items that advanced from Round 2 on two 5-point Likert-type scales for both desirability and feasibility. The

analysis of data in both Round 2 and 3 encompassed the application of descriptive statistics of ratings to identify consensus. Chapter 4 concludes with a summary of responses in accordance with each research question and sub-question.

Research Setting

The online survey technique on the SurveyMonkey platform was used to collect data for the study (Murphy et al., 2020). The interview questions for the first-round questionnaire were grounded in the study's conceptual framework, Hadi and Erzaij's (2019) determination and analysis of the concession period conceptual model that addresses the benefits of the concession period when there is equity in risk-sharing among parties and balanced distribution of benefits. As this was an e-Delphi study, it was impossible to observe the participants' physical or organizational conditions during data collection (Cole et al., 2013). I did not collect any demographic data other than the assertion of eligibility with the inclusion criteria as provided by each participant. The instruments did not contain questions asking the participants to disclose any information on the organizational conditions that may have affected them during the data collection phase. Thus, I do not have any information on the personal or organizational conditions that may have affected the participants and possibly influence the study results' interpretation.

Demographics

In an e-Delphi study, a researcher delineates the scope of expert criteria before the study's initiation but more significantly ensures the panel composition can influence relevant results (Toronto, 2017). Each participant in the study met the following criteria:

(a) possessed a minimum of at least 5 years of experience in PPP negotiating a concession period for water infrastructure development; (b) held a Masters' Degree in Finance, Engineering, and or Project Management; (c) were currently employed in the Development Bank of Southern Africa (DBSA); (d) employed for over 5 years at the National Treasury in the PPP unit; and (e) were 18 years of age or older. I applied LinkedIn to validate the participants' profile to ensure that they met the eligibility criteria before recruiting participants for the research. Twenty panelists completed the first round of the current study. Participants' demographic data were limited to need-to-know information and based on selection criteria only. The first inclusion criterion that each expert needed to possess a minimum of at least 5 years of experience in PPP negotiating a concession period for water infrastructure development were determined by current employment position and held job tittle. Table 2 and Table 3 below present the Round 1 participants' demographic characteristics regarding their employment experience and positions at work.

Table 1

Categories of Job Titles of Panelists (N=20)

Employment title	*n*	%
Executive director	4	20.0
Project engineer	5	25.0
Financial engineer	4	20.0
PPP practitioner	7	35.0

Table 2

Years of Experience of Experts (N=20)

Years	*n*	%
5-9	6	30.0
10-14	9	45.0
15-19	5	25.0

Table 3 below comprised of data regarding the third and fourth criteria for experience participants employed and focusing in executing PPP concession period contracts. Accordingly, all experts in Round 1 met the inclusion criteria as shown in Table 4 and 5 below.

Table 3

Experts' Experience in PPP Concession Period Contracts Execution (N=20)

Years	*N*	%
5-9	7	35.0
0-14	8	40.0
15-19	5	25.0

Table 4

Experts' Level of Education/Qualification (N=20)

Degree	*N*	%
Master's	14	70.0
Ph.D. (e.g., engineering, finance, project management	6	30.0

Table 5 illustrates experts' certification and or registration with their respective councils, while Table 6 show various industries of experts' employment and involvement.

Table 5

Experts' Council Registrations (N=20)

Registration	*N*	%
ECSA	4	20.0
SABTACO	3	15.0
SACPMP	6	30.0
SACQSP	2	10.0
Unregistered	5	25.0

Table 6

Experts' Industries (N=20)

Industry sector	*N*	%
National Treasury	7	35.0
DBSA	8	40.0
Built environment	5	25.0

The demographic characteristics of the expert panel in Round 1 were included in the tables above to illustrate the collective intelligent and diverse experience, knowledge, as well as provide a background to validate experts' value in the study. The South African experts selected covered a wide rage sector, and demonstrated broad knowledge and experience in PPP concession period execution. I also included Table 7 showing the gender identity of experts, and Table 8 showing their age group.

Table 7

Experts' Gender (N = 20)

Gender	*N*	%
Female	8	40.0
Male	12	60.0

Table 8

Experts' Age Group (N=20)

Age	*N*	%
30-39	6	30.0
40-49	4	20.0
50-59	7	35.0
60-65	3	15.0

Data Collection Overview

Recruitment Process

Data collection was conducted across South Africa. Confidentiality and anonymity among the panelists were maintained throughout data collection using a unique identified link only known to me. Following Babbie's (2017) anonymity approach to data collection, I applied Varela et al.'s (2016) high degree of anonymity and confidentiality to ensure that data collection and analysis were aggregated and not attributed to individual participants. I protected participants' information during data collection and ensured that none of the participants shared other participants' identity or

information. To maintain research integrity and ethical standards based on IRB prescriptions, I only shared participants' information with the dissertation committee.

Participant Overview

Expert participants were selected through applied purposive sampling and snowballing. Ravitch and Carl (2016) and Cone and Unni (2020) expressed that purposive sampling allows researcher perspective-based triangulation that ensures participants selection is systematically and intentionally inclusive of all participants' perspectives. The purposive sampling and snowballing approaches helped identify experts to answer the research question (Cone & Unni, 2020; Ravitch & Carl, 2016).

In Round 1, 20 invitations were sent to experts who volunteered to participate in the study. Any consenting participant confirmed his/her participatory status by selecting the “I Consent” response. Following a signed informed consent, participants were given a link to SurveyMonkey to complete Round 1. The 20 experts also accepted to respond to the questionnaire that comprised of five open-ended questions. The participants generated 144 statements, 23 strategies and five categories. Table 9 illustrates the survey completion rate for each round of the study.

Table 9

Survey Responses by Round

Round	*n* distributed questionnaires	*n* respondents	Response rate (%)
1	20	20	100.0
2	20	16	80.0
3	20	17	85.0

McPherson et al. (2018) noted, but notably, Linstone and Turoff (2011), that the attrition rate in a Delphi research presents a challenge, as experts drop out during the iterative data collection and analysis process, either due to engagement or other responsibilities. The level of drop-out in this study was low. In Round 1, the drop-out rate was 0%, Round 2 drop-out rate was 20%, and in the final round was only 15%.

Data Collection

The SurveyMonkey link remained open for a month, from January 19, 2021, until February 14, 2021, which is 26 days of data collection instead of the initial 21 days (3 weeks). The data collection and analysis in the second and third-round set of questionnaires started on March 10, 2021, and completed on March 26, 2021. In Round 1, the attrition rate was 0%, and Round 2 and Round 3 attrition rate fluctuated between 20%-15% respectively.

I analyzed the Round 1 data to inform constructing the Round 2 survey questionnaire. The results from Round 1 reflected data saturation and presented sufficient information to proceed to the next round. Round 2 started immediately after IRB approval of the questionnaire on March 10, 2021. The collection of Round 2 data followed on March 10, 2021, and data analysis was completed on March 14, 2021. The data analysis from Round 2 helped to identify items that satisfied the threshold to construct the Round 3 questionnaire. On March 18, 2021 the IRB approved the Round 3 instrument. Subsequently, on March 18, 2021 Round 3 data collection started and was completed on March 21, 2021, while data analysis was completed and closed on March

26, 2021. In the overall, all the three rounds of data collection satisfied the standards acceptable for e-Delphi studies (Datta et al., 2021; Hsu & Sandford, 2007).

Round 1

Twenty participants accessed a link to SurveyMonkey in accordance with IRB applicable standards. The expert panelists completed a set of five open-ended questions (Cole et al., 2013). Their responses generated narrative data, the analysis of which led to the creation of the Round 2 questionnaire. I also collected demographic data from the panelists.

Round 2

All 20 participants from Round 1 were invited to participate in Round 2 and 16 submitted completed surveys. The panel of experts rated 23 strategies in five categories against a 5-point Likert-type scale for *desirability*. The threshold of 70% of the highest two ratings of 4 and 5 with a median of 4 and or greater resulted in 16 of the 23 items meeting consensus for desirability. These 16 items advanced to the Round 3 survey.

Round 3

All Round 1 panelists were invited to participate in Round 3 and 17 participants submitted completed surveys. In Round 3, the panelists were asked to rate 16 items in five categories for both desirability and feasibility against two 5-point Likert-type scales, one for desirability and one for feasibility. Participants were allowed to provide additional comments if desired. The threshold for both desirability and feasibility were 85% for the highest two ratings of 4 and 5 with a median of 4 and or greater, which resulted in five items in two categories meeting the final consensus. From the two

categories, only strategies of performance measurements (i.e., efficiency, reliability, value for money, social value, as well as control and monitoring) were highly rated, and satisfied the utmost *desirable* and *feasible* strategies within the South African context essential to optimize PPP concession period agreements and drive infrastructure financial value at postconcession termination.

Data Analysis

Ravitch and Carl (2016), but notably Miles et al. (2014) was critical to inform the coding methods undertaken for this e-Delphi study. I used *in vivo coding* as the source to categorize participants' response from the best practice and practical strategies for the South African government to apply rigorous performance monitoring measures and the best practice and practical strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development.

In Round 1, the panel of experts' responses were separated into an Excel spreadsheet column according to the following classifications: (a) participants with IDs from 1-20, (b) questions, (c) panel responses, (d) codes, and (e) themes. The iteration approach among other strategies helped eliminate redundancies based on the literature reviewed concepts. The elimination strategy was essential to focus data analysis and categorization of themes according to experts' input (Velez et al., 2020). I used in vivo coding to identify patterns and themes in the narrative responses and obtain data saturation. After categories were assigned on an Excel spreadsheet, I used color coding of

categories and analyzed the Round 1 narrative data. The final outcome of Round 1 coding of categories and subsequent analysis helped to develop the Round 2 questionnaire.

In Round 1, experts made comments regarding budget and technical skills requirements for success of water infrastructure projects in South Africa. Aggregated data showed that budgets and technical skills requirements could affect the success of water infrastructure projects in South Africa. The responses also included comments about why the South African government applied the PPP concession period and used it as an alternative funding instrument for water infrastructure development. Participants indicated that the lack of expertise to plan, develop, and execute large-scale infrastructure projects, budget constraints, and the incapacity to operate and maintain large water infrastructure assets were the main reason that compel the South African government to apply a PPP concession period model as alternative funding instruments to develop water infrastructure across localized communities.

Panelists also indicated best practices and practical strategies to drive the rigorous and consistent application of performance measurement to create access to capital investments in water infrastructure development. Experts indicated that incorporating performance measurement on PPP concession period contracts was crucial to create access to capital investments for water infrastructure development in South Africa. Responses also focused on the best practices strategies applicable during negotiation between public and private sector partners to reach a consensus on the project completion schedule. The comments revealed that both public and private sector partners needed to create a win-win concession principle that clearly articulate rights and obligations in the

PPP concession period agreement. Other responses focused on the best practice and practical strategies applicable for the South Africa government is to use rigorous performance monitoring measures to optimize concession agreements and drive infrastructure financial value at postconcession termination. The experts indicated that there was a need for South Africa to incorporate and consistently apply performance measurements of reliability, efficiency, social value, and value for money to optimize concession period agreement and drive water infrastructure financial value at postconcession termination.

In Round 2, the panel of experts rated 23 items in five categories using a 5-point Likert-type scale for desirability. I used a median of 4 or greater with a minimum threshold of 70% for the highest ratings (4 and 5) of desirability. Sixteen items satisfied the expert-consensus and succeeded to Round 3.

In Round 3, panelists rated the 16 items in five categories that advanced from Round 2 using two Likert-type scales, one for desirability and one for feasibility. The median rating for consensus was 4 or greater with a minimum threshold of 90% for the highest ratings (4 and 5) for both desirability and feasibility. The 85% threshold, which was set initially, was increased to 90% to create a better measure of expert convergency. Using the higher rate of 90% resulted in five items satisfying expert-consensus in five categories.

Evidence of Trustworthiness

Credibility

In qualitative research, credibility is mainly dependent on systematic, in-depth fieldwork, conscientious analysis of data, credibility to an inquirer, and a user's philosophical convection in the qualitative investigation (Merriam & Tisdell, 2015). Necessarily, to achieve credibility, I maintained an authentic and scientific approach to data analysis to establish generalizations (Miles et al., 2014). Subsequently, every aspect of data analysis was covered, and all responses analyzed to improve credibility (Babbie, 2017; Miles et al., 2014). In the e-Delphi method, credibility occurs through an ongoing iteration and feedback given to experts and member checks (Hasson & Keeney, 2011; Msibi et al., 2018). The use of an iterative process in an e-Delphi study involves a chance for initial feedback, a coalition of feedback, and distribution of feedback to participants for review (Msibi et al., 2018). During this reviewing process, the participants' responses allowed me to review and comment on the collected data (Msibi et al., 2018). The IRB approval process of research questions and instrumentation congruent with the study's purpose and aligned to the e-Delphi research design added to achieving credibility of the study. A comprehensive member checking, and application of descriptive statistics to measure the level of consensus or divergence between experts helped achieve the study's credibility (Hirschhorn, 2018). The findings revealed meaningful parallelism across data collected and analyzed, and the data presented were well linked to the categories of an emerging construct (Miles et al., 2014). The research findings were clear, systematically

related, coherent, and any area of uncertainty was identified, and participants considered the conclusions to be initially accurate.

Transferability

Transferability can be achieved by verifying e-Delphi findings (Msibi et al., 2018) and can be compared with external validity (Creswell, 2009; Kumar, 2014). I provided prudential details to data descriptions and contexts to ensure that both the readers and the research audience can compare contexts based on the available information, which helps achieve transferability. To achieve transferability, I provided an account of each sample, settings, and study process (Ravitch & Carl., 2016). I applied processes that ensured the full description of the findings, which helps to evaluate their settings' potential transferability. I appropriated pronounced strategies to establish transferable findings, including confirming concerns and predicaments raised in the final report (Miles et al., 2014). Additionally, the report specified sample selection limitations and critically examined the sample's ability to generalize to other study contexts (Miles et al., 2014). The diversity of the sample assisted in supporting the broader applicability of the findings. The findings demonstrated sufficient descriptions for audiences to assess the prospective transferability and that the processes described could be applicable in comparable settings (Babbie, 2017; Miles et al., 2014).

Dependability

The e-Delphi dependability ensures consistency of research results across researchers and time, and was achieved primarily through peer examination, audit trials, and stepwise replication (De Loë et al., 2016; Fusch & Ness, 2015). Additionally, I

included a diverse range of industry experts to help achieve dependability of the study (Hasson & Keeney, 2011; Msibi et al., 2018). I also aligned to Babbie's (2017) audit inquiry as a strategy to determine the consistency of patterns or themes observed and the processes by which patterns or themes ensured the exact achievement of dependability. Furthermore, I was able to establish dependability by ensuring that research questions were straightforward and the design of the study was consistent with the research question (Miles et al., 2014). Equally, I demonstrated integrity by ensuring equal provisions of participants with data collection protocols across all settings and ensured that findings provided exact parallelism across all data sources (Miles et al., 2014). Dependability means that the collected data were consistent with the research design and answered the research question (Babbie, 2017). I employed sequencing methods based on well-expressed reasoning to ensure that data collected answered the research questions. Miles et al. (2014) asserted that research findings were more dependable if compared with several independent sources to the findings, but equally that more than one data collection instrument needs to be applied to measure the same data and achieve consistencies. Data quality checks were made to mitigate bias and deceit, and basic standards and analytic constructs were specified and applied in accordance with Babbie's (2017) audit inquiry approach to ensure data were connected to the research findings.

Confirmability

The final criterion to ensure trustworthiness is confirmability, assessed by maintaining a detailed description of the e-Delphi collection and analysis processes (Msibi et al., 2018; Shariff, 2015). Confirmability was essential to convey and maintain

neutrality related to the concept of objectivity and was achieved by maintaining a detailed description of the Delphi data collection and analysis process (Hasson & Keeney, 2011). Confirmability is a standard achieved when the researchers acknowledge a sense of subjectivity in the study as research instruments. Qualitative researchers also endeavour to be relatively neutral, confirmable, reasonably objective, and free from researchers' unacknowledged biases (Miles et al., 2014). Confirmability achievement requires the researcher to endeavour to ensure that the methods and procedures of data collection and analysis are explicitly detailed. It also requires a vivid sequence of data collection protocols, processes, and procedures to transform data to arrive at specific research (Tracy, 2019). I demonstrated that applied research methods and data collection procedures could be represented and audited by independent sources. The use of the confirmability strategies was aimed to explore ways and means to reduce bias to map into an interpretation of data collected. I used applicable research methods and data collection and analysis procedures with precise sequencing, showing how data were collected, processed, analyzed, and results reached (Kumar, 2014). Furthermore, I used reflexivity processes and external audits to achieve confirmability (Miles et al., 2014). The study results are available for reanalysis and the research findings are explicitly linked to exhibits of condensed data (Babbie, 2017; Miles et al., 2014).

Study Results

The purpose of this e-Delphi study was to examine the level of consensus among PPP experts on best practice within the South African context for using performance measurements to optimize PPP concession period agreements for water infrastructure

development and drive infrastructure financial value at postconcession termination. A panel of experts in Round 1 answered open-ended questions and suggested strategies that informed the development of the Round 2 questionnaire. Panelists rated these items for desirability. Items that met the threshold for consensus in Round 2 advanced to Round 3 and panelists rated them for desirability and feasibility.

Round 1

The narrative responses in Round 1 to five open-ended questions generated 144 statements, 23 strategies, and subsequent five categories. The 144 statements were analytical iterated, audited, and replicated to generate the Round 2 questionnaire (Hirschhorn, 2018).

Round 2

The strategic items in the Round 2 questionnaire were grouped in the following categories: technical skills requirements, budget constraints, performance measurement frameworks, negotiation best practice strategies (win-win approach), and performance measurement monitoring. The threshold for Round 2 was the top two percentage (ratings of 4 or 5) of 70% and the median rating of 4 and or greater. The threshold resulted in 16 strategies meeting consensus, and the results as illustrated in Table 10 below were the baseline for constructing the Round 3 questionnaire. Tables 10 and 11 below comprised of list of categories (*budget requirements, alternative funding model, performance measurements, best negotiation practice, and performance monitoring measures*) and items that satisfied the initial 70% threshold for Round 2. Table 10 below illustrates a summary of the ratings of the 23 items in the Round 2 questionnaire.

The consensus levels differed from category to strategies. In Round 2, experts rated certain items very high and low for desirability. Strategic items for technical capacity and skills were regarded as the major limitation that affect success of water infrastructure projects in South Africa, and budget constraints as such compel the South African government to apply a PPP concession period model as an alternative funding instrument to develop water infrastructure across localized communities.

Table 10

Round 2 Experts' Consensus Strategic Items – Desirability

Categories	Item no.	Top two (%)	Median
1.Budget Requirements:			
Plan Budget	5	91.0	4.5
Plan Projects	7	85.0	4.0
Develop Funding Model	8	78.0	4.0
2.Negotiation Best Practice:			
Win-Win approach	12	92.0	4.5
Risks and Revenue Share	14	85.0	4.0
Rights and Obligations	15	78.0	4.0
3.Performance Measurements:			
Efficiency	17	100.0	5.0
Reliability	18	100.0	5.0
Social Value	21	100.0	5.0
Value for Money	24	100.0	5.0
4.Alternative Funding Model:			
Public-Private-Partnership (PPP)	25	80.0	4.0
Built-Operate-Transfer (BOT)	27	95.0	4.5
Design-Built-Operate-Transfer (DBOT)	31	88.0	4.0
5.Performance Monitoring Measures:			
Control and Monitoring	33	100.0	5.0
Budget Control	37	100.0	5.0
Quality Control	38	100.0	5.0

The median rating for the strategies above in Table 10 were between 4 and or greater in Round 2. The experts rated very high at 100% desirability for the incorporation of performance measurements frameworks as best practice and practical strategies

essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development. Equally, the strength of experts-consensus was very high at 80% for the win-win approach as the best practice strategies during the negotiation period between public and private partners. But the strategy win-win concession approach achieved unsatisfactory results in accordance with the second 90% threshold initiated for Round 3. Also, there was great expert-consensus for the application of the performance monitoring measures as the best practice and practical strategies for the South Africa government to apply rigorous performance measures to optimize concession period agreements, and drive infrastructure financial value at postconcession termination. The performance monitoring measures strategy for control and monitoring satisfied both the initial threshold of 70% and the second threshold of 90% for desirability for the incorporation of the strategy in PPP concession period model application.

Nevertheless, the strength of expert-consensus on risk and revenue equity strategy was very low and achieved <4.0 median rating and would not be regarded as best practice strategy to achieve win-win goal during negotiation period between public and private partners. Again, there was lower expert-consensus <4.0 for the revenue collection constraints as the problem that compel South African government to apply a PPP concession period model as an alternative funding instrument to develop water infrastructure across localized communities, and project planning as challenges that affect the success of water infrastructure projects in South Africa. Furthermore, there was low expert-consensus <4.0 for project evaluation and monitoring as the best practice and

practical strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development. The main five areas of performance measurements: control and monitoring, efficiency, reliability, social value, value for money were regarded by experts as highly desirable and achieved the most high rating equaling 5.0 and exceeded the second 90% threshold to achieve 100% desirability to be incorporated as the best practice strategies within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure assets' financial value at postconcession termination. Tables 11, 12, 13, 14, and 15 below illustrate expert-consensus in Round 2 on the desirability of strategies by category.

Table 11

Round 2: Budget Requirement Strategies for Success of Infrastructure Projects in South Africa

Item no.	Strategy
5	Develop and implement revenue collection management systems, and implement financial control measures.
7	Develop management capacity to generate bankable business plan for projects, operate and maintain projects to sustain infrastructure economic life.
8	Develop and implement accounting systems for infrastructure budget.

Table 12

Round 2: Negotiation Best Practice Strategies for Achieving Consensus Between Public and Private Sector Partners for Infrastructure Projects Completion

Item no.	Strategy
12	Develop a win-win principle between parties to PPP concession period agreements.
14	Balance risks and revenues allocation between parties to a concession period agreement.
15	Clearly define rights and obligation between parties to the concession period agreement.

Table 13

Round 2: Performance Measurement Incorporation to Create Capital Investment Access for Water Infrastructure Development

Item no.	Strategy
17	Incorporate performance measurement efficiency.
18	Incorporate performance measurement reliability.
21	Incorporate performance measurement social value.
24	Incorporate performance measurement value for money.

Table 14

Round 2: Apply PPP Concession as Alternative Funding Model for Infrastructure Development

Item no.	Strategy
25	Develop expertise to plan and execute for financial engineering process to develop infrastructure projects.
27	Develop expertise to execute large-scale infrastructure projects.
31	Develop budget capacity implementation, as well operate and maintain capacity to sustain infrastructure efficiency.

Table 15

Round 2: Implement Performance Monitoring Measures to Optimize Concession Period Agreements and Drive Infrastructure Financial Value at Postconcession Termination

Item no.	Strategy
33	Implement performance monitoring measures of control and monitoring.
37	Implement performance monitoring measures of efficiency and reliability.
38	Develop and implement performance monitoring measures of value for money and social value.

Round 3

In Round 3, experts rated 16 items in five categories for both desirability and feasibility. Thepanelists eliminated further multiple items that were not both desirable and feasible. Through their ratings, the panelists indicated the items that they agreed were most desirable and feasible. These items reflect strategies to help the South African government to consider critical when implementing concession period using performance

measures of reliability, efficiency, social value, value for money, and control and monitoring measures as best practice within the South African context to optimize concession agreements for water infrastructure development and drive water infrastructure financial value postconcession termination. The threshold to achieve expert-consensus in Round 3 was top two percentage of ratings of 4 and 5 at 90% and a median rating of 4 or higher for both desirability and feasibility. The consensus threshold in Round 3 resulted in five strategies in two categories achieving expert-consensus. In Round 3, the experts provided descriptive comments about their ratings. Table 16 below illustrates the top two percentages and medians of items in accordance with expert ratings in Round 3 using a top two percentage threshold of 90% and a median of 4 or higher.

Table 16

Round 3: Strategic Items that Achieved Experts-Consensus for Desirability and Feasibility

	Desirability			Feasibility	
Categories	Item no.	Top two (%)	Median	Top two (%)	Median
1.Budget Requirements:					
Plan Budget	5	88.0	<4.0	78.0	<4.0
Plan Projects	7	85.0	<4.0	80.0	<4.0
Develop Funding Model	8	78.0	<4.0	70.0	<4.0
2.Negotiation Best Practice:					
Win-Win approach	12	83.0	<4.0	80.0	<4.0
Risks and Revenue Share	14	80.0	<4.0	75.0	<4.0
Rights and Obligations	15	75.0	<4.0	70.0	<4.0
3.Performance Measures:					
Efficiency	17	100.0	5.0	100.0	5.0
Reliability	18	100.0	5.0	100.0	5.0
Social Value	21	100.0	5.0	100.0	5.0
Value for Money	24	100.0	5.0	100.0	5.0
4.Alternative Funding Model:					
Public-Private-Partnership (PPP)	25	79.0	<4.0	80.0	<4.0
Built-Operate-Transfer (BOT)	27	70.0	<4.0	85.0	<4.0
Design-Built-Operate-Transfer (DBOT)	31	75.0	<4.0	70.0	<4.0
5.Performance Monitoring Measures:	33	100.0	5.0	100.0	5.0
Control and Monitoring	37	85.0	<4.0	79.0	<4.0
Budget Control	38	80.0	<4.0	75.0	<4.0
Quality Control					

The consensus results in Round 3 category 1, 2, and 4 demonstrated that experts reviewed their decision regarding alternative funding model, budget, negotiation best practice, and technical capacity as critical factors to optimize PPP concession period agreements for water infrastructure development and drive infrastructure asset financial

value at postconcession termination. The low consensus score could also indicate lack of appreciation of the complexities associated with PPP concession period design and structuring to implement concession period agreements. In Round 3, the rating results of the panelists on performance measures strategies on consensus were 100% on top two ratings on all the four critical factors of performance measurements, that of efficiency, reliability, social value, and value for money. On performance monitoring measures of control and monitoring the consensus was also 100 % on the top two ratings. The results showed the level of consensus among panelists. This overall outcome was sufficient support for desirability and feasibility of performance measures incorporation on concession period model to optimize infrastructure development and drive infrastructure financial value at postconcession termination.

The strategies for each category that achieved expert-consensus in Round 3 met the 90% threshold and the median of 4 or above. The overall top two ratings in Round 3 varied from 70 to 100% agreement for both desirability and feasibility. The highest 100% ratings for Round 3 on both the anchor of desirability and feasibility were found for the four strategies of performance measurements (*efficiency, reliability, social value, and value for money)* and one performance monitoring measures strategy (*control and monitoring*) as shown below. The other strategies with lower consensus ratings of < 90% were rejected. Table 17 and Table 18 below illustrate categories and strategies that met the criteria for final expert-consensus.

Table 17

Round 3: Performance Measurement Incorporation to Create Capital Investment Access for Water Infrastructure Development

Item no.	Strategy
17	Incorporate performance measurement efficiency.
18	Incorporate performance measurement reliability.
21	Incorporate performance measurement social value.
24	Incorporate performance measurement value for money.

Table 18

Round 3: Implement Performance Monitoring Measures to Optimize Concession Period Agreements and Drive Infrastructure Financial Value at Postconcession Termination

Item no.	Strategy
33	Implement performance monitoring measures of control and monitoring.

Answering the Research Question

The major focus of this section was detailing the conclusions in relation to the main research question and subquestions. The main research question of the study pertained to the level of consensus among PPP experts on best practice within the South African context for using performance measurement to optimize concession period for water infrastructure development and drive infrastructure asset financial value at postconcession termination. Three research subquestions guided the current study. These subquestions pertained to desirable and feasible strategies (a) for driving rigorous and

consistent performance measures on PPPs to create access to capital investments in water infrastructure development; (b) during the negotiation period between public and private partners, so both parties come to a consensus on a project completion schedule; and (c) for the South African government to apply rigorous performance monitoring measures to optimize concession period agreements, and drive infrastructure financial value at postconcession termination.

The Round 2 results revealed 16 desirable strategies in five categories. The Round 3 results revealed five desirable and feasible strategies in two categories of performance measurement incorporation and implementation of performance monitoring measures to optimize concession period agreements and drive infrastructure financial value at postconcession termination. Accordingly, the performance measurement strategies for: (a) incorporation of performance measurement of efficiency; (b) incorporation of performance measurement of reliability; (c) incorporation performance measurement of social value, and (d) value for money on concession period model are critical to achieve optimal application of PPP concession period agreements, drive infrastructure asset value for money, and balance profits generation and social value for both public and private sector partners. The strategy for performance monitoring measures for: (a) implement performance monitoring measures of control and monitoring, (b) implement performance monitoring measures of efficiency and reliability, and (c) develop and implement performance monitoring measures of value for money and social value. Experts viewed the strategies of performance monitoring measures and that of performance measurement incorporation as equally critical to optimize concession period agreements for water

infrastructure development and drive infrastructure asset financial value at postconcession termination.

Summary

The purpose of this e-Delphi research was to identify consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure assets' financial value at postconcession termination. After three iterative rounds of data collection and analysis, consensus among the panelists revealed five desirable and feasible strategies in two categories. These categories are: (a) performance measurements of efficiency, reliability, social value, and value for money to create access to capital investments in water infrastructure development and (b) performance monitoring measure of control and monitoring, implementation of efficiency and reliability measures, implementation of social value and value for money measures to optimize concession period agreements and drive infrastructure asset financial value at postconcession termination.

In Chapter 4, the focus was on the results of the study. Through the application of the e-Delphi three-round approach, the findings reflect consensus among PPP experts on best practice strategy within the South African context for using performance measurement to optimize concession period agreements for water infrastructure development and drive infrastructure asset financial value at postconcession termination. Chapter 5 consists of the interpretation of the study conclusions, discussions, and recommendations.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative, e-Delphi study was to determine the level of consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements for water infrastructure development and drive infrastructure financial value at postconcession termination. The concession period is a crucial decision to arrange a successful partnership contract because its value decides when the ownership of the infrastructure asset should be transferred from the private sector to the public one, thereby demarcating the influence, and responsibility, between the private party and the government (Hadi & Erzaij, 2019; Pagoni & Georgiadis, 2020).

Without using rigorous performance measures to optimize concession period agreements, the South African government risks the potential to sustain water supply due to inefficient water infrastructure performance postconcession termination (Dithebe et al., 2019a; Mabuza, 2019). Accordingly, to address this literature gap, an e-Delphi study design (Cole et al., 2013) to answer the research question was essential to meet the study's purpose through a panel of experts. I selected a panel of PPP experts across South Africa. I recruited 20 study participants through purposive sampling to form a panel with experience in the underlining study constructs (Strasser, 2017). I evaluated data's trustworthiness resulting from this e-Delphi study using credibility, transferability, dependability, and confirmability criteria (Staykova, 2019).

The results of the study demonstrated the need to incorporate the five key consensus performance measurement items incorporating (a) infrastructure reliability, (b)

efficiency, (c) social value, (d) value for money, (e) control and monitoring. The integration of the five key performance measurements would essentially benefit all parties into the PPP concession period model, but more importantly ensure to optimize concession period agreements and drive infrastructure assets financial value at postconcession termination.

Interpretation of Findings

The findings of the e-Delphi study incorporate experts' consensus on five key performance measurement applications of (a) infrastructure reliability, (b) efficiency, (c) social value, (d) value for money, and (e) control and monitoring. These performance measurement applications are critical for concession period model design that could help optimize concession period agreements and drive infrastructure assets' financial value at postconcession termination. The literature was critical to provide the basis for the study interpretations. I also examined the level of convergence and divergence based on the literature.

Incorporate Performance Measurements of Value for Money

Infrastructure performance measuring is part of an evaluation process used to calculate and measure concession period-based infrastructure effectiveness, reliability, and efficiency (Liang & Wang, 2019). Performance measuring constructs that support concession-based infrastructure for sustainability include value for money. Mohamad et al. (2017) found that value for money was key to concession period success and needed to be implemented and incorporated in performance measurement to ensure infrastructure assets to achieve financial value at postconcession termination. Performance

measurements of value for money are critical determining initial capital outlay for concession period-based infrastructure project, and it can be applied to compute whether infrastructure asset expected performance defined in the concession agreement sustain operation at postconcession termination (Zheng et al., 2019). Performance measurements incorporation for value for money in PPP concession period model essentially help mitigate risk and increase the prospect of project performance (Zheng et al., 2019).

The incorporation of performance measures of value for money greatly ensures revenue and profits generation, and to ascertain greater certainty in public value and financial value for both public and private sector parties to the PPP concession period agreements (Song et al., 2017). Equally, Liang and Wang (2019) confirmed that incorporating performance measurements for value for money was a crucial aspect that ensures infrastructure economic life cycle was sustained at postconcession termination. The sustainability of infrastructure asset financial value postconcession termination essentially, this presents the highest positive economic impact to localized communities (Aiyetan & Das, 2021; Feng et al., 2019).

The performance measurement of value for money is strategic and could be crucial for the effective redesign and remodel of PPP concession period model (Liang & wang, 2019) taking into account infrastructure operation efficiency at postconcession period. The overall performance measurement strategy achieved the highest 100% rating and median rating of 5.0 for desirability and feasibility. Equally, rating for performance monitoring measures was 100% with a median rating of 5.0 for desirability and feasibility to be incorporated in PPP concession period model to optimize concession period

implementation. Moreover, effective value for money incorporation on concession period model could facilitate adequate and efficient infrastructure project value delivery (Aiyetan & Das, 2021).

Incorporate Performance Measures of Social Value

Infrastructure asset efficiencies sustainability fundamentally is a critical success factor to achieve infrastructure asset social value at postconcession termination (Cui et al., 2018; J. Liu et al., 2014). The success of concession period-based infrastructure is largely depended on corporate relationship between public and private sectors where public welfare in an infrastructure project is considered fundamental (Zeng & Chen, 2019). Consequently, performance measurement incorporation of social value in concession period model supports scholars and practitioners to optimize concession period agreements and drive infrastructure asset financial value at postconcession termination (Liang & Wang, 2019). The traditional application of triangles performance measurements such as time, cost, and quality in the concession period-based infrastructure project makes it inherently complicated and riskier to achieve infrastructure social value.

As a result, consistent application of concession period model that integrates social value performance measures demonstrated to be among critical success factors that can considerably influence concession period agreement success (J. Liu et al., 2014; Y. Zhang et al., 2017; Liang & Wang, 2019). In an environment where performance measure of social value is incorporated on PPP concession period model application, there are huge possibilities that parties to the concession period agreement take equal

responsibilities for construction, operation and maintenance with effective risk and revenue sharing. Thus, results in incentive for mitigating contract renegotiation, early termination, and subsidy costs to ensure project success (Zheng et al., 2019). Performance measures of social value according to J. Liu et al. (2015), but notably Carbonara et al. (2017) play a significant role in political environment stability, government incentives, and infrastructure project policy environment.

Appropriate incorporation of performance measurement of social value relevant to concession period based-infrastructure development is critical since the length of the concession period agreements directly influence the benefits and welfare of parties into the concession contracts (Zeng & Chen, 2019). Mohamad et al. (2017) indicated as well that there was a need to adequately supply resources and skills to plan and maintain infrastructure projects to achieve infrastructure assets' future value at postconcession termination. To optimize infrastructure asset social welfare, necessarily, there is a need to integrate performance measures on PPP concession period model thereby achieving a win-win concession outcome for both parties into concession period agreement (Z. Liu et al., 2015).

F. Wang et al. (2018) also found that social welfare was critical regardless of whether the concession initiative and execution was public and or private sector, especially as it relates to infrastructure asset capacity utilization and value for money at postconcession termination. From the study's findings, it is evident that the existing PPP concession period model based on the literature reviewed is biased to private sector investor, and is not appropriately structured to guaranteed revenue and returns for public

sector (Ma et al., 2018). Nevertheless, equally, optimize concession period agreements, and drive infrastructure financial value at postconcession termination. As a result, PPP practitioners and or organizations, while executing PPP concession period agreements, might need to ruminate incorporating best practice and practical strategies that incorporate performance measurements and applies performance monitoring measures as best practice strategies to optimize concession period agreements and drive infrastructure financial value at postconcession termination. South Africa's financial constraints, inadequate capacities to attract investments, inappropriate governance structures, have opted to look at alternative funding models that considers public welfare and economic priorities (McCallum & Viviers, 2020).

Incorporate Performance Measurement of Efficiency

South Africa's government is currently constructing, operating, and planning a massive infrastructure project development scale (National Treasury, 2019). The government is expanding bulk infrastructure projects network in water and sanitation, roads, electricity, housing, and agriculture to improve service delivery and ultimately increase national economies (Matji & Ruiters, 2015). The PPP concession period model is greatly used in South Africa as a model to develop large infrastructure projects. Incorporating performance measurements efficiency was considered critical by experts to drive infrastructure asset financial value. Although prior studies have defined the fundamental dimension of infrastructure efficiency generally in PPP concession period model. The requirements for infrastructure efficiency integration on PPP concession period support experts' value-based perception, and accordingly can influence the change

on PPP concession period model that is consistent with income generation sustainability at postconcession termination (J. Liu et al., 2014).

Considering water infrastructure projects and other similar projects, all require initial capital injection, but equally investors anticipate infrastructure asset efficiency to have a long-term operation capacity, and sustainable financial value at postconcession termination (Liang & Wang, 2019). As Zheng et al. (2019) presented, challenges in relation to PPP concession period-based infrastructure success such as facility incapacity to fully performance, difficulty in refinancing the asset, deterioration of operation and maintenance, decline in asset economic sustainability that occurs in a full project cycle were related to management of performance measures of efficiency, reliability, social value, value for money, and control and monitoring.

Incorporate Performance Measurement of Infrastructure Reliability

The South African government aims to create value from the concession period-based infrastructure assets built through private sector investment initiatives. South Africa considers the concession period application a viable economic option and an exceptional financial instrument to attract funds to benefits infrastructure projects development that ensures social value and profit maximization. Incorporation of performance measures of reliability on PPP concession period according to McCallum and Viviers (2020) is critical to ensure correlation exists between infrastructure reliability, social value, and financial return on investments. Postconcession period transitioning of infrastructure assets that is based on reliability was needed to form an essential criterion that from time to time informs practitioners and scholars of PPP

concession period-based infrastructure investments to ensure any infrastructure asset built create value for money at postconcession termination (Correria et al., 2015; Greiner, 2020; Y. Zhang et al., 2017). During and postconcession termination integrated performance measures of reliability ensures that infrastructure assets adequately guarantee public and private sector achieve revenues, and create profit equity (Feng et al., 2019). Effectively, infrastructure asset reliability is a deterministic mechanism that can help predict profits and underlying cash-flow stability, while safeguard the public sector benefits at postconcession termination (L. Zhang et al., 2019).

Accordingly, F. Wang et al. (2018), but notably Liang and Wang (2019), found performance measurement reliability to be essentially needed to accurately provide the baseline for infrastructure assets performance compared with expected returns on investments. Key elements that government need to consider when infrastructure asset transitioned to public use postconcession termination include but not limited to infrastructure reliability, efficiency, value for money, and social value (Dithebe et al., 2019a; Greiner, 2020; Ramirez et al., 2019). The integration of performance measures of infrastructure reliability supports the value-add perspective such that at postconcession termination asset infrastructure transitioning from private sector to public sector ownership (Nwokedi & Emenike, 2018), needed to guarantee that infrastructure retains value for money.

Incorporate Performance Measurement of Control and Monitoring

Mohamad et al. (2017) observed that key to concession period success, there was a need to implement performance monitoring measures of quality and financial controls,

budget control, as well as control and monitoring to optimize incomes and profits generations. The experts-consented that incorporating performance measures of control and monitoring on concession period model was critical to achieve certainty in infrastructure asset maintain operational capacity, improve economic life cycle, and increase reliability and efficiency equally to safeguard investors' return on investments (Ismail & Haris, 2014; Nwokedi & Emenike, 2018). Incorporating performance measurement criteria that regulate concession period implementation ensures public and private sector investors execute concession contracts based on a win-win principle, share risks and revenue, and ensure to optimize concession period agreements and drive infrastructure asset financial value at postconcession termination (Xiong & Zhang, 2014; Y. Zhang et al., 2017).

Authors such as Ma et al. (2018) and X. Zhang et al. (2016), but notably Yan et al. (2020), found that the control and monitoring measures critically addresses win-win approach and integrates infrastructure assets' performance efficiency measures, reliability, and social value. As such, it helps improves concession period model capabilities to execute a well-structured and balanced contract, and increase sustainability of infrastructure financial values at postconcession termination (Hadi & Erzaij, 2019; Carbonara et al., 2017; Ma et al., 2018).

Limitations of the Study

The qualitative, e-Delphi technique imposed a certain degree of restrictions on the research process that might have constrained the research outcomes. Some limitation included the exclusion criteria that imposed exclusion of participants who could have

participated in the study. The experts' experiences, academic background, and years of involvement might have come across creating experts bias in terms of their responses. The period at which experts participated in response to the questionnaire and the fluctuation in response rates may affected the results outcome of the identified strategies. Limited access to internet access due to inconsistent supply of electricity and the impact of COVID-19, and the difficulties to retrieve data in a computer-based screen compared to hard copies (Donohoe et al., 2012), also contributed to the study limitations. Other than internet infrastructure availability, participants attrition, unreliable supply of electricity created difficulties in Internet access might have compromised the quality of feedback that was expected from the participants.

All the three rounds coincided with electricity load shading and COVID-19 challenges. These challenges contributed to fluctuations of 20% and 15% in response rates on questionnaires in Round 2 and Round 3, respectively. Another limitation related to the time required to complete sets of questionnaires and the possibility of participants dropping out from the research process (Hsu & Sandford, 2007). The anticipated period for completion of data collection was 45 days, but instead the period went beyond 80 days. All Delphi techniques were portions of an iterative process, therefore taking a large block of time for data collection was unavoidable (Hsu & Sandford, 2007; Murphy et al., 2020). The e-Delphi technique limitations were that the questionnaire method potentially slowed down data collection and analysis processes considerably due to time cost and potentially driving participant drop-out. Round 2 and Round 3 of the current study had a moderate 10-15% attrition drop-out due to resources, electricity supply shortages, and

time constraints. This limitation was mitigated by recruiting 20 participants in anticipation of drop-out throughout the study. As a result, participation in all the e-Delphi three rounds of study met the 70% retention threshold, and the final sample of 17 panelists was above the approximated 10 participants, a minimum sample size standard for e-Delphi studies.

Further limitations related to researcher bias resulted from my experience and exposure in concession period-based PPP infrastructure projects development. These challenges did not compromise the sample panel representation to achieve maximum consensus in this e-Delphi research study. Although there was limitation in recruiting PPP experts with subject knowledge to solicit an initial e-Delphi panel member size of 20 experts, meeting the study inclusion criteria through a rigorous sampling strategy was practically achieved. The response rate was 100% Round 1, 80% Round 2, and 85% in the final round.

Although the retention rate of participants' responses in this e-Delphi survey met the 70% threshold for each round of data collection as recommended by Hsu and Sandford (2007) and Murphy et al. (2020). To what extent the expert-panel feedback reported reflected the views of those panelists who did not respond to the Round 2 and Round 3 invitations is unknown. Throughout the study, I maintained a high level of communication between myself and the participants to sustain research study credibility. In all three rounds, the audit trail, member-checking, data triangulation (Ravitch & Carl, 2016), and statement rating performed by participants also assisted in increasing the credibility of the study findings.

The high-level outcome of expert consensus at 88% was a clear articulation of the extent to which performance measurements incorporation in PPP concession period models was considered critical and significant practice required to optimize concession period agreement and drive infrastructure asset financial value at postconcession termination. To achieve transferability, I applied data iteration and data audits (Babbie, 2017) in Rounds 1, 2, and 3, and this included methodology description and participant selection to ensure transferability. During data collection and analysis, I kept notes and a reflexivity journal to achieve dependability of the research results. The best approach to achieve confidence in data is to conduct data triangulation to help address the study's problem and assist in uncovering the relevant results (Kumar, 2014). The e-Delphi iteration approach essentially assisted me in comparing the responses from expert-panelists and similar research to establish dependability.

All survey transcripts were entered in an Excel spreadsheet, and the reflexivity journal was used to deposit my assumption about the study, limitations, opinions, and articulation while continuing with data collection and analysis of each round of questionnaire. The extent of confirmability was achieved through data triangulation, which also assisted in strengthening probabilities of future replication of the study. Overall, the responses from participants offered a variety of perspectives and ensured collected data represented all aspects of the study.

Recommendations

This e-Delphi study was first to be conducted on this topic. I used the notes taken during the study were used to label and explain the outcomes in this e-Delphi study and

to answer any additional questions from participants. The data in which participants described their views and lived experience in the PPP concession period model were documented in their terms throughout the research study to provide fertile and important recommendations.

Reflection of Researcher Experience

Twenty expert panelists were selected in Round 1 to help determine the level of consensus among PPP experts on the best practice within the South African context for using performance measurements to optimize concession period agreements to develop water infrastructure and drive infrastructure assets' financial value at postconcession termination. For the e-Delphi study, personalized email invitations were used mainly as an effective method to invite and communicate with the number of consented participants. The approach used demonstrated a high response rate, which was above the 70% expected threshold. The outcome indicated that to be successful, perhaps researchers needed to access experts through appropriate infrastructure, including professional and PPP practitioners' networks.

Other researchers could apply the varied approach to recruit participants for an e-Delphi study to using inclusion criteria to ensure that the participants: (a) had a minimum of at least 5 years of experience, (b) possessed a master's degree or above, (c) held employment relevant to the study, and (d) were over the age of 18. Transforming the eligibility criteria for expert-panels to conduct the Delphi study could broaden the knowledge base through a more comprehensive collection of data approach. Other Delphi studies could be comprised entirely of concession period model experts to determine their

appreciation of the study's topic. Based on the study's outcome, researchers may develop further studies following the findings of the e-Delphi studies. In the next section, I discuss possible areas of further studies.

In line with experts' recommendations, the initial execution of performance measures incorporation should be guided by the information and or recommendation provided. Incorporated performance measures on the PPP concession period model should benefit concession period contracts. However, continuous execution of performance measurements incorporation requires substantial practice change in concession period model application. One recommendation is for studies to incorporate other research designs to examine the level of PPP consensus on best practice in South Africa for using performance measurements to optimize PPP concession period and drive infrastructure financial value postconcession termination. Further studies should be conducted on the concession period model incorporated with performance measures effectively to evaluate the PPP concession period model value for money.

Concession period remodel incorporating performance measures process flow should accordingly be based on experts-consensus aimed to benefit each stage of concession period model through to the end of infrastructure economic life. Incorporation of performance measurements on concession period model is important especially that each performance measure incorporation on PPP concession period is likely to influence infrastructure financial value pre-and postconcession termination. Thus, further research is needed to determine the optimal performance of the concession period model when equally sharing risk and return. The stated concession period attributes in the literature

addressed multi-approaches to PPP concession period infrastructure development. However, recommendations for specific elements of concession period application (e.g., cost-benefit analysis, revenue-profit sharing, investment return forecast, win-win principle) were beyond the scope of this e-Delphi study. However, future work could consider concession period remodeling, especially to develop a standard approach to the PPP concession period that can be applicable across South Africa infrastructure development.

Lastly, I conducted the current study under the difficult conditions of the COVID-19 pandemic. This pandemic had a large impact on the economies of the world. The pandemic was not anticipated, and the diversity of opinions on the pandemic across medical experts did not assist the situation. After this pandemic, the world is likely to be confronted with a new reality of life. Thus, there is a need for future research after the pandemic to examine PPP concession period infrastructure development in line with the new digital communities.

Implications

Implications for Positive Social Change

The findings may make a unique and significant contribution to remodel the PPP concession period model, allowing parties to optimize concession period agreements and drive infrastructure asset financial value at postconcession termination. The results potentially could create a win-win concession period that creates a balance between risks and return, as well social value and infrastructure efficiency and financial value at postconcession termination. Similarly, the findings could allow PPP practitioners and

government agencies to apply the PPP concession period model as an alternative funding instrument to develop infrastructure across localized communities.

The results are likely to increase capital funding accessibility that improves infrastructure development that optimizes water infrastructure service delivery, reduces poverty, increases economic activity, and improves health living standards of communities. Infrastructure development is essential for achieving sustainable, socio-economic development across Africa.

Building resilient infrastructure and promoting sustainable industrialization has long been featured on the multilateral agenda and was first recognized in the United Nation's Millennium Development Goals (MDGs) as an essential requirement for improving living standards (Khatleli, 2020a). The challenge for South Africa to maintain and expand its electricity, water, transport, and communications infrastructure in order to support economic growth and social development goals through meeting its commitment to the United Nations Sustainable Development Goals 6 (ensure availability and sustainable management of water and sanitation for all), and 9 (build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation).

South Africa leads this avenue of sustainable infrastructure development among developing Southern African nations only in MDG 9: building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. South Africa is a country generally regarded to have relatively high levels of success in PPP, such that comprehensive PPP frameworks and legislation in contrast to its neighbors, which has served as necessary best practices for implementing PPP within the region.

South Africa has also begun to undertake cross-border PPP concession-based infrastructure development. The results of the study could also offer valuable lessons for developing and implementing regional infrastructure projects if successfully implemented.

While in recent years, several countries have begun to develop legislation and dedicated PPP capacity, mirroring South African best practice as well as frameworks and toolkits developed by multilateral institutions such as the World Bank, more progress on these MGs 6, 7, 8, and 9 need to be made (Khatleli, 2020b). By conducting further research in implementing PPPs in South Africa, positive social change can be driven by providing practitioner-based information to regional and national governments with much more attractive conditions for private-sector investments. In return, the government can gain many advantages from the private investor, such as improvements in operational efficiency, management capacity, technology, and innovation –ultimately leading to better quality public services and coming closer to meeting the Millennium Development Goals in improving living standards in developing nations through modern infrastructure development (Haywood et al., 2019; Khatleli, 2020a).

Methodological and Theoretical Implications

The findings of the study are aimed at incorporating performance measurements that address a knowledge gap in the literature on the inability of the current PPP concession period model to balance goals of social value and profit generation within local water infrastructure development may be due to inconsistent application of performance measurements to forecast long-term investment returns at postconcession

termination (Arimoro, 2020; Dithebe et al., 2019a). The fiscal constraints to build infrastructure assets required for growing national economies and increasing societal demand for immediate service delivery has forced South Africa to opt for concession period models as an innovative funding tool to address infrastructure deficiencies.

The application of concession models in developing African economies with PPP shows a certain level of inefficiencies to achieve infrastructure assets return and benefit from investments in water infrastructure (Opawole & Jagboro, 2016b). Consequently, the above is likely to be attributed to concession period challenges reported in emerging economies such as an inadequate definition of obligations, lack of skills to execute concession contracts, and failures to incorporate standards and measures safeguarding benefits and public sectors' investments interests in concession period contracts pre-and-posts concession period termination (Opawole et al., 2018; Pivatto et al., 2017). The fact that governments adopt a concession period is fundamental in PPP contracts and consistently applied as an alternative funding model to develop large-scale infrastructure projects for service delivery and improve national economies (Feng et al., 2019; F. Wang et al., 2018; Y. Zhang et al., 2017).

The current literature on the concession period demonstrates a lack of performance measurement incorporation to execute an optimal PPP concession period agreement and drive infrastructure asset financial value at postconcession termination. The current research findings are likely to contribute to the body of knowledge to broaden the theoretical knowledge perspective based on experts' panel opinions and consensus. Research results based on strategies for financing infrastructure projects are

likely to provide helpful knowledge for concession period-based PPP in defining clearly, parties' obligations and equities aiming to benefit all party's concession period PPP contracts (Feng et al., 2019). Incorporation of the e-Delphi method to extend Hadi and Erzaij's (2019) conceptual framework supported the study's overall purpose of developing a set of best practices based on experts' level of consensus on using performance measurements to optimize concession period agreements and further extend the bargaining game theory (Carbonara et al., 2014; Nash, 1950).

Recommendations for Practice

The study findings might be significant to knowledge contribution in the PPP field of research within the South African context. More specifically, the concession period's remodeling against current concession models might contribute to concession periods research pertinent to developing countries focused on socio-economic infrastructure development opportunities (Mouraviev & Kakabadse, 2016; Song et al., 2015). The research was aimed at providing essential benefits to scholars, practitioners, government agencies, legal agencies, project managers, engineers, and, to no small extent, academics involved in PPP practice (Mouraviev & Kakabadse, 2016; Y. Zhang et al., 2017). The lack of balance between South Africa's PPP' social value contribution and profit generation within local water infrastructure development may be due to inconsistent use of performance measurements to forecast long-term investment returns (Arimoro, 2020). For a government to implement the concession period model and source funding against fiscal funding, it is critical to use rigorous and consistent performance

measures on PPP to access capital investments for infrastructure development (Y. Zhang et al., 2017).

The results of this study may be significant to business and management practices by contributing towards a rigorous process of practitioner-based knowledge production generated from within the South African context to inconsistent use of performance measurements to forecast long-term investment returns at postconcession termination (Dithebe et al., 2019a). The study results may be crucial to design concession period-based models that are fair and crucial to increase equal investment returns to benefit all investors pre-and-postconcession termination (Pivatto et al., 2017). Concession period-based infrastructure development is critical in revenue generations and reduces government budget burden (Nguyen & Notteboom, 2017). Executing concession period-based infrastructure development for the country subsequently contribute towards social development, both from an income generation and skills development perspective (Zeng & Chen, 2019), and these elements are critical to sustaining positive social change in societies (Liebenberg, 2018).

Conclusions

The e-Delphi study was successful in identifying consensus recommendations from a multidisciplinary expert-panel of finance, engineering, project management, and practitioners employed in both DBSA and the National Treasury with over 5 years of experience. The PPP experts selected were those working on water infrastructure projects across local, national, and regional water scheme settings. The recommendations to incorporate performance measurement on the PPP concession period model offer a

pragmatic approach to complement access to capital for infrastructure development and success for water infrastructure project implementation.

Equally, performance measurement incorporation is critical to creating a win-win concession period, optimizing the PPP concession period agreement, and subsequently driving infrastructure asset financial value at postconcession termination. The implication of performance measurement incorporation on PPP concession period termination serves as an additional tool for ensuring infrastructure assets achieve efficiency, reliability, value for money, and social value critical to guarantee infrastructure investment returns.

Their incorporation and application in PPP concession period practice need to be guided by thoughtful interpretation in the context of the individual practitioner's experience and expected concession period model changes over time. Additional work is required to measure the applicability of incorporating performance measurement on concession period model based on expert-panel recommendations for each PPP concession period agreement across South Africa and the region. There are no standards applicable to implement concession-based infrastructure development at the various government levels in South Africa, and there is a lack of strong institutional capacity to analyze and address water infrastructure technical challenges effectively. As a result, access to affordable water and other essential infrastructure services was critically important and is a prerequisite for South Africa's economic development. For South Africa, the route to achieving the 2030 National Agenda of Sustainable Development Goals relies on the PPP capacity innovations for funding and technical efficiencies to evaluate, monitor, and implement concession period-based infrastructure development.

South African infrastructure projects operate within a PPP framework that accommodates concession period-based infrastructure assets development.

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Appendix A: First Round Questionnaire

Open-ended questions

Please provide your response in a bulleted format with 3-5 recommendations for each question.

1. South Africa's water infrastructure improvement is critical to advancing economic activity and human health. The lack of potable water is estimated to result in approximately two million mortalities annually. Which *challenges affect the success of water infrastructure projects* in South Africa?
2. The South African Financial and Fiscal Commission (FFC) noted that for South Africa to achieve sustainable water and sanitation infrastructure to suitable standards, an additional R4 billion ($300 million) would be required annually for five years. What problems compel the South African government to apply a *PPP concession period model as an alternative funding instrument* for the development of water infrastructure across localized communities?
3. For a government to implement the concession period model and source funding against fiscal funding, it is critical to use rigorous and consistent performance measurements on PPP concession models. In your expert opinion, what would be best practice and practical strategies essential for driving *rigorous and consistent performance measures on PPPs to create access to capital investments* in water infrastructure development?
4. Project cash flows during the concession period and cash flows postconcession period until the end of infrastructure project economic life are critical to realizing.

In your expert opinion, what are the best practice strategies *during the negotiation period* between public and private partners, so both parties come to a consensus on a project completion schedule?

5. Inconsistent measurements for reliability, efficiency, and value for money to optimize concession period agreements have left emerging economy governments with revenue uncertainties. In your expert opinion, what are the best practice and practical strategies for the South African government to *apply rigorous performance monitoring measures* to optimize concession period agreements, and drive infrastructure financial value at postconcession termination?

Appendix B: Second Round Questionnaire

	Likert-type scale (Desirability)				
Rating Scale: 1 up to 5	**Exceedingly Undesirable**	**Undesirable**	**Undecided**	**Desirable**	**Exceedingly Desirable**
	1	**2**	**3**	**4**	**5**

Questionnaires/ Statements (Mark with an-*x*)	**1**	**2**	**3**	**4**	**5**
Q1. Water infrastructure assets in South Africa requires budget allocation for operation and maintenance, technical skills for planning and implementation, and revenue management systems for maximum revenue collection. Do you agree these practices and practical strategies are critical success factors for water infrastructure implementation?					
Q2. Increasing service delivery pressure compels South Africa government to apply PPP as alternative funding instruments to build water infrastructure projects because of lack of expertise to fund and execute large scale infrastructure project, budget constraints, and the incapacity to operate and maintain large water infrastructure assets. Do you agree these critical failure factors compel South Africa government to use PPP as alternative funding instruments to access skills to build large-scale water infrastructure projects in South Africa?					
Q3. Do you agree that incorporating performance measurements frameworks, performance measurement systems, and key performance measures into PPP concession period contracts provide best practices and practical strategies to create access to capital investments for water infrastructure development?					
Q4. Both public and private sector partners need to create a win-win concession period that clearly indicate rights and obligations of each party in the concession agreement, and detailing risks and revenue sharing-agreements in the concession period prior to signing of the concession agreement. Would you consider these practice and practical strategies is critical important to reach consensus between parties into concession period agreements?					
Q5. Do you agree that there is a need for public and private sectors in South Africa to incorporate and consistently apply performance measurements of reliability, efficiency, social value, and value for money to optimize concession					

period agreement and drive water infrastructure financial value at postconcession termination?

Appendix C: Round 3 Questionnaire on Désirability

	Likert-type scale (Desirability)				
Rating Scale: 1 up to 5	**Exceedingly Undesirable**	**Undesirable**	**Undecided**	**Desirable**	**Exceedingly Desirable**
	1	**2**	**3**	**4**	**5**

Round 3 Questionnaire on Desirability (Mark with an *x using the criteria above for your answer*)	**1**	**2**	**3**	**4**	**5**
Q1. Overall, how desirable it is to incorporate performance measurements on concession period model to ensure infrastructure projects preserve:					
(a) Reliability					
(b) Efficiency					
(c) Social Value					
(d) Value for Money (VfM)					
Q2. Overall, how desirable is technical skills incorporation on concession period model to ensure implementation of concession period agreements that maintains infrastructure financial value sustainability at post concession period termination?					
Q3. Overall, how desirable it is to incorporate negotiation best practices and standards on concession period model to ensure rights and obligations are maintained, and there					

is equity sharing in risks and returns based on infrastructure-assets investment?

Q4. Overall, how desirable it is to incorporate rigorous performance monitoring measures on concession period model to:

(a) optimize concession period agreements

(b) drive infrastructure assets value for money at postconcession termination

Appendix D: Round 3 Questionnaire on Feasibility

	Likert-type scale (Feasibility)				
Rating Scale: 1 up to 5	**Exceedingly Infeasibility**	**Infeasible**	**Undecided**	**Feasible**	**Exceedingly Feasible**
	1	**2**	**3**	**4**	**5**

Round 3 Questionnaire on Feasibility (Mark with an *x* 1 2 3 4 5 *using the criteria above for your answer*)

Q1. Overall, how feasible it is to incorporate performance measurements on concession period model to ensure infrastructure projects preserve:

(e) Reliability

(f) Efficiency

(g) Social Value

(h) Value for Money (VfM)

Q2. Overall, how feasible is technical skills incorporation on concession period model to ensure implementation of concession period agreements that maintains infrastructure financial value sustainability at post concession period termination?

Q3. Overall, how feasible it is to incorporate negotiation best practices and standards on concession period model to ensure rights and obligations are maintained, and there

is equity sharing in risks and returns based on infrastructure-assets investment?

Q4. Overall, how feasible it is to incorporate rigorous performance monitoring measures on concession period model to:

(c) optimize concession period agreements

(d) drive infrastructure assets value for money at postconcession period termination

Appendix E: Code Descriptions & Definitions

Category	Code Description	Code	Code Definition	Codebook Excerpts
Budget Constraints	**Budget Constraints**: The experts in their consensus revealed that budget constraints were a critical challenge that affect the success of water infrastructure projects in South Africa	BG-1	The experts believed that budget constraints mainly affect the success of water infrastructure in South Africa, and also compel South Africa government to use PPP concession period model as alternative funding instrument	*"Another challenge that is affecting the success of water infrastructure is limited resources allocated to fund the projects. Budgetary constraints imply that most of the plans remain on the drawing board far longer than necessary because of inadequate funds; So, the problem that will force the government's hand is likely to be a distressed debt or severe liquidity crisis. At this point, government will realize that is it is unable to provide water and sanitation infrastructure simply because such expenditure has been crowded out by other items (mainly uncontrollable debt service costs) and social transfer".*
Technical Skills	**Technical Skills:** Experts responses from analyzed data revealed consensus that technical skills inefficiency contributed towards challenges that affect the success of water infrastructure projects in South Africa	TS-2	Technical skills could refer to the ability to select and apply appropriate techniques, resources, and modern engineering tools as well as modeling to complex engineering activities with an understanding of the limitations	"*The lack of technical and financial skills and monitoring of the private operator are serious challenges; The other challenge is limited human resources capacity in the municipality to develop, operate and maintain the infrastructure".* *"Create a team with technical and management skills to manage the funds and infrastructure development projects*
Performance Measure: Reliability, Efficiency, Social Value,	**Performance Measure Reliability**: The was consensus among experts that supported the	PM-RESV-3	Infrastructure performance measuring is part of an evaluation process used to measure	"*…In addition, because of the higher risk (design, engineering and construction phase), capital markets require more equity than debt. But during the operational phase, where revenues and cash flows*

and Value for Money	incorporating performance measures of infrastructure reliability, efficiency, social value, and value for money were critical to ensure sustainability of infrastructure asset financial value at postconcession period		infrastructure effectiveness, reliability, and efficiency	*are more stable, projects can be re-financed with potentially cheaper debt"* *"There need to be clearly defined guarantees provided over a reasonable period of time to ensure sustainability of the infrastructure and its operability,* *"Project scoring is part of the wider performance management system. Related elements are: • OPR—output to purpose reviews, which are the main source of information to support a performance score.*
Best PPP Practice Strategies Application	**Best PPP Practice and Practical Strategies**: Data analyzed from experts responses revealed consensus that there was a need for a fair and a balanced approach during negotiation period between public and private partners, hence both parties come to a consensus on a project completion schedule	BPP-4	Best PPP practice and practical strategies have pervasive effect on negotiation, and could be the best technique of achieving a win-win concession period.	*"The best practice and practical strategies to drive rigorous and consistent performance measure on PPPs to create access to capital investments in water infrastructure development will be dependent on the following: creating a conducive enabling environment that will enforce Public Sector readiness (legal and institutional framework); Public sector readiness (capacity building); Private sector readiness that promote access to finance ; Private Sector Readiness that encompass Local Industry Development and Trade reforms , promotion of civil society readiness in order to foster Transparency and Anti-corruption and civil society readiness in stimulating communication , information and participation"*
Win-Win Concession Principle	**Win-Win Principle**: A win-win principle is significant to guarantee and	WWP-5	**Win-Win Principle**: A win-win principle is significant to guarantee and	*"Negotiations must be based on win-win principles, be premised on sound economic principles and fiscal capabilities, long term in nature, to benefit communities*

	safeguard the interest of both public and private sectors undertaking to execute infrastructure projects development through concession period models		safeguard the interest of both public and private sectors undertaking to execute infrastructure projects development through concession period models	*at all times, coupled with south community development and stakeholder management and more importantly ethical consideration* *"What we have seen in the past which tend to affect the cash flow during the operation is the use of unrealistic assumptions which informs the cashflow. If proper planning has been done properly, it saves a lot of time in negotiation. Furthermore, a negotiation framework should be prepared beforehand. Assumption on regulatory issues should be realistic to enable smooth project delivery which can affect the completion time"*
Performance Monitoring Measures	**Performance Monitoring Measures:** All experts viewed and consented that performance monitoring measures were intrinsically critical to quantify and appraise concession period-based infrastructure asset performance sustainability, and can be used to determine the certainty of infrastructure asset financial asset values.	PMM-6	Performance monitoring measures critically help to quantify and appraise concession period-based infrastructure asset performance sustainability and can be applied to monitor and determine the certainty of infrastructure asset financial asset values.	*"The best practice on performance monitoring as mentioned earlier, will through the development of a rigorously test framework that is agile and can accommodate different types of contracts and concession rules.* *"Monitoring and Evaluation programme must be implemented and managed by independent experts with proper technical skills and financial expertise. The PPP must hold monthly meetings and quarterly detailed reviews led by exco and board of the PPP structure".*
Financial Control Measures	**Financial Control Measures:** Data analyzed revealed that the experts	FCM-7	Financial control refers to activities where in financial transactions are accurately recorded	*"We need Treasury to participate in tge funding strategies early in the conception of all water infrastructure projects. The PPPs must be managed by a*

	viewed financial control as a measure to protect infrastructure asset investments and toe ensure that all water infrastructure financial transactions were recorded and reported accurately.		and reported to all stakeholders according to internal control policy measures	*competent leadership structure in the form of a board, you need to set SMART goals for the PPP and targets, there is a need for clear KPI with monitoring and evaluation programme, develop protocols for stakeholder engagement"*
Postconcession Period	**Postconcession Period**: Postconcession period transitioning of infrastructure assets based on quality management needs to form an essential criterion that from time to time informs concession period model capabilities to create infrastructure assets financial value postconcession termination	PCP-8	Postconcession period transitioning of infrastructure assets based on quality management needs to form an essential criterion that from time to time informs concession period model capabilities to create infrastructure assets financial value postconcession termination	*"The "Hand Over" clauses are important, the state in which the infrastructure must be in at hand over and the maintenance records must be available including all the assets acquired and the state thereof "You must how the affordability of the services to be provided to the general population, the operation period and transfer must be reasonable enough so that the investors get a fair return on investment, Government must also offer alternatives to the poor pr disadvantaged communities"*
Accountability	**Accountability**: The experts maintained that accountability on infrastructure projects investments was essential to assist investors in exercising control and ensure infrastructure	AC-9	Accountability emphasises reforms aimed at improving efficiency and effectiveness of all sectors' activities ranging from public and private sector functions, to the introduction of performance measurement techniques, the establishment of	*"The lack of accounting methods to account for revenues and costs just associated with water, make it difficult to ring fence cash flows that are required for successful project finance. The challenge that some municipalities do not have the requisite scale for feasible PPP, the majority excluding the Metros cannot achieve bankable feasility.*

	asset sustain value for money at post concession period		audit and regulatory frameworks, and the decentralisation of functions to all sectors to ensure maximization of positive accounting outcomes	
Operation & Maintenance	**Operation & Maintenance**: Experts consented that O&M of infrastructure services is agreed to sustainable I the infrastructure realises its anticipated service during its design life. Proper operation of services refers to the activities involved in the delivery of a service; it depends on both users and providers using the facilities and equipment with care in order to ensure the long life of services and to reduce maintenance needs. Maintenance refers to the activities that ensure infrastructure remains in a serviceable condition; it cove	O&M-10	Operation and maintenance of infrastructure services refers to the ability of the infrastructure asset to delivery reliable services effectively and efficiently during the infrastructure economic life	*"Maintenance of the current infrastructure and water purification.* *"Financial resource constraints, lack of requisite skills and inadequate human resources to operate and maintain the water supply infrastructure* *"Maintenance, cost recovery and payment for service* *"South Africa is generally a dry country where water sources are not in close proximity which demands huge infrastructure investment. This brings a challenge to poor municipalities to raise funding for the infrastructure. The other challenge is limited human resources capacity in the municipality to develop, operate and maintain the infrastructure"*
Revenue Management Systems	**Revenue Management Systems**: The revenue management systems were	RMS-11	Revenue and profit generation deterministic mechanism have to show profits and underlying cash-	*"The limited revenue base and poor revenue collection in municipalities make it difficult to have infrastructure development fund. Even the national fiscus is limited due to low tax collection. The private*

identified as a critical revenue and profit generation deterministic mechanism that showed profits and underlying cash-flow stability and assurance to the public sector sustainability of infrastructure assets financial value postconcession period	flow stability and ensure the public sector sustains infrastructure assets financial value postconcession period	*sector also comes along with requisite skills to develop, operate and maintain the infrastructure.* *"The concession must be premised on solid performance agreement with measurable indicators. The state should provide guarantees with regards to revenue collection, good governance, and protection of infrastructure against vandalism or illegal connections*"

Appendix F: Aggregated Participant Responses Round 1

Categories 1-5

Aggregated Participants Responses Round 1

Round 1 Question	Aggregated Expert Panel Responses	Analytic Codes	Codes	Categories
1.Which challenges affect the success of water infrastructure projects in South Africa?	Analysis of infrastructure challenges versus success in water infrastructure in South Africa showed excessive lack of project management, lack of funding to sustain water infrastructure assets, lack of technical expertise in planning and managing infrastructure projects, and deficient performance measurements systems to guarantee infrastructure design efficiency, reliability, value for money, and social value were found to be the most challenges affecting the success of water infrastructure projects in South Africa.	1.Project Planning 2.Budget Constraints 3.Technical Skills 4.Performance Monitoring Measures 5.Project Operation & Maintenance 6.Performance Measurement 7.Accountability	1.PRJ.PLN: Project Planning 2. BGT-CONSTRTS: Budget Constraints 3.TCHNCL-SKL:Technical Skills 4.PERF-MON-MESURS-SKL: Performance Monitoring Measures 5.FIN-CTRL: Financial Control 6.PERF-MESUMNT: Performance Measurement 7.ACC-STD: Accounting Standards	1.Project Plan 2.Budget Resourcing Incapacity 3.Operation & Maintenance Incapacity 4.Technical Incapacity 5.Applicable Design Standards 6.Financial Control Measures
2. What problems compel the SA government to	Analysis of application of PPP concession model versus alternative funding instruments based on water infrastructure development in South	1.Budget Constraints 2.Technical Skills	1.BGT-CONSTRTS: Budget Constraints 2.TCHNCL-	1.Budget Resourcing Incapacity

apply PPP concession period model as an alternative funding instrument to develop water infrastructure across localized communities?	African government showed financial resource constraints, inadequate human resources; constrained fiscal environment due to low economic growth in South Africa, and deficient procurement systems, inability to apply technical and engineering capacity to plan and execute large infrastructure; and high maintenance infrastructure costs compelled the South African government to use PPP as an alternative funding model to deliver water infrastructure projects in South Africa.	3.Standardized Operation & Maintenance 4.Performance Measures Value-Add 5.Design Standards	SKL:Technical Skills 3.S-O&M: Standardized Operation and Maintenance 4.PERF-MESRS-VL-AD: Performance Measures Value-Add 5.DSGN-STD: Design Standards	2.Operation & Maintenance Incapacity 3.Technical Incapacity 4.Applicable Design Standards Challenges 5.Financial Control Incapacity
3. In your expert opinion, what would be best practice and practical strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development?	Analysis of best practice and practical strategies for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure showed that upfront development of performance management criteria; application of performance measurement systems; development and application of performance measures; application of revenue management systems to increase revenue generation and profits. As well as the establishment of central capability for the management and oversight of PPP performance of concession period agreements; and the application of solid performance measurements with measurable	1.Performance Measurement Frameworks 2.Performance Measurement Systems 3.Key Performance Agreement Indicators 4.Revenue Management Systems 5.Standardized Operation & Maintenance Systems 6. SMART Goals	1.PERF-MESRMNT-FRMWK: Performance Measurement Frameworks 2.PERF-MESRMNT-SYSTMS: Performance Measurement Systems 3.KY-PERF-AGRMNT-IND 4.RVN-MNGMT-SYSTM: Revenue Management Systems	1.Develop Performance Measurement Frameworks 2.Develop Performance Measurement Systems 3.Define Key Performance Agreement Indicators 4.Design Revenue Management Systems 5.Define Standardized Operation and Maintenance 6.Standardized SMART Goals

	indicators were identified to be consistent with best practice and practical strategies essential for driving rigorous and consistent performance measures on PPPs to create access to capital investments in water infrastructure development		5.STD-O&M-SYSTMS: Standardized Operation & Maintenance Measures 6.SMART-GLS: Specific, Measurable, Attainable, Relevant, and Timely Goals.	
4. In your expert opinion, what are the best practice strategies during the negotiation period between public and private partners? Hence, both parties come to consensus on a project completion schedule?	In the overall, analysis revealed that negotiations based on win-win principles and premised on sound economic principles, including incorporation of performance standards in line with the industry to ensure infrastructure value for money; designed standards aimed at avoidance of costly deviations to budgets, stability of infrastructure performance during economic life cycle; and benefit to the communities were regarded as consistent with best practice strategies during negotiation period to achieve consensus on project completion.	1.Win-Win Principle 2.Standardized Rights & Obligations 3.Equal Revenue & Risk Sharing Principle 4.Social Value Performance Measure 5.Efficienct Performance Monitoring Measures 6.Asset Reliability Performance Measures	1.WW-PRCPL: Win-Win Principle 2.STD-R&O: Standardized Rights & Obligation 3.EQU-R&R-S:Equal Revenue & Risk Sharing 4.SCL-VL-PERF-MESRS: Social Value Performance Measures 5.EFFCT-PERF-MON-MESRS: Efficient Performance Monitoring Measures 6.ASST-PERF-RLBLTY-MESRS:	1. Define Win-Win Concession Period Model 2. Design Rights & Obligation Frameworks 3.Develop Equal Revenue & Risk Sharing Principle 4.Incoporate Social Value Performance Measures 5.Incorporate Asset Reliability Performance Measures 6.Incoporate Monitoring Performance Measures

			Asset Reliability Performance Measures	
5.In your expert opinion, what are the best practice and practical strategies for the SA government to apply rigorous performance monitoring measures to optimize concession period agreements, and drive infrastructure financial value at postconcession period termination?	Analyzed aggregated data from experts showed that project performance monitoring required constant assessment of infrastructure project development stages, implementation of risks mitigation strategies; development and application of infrastructure interproject process improvement life cycle; the application of people capability maturity model and project management maturity model were viewed as consistent with best practice and practical strategies for the South African government to apply rigorous performance monitoring measures to optimize concession period agreements, and drive infrastructure financial value at postconcession period termination.	1.Incorporate Performance Measurement: 1.1.Reliability; 1.2.Efficiency; 1.3.Social Value; 1.4.Value for Money 2.Perfromance Monitoring Measures 3. Postconcession Management 4.Incorporate Infrastructure Design Standards	1.Inc-PERF-MESRMNT: Incorporate Performance Measurements (RELBLTY;EFCNY & SOC-VL) 2.PERF-MON-MESRS: Performance Monitoring Measures 3. PST-CNCSN-MGMT: Postconcession Management 4.Inc-IFRASTRCT-DSGN-STD: Incorporate Infrastructure Design Standards	1. Incorporate Asset Infrastructure Performance Measurements: Reliability; Efficiency; Social Value; and Value for Money 2. Incorporate Asset Infrastructure Performance Measures 3. Develop Postconcession Period Contract Management Systems 4.Incorporate Infrastructure Design Standards