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An Analysis of the Causes of Public-private Partnership Project Failure in South Africa

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Abstract

Public-private partnerships (PPPs) are collaborations between government agencies and the private sector to provide the public with goods and services. PPPs play a role in expanding and financing government infrastructure and services. South Africa experiences challenges in managing PPP projects due to for example political interference, corruption and a lack of transparency between the partners. This results in a shortage in infrastructure investment, which will cause economic strain in the future. The purpose of this study is to "analyze the causes of public-private partnership project failure in South Africa". The study adopted a quantitative approach, through a literature review and questionnaire survey. Eight factors namely completion time, communication, political interference, project planning, skills/experience, change in project scope, corruption, and disputes and conflict between parties were measured using the forced four-point Likert scale. The findings were that political interference (18.9%), lack of communication (17.2%) and dispute and conflict (15.5%) ranked highest in the study. Accusation and corruption, project planning and completion time scored low. Engineering managers should use these rankings as lessons learned going into future PPP projects. Artificial intelligence (AI) is recommended to converge the PPP factor for transparency during project phases. To assess allegations of corruption gaps, the public sector should have a larger share of participants than the private sector.

Keywords
Public-private Partnership, Failure, Quantitative, Cronbach's Alpha, and Models for PPP Projects.

1. Introduction
Public-private partnerships (PPPs) have gained increasing recognition in recent decades for their role in expanding and financing government infrastructure and services. The effectiveness of PPPs has led to the widespread adoption of this approach by over forty countries globally (Babatunde et al. 2015). Kang et al. (2019), define the PPP as one type of service arrangement in which the public and private sector enter into a long-term cooperative relationship to deliver a public good or service. It is more likely the underlying financial benefits and practicalities that have motivated the formation of PPPs, rather than ideology. Given the public sector's general lack of resources, skills, capacity and competencies in the provision of infrastructure and services it has become necessary to incentivize the participation of the private sector. Their greater capacity and competencies for providing innovative, sustainable and cost-effective infrastructure development and service delivery, while also reducing corruption, are sought by the public sector. In South Africa, the PPPs have adopted the model structures for infrastructure development and service delivery as outlined in Treasury Regulation 16, 2004 (National Treasury of South Africa, 2004). It entails the following: design, build, operate and transfer (DBOT) projects; design, finance, build, operate and transfer (DFBOT) projects; equity partnership projects; facilities management projects and design, finance and operate (DFO) projects. The problem that arises is that in the absence of certain critical factors, the above-mentioned models do not guarantee the success (or failure) of the projects embarked on. Examples of PPP successes and failures are briefly outlined below.

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- *Global Success:* the United Kingdom is widely recognized as the pioneer in implementing the contractual PPP model known as DBFMO (Design, Build, Finance, Maintenance and Operation). Interestingly, the Netherlands has also embraced and adopted this model where it has achieved even more impressive outcomes compared to other European countries (Koppenjan and de Jong 2018).

- *Local Success:* according to the Washington University Global Studies Law Review (2019), South Africa was ranked the first developing country in Africa in comparison to nineteen other African countries, to consistently execute and sustain their PPP projects. The study was conducted by the World Bank Group and the Public-Private Infrastructure Advisory.

- *Global Failure:* Babatunde et al. (2015) have exposed a few of the PPP projects that failed in Nigeria, like the 105 km Lagos-Ibadan expressway worth US$597 million, the cancellation of the Murtala Mohammed Airport terminal worth US$250 million and the cancellation of the Nnamdi Azikiwe Airport in Abuja. From the above examples, it can be appreciated that the failure of different PPP projects was caused by many factors such as poor leadership, poor planning and estimation, a lack of communication, frequent design scope changes, poor contracting and contractor practices, socio-cultural and political interference, to mention a few (Eja and Ramegowda 2020).

- *Local Failure:* the Gautrain study by Fombard defines the Gautrain project as a failure due to exceeding the expected time of completion. Regarding the project's timeline, the following facts were reported. The project started in 1999 with a feasibility study, declared in parliament in 2000 and approved in 2001 by the National Treasury. The procurement stretched from 2002 to 2006, and the initial phase of the project, pressured by the 2010 Football World Cup deadline, was completed by June 8, 2010 (Fombad 2015). Moreover, the study was able to pinpoint factors that affected the successes and failures of this project, such as accountability, transparency, political will, participatory involvement, risk sharing, environmental issues and social processes.

Despite various studies that point to factors affecting the success of PPP projects in different sectors, especially in developing countries, it is important to identify and rank these obstacles, as they can help engineering managers participating in PPP projects (Babatunde et al 2015). This paper aims to analyze the causes of the failure of South African PPP projects.

1.1 Objectives

The overall aim of this research study is to evaluate the key factors contributing to the failure of PPP projects in South Africa. To explore further, the following research questions were formulated (a) "What are the primary factors that lead to the failure or successes of PPP projects in South Africa?" was identified, formulated and defined with the following supporting research questions. (b) What modes of failure are evident in PPP project failure? (c) What strategies are recommended for preventing such failures of PPP projects in South Africa to address the identified research problems? The research objectives (ROs) for this study were focused as follows:- RO1 - to define what distinguishes the success or failure of a PPP project and to identify the criteria for measuring the failure or success of PPP projects; RO2 - to determine and rank the primary causes of the failure of PPP projects in South Africa; and RO3 - to recommend strategies for addressing these primary causes of failure in PPP projects in South Africa.

2. Literature Review

The Public-Private Partnership Handbook produced by the Asian Development Bank provides the following definitions and descriptions of PPPs. When referring to a diversity of potential partnerships or contractual agreements between public organizations for infrastructure and other services, the term "public-private partnership" is utilized (Felsinger 2008). Section 217(1) of the 1996 Constitution of the Republic of South Africa states that all organs in the national institution are mandated to provide goods and services and must do so in obedience to a system that is equitable, fair, cost-effective, and transparent (Fombad 2015). Ruiters and Matji (2016) have stated that "countries like South Africa have no choice but to look at innovative approaches, such as public-private partnerships (PPP) models". It is thus important to study the factors that influence such PPP projects. The percentage contribution of PPP contracts to the South African GDP in 2015 was 21% (Fombad 2015) and this percentage is projected to grow to 30% by 2030. According to Matshonisa Seeletse (2016), Canada used PPPs to grow its economy.

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PPPs are regulated differently in every country. In South Africa, a typical PPP project cycle is administered by the National Treasury under Regulation 16 of the Public Finance Management Act, 1999. The PPP project cycle is guided through the following five phases: inception, feasibility study, procurement-development, delivery and exit. It is, therefore, significant to define PPPs from different authors' perspectives. The public partners in a PPP are government entities, including departments, municipalities, state-owned enterprises, or ministries (Felsinger 2008). The private partners may be domestic or foreign companies or investors with applicable technical or financial experience (Felsinger 2008). Kudtarkar (2020), stresses that a PPP project needs technical experts with extensive experience in financing private projects, creating effective project teams and building organizational structures. The public command team has to appoint a private partner that will safeguard the project to be completed on time and within budget. PPPs have been completed globally in the following sectors: roads, railways, prisons, hospitals, power generation and distribution, refuse disposal, water and sanitation, stadiums, air traffic control, housing, pipelines and information technology systems (billing and other systems), to name a few (Felsinger 2008).

PPP Project Failure in South Africa and Globally

Three types of failure that can happen in an organization such as intelligent, preventable and unavoidable failure. Zheng et al. (2013), define failure as an event below expectations. Another project for tourism infrastructure development in South Africa that failed could not deliver the expected outcomes of sustainability and community growth. The failure was due to a defective feasibility study and wrong revenue stream projections (Rogerson 2016). On the 12th of October 2022, the Minister of Finance Mr. Enoch Godongwana announced the elimination of e-tolls (SANRAL – South African National Road Agency SOC Ltd) on the Gauteng freeways. This decision resulted in a R47 billion debt, which was divided 30/70 between the national and provincial governments of Gauteng (Mosala and Chinomona 2020;). According to Umar et al. (2019), between 2000 and 2015 more than 250 water projects have been called off worldwide. They further mention that five electrical PPPs were canceled in sub-Saharan Africa in 2009. In the USA a proposed bridge project failed (Umar et al. 2019). Table 1 lists causes that have led to PPP failures in South Africa. The list does not follow any chronological order. The causes were drawn from different studies that directly and indirectly influenced PPP project failure in South Africa. Both the global and local PPP failures carry similar factors and were incorporated as indicated in Table 1 below.

Table 1. Causes of PPPs project failure (Fombad 2015; Warsen et al. 2020; Eja and Ramegowda 2020; Babatunde et al. 2015; Nieto-Garcia and Guzman 2019; Babatunde and Perera 2017; Uddin and Akter 2021; Taherdoost and Keshavarzsaleh 2016)

1. Inadequate feasibility study and forecasting skills
2. Accusations of corruption and corrupt tendencies
3. Inadequate PPP skills and knowledge
4. Inadequate project management by the public sector
5. Poor risk identification, allocation and management
6. Lack of transparency and accountability
7. Inexperienced private partners
8. High cost in procuring PPP projects
9. High end-user charges
10. Inadequate government commitment and support
11. Long-term disputes and conflicts between parties
12. Inadequate mechanisms for recovery of private investors' capital
13. Lack of competition
14. Societal discontent against the private sector
15. Poor enabling policies
16. Poor regulatory frameworks and guidelines
17. Law and regulation charges
18. Problem of administrative procedure and guidelines
19. Difficulties in securing credit facilities from banks

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20. Perceptions of a country or nation as a high-risk economy by foreign investors
21. Lack of independence of the regulatory body
22. Difficulty in specifying work requirements and the quality of service
23. Poor evaluation, monitoring and due diligence by the public sector
24. Project management skills
25. Contract design skills
26. Stakeholder management skills
27. Engineering skills
28. Poor communication
29. Poor project planning
30. Change in project scope
31. Poor financial capacity
32. Socio-cultural and political interference
33. Poor contracting and contractor practices
34. High project revenue risk
35. Sudden change in the cost of debt
36. Delay in debt syndication
37. Failure to manage equity in time
38. Recession in economy
39. Delay in getting project approval
40. Policy restrictions on risk acceptance
41. Fluctuation in foreign exchange
42. Liquidity crisis in the market

PPP Project Success in South Africa and Globally

South Africa as a developing country, is not immune to both the successes and failures of the PPP projects that are experienced globally. In South Africa high monetary investment is prioritized towards the PPP to develop infrastructure (Matshonisa Seeletse 2016). In the study undertaken by Walwyn and Nkolele (2018), South Africa yet again has demonstrated the success of a PPP in the Biovac Institute project which was responsible for managing the localization of vaccine research and development, manufacturing and supply. In 1999 South Africa formalized the PPP structure with the National Treasury (Walwyn and Nkolele 2018) and, according to the South African government, established that the infrastructure stake as a total percentage of GDP needs to grow from 21% in 2015 to 30% by 2030. As a result, PPP models can have a greater impact on the development of such projects (E Public-private Partnerships 2017). Many studies identify the importance and success of PPPs in advancing the economies of less developed countries and resource-rich countries (Babatunde and Perera 2017) and drastically improving their GDPs (Uddin and Akter 2021). For example, Nigeria, between 1990 and 2015, successfully closed 56 PPP infrastructure projects valued at US$39.4 billion (Babatunde and Perera 2017). Colombia developed the fourth PPP road program (4G) which amounted to a US$26.5 billion total investment in 2013 (Nieto-Garcia and Guzman 2019). Canada is known globally as the main hub user of the PPPs with more than 200 infrastructure projects completed successfully between the early 1990s and 2018 (Warsen et al. 2020). It has become evident that both developing and developed countries continue to invest in the PPP model, which is the backbone of any nation's economic financial freedom (Babatunde and Perera 2017). Below depicts South Asia as a developing country, with investment down in 2002 and then starting to show incredible growth from 2006 to 2012, in comparison with other developed countries (Figure 1).

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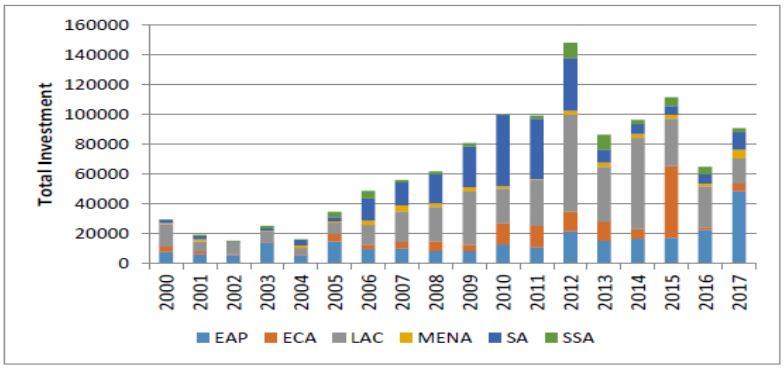
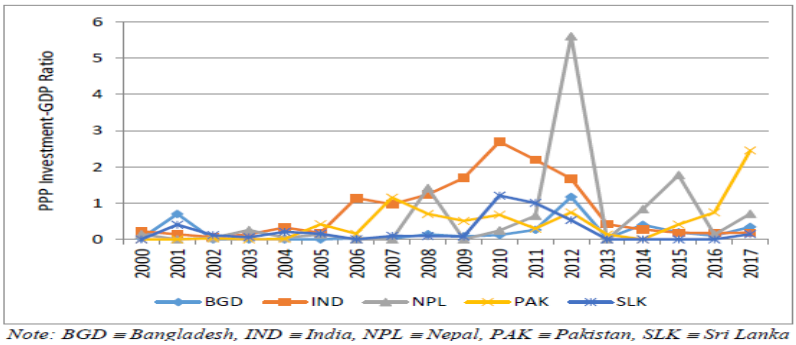


Note: EAP = East Asia and the Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MENA = Middle East and North Africa, SA = South

Figure 1. PPP investment in South Asia and comparable regions. (Uddin and Akter 2021)

According to Das et al. (2018), the economic growth of a country depends on capital investment by both the public and private sectors. Moreover, Uddin and Akter (2021) show the PPP investment in terms of the GDP ratio in comparison with the different countries in South Asia, where all countries experienced a 0.5% decline ratio in 2005, but then grew impressively from 2006 to 2017. See graph in Figure 2.



Note: BGD = Bangladesh, IND = India, NPL = Nepal, PAK = Pakistan, SLK = Sri Lanka

Figure 2. Trends in PPP investment (% of GDP) in South Asia, 2000-2017 (Uddin and Akter 2021)

Successful PPP Projects in South Africa Using Different Models

PPPs in South Africa can engage in different project models that are already in existence as mentioned in Chapter 1 of the National Treasury prescript (National Treasury of South Africa, 2004). Many projects in South Africa were completed on different contractual models agreed upon by both the government and private sector. For example, the Gautrain Rapid Rail Link project of which the feasibility study was initiated in 1999 and declared official in parliament in the year 2000, followed the DFBOT-type PPP (Fombad 2015). Other projects such as the Inkosi Albert Lithuli hospital, Department of Trade and Industry head office accommodation, Free State Social Grant Information System, and the Department of Labour and Correctional Services maximum correctional service facilities as depicted in the table below, had chosen different contractual models (Table 2).

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Table 2. List of PPP projects concluded in South Africa (E Public-private Partnerships, 2017)

Project Name	Government Institution	Type	Date of close	Duration	Financing structure	Project value R million	Form of payment
Gautrain Rapid Rail Link	Gauteng Dept of Public Transport, Roads and Works	DFBOT	Sep-2006	20 years	Debt 11% Equity 2% Govt 87%	31800	User charges and patronage guarantee
SANRAL N4 East Toll Road	SANRAL	DFBOT	Feb-1999	30 years	Debt 80% Equity 20%	3200	User charges
Mangaung & Makhado Maximum Security Prisons	Dept of Correctional Services	DFBOT	Aug-2000	30 years	Debt 88% Equity 12%	3600	Unitary payment
Polokwane Hospital renal dialysis	Limpopo Dept of Health and Social Development	DBOT	Dec-2006	10 years	Equity 100%	88	Unitary payment
Inkosi Albert Luthuli Hospital	Kwazulu-Natal Dept of Health	DFBOT	Dec-2001	30 years	Debt 70% Equity 20% Govt 10%	4500	Unitary payment
Cradle of Humankind Interpretation Centre Complex	Gauteng Dept of Agriculture, Conservation, Environment and Land Affairs	DBOT	Oct-2003	10 years	Equity 100% Govt 100%	39	User charges
Social grant payment system	Free State Dept of Social Development	DFO	Apr-2004	3 years	Equity 100%	260	Unitary payment
Head office accommodation	Dept of Trade and Industry	DFBOT	Aug-2003	25 years	Debt 80% Equity 8% Govt Govt 12%	870	Unitary payment

In many of these PPP projects a unitary payment was agreed upon. This means the private party was reimbursed for meeting its commitment in a PPP (Glossary. Available from: https://www.treasury.gov.za/documents/national%20budget/2022/review/Glossary.pdf' 2002).

3. Methods

The study followed the onion layers as depicted in **Error! Reference source not found.**. The philosophy focused on an approach of positivism, as testable hypotheses and research topics were generated (Melnikovas 2018).

Due to the nature of the questions, a "mono-method quantitative research" was adopted. A "mono-method quantitative research" study uses only one quantitative research method to collect and analyze data. This approach focuses on numerical data and statistical analysis to investigate research questions. It contrasts with "multi-method" or "mixed method" approaches, which incorporate both quantitative and qualitative methods.
The strategy was to use a survey. Time horizons used the cross-sectional approach as data were collected once over one and a half months. Technique and procedure data were collected using a Google form.

3.1 Research Design

The researcher used the descriptive non-experimental approach as it involves collecting data through surveys. The research methodology for this study was quantitative using close-ended Likert scale questionnaires. The study was not limited to any public and private organizations. Data was collected for analysis before being consolidated into results. See Figure 3 for the flow diagram of the research design.

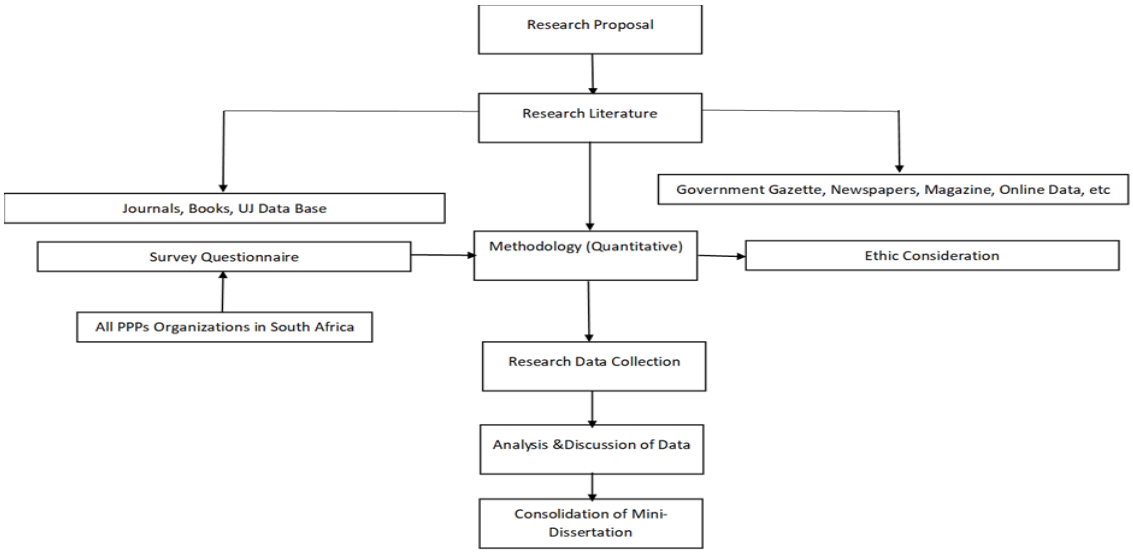

Figure 3. Research design flow diagram.

3.2 Sampling Technique and Sample Size

The study participants came from a randomized sample, for example, mining, infrastructure, petroleum, energy, medical, road and transport, agriculture, water and sanitation and food industry. Participants were not selected based on age, gender, belief, or religion, but rather on their knowledge and experience in PPP projects. The participants were considered to be professionals in their field of public or private organizations. The study consisted of 15 survey questionnaires and 30 responses were captured. The population was approximately 100.

3.3 Questionnaire Structure

The research used forced four-point Likert scale questions to collect data. The overall intention of this research was to evaluate the failure modes that hinder the success of PPP projects in South Africa. To achieve this, the following eight failure modes were compared (a) slip in completion time, (b) poor communication, (c) political interference, (d) inadequate project planning, (e) lack of skills/experience, (f) change in project scope, (g) corruption, and (h) disputes and conflict between parties.

4. Data Collection

4.1 Survey Data Collection

The electronic Google form questionnaires that were utilized to obtain results, were pre-approved by the University of Johannesburg Ethics Committee. The University Ethics Committee accepted the research design in January 2024. The questionnaires were reviewed and approved by the co-supervisor and supervisor before being submitted to the committee. The participant's responses to the questionnaires were anonymous to protect the privacy of the professionals. No participant was forced to take part in the research against their free will. Collected data were kept secure with one access authenticated Google password during and after completion of the degree whereafter the data were destroyed. Data were collected over a one-and-a-half-month period. Participants used platforms such as emails, mobiles and LinkedIn to respond to the Google form link.

4.2 Data Analysis Method

The analysis of the study research must be reliable and valid. In research methodology, reliability and validity are fundamental concepts used to evaluate the quality and integrity of measurements, as well as the overall robustness of a study. An Excel sheet and a descriptive statistics formula were used to determine the quantitative scale of the study.

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4.3 Ethical Considerations

The researcher put forward an application for ethics clearance to the Ethics Committee of the University of Johannesburg, requesting consent to continue with the research survey. The following ethical considerations were adhered to:

- Validate that participants have signed their informed consent forms.
- Acknowledge the anonymity and confidentiality of participants and their responses.
- Ensure no distress consequences were experienced by the participants.
- Ensure that authorization from the University of Johannesburg was granted.

4.4 Strengths and Limitations

- Questionnaires were shared with the local PPP participants. This included public and private representatives in South Africa.
- The overall research was not limited to specific PPP projects but rather addressed a given PPP project in different organizations.
- Based on the participants' field experience, they can strongly agree or disagree on a certain factor, which might seem like a professional bias.
- The rate of reply can be positively or negatively influenced by the quality of the question asked and the level of education and knowledge of the participants of the processes.

4.5 Participant Profile

Q1&Q2: While investigating answers to the research questions, it is imperative to get the right professionals on board. Thus, 93% agree that they have participated in PPP projects from an organizational and individual standpoint. This was a good build-up to establish the reliability of the answers of respondents.

Q3: The level of education contributes to the reliability of the survey results, as it represents the number of knowledgeable professionals from different disciplines who participated in the survey. Of the respondents, 97% were individuals with the highest qualifications and only 3% had no form of academic education. It can be concluded that the respondents have a sufficient level of academic education and industrial experience. This confirmed the reliability of the survey (Babatunde and Perera 2017).

Q4: Illustrate the percentage of experience that the respondents have acquired in PPP projects. Of the participants, 70% agreed that they have adequate experience whereas 7% strongly confirmed a high level of experience. Only 10% and 13% indicated that they did not have sufficient experience in PPP projects.

Q5: Despite the model adopted for use in any PPP project, the government must persuade private financiers to invest in that particular project (Washington University Global Studies Law Review 2019). In South Africa, the Gautrain Rapid Link project was a DFBOT-type project where functions such as operation and maintenance, design, construction, and finances were managed by a private bidder (Fombad 2015). Of the participants, 76.7% confirmed that they had been involved in different types of PPP projects. This added value to the reliability of the research responses. Only 23.3% of respondents had not taken part in any of the PPP project types.

5. Results and Discussion

This section of the report analyzes the research survey questionnaires and evaluates the raw data. Each survey questionnaire contributes to answering the study research questions and was analyzed and discussed in the overall conclusion of the paper. The reliability of the questionnaires was tested by calculating the Cronbach's alpha.

5.1 Numerical Results

By analyzing the research survey questionnaires, it automatically addressed RO2 and answered RQ2, which respectively were: to determine and rank the primary causes of failure of PPP projects in South Africa, and what modes of failure are evident in PPP projects' failure.

Project Management

Q6, Completion time: Once a project exceeds its expected completion timeline, it is regarded as a failure. According to the results, 34.5% of the PPP projects reached completion within the expected time. Of the respondents 37.9% had experienced projects exceeding completion time by between 1 month to 6 months; 17.2% exceeded their schedule by

6 to 12 months, and 10.3% exceeded it by 24 months and longer. Studies have acknowledged a project failure as any occurrence that prevents it from reaching its goal (Eja and Ramegowda 2020).
Q9, Inadequate project planning: Good planning is the backbone of yielding successful projects (Eja and Ramegowda 2020). The participants agreed with the importance of good planning and a total of 80% voted in its favor. The remaining 20% did not have a good experience in their projects regardless of project planning.

Q12, Change in project scope: Taherdoost and Keshavarzsaleh (2016), have reported that change in project scope is one of the leading factors in project failure. Changes in project scope form part of the project challenges and often leave eggs on the faces of the project managers (Eja and Ramegowda 2020). The participants experienced equal positive and negative effects when the project scope was changed in their projects. Positive responses were provided by 43.3% and negative responses by another 43.3% of respondents. A further 13.3% of respondents were very negative towards change in project scope, which attests to the earlier statement of change in project scope contributing to failure.

External/political influences
Q8, Political interference: The negative contribution of political interference had been experienced by 63.3% of the participants. An additional 16.7% voted very negatively towards political interference. Only 20% of the respondents have encountered positive political interventions. Conflicts through socio-cultural interference and hostility in public projects have hindered the completion of projects in Nigeria (Eja and Ramegowda 2020).

Q13, Accusation & corruption: Interestingly, 33.3% of participants voted in favor of not encountering accusations of corruption during their PPP projects while another 33.3% had experienced accusations of corruption in their projects. However, an additional 30% voted in favor of not experiencing corruption, thus a total of 63.3% were in disagreement with their project failing due to accusations of corruption and corrupt tendencies (Fombad 2015). The Gautrain study has pointed out corruption allegations that were raised due to explicit bidding criteria for suppliers.

Organizational Factors
Q7, Poor communication: The consequence of poor communication often leads to slowdowns in project implementation which may result in total failure and project abandonment (Eja and Ramegowda 2020). A percentage of 36.7% and 30% of participants respectively showed that poor communication is likely and very likely to lead to project failure; 33.3% of respondents did not experience poor communication in their PPP projects. However, according to Eja and Ramegowda (2020), communication is the key to any project's success.

Q11, Lack of skill/experience: Lack of knowledge and incompetence contributed to project failure. Unskilled labor is a crucial cause of project failure (Eja and Ramegowda 2020).

Q14, Dispute and conflict: Disputes between the public and private partnership can be triggered by, for example, terms and conditions that were not specified in the contract (Fombad 2015). However, 46.7% of the participants showed that conflicts between partners during their projects were rare while 33% highlighted that conflicts and disputes did exist. A further 10% of the participants showed that they never experienced conflict and the remaining 10% responded that there was always conflict on their projects. To recommend strategies for addressing the primary failure causes in PPP projects in South Africa, Table 3 below summarizes the outcomes of the above-mentioned RQs and Ros (Table 3).

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Table 3. Consolidated failure hierarchy for engineers

Item Number	Factor Hierarchy	Score	Percentage
1	Political interference	11	18.9%
2	Poor communication	10	17.2%
3	Dispute and conflict	9	15.5%
4	Lack of skills/experience	8	13.8%
5	Change in project scope	8	13.8%
6	Slip in completion time	4	6.9%
7	Inadequate project planning	4	6.9%
8	Accusation & corruption	4	6.9%
		58	**100%**

Loss of revenue to the state, loss of revenue by citizens, low empowerment in the community and project cost overruns were due to the combination of the consequences of all factors that contributed to PPP project failure (Eja and Ramegowda 2020). Eight factors were compared to rank them in order of their negative impact on projects and inform future engineers to take note of them during their projects. Table 3 and Figure 6 illustrate the consolidated outcomes of the research study from a high failure contribution factor to a low failure contribution factor. Political interference was the highest failure contribution factor at 18.9%. Communication came second at 17.2%, followed by dispute and conflict at 15.5%, and skills/experience and change in project scope both at 13.8%. Completion time, project planning accusation and corruption all stood at 6.9%.

5.2 Graphical Results

Participants were in Question 10 asked to rank the combination of individual factors (completion time, communication (Figure 4). political interference, and project planning) that had already been discussed earlier. Figure 5 presents a graphic view of the factors contributing most to PPP failure. Responses showed that political interference at 40% contributed the most to PPP project failure and at 33% poor communication was the second highest contributor. Slipping on completion time and inadequate project planning respectively presented a response of 13.3%. It has been reported that several projects in Nigeria failed due to incorrect cost estimation which was aggravated by corruption (Eja and Ramegowda 2020).

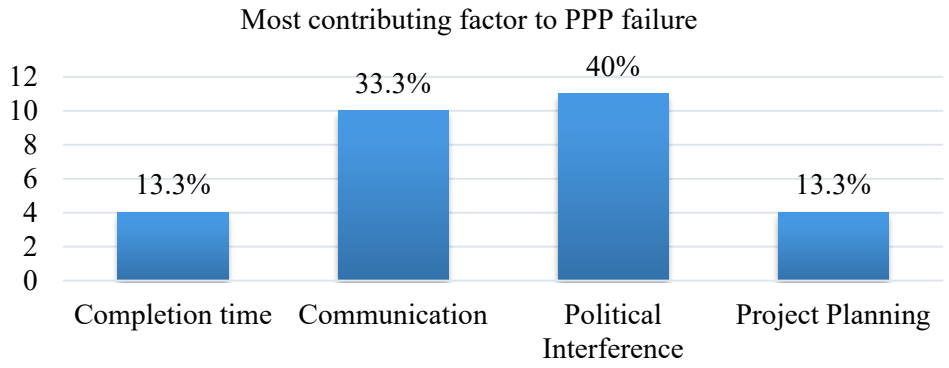

Figure 4. Which of the following contributed enormously to your PPP's project failure?

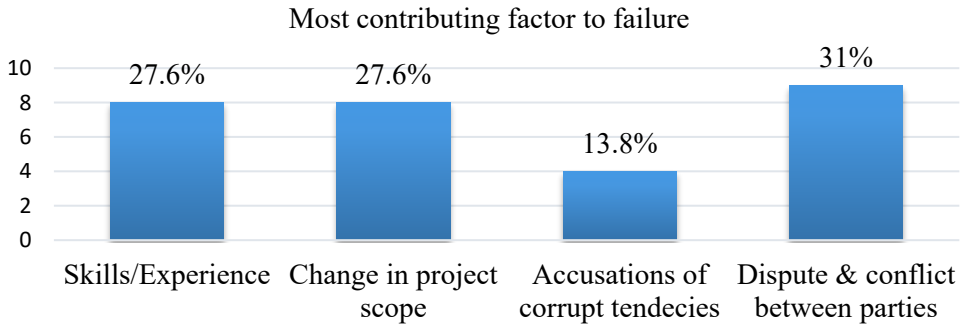

Figure 5. Which of the following contributed enormously to your PPP project's failure?

Respondents were asked to rate the combination of individual factors (skills/experience, change in project scope, accusation of corrupt tendencies and dispute & conflict between parties) that have already been discussed above. Skills/experience and change in project scope shared a score of 27.6% for their contribution to PPP project failure. Accusations of corrupt tendencies yielded a score of 13.8% whereas dispute and conflict between parties had the highest score at 31% as a cause for project failure. See the bar graph in Figure 6.

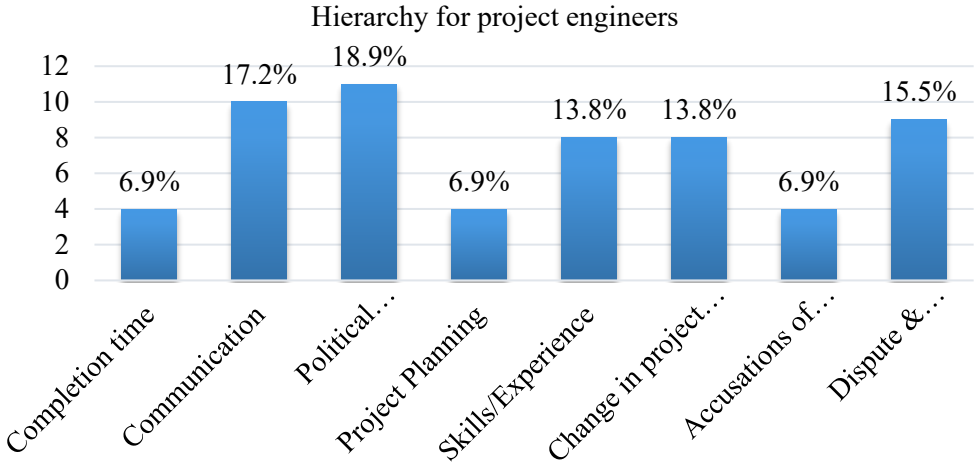

Figure 6. Consolidated failure hierarchy for project engineers

5.3 Proposed Improvements

The factors that led to PPP project failure in different organizations in South Africa have now been identified. It would, therefore, be beneficial to start implementing "Building Information Modelling (BIM) and Blockchain Technology" tools for both the public and private partners to have visibility of their projects through all their phases (pre-feasibility, feasibility, detailed design, selection and costing, installation and commission, operations and maintenance). Suggestions for South African PPP participants to assess allegations of corruption and skill/experience gaps, the public sector should have a larger share of participants than the private sector (Matshonisa Seeletse 2016).

5.4 Validation

Validity can be experienced in the questionnaire response processes as it can be validated through the analysis of individual response patterns on an instrument. The reliability of the questionnaires was tested by calculating the Cronbach's alpha. it is important to determine Cronbach's alpha coefficient in any Likert scale, regardless of its multiple scale or subscale. The Cronbach's alpha coefficient calculated for the study was 0.94 which is an excellent statistical measure of internal reliability. In separate studies, Feuerborn et al. (2019)) reported that scientists welcome Cronbach's alpha ≥0.6 for experimental measures when not required to make decisions and alpha ≥0.7 for exploratory research. Values ≥0.8 are expected for research where decision-making, based on the research, is mandatory.

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6. Conclusion

The total ranking of the eight factors yielded the top three factors causing failure, from first place to third place, as political interference (18.9%), lack of communication (17.2%), and dispute and conflict (15.5%) respectively. These top three factors contributing to the failure of PPP projects all emphasize the extreme importance of managing the stakeholder ecosystem of PPP projects. See Figure 6 for a graphic presentation of the results. Follow-up research, aimed at deeper investigation of stakeholder management for PPP projects, is recommended. Accusations of corruption, project planning, and completion time were scored low with an equal percentage of 6.9%. Fombad (2015), has indicated that anti-corruption special units need to be reinforced and integrated within the life cycle of PPP projects for the sake of transparency and accountability. Change in project scope and skills/experience were both holding the middle position with the same score of 13.8%. It is evident that engineering managers need to pay attention to each of the rankings as all factors depend on one another for the success of any PPP project.

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Biographies

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Paul Bester is experienced in transportation, ICT, infrastructure development, asset management, systems and logistic engineering, and program management. This professional engineer (Pr Eng) has it all. Throughout his 41 years in the firm, Paul has managed many business divisions, managed project portfolios, and offered consultancy services. He has worked in a variety of areas, including information technology, manufacturing, transportation, education and training, defense, and construction. Paul is a BCom and MBL graduate of the University of South Africa (UNISA) and has an MSc Eng from the University of the Witwatersrand (Wits). Over his professional career, he has also finished several postgraduate courses in engineering logistics, systems engineering, and project management. A former board member and treasurer of the SA Heavy Haul Association, he is currently a member of the INCOSE SA Chapter. After serving as the Wits Center's Senior Manager of Programs until the end of 2022.

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Appendix

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Table 4: Summary of the survey respondents for evaluating PPP failure factors

Question No:	Survey questionnaire	Survey results. Total Distribution = 32
	Does your organization part take in public-private partnership projects?	
	Agree	30
Q1	Disagree	2
	Have you/Do you take part in public-private partnership projects?	
	Agree	30
Q2	Disagree	2
	Do you possess the highest qualification level, For example (diploma, degree, masters, PhD) etc?	
	Agree	29
Q3	Disagree	1
	Have you acquired enough experience level in PPPs projects?	
	Strongly Disagree	3
Q4	Disagree	4
	Agree	21
	Strongly Agree	2
	Did you follow the following PPPs model in your previous/current project? For example – DFBOT {Design, Finance, Build, Operate & Transfer}, DBOT {Design, Built, Operate & Transfer}, DFO {Design, Finance and Operate}, Equity partnership projects Facilities management project?	
	Strongly Disagree	3
Q5	Disagree	4
	Agree	21
	Strongly Agree	2
	By how long did your project exceed expected completion time?	
	0 months	10
Q6	6 months	11
	12 months	5
	24 months	3
	How likely did lack of communication contribute to your PPPs project failure?	
	Very Unlikely	6
Q7	Unlikely	4
	Likely	11
	Very Likely	9
	How did political interference contribute to your PPPs project?	
	Very Negative	5
Q8	Negative	19
	Positive	6
	Very Positive	0

Question No:	Survey questionnaire	Survey results. Total Distribution = 32
	How important did project planning contribute to your PPPs project?	
	Very Unimportant	5
Q9	Unimportant	1
	Important	10
	Very Important	14
	Which of the following contributed enormously in your PPPs project failure?	
	Completion time	4
Q10	Communication	10
	Political Interference	11
	Project Planning	4
	How satisfied were you with the skills/experience the PPPs team brought to the project? For example contract skills, engineering skills, stakeholder management skills, feasibility study and forecasting skills	
	Very dissatified	0
Q11	Disssatified	4
	Satified	23
	Very Satified	2
	How did change in project scope contribute towards your PPPs project completion?	
	Very Negative	4
Q12	Negative	13
	Positive	13
	Very Positive	0
	Did your PPPs project fail due to accusations of corruption & corrupt tendencies?	
	Strongly Disagree	9
Q13	Disagree	10
	Agree	10
	Strongly Agree	1
	How frequent did the public and private partners engage in disputes and conflict during or before PPPs project?	
	Never	3
Q14	Rarely	14
	Often	10
	Always	3
	Which of the following contributed enormously in your PPPs project failure?	
	Skills/Experience	8
Q15	Change in project scope	8
	Accusations of corrupt tendecies	4
	Dispute & conflict between parties	9

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