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Examining the Project Success Antecedents of Public Private Partnerships (PPP) in Public Infrastructure Works of Zambia

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Abstract

A nation's economic progress has long been seen to be accelerated by the development of its infrastructure. Zambia has suffered from an infrastructure shortage that has impeded economic and developmental progress. In an effort to lower the national debt and find a more effective way to fund infrastructure projects, policymakers have been looking to Public Private Partnerships (PPP) for far too long. However, the issue with PPPs has been that crucial success factors have been poorly implemented, which has resulted in inadequate funding for infrastructure, budgetary restrictions, inefficiencies in public sector infrastructure management, and low public spending. The impact of PPP success antecedents on actual PPP project success was investigated in this study. Data was gathered from a sample of 90 PPP practitioners selected from both public and private sector companies using a structured questionnaire as part of a quantitative research approach. Hierarchical regression and correlation models were used to analyse the data. The results demonstrate the applicability of both the institutional and human capital theories in Zambia. Furthermore, with a combined large effect size of (0.917) and a coefficient of determination of 82.8%, the results showed that the most significant predictors of actual PPP project success in Lusaka are sound financial factors, economic viability, and appropriate risk allocation factors, as well as favourable business environment factors and reliable concessionaire consortium factors.

Keywords: Public Private Partnerships (PPP), Public Infrastructure, Project Success, Zambia

1. Introduction

Infrastructure development has long been regarded as a key aspect in a country's economic progress. Infrastructure is said to encourage economic growth. The worldwide infrastructure needs are approximately 4% of global GDP, or $4 trillion each year (Estache et al., 2015; Mwanaumo et al., 2021). The Private Finance Initiative (PFI) in the United Kingdom was the first successful implementation of the PPP structure (Silvestre, C.H., and Araújo, 2012). Prior research demonstrated that not only could public services and facilities be supplied differently, but there were also advantages for all parties involved, including the general public (Cheung, 2009).

Infrastructure improvements have contributed 0.6 percentage points to Zambia's yearly per capita GDP growth over the last decade, owing primarily to the exponential growth of information and communication services. Improving Zambia's infrastructure endowment might improve annual growth by up to two percentage points (Foster and Dominguez, 2013). Zambia would need to spend an average of $1.6 billion per year from 2006 to 2015 to create infrastructure comparable to the rest of the developing countries. This is comparable to 20% of Zambia's GDP and roughly doubles the country's investment pace in recent years. To close the country's $500 million yearly infrastructure financing deficit, more funds must be raised, more cost-effective solutions to accomplish infrastructure targets must be found, and inefficiencies that cost $300 million per year must be eliminated (World Bank, 2018).

According to the United Nations Development Programme (2010), Zambia has an infrastructure deficit, which has hampered development and economic progress. Mwanaumo et al. (2018) go on to say that Zambia's deficit has resulted in poor infrastructure provision at both the state and local levels, including intermittent electricity supply, water shortages, fuel scarcity, and inadequate health-care facilities. According to Schwab (2016), in the World Economic Forum's (WEF) Global Competitiveness Index 2016-2017, infrastructure is the second pillar of basic necessities and the major component driving a country's economic growth. According to recent assessments, Zambia's infrastructure faces a massive challenge, with an estimated cost of US$1.6 billion per year for the next ten years to fulfil average infrastructure requirements.
Public-private partnerships (PPPs) have grown in popularity as a method of procuring public-works projects. Infrastructure public-private partnerships are now commonplace. Partnership language and contract types have evolved during the last few decades. PP can become an integral part of global infrastructure development if prior experience is used to learn (Hodge et al., 2017).

Many countries have expressed an interest in adopting the approach after hearing about its success. Zambia is one of the countries that have adopted this approach of public service delivery. In December 2008, the Zambian government established a Policy Framework for the implementation of PPPs. This document outlined the government's strategic objectives for infrastructure development and effective social service delivery. This would be accomplished by implementing PPP arrangements to ensure economic growth through increased productivity, competitiveness, and wealth creation (PPP Unit Report, 2018).

In August 2009, parliament passed the PPP Act No. 14 of 2009 based on the government's policy announcement. The act seeks to encourage and facilitate the implementation of privately funded public infrastructure projects in Zambia (Zambia Development Agency, 2009). Public-private partnerships (PPPs) are long-term cooperation ties formed by the public and private sectors. PPPs are an alliance between the government and private parties that is regulated by a long-term concession/contract between two primary joint partners, the PPP concession firm and the government (Ho and Tsui 2009). As a result, any form of collaboration between public authorities and the private sector for the construction, management, and/or provision of infrastructure or public services can be considered a PPP.

As Zambia aims to become a leading commercial hub, a variety of public works have been examined, with PPPs proposed for these projects. The Public-Private-Partnerships in Infrastructure in Zambia (2014) revealed that prior to Parliament passing the PPP Act in 2009, there was only one concession agreement under its provisions, namely the redevelopment of the Long Acres Lodge by the Thuthuka Group International of South Africa. It was a $200 million project that included the construction of a five-star hotel, a shopping mall, a conference centre, an office building, and supporting infrastructure. In recent years, various studies have been carried out in order to identify and quantify the critical success factors (CSFs) of PPP projects (Ahmadabadi and Heravi, 2019). PPP practitioners in Zambia have also conducted similar studies and reported their findings. Mwanaumo et al., for example, conducted research on the unique success criteria for public-private partnerships in Zambian infrastructure projects. Previously, authors concentrated on identifying CSFs for PPP projects; however, few research in the Zambian context have studied the relationship between PPP CSFs and actual PPP project success. Furthermore, existing research on PPP tend to focus on its advantage or application in practice, while ignoring the differences in partnership qualities that are key to their success or failure (Kivleniece and Quelin, 2011).
However, the issue with PPPs has been the failure to implement critical success factors, which has resulted in inadequate infrastructure financing, budget constraints, inefficiencies in infrastructure management on the part of the public sector, and insufficient public spending (Croce and Gatti, 2015).

A variety of elements contribute to the success or failure of an infrastructure project in terms of meeting its objectives (Zhang et al., 2014). Thus, Shi et al. (2016) argue that, while it is critical to identify significant CSFs required for PPP success, it is also critical to understand that various factors influence PPP project success to varying degrees; some factors and their interactions may result in project inefficiency and ineffectiveness. The study aimed to investigate the antecedents of PPP project success by assessing the impact of PPP CSFs on actual PPP project success in Zambian infrastructure projects.

2. Literature Review

2.1. Antecedents for Public Private Partnership Success

Prominent PPP scholars also refer to the success antecedents or predictors as crucial success factors (CSFs). The effective distribution of scarce resources will be made possible by the assessment of the CSFs' impact on these goals. PPP authors have identified the CSFs using either expert views or quantitative measurements (Chan, 2010). Unquestionably, the successful implementation of PPP in certain developed and developing countries is due to the ongoing evaluations and investigation of the prevalent critical success factors (CSFs) for PPP projects in these nations (Abdel Aziz, 2007; Cheung et al., 2012; Osei-Kyei and Chan, 2015). For instance, Chan et al. (2010) use an analytical hierarchy process to survey

expert opinions on CSFs for construction projects. This suggests that before PPP to be successful in a nation, a few crucial requirements must be met (Wibowo and Alfen, 2015). CSFs were created over time based on how public-private partnership practitioners worldwide see the adoption of PPPs.

The CSFs identified by PPP researchers' steps are grouped into five primary characteristics each comprising a number of success sub factors (SSFs). A PPP project procurement process should be based on a public–private win–win paradigm. It should create a favourable atmosphere and offer the necessary support for private sector engagement, as well as implement effective procedures to guarantee that privatised projects and services meet public norms and quality. Government support and private sector contributions should be balanced. The above-mentioned systematic study approach enabled Zhang et al. (2015) to find several CSFs, which were then analysed, distilled, coded, and finally classified into five primary CSFs, each of which contained a number of SSFs. The five main CSFs are: (1) a favourable investment climate, (2) economic feasibility, (3) a dependable concessionaire consortium with strong technical strength, (4) a solid financial package, and (5) proper risk distribution through reliable contractual arrangements. The macro-environment includes a good investment climate, economic viability, and a sound financial package, according to Wibowo and Alfen (2015). Furthermore, these existing factors provide useful references for assessing the PPP project's long-term implementation (Shi et al., 2016). Zhang (2005) discovered, analysed, and classified numerous key success factors (CSFs) for public-private partnerships in general using a systematic research strategy that includes case studies, literature reviews, and interviews/correspondence with foreign experts. The industry has recognised these factors.

The PPP Success Antecedents of Infrastructure Projects

A summary of CSFs in Chinese BOT projects was provided by Qiao et al. (2001), who separated the 27 factors into six project phase categories: preliminary qualification evaluation, tendering, concession award, construction, operation, and transfer. In the PPP project, Jamali (2001) distilled 14 essential components of successful collaboration. The study of CSFs in PPP/PFI (private finance initiative) projects in the UK was improved by Li et al. in 2005. They categorised 18 factors into five groups: government guarantee, efficient procurement, the project's implementability, favourable economic conditions, and accessible financial markets (Shi et al., 2016).

Prior research, according to Mwanaumo et al. (2012), recognises CSFs in the provision of infrastructure, which includes a favourable legal framework and a well-organised public sector; government involvement in guaranteeing support and backing; authority sharing between the public and private sectors; public/private sector commitment; technical feasibility for projects; a strong private sector consortium; a stable macroeconomic environment with a favourable legal framework, among other things. Zhang (2005) went on to classify the 47 factors into five categories: economic viability, sound financial package, favourable investment environment, appropriate risk allocation through dependable contractual arrangements, and a dependable concessionaire consortium with strong technical strength.

According to Babatunde et al. (2012), public-private partnerships (PPPs) in Nigeria were implemented as a result of ongoing fiscal limitations that the different governments faced. Among these was the depletion of prospects for the complete privatisation of public infrastructure (Jones, 2002). In order to provide and run public facilities, the federal and state governments started looking into more nuanced ways to get resources from the private sector. The focus of policy discourse shifted from public sector restructuring to the pursuit of creative solutions and a more detailed examination of the precise ways in which governments may best address infrastructure needs (Yahaya, 2008). Furthermore, as explained by Osiei Kyei and Chan (2017), Ghanaian scholars conclude that steady and favourable macroeconomic indicators are necessary for the implementation of successful PPP initiatives in developing nations (Osei-Kyei and Chan, 2015; Qiao et al., 2001). Interest rates, GDP growth, inflation, unemployment, and exchange rates are examples of macroeconomic indicators. For practitioners to create accurate and trustworthy financial estimates of PPP projects, these indicators—in particular, interest and inflation rates—must remain steady for a considerable amount of time (Osei-Kyei and Chan, 2017a).

In order to successfully implement PPP projects in underdeveloped nations, prior research has emphasised the importance of political stability and support (Babatunde et al., 2012; Cheung, 2009; Dulaimi et al., 2010; Qiao et al., 2001). Furthermore, governments ought to provide private investors with full compensation if they are wrongfully harmed (Cheung et al., 2012). Chan et al. used the factor analysis technique to identify 18 CSFs while taking into account the opinions of Chinese experts. These CSFs were then categorised into five groups: prudent government control, transparent and efficient procurement processes, shared responsibility between the public and private sectors, stable political and social environments, and stable macroeconomic environments (Chan, 2010).

Khawajian et al. (2014) identified 19 CSFs of PPP projects in Syria using the Ishikawa Diagram and divided them into four groups: investment environment, administrative environment, private sector, and public sector. Political support, a strong private consortium, and appropriate risk distribution and sharing were the top three CSFs, according to Osei-Kyei and Chan's study and review of the literature on PPP CSFs from 1990 to 2013 (Osei-Kyei and Chan, 2015). Numerous research have been conducted by prior scholars to determine and assess the success criteria for PPP projects. Additionally,

these contemporary features are helpful resources for studying the sustainable execution of the PPP project (Shi et al., 2016).

Economic viability, a favourable business environment, a strong concessionaire with strong technical strength, appropriate risk allocation via a dependable contractual agreement, and a strong financial package are among the critical success factors for PPP projects, according to the reviewed literature (table 1).

Table 1: PPP critical success factors

ID	Authors	Critical Success factors				
		Favourable Investment Environment	Economic Viability	Appropriate Risk Allocation via Reliable Contractual	Reliable Concessionaire Consortium with Strong Technical Strength	Sound Financial Package
1	Sanvido et al. 1992			X		
2	Woodward 1995					
3	Walker & Smith 1995	X	X			
4	Pahlman, 1996		X			
5	Tiong 1996				X	
6	Asian Development Bank 1997			X		
7	Merna & Dubey 1998			X		X
8	Delmon, 2000			X		
9	Ye & Tiong 2000		X			
10	Akintoye & Chinyio, 2005		X			
11	Zhang, 2005		X		X	X
12	Ke et al., 2010			X		
13	Chua et al. 2010			X		
14	Zhang and Kumaraswamy, 2011	X				
15	Public Private Infrastructure Advisory Group, 2012	X				
16	Busenitz et al. 2014				X	
17	Sanni, 2016					X
18	Mwanaumo, 2016			X		
19	Almarri & Boussabaine, 2017		X			
20	European Court of Auditors, 2018				X	
21	Galilea & Medda, 2019	X				
22	Amovic et al. 2020				X	X
23	Delmon 2020			X	X	
24	Zhou et al., 2021		X			

Source: Researchers' literature survey

2.2. Theoretical and Conceptual Framework

There are several theories which have been advanced in studying the implementation of PPP projects. However, this study is anchored on two theories namely the institution theory as well as the human capital theory.

Institutional Theory

Organisational behaviour is influenced by both formal and informal institutional influences, also known as the "rules of the game," according to institutional theory (Engle, 2011; North, 1990; Scott, 1995, 2008). Nobes and Parker (2008), explain that there were external forces coming from the west that began to influence other nations to move from communism to democracy. The emergence of concepts like good governance and privatisation altered the way public institutions functioned. Public-Private Partnerships (PPPs) are institutional agreements incorporating public and private players in long-term contracts, according to Firmino (2018).

According to DiMaggio and Powell (1983), institutions can be divided into three categories: normative (morally acceptable and culturally supported), mimetic/imitative (a professionally and culturally endorsed method of coping with uncertainty),

and coercive (legally sanctioned). Scott (2008) follows this example by outlining three pillars: normative (a prescriptive, evaluative, and compulsory dimension into social life), regulatory (rule-setting, monitoring, and sanctioning activities), and behavioural. The common concepts that make up social reality and the frameworks that are used to generate meaning are represented by the cognitive.

Normative dimension

The extent to which PPP practitioners in a country respect and appreciate PPP success antecedents is reflected in the normative dimension of institutional theory. Public-private partnerships, or PPPs, are increasingly being used to acquire public works projects. The world has witnessed the success of nations like Australia and the United Kingdom. According to Foster (2010), despite Australia's lack of PPP project experience in comparison to the UK, innovative PPP practices and processes have been adopted in Victoria State in particular, building on the experiences of other nations.

Many nations have been eager to implement the approach as a result of these success stories. Zambia is among the nations that have embraced this approach to public service delivery. The Zambian government established a policy framework for PPP implementation in December 2008. This outlined the government's strategic goals to support infrastructure development and efficient social service delivery.

Regulatory dimension

These normally take the form of regulatory measures and their influence on institutions and individuals. International bodies such as the IMF and the World Bank set financial restrictions on non-democratic countries to access loans and financing. Further, urging nations to find sustainable means of delivering infrastructure products by adopting PPP CSFs that relate to putting in place a legal framework. This influenced PPP practitioner's behaviour towards the actual execution of PPPs in Zambia and other developing countries. This saw the enactment of the PPP act of 2009.

Cognitive dimension

According to Busenitz and Barney (1997), cognitive traits are elements that affect how people think and make judgements. According to Busenitz et al. (2004), the cognitive institution is made up of the common knowledge and abilities that citizens of a nation hold regarding launching and running a firm. According to a 2018 report by the European Court of Auditors, EU-co-financed PPPs in the areas of information and communication technology (ICT) and road transport in France, Greece, Ireland, and Spain show that people's abilities and experience are crucial to the successful execution of PPP projects globally.

Therefore, we may comprehend how PPP success antecedents affect real PPP project success by looking at cognitive, normative, and coercive characteristics. According to (Panayides et al., 2015), PPP project success is influenced by the institutional theory dimensions of PPP CSFs. Additionally, Opara et al. (2017) confirm that project performance and program permanence are significantly impacted by the institutional context.

Human Capital Theory

The human capital hypothesis is introduced and examined by Becker (1964) and Becker et al. (2010). Human capital is simply the skills and attributes that enable individuals to be productive. The most crucial of these is knowledge, but there are other considerations as well, such as someone's health or sense of timeliness. According to the authors, the prosperity of Asian countries like South Korea and Taiwan, who have little natural resources outside their inhabitants, is evidence of the need of investing in human capital, especially in the development of education systems.

Therefore, when assessing the impact of PPP CSFs on real PPP project success, PPP practitioners' experience (exposure) and skills are crucial. According to Tiong (1996), the most crucial success factors in competitive tendering for a PPP project are technical and financial strength. Technical assessment entails analysing designs and proposed facilities in a life cycle scenario, taking safety and health concerns as well as environmental effects into account. The private sector possesses the capabilities necessary to carry out PPP arrangements, which is why PPPs with the private sector are necessary. Furthermore, it is crucial to evaluate how exposure to technical strength affects the performance of PPP projects in practice. The study's initial conceptual framework, or model, was created based on the theoretical basis mentioned above.

Conceptualisation

Panayides et al. (2015) and Luethje and Franke (2003), among other academic publications (Chua et al. 2010; Mwanaumo, 2016; Almarri & Boussabaine, 2017; Galilea & Medda, 2019; Delmon 2020; Zhou et al., 2021), provided guidance for the conceptual framework that was modified for this investigation. The preposition is that, as figure 1 illustrates, there is a direct relationship between and among the variables.

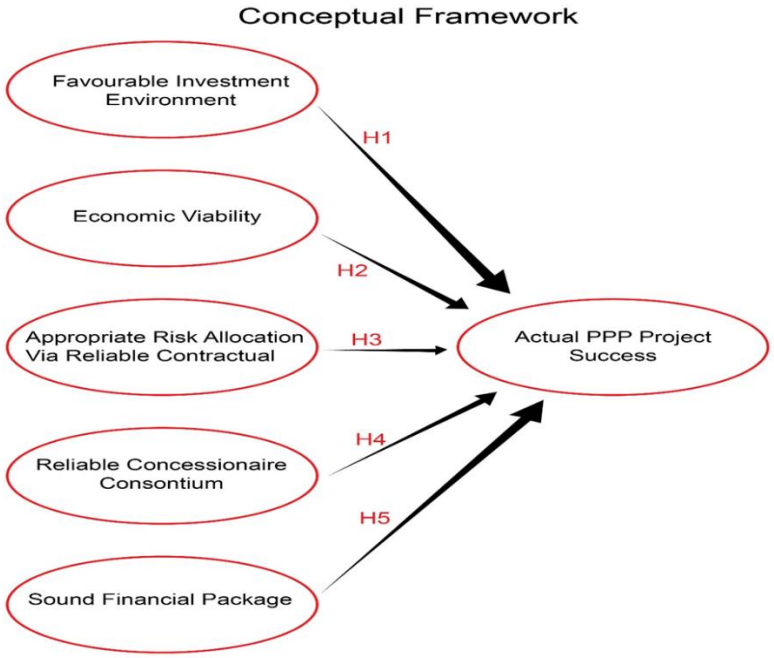

Figure 1: Antecedents (CSFs) of actual PPP project succes
Source: adapted from (Luethje and Franke, 2003; Panayides et al., 2015).

Favourable Investment Environment and Actual PPP Project success

A positive business environment is one in which the climate in which public infrastructure projects are implemented has a significant impact on the willingness of private sector lenders and investors to construct such projects. To enable the creation of efficient contractual vehicles for PPPs that are in line with a nation's legal system, a practical legal and regulatory framework should be put in place. According to Galilea and Medda (2010), the success of PPP projects in that nation was largely due to a positive business environment. Consequently, the success of a PPP project is influenced by a suitable business environment. The study makes the following assumptions in light of these viewpoints:

H_1 A favourable business environment engenders actual PPP project success.

Economic Viability and Actual PPP project success

Building on the theories outlined above, economic viability is essential to every project's success. Many factors influence a PPP infrastructure project, but in particular: (1) long-term demand for the project's goods and services; (2) little competition from other projects; (3) enough project profitability to draw investors; (4) long-term cash flow that appeals to lenders; and (5) long-term availability of suppliers required for the project's regular operation. Financial viability has traditionally been assessed using four methods: internal rate of return, net present value, discounted payback period, and payback period (Woodward 1995, Ye and Tiong 2000). Determining how the proposed project would affect the procurer's cash flow and overall financial situation is the aim of the economic appraisal (Boussabaine, 2006). According to Almarri and Boussabain (2017), economic factors have an impact on PPP success and cash flow timing needs to be taken into account. According to the researchers' hypothesis, PPP projects' economic viability is influenced by value for money metrics. Thus, researchers conclude that the success of genuine PPP projects is greatly influenced by economic viability. The study makes the following assumptions in light of these viewpoints:

H_2 Economic Viability influences actual PPP project success.

Appropriate Risk Allocation via Reliable Contractual Agreements and Actual PPP project success

For construction projects, the contractual structure (contract type, contract-award procedure, and risk allocation) is a CSF (Zhang, 2005). To create a more efficient contract negotiation process and lower the incidence of disagreement throughout the concession period, it is critical that the public and private sectors develop efficient risk distribution mechanisms for public-private partnership (PPP) projects (Ke et al., 2010). According to earlier studies, improper risk distribution in a PPP project can have disastrous consequences for the project's success. Accordingly, PPP project success is greatly influenced by proper risk distribution through trustworthy contractual arrangements (Mena and Dubey 1998; Delmon 2020). The study makes the following assumptions in light of these viewpoints:

H_3 Appropriate risk allocation via reliable contractual agreements influences actual PPP project success.

Reliable Concessionaire Consortium with Strong Technical Strength and Actual PPP project success

Private sector players are crucial to the successful execution of specific PPP projects, even though the government is better

positioned to foster an environment that encourages private sector involvement in public infrastructure development generally. One notable aspect of the PPP system is the significant realignment of risks among several project partners, where the concessionaire takes on significantly greater responsibilities and carries far deeper and broader risks than a simple contractor (Zhang, 2005).

The most crucial success elements in competitive tendering for a PPP project are technical and financial strength (Tiong 1996). (Amovic et al., 2020) indicates that when line ministries and commissions participating in project planning and oversight lack sufficient technical skills regarding project funding, risk appraisal, and contract design, it inhibits the success of PPP projects. According to earlier research by Ismail (2014), actual PPP project success is influenced by prior PPP exposure. According to Busenitz et al. (2014), the cognitive institution is made up of the common knowledge and abilities that citizens of a nation hold regarding launching and running a firm. The study makes the following assumptions in light of these viewpoints:
H_4 Reliable concessionaire consortium with strong technical strength influences actual PPP project success.

Sound Financial Package and Actual PPP project success
According to (Zhang, 2005), project finance can make use of a variety of financial instruments, including debt, equity, mezzanine finance, contractor, supplier, and buyer credit, or sureties. Since lenders and investors have no alternative source of funding and the project's assets may or may not have residual value, a strong revenue stream is the foundation of project finance (Merna and Dubey 1998; Amovic et al., 2020). According to Sanni (2016), a strong financial package plays a major role in a PPP project's success. The study makes the following assumptions in light of these viewpoints:
H_5 A sound financial package influences actual PPP project success.

3. Research Methodology

Data from 90 PPP practitioners from both public and private sector organizations—including the Road Development Agency (RDA), Ministry of Finance, Zambia Development Agency (ZDA), University of Zambia, East Park Mall, Levy Mall, and Industrial Development Corporation (IDC)—were gathered for this study using a descriptive cross-sectional survey design. Two criteria were used to choose the responders: 1) They must be sufficiently knowledgeable about PPP; 2) They must have practical experience with PPP projects, have conducted PPP research, or have closely followed the evolution of PPP as defined by Cheung et al. (2010). Given that there were 146 PPP practitioners in Lusaka at the time of the study, a minimum representative sample of 96 would be needed, with a 90% confidence level and a 5% margin of error (Raosoft, 2021). Questionnaires were given to respondents directly in order to lower the possibility of a poor response rate. Additionally, respondents were continuously reminded and monitored to make sure they completed the questionnaires. This resulted in 90 of the 96 questionnaires that were actually distributed receiving a successful answer.
to investigate the PPP project's antecedents (CSFs) on Zambia's public infrastructure project success. Through the questionnaire survey, the practitioners' opinions regarding the impact of PPP success antecedents on real PPP project success were recorded. For this study, a structured questionnaire template was modified based on information from Zhang (2005) and Li (2003). There were a number of benefits to using a tool created by the identified scholars rather than creating a new template, even if the authors might have created their own research instrument. There is a good chance that the questionnaire's 5-point scale, which is weighted from 1 to 5, will yield distributions that can be regarded as interval data (Mwanaumo et al., 2016; Ngoy et al., 2023).

4. Findings

Among the successful responses 51% of the respondents represented the private sector participants with PPP experience in Zambia, while 33.3% represented the public sector participants with experience and knowledge in PPP projects. The remaining percentage (15.6 %) represented the other stakeholders from other sectors with PPP experience as shown in figure 2.

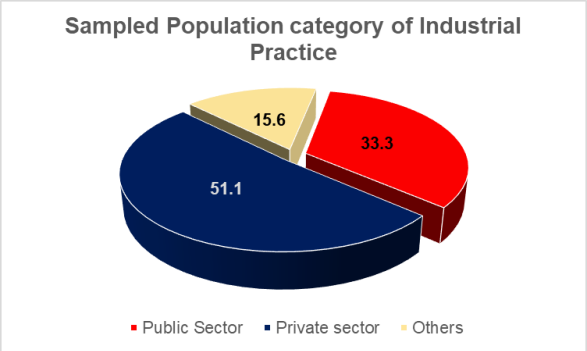

Figure 2: Sampled population by sector

4.1. Level of education, experience and expertise

With regard to the respondents' level of education, 28.9% of the respondents had degrees, 46.7% had masters' degrees and 8.9% had professional qualifications. On the areas of expertise 42.2% of the respondents were from Finance / Accounting, 18.9% of the respondents in Construction / Civil engineering, 16.7% of the respondents in social work, 5.6% of the respondents in Administration, 7.8% of the respondents in Law/ Human resource and 8.9% of the respondents were from Economics as shown in table 2.

Tables 2. Level of education, experience and expertise

Sample Variable		Frequency (n)	Percent (%)
Level of Education			
1	Degree	26	28.9
2	Masters Degree	42	46.7
3	Doctorate	14	15.6
4	Professional Qualification	8	8.9
Area of Expertise			
1	Finance/Accounting	38	42.2
2	Construction/Civil Engineering	17	18.9
3	Social Work	15	16.7
4	Administration	5	5.6
5	Law/Human Resource	7	7.8
6	Economics	8	8.9

4.2. Measurement of variables

The questions used to assess advantageous business conditions, economic viability, a dependable concessionaire consortium, a solid financial package, suitable risk distribution, and actual PPP project success are shown in Table 3. A high level of internal consistency is indicated by any Cronbach's Alpha value above the minimum cutoff of 0.70 (Pallant, 2016). The data was examined for completeness, outliers, and missing information. By averaging the data, central tendency metrics like mean, mode, and median were mostly employed for analysis. Skewness and kurtosis were also checked and showed to be within acceptable range of +2 and -2 (George and Mallery, 2003; Mwiya et al., 2017).

Table 3: Measurement of variables

Variable	Items	Cronbach's Alpha
Favourable Business Envionment	Stable political system	0.969
	Favourable Economic system	0.968
	Adequate local financial market	0.968
	Predictable currency exchange	0.968
	Predictable and reasonable legal framework	0.968
	Government support	0.969
	Supportive and understanding community	0.969
	The project is in public interest	0.968
	Predictable risk scenarios	0.968
	The project is well suited for privatisation	0.969
	Promising economy	0.968
Economic viability	Long term demand for the products/services offered by the project	0.968
	Limited competition from other projects	0.970
	Sufficient profitability of the project to attract investors	0.968
	Long term availability of suppliers needed for the project	0.969

Reliable Concessionaire Consotium	Leading role by a key enterprise or enterpreneur	0.969
	Effective project organisation structure	0.968
	Good relationship with the host goverment authorities	0.969
	Partnering skills	0.968
	Rich experience in international PPP project management	0.969
	Multi-displinary solution	0.968
	Sound technical solution	0.969
	Innovative technical solution	0.968
	Cost effective technical solution	0.968
	Low environment impact	0.968
	Public safety and health consideration	0.968
Sound Financial Package	Sound finacial analysis	0.969
	Investment payment and drawdown schedules	0.969
	Sources and structure of main loans and standby facilities	0.968
	Sufficient profitabiity of the project to attract investors	0.968
	High equity/debt ratio	0.969
	Low financial charges	0.968
	Fixed and low interest rate financing	0.968
	Long term debt financing that minimizes refinancing risk	0.968
	Abilities to deal with fluctuations in interest/exchange rates	0.969
	Appropriate toll/tariff levels and suitable adjustments formula	0.968
Appropriate Risk Allocation	Concession agreement	0.969
	Shareholder agreement	0.969
	Design and construct contract	0.969
	Loan agreement	0.968
	Insurance agreement	0.968
	Supply agreement	0.968
	Operation Agreement	0.968
	Oftake agreement	0.968
	Guarantees/support/comfort letters	0.968
Actual PPP Project Success	PPP Success antecedents have actually influenced the successful implementation of PPP project(s) in the last five years	0.969

4.3. Preliminary Statistical Analyses

To investigate the link between variables, correlation is frequently utilised (Pallant, 2010). The means, standard deviations, and intercorrelations between the dependent, independent, and control variables from the survey sample are displayed in Table 4 of the current study. The conventional linear regression assumption that there is no linear relationship between explanatory variables is broken by multicollinearity. Multicollinearity can be found using the high variance inflation test. In a multiple regression model, it appears as a statistical phenomenon where two additional predictor variables have a high correlation (often between 0.80 and 0.9 correlations), allowing one to be linearly predicted from the other or variables with a non-trivial degree of accuracy (Pallant, 2010; Mwnanaumo et al., 2025).

Table 4: Correlations among Variables

# Variables	Mean	Std.Deviation	N	1	2	3	4	5	6	7
1. Actual PPP Project Success	3.572	0.709	90	-						
2. Gender	0.390	0.490	90	0.007	-					
3. Age	3.020	1.005	90	0.116	-0.018	-				
4. Reliable Concessionaire Consortium	3.662	0.571	90	.211*	-0.147	0.052	-			
5. Sound Financial Package	3.594	0.753	90	.639**	0.105	0.16	.223*	-		
6. Economic Viability	3.600	0.800	90	.566**	0.134	0.095	0.129	.530**	-	
7. Favourable Business Environment	3.591	0.715	90	.424**	0.002	-0.181	0.087	.305**	0.183	-
8. Appropriate risk allocation	3.696	0.625	90	.856**	0.115	0.002	0.103	.597**	.775**	.297**

*** Correlation is significant at the 0.05 level (2-tailed).** **** Correlation is significant at the 0.01 level (2-tailed).**

Even while the model's overall predictive capacity may include independent variables, multicollinearity reduces the interpretation of a particular coefficient, which is why testing for it is crucial (Hair et al., 2006). According to Hair et al. (2006), a high multicollinearity indicates that other independent variables strongly predict an independent variable.

Low inter-correlations between the variables in the current study indicate that multicollinearity shouldn't be an issue (Hair et al., 2006; Burns and Burns, 2008; Wang and Ahmed, 2009; Pallant, 2010). Regression analyses can therefore be performed without concern for skewed or exaggerated estimations of regression and correlation coefficients; the resulting coefficients of determination (R2) will not be excessively inflated.

Correlations between Actual PPP project success and its antecedents

Table 4 shows that actual PPP project success has statistically demonstrated significant correlations with its antecedents, which include a dependable concessionaire consortium with strong technical strength, a sound financial package, economic viability, a favourable business environment, and appropriate risk allocation. This is consistent with institutional theory by Scott (1980), Panayides et al. (2015), and Baker (1964).

Reliable concessionaire factors exhibit a significantly positive correlation effect on actual actual PPP project success.

Reliable concessionaire factors are negatively linked to age and gender. The age and gender of a PPP practitioners does not influence actual PPP project success. Sound financial package factors indicate a significantly positive correlation effect on actual actual PPP project success. A sound financial package is also positively related to a reliable concessionaire consortium. Actual PPP project success is increased by the combined impact of other PPP success antecedents, such as a dependable concessionaire consortium with strong technical strength, economic viability, a favourable business environment, and appropriate risk allocation to financial package factors (Shi et al., 2016; Ngoy et al., 2023).

Economic viability factors indicate a significantly positive correlation effect on actual actual PPP project success. Economic Viability factors are not significantly related to reliable concessionaire consortium factors but positively related to sound financial factors. According to Shi et al. (2016), it's also critical to recognise that different elements affect PPP project success to differing degrees; certain aspects and their interconnections may result in the project's inefficiency and ineffectiveness. Favourable business factors and appropriate risk allocation confirm significant positive correlations with actual PPP project success.

This therefore, this means that the presence of PPP success antecedents increases the likelihood for actual PPP project success. All five PPP success antecedents where significantly correlated ($p<0.01$ and $p<0.005$) with actual PPP project success.

The findings agree with supports prior studies conducted in Nigeria by Babatunde et al. (2012), Asia by Zhang (2005), and Zambia by Mwanaumo et al (2016) inter alias, that PPP success factors influence actual PPP project success.

Regression Analysis between Actual PPP project success and its Antecedents

Results of regression analysis evaluating the fundamental Lumpkins and Dess five-dimension model are shown and discussed in this section. To make sure the assumptions of normality, linearity, multicollinearity, and homoscedasticity were not broken, preliminary analyses were conducted. Low variance inflation factors (VIF<5) further support the idea that multicollinearity shouldn't be an issue among the variables in any of the simple and multiple regression analyses carried out in this study (Burns and Burns, 2008; Hair et al., 2006; Pallant, 2010; Wang and Ahmed, 2009; Ngoy et al., 2023).

According to the table in appendix 8.8, all of the VIFs are less than five. This means that biassed or exaggerated estimates of regression and correlation coefficients are not a concern when performing multiple regression analyses and hierarchical regression. There is no overestimation of the resultant coefficients of determination (R2). Additionally, every regression coefficient points in the anticipated upward direction.

The aggregate findings showed that real PPP project success for infrastructure works is influenced by the previously described PPP success antecedents. The good business environment, dependable concessionaire consortia, sound financial, economic viability, and suitable risk distribution are some of these antecedents. As indicated in Table 5, the hypotheses are validated at the 0.1%, 1%, or 5% level of significance.

Table 5: Hypothesis authentication

Hypothesis	Description	Test	Coefficient
H1	A favourable investment environment engineers actual PPP success	Regression	.173***
H2	Economic viability influences actual PPP success	Regression	.211*
H3	Appropriate risk allocation influences actual PPP success	Regression	.141**
H4	Reliable concessionaire influences actual PPP success	Regression	.285***
H5	Sound financial package influences actual PPP success	Regression	.939***

***Significant at 0.0001 level. **Significant at the 0.01 level. *Significant at the 0.05 level.

4.4. Discussion

According to the results of this study, actual PPP project performance for big works is greatly influenced by a number of elements, including a favourable business environment, a dependable concessionaire consortium, good financial considerations, economic viability, and proper risk allocation considerations. On the other hand, age and gender had indicated a markedly unfavourable correlation with the success of genuine PPP projects. Sound financial variables, economic viability, and suitable risk distribution factors are the biggest determinants of real PPP project success, according to the precisely assessed Hierarchical regression model.

The findings from this research have supported the conceptual model and all the hypothesis relationships. This means that the higher the presence of PPP success antecedents and skilful application of these success antecedents, positively influences the actual PPP project success for large infrastructure works. These findings are thus in line with the findings of (Babatunde et al. 2012; Adegoke, Amovic et al., 2020; Shi et al., 2016; Armento, 2010; Zhang, 2005) inter alia, that nations that ensure there is a presence and skilful application of PPP critical success factors are more likely to successfully

execute PPP infrastructure projects.

The study further observes that the PPP framework has the potential to provide a win- Win scenario for governments in developing countries and the private sector in those countries when PPP CSF are well understood and applied. The study further suggests that this may significantly contribute to providing quality, cost effective services to the public without stressing government expenditure, reduction in government debt construction, increased private sector participation and national development.

The study also confirms the findings of Mwanaumo et al. (2016), who found that the public and private entities' perceptions of the CSFs on the delivery of infrastructure projects were not positive. It can be assumed that both parties valued successful project implementation and that it helped them accomplish the contract's goals.
Hypothesis review

Do favourable business environment factors engender actual PPP project success?
H1: This study has proved that favourable business environment factors influence actual PPP project success for infrastructure works. This means that the more favourable business environment factors present themselves in PPP projects, the less likely for PPP projects in infrastructure to fail (Cheung et al., 2010).

Do economic viability factors influence actual PPP project success?
H2: This research has confirmed that economic viability factors influence actual PPP project success for infrastructure works. This supports conclusions made by (Almarri and Boussabaine, 2017) that economic viability factors have a significant impact on PPP project success.

Does appropriate risk allocation via reliable contractual agreements influence actual PPP project success?
H3: According to the research, proper risk distribution considerations have a positive impact on the success of PPP projects for infrastructure projects. This confirms the findings of earlier researchers that proper risk sharing and allocation ensure the most possible advantages from PPPs through risk minimisation, allocation to the most qualified partner, and risk limiting.

Do concessionaire consortium factors influence actual PPP project success?
H4: The success of genuine PPP projects for infrastructure works is influenced by trustworthy concessionaire consortium characteristics, as the report has confirmed. Thus, choosing the best concessionaire is essential to the project's success. A competitive tendering process can help achieve this. According to Tiong (1996) and Amovic et al. (2020), the most crucial success elements in competitive tendering for a PPP project are technical and financial strength.

Do sound financial factors influence actual PPP project success?
H5: The paper has affirmed that; a sound financial package has a significant impact on the actual PPP project success. This supports conclusions made by prior researchers that the preparation of a sound financial package is key to the successful delivery of a PPP project (Sanni, 2016).

5. Conclusion and Implications

This study has made it possible to compare and comprehend the actual PPP adoption of the antecedents. This is important because, from the beginning of a business case, policy makers and practitioners will have a better foundation for decision-making if they have a thorough understanding of PPP CSFs and how they affect the success of PPP projects. The effective distribution of scarce resources will be made possible by the assessment of the CSFs' impact on these goals. Cooperating partners will be able to better utilise the PPP CSFs by offering a resilient and sustainable service thanks to this study.
Policy makers and practitioners must understand the predicting variables that lead to actual PPP project success. This will may help them appropriately allocate risk. Some of the challenges in the execution of the Ndola-Lusaka dual carriage way PPP road project and other pending PPP projects could have been averted by making use of the information provided in this research on risk allocation and comparator analysis.

Conflict of Interest

The authors declare that they have no conflicting interests

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Data Availability statement
The data used to support the findings of this study are available from the corresponding author upon request.

Ethical considerations

The article followed all ethical standards appropriate for this kind of research.

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