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Examining the Risks Associated with Public-Private Partnership Procurement Systems in Developing Economies

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Abstract
Procurement systems are vital in the implementation and delivery of infrastructural projects. The type of procurement system adopted directly influences the successful outcome of these projects. The widespread adoption of the public-private partnership (PPP) procurement system is highly proliferated in developing economies due to the government's financial constraints. This paper aims to identify and evaluate the risks associated with using the PPP procurement system in the South African construction industry. A quantitative research methodology was employed in the study. A structured questionnaire survey was disseminated among active construction professionals in the Gauteng province of South Africa to facilitate data collection. The collected data underwent descriptive statistical analysis. The study's results identified 26 significant factors, including political risks, unstable economic risks, cost overruns, delays in project approval permits, and lack of commitment from either partner as the top five risks linked to using PPP. The findings highlight the need to address these risks to ensure the PPP procurement system fulfils its objectives and benefits. It is highly recommended that comprehensive risk assessment, detailed contractual agreement, effective regulatory and institutional framework, capacity building and training, effective stakeholder engagement, political and economic stability, and regular monitoring and evaluation are ensured to overcome the various risks identified.

Keywords
Construction Infrastructure, Developing Countries, Public-Private Partnerships, Procurement Systems, South Africa.

1. Introduction

Project performance is the degree of achievement of certain effects (Oladirin et al., 2013). The procurement system employed in delivering services, projects, and infrastructure is known to determine its performance significantly. There are several procurement systems in the construction industry (CI), such as the traditional procurement system, construction management, design and build, public-private partnership (PPP) procurement system, design and manage, and many more. The most frequently used procurement system is the traditional one (Morledge et al., 2021). According to Love et al. (1998), a procurement system is an organisational system that gives specific responsibilities and authority to people and organisations in the project. The relationship of various elements in project construction is through the procurement systems. Procurement systems in the CI have made most construction projects successful by reducing cost overruns and improving the quality of work and performance of the project. Similarly, procurement systems help the CI to function effectively and efficiently. They have been established to deal with the need to implement and deliver construction projects successfully. Considering that the construction industry is one of the major sectors contributing to the South African economy, the choice of procurement system is imperative to deliver infrastructural projects successfully. The term 'procurement' refers to the selection of contractual engagements available for selecting a contractor or a construction method for a construction project (Rowlinson, 1999). The above

definitions show that procurement requires complicated interactions of the number of components that determine the project's outcome.

Procurement systems significantly contribute to the failure or success of any project (Thwala & Mathonisi, 2012). Different procurement systems are currently in use worldwide, considering the unique terrain, political and economic factors of such an environment. Focusing on the African continent and taking cognisance of the economic situation of most countries on the continent, the PPP procurement system is highly employed. There is rapid growth in the use of public-private partnership procurement systems in the CI. The term 'public' means that the services are provided by the state/ government rather than an individual or a commercial company. 'Private', on the other hand, is the opposite of public, meaning that the services are provided by an individual rather than the state/government. The term 'partnership' signifies a mutual arrangement whereby parties agree to unite and advance their common interests (Sundaram & Chowdhury, 2009). A PPP is thus a partnership between an individual or private enterprise and the state (government) to further or achieve a particular set of objectives. It is a model the government uses to partner with the private sector to implement construction projects (Sinha & Jha, 2021). This partnership allows the private entity to finance, design, construct, operate, and maintain public sector plans and projects.

The construction procurement process has been heavily criticised for its uneven approach to delivering construction projects, which has greatly impacted the effectiveness of some projects (Liu et al., 2016). The current procurement systems do not effectively encourage integration, coordination, and communication between the construction members/stakeholders. There are plenty of procurement systems in South Africa. Still, many construction stakeholders are unaware of them because they are too familiar with certain unsuitable procurement systems for all types of projects. The delivery of a construction project is influenced by the procurement system chosen. Masterman (2013) stated that there are fewer studies on procurement systems and their influence on project performance, considering that projects are becoming more complex daily. The gap has often contributed to clients, consultants, and professional teams having difficulty choosing an appropriate procurement system suitable for a certain project. Ogunsamni (2013) found that the most frequently used procurement system is the traditional system, and it has been highly criticised for not meeting some projects' requirements, like completing the project on time. There is a gap in the variety of procurement systems available in the public sector, and construction professionals must look into the client's needs. The study of Ogunsanya et al. (2016) indicated that the procurement of public works in Nigeria has several problems, such as inadequate management of the highly competitive contractual relationships, lengthy project time, failure of infrastructure in serviceability requirements, dangerous cases of frequent buildings collapsing long before the design's lifespan expires, and controversial claims. These problems are also experienced in South Africa. Choosing the wrong procurement system has led to some projects not being completed on time and within budget. Construction procurement systems have become a concern, drawing global attention. This is because of the critical role procurement plays in delivering specific objectives and benefits to project stakeholders. Hence, this study aims to assess and identify the risks associated with the PPP procurement system in South Africa to better maximise its benefits for infrastructure and socio-economic development.

2. Research Methodology

A quantitative research methodology was employed in this study. This approach involves collecting data from subjects or respondents through self-reporting, wherein participants answer questions posed by the researcher (Grove et al., 2014). Both primary data, obtained via a questionnaire survey, and secondary data, derived from a literature review, were utilised to provide comprehensive insights into the respondents' perspectives on the risks associated with the PPP procurement systems. The study targeted a sample of duly registered construction professionals, such as architects, project managers, quantity surveyors, construction managers, town planners, civil engineers, and construction project managers within the Gauteng Province of South Africa. A total of 200 structured questionnaires, comprising closed-ended questions, were distributed to these respondents. The aim was to gauge their perceived likelihood of the severity of twenty-six identified risks associated with adopting and implementing PPP procurement systems for project delivery in the South African construction industry. Responses were measured using a five-point Likert scale (5 = very large risk, 4 = large risk, 3 = moderate risk, 2 = small risk, 1 = not risk). Of the 200 questionnaires distributed, 105 were completed and returned, resulting in a response rate of 53 percent. The collected data were analysed using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics (specifically mean and standard deviation) were employed for the analysis. A mean score of 2.50 or higher was considered significant for the study (Field, 2005). The mean values and standard deviations of the factors were then tabulated for comparison.

3. Results and Discussions

3. 1 Demographic Background of Respondents

The analysis of the background information of the respondents revealed that 53.3% possess a bachelor's degree, 31.4% have an Honour's degree, 14.3% have a Master's degree and 1% have a Doctorate. Also, most respondents (41%) are quantity surveyors, 22.9% are civil engineers, 10.5% are project managers, 9.5% are construction project managers, 6.7% are town planners, and both construction managers and architects are 4.8%, respectively. Most respondents are consultants, representing 49.5%, 32.4% are contractors and 18.1% work for the government. Similarly, it was revealed that 48.6% of the respondents had 1-5 years of experience, 13.3% of the respondents had 11-15 years of experience, 23.8% of the respondents had 6-10 years of experience, and 9.5% of the respondents had more than 20 years of work experience in the construction industry.

3.2 Result from Descriptive Analysis

The result of the descriptive analysis is presented in Table 1. The Table reveals the respondents' ranking of the risks of using the PPP procurement system in the South African construction industry. 'Political risks' was ranked first with a mean score of 3.71, standard deviation of 1.24, and asymp. sig value of 0.94; 'instability economic risk' was ranked second with a mean score of 3.60, standard deviation of 1.24, and asymp. sig value of 0.46; 'construction cost overruns' was ranked third with a mean score of 3.57, standard deviation of 1.31, and asymp. sig value of 0.33; 'delays in project approval and permits' was ranked fourth with a mean score of 3.55, standard deviation of 1.31, and asymp. sig value of 0.07; and 'lack of commitment from either partner' was ranked fifth with a mean score of 3.53, standard deviation of 1.26, and asymp. sig value of 0.46. The least ranked but equally significant risks associated with the PPP procurement systems in South Africa are 'changes in tax regulation' ranked twenty-fourth with a mean score of 3.05, standard deviation of 1.26, and asymp. sig value of 0.06; 'environmental pollution' was ranked twenty-fifth with a mean score of 2.94, standard deviation of 1.28, and asymp. sig value of 0.10, and 'natural disasters' was ranked twenty-sixth with a mean score of 2.93, standard deviation of 1.32, and asymp. sig value of 0.28. The results are in tandem with the studies of Alfraidi et al. (2020) and Almeile et al. (2024), which highlighted that economic and political factors constitute the major challenges facing the successful implementation of the PPP procurement system in the Kingdom of Saudi Arabia. Similarly, poor political decision-making and financial risks are among the major risks associated with the PPP procurement systems in China (Ke et al., 2011). Similar challenges are identified in other countries such as Nigeria (Owolabi et al., 2019), Turkey (Aladağ & Işik, 2022), Malaysia (Abd Karim, 2011), United Kingdom (Smith & Gannon, 2008), and Indonesia (Wibowo, 2015), thereby validating the risks associated with PPP in South Africa not just to be a national issue but a global menace which must be tackled head-on if the benefits of this procurement system will be maximised.

Table 1. Risks associated with Public-Private Partnership procurement systems.

Potential Risks	Mean	Standard Deviation	Kruskal Wallis H	Asymp. Sig	Rank
Political risks	3.71	1.24	1.79	0.94	1
Unstable economy	3.60	1.24	5.65	0.46	2
Construction cost overruns	3.57	1.31	6.87	0.33	3
Delays in project approval and permits	3.55	1.31	11.76	0.07	4
Lack of commitment from either partner	3.53	1.26	5.71	0.46	5
Revenues below expectation	3.51	1.29	6.83	0.34	6
Interruptions in operation	3.50	1.35	11.88	0.07	7
Failure to meet performance criteria	3.49	1.20	8.49	0.21	8
Poor public decision making	3.49	1.20	8.07	0.23	8
Excessive design changes	3.49	1.29	11.60	0.07	8
Inadequate experience of managers	3.47	1.29	12.40	0.05	11
Poor quality of workmanship	3.44	1.35	6.10	0.41	12
Difficulty in land acquisition	3.40	1.28	5.31	0.51	13
Too many legislation changes	3.39	1.17	1.99	0.92	14
High finance costs	3.38	1.25	12.33	0.06	15
Construction cost overruns	3.38	1.20	12.33	0.06	15
Change in market demand	3.29	1.25	2.37	0.88	17
Inadequate distribution of responsibilities	3.27	1.23	9.91	0.13	18
Lack of competitive tendering	3.26	1.30	5.60	0.47	19
Use of unproven engineering techniques	3.25	1.31	4.89	0.56	20

Nationalisation of assets	3.19	1.29	4.82	0.57	21
Unpredictable geotechnical conditions	3.17	1.27	4.61	0.59	22
Too many contracts	3.10	1.20	3.26	0.78	23
Changes in tax regulation	3.05	1.26	12.04	0.06	24
Environmental pollution	2.94	1.28	10.77	0.10	25
Natural disasters	2.93	1.32	7.48	0.28	26

3.3 Result from Explorative Factor Analysis

Following the descriptive analysis of the retrieved data, exploratory factor analysis was conducted. Table 2 presents the results of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. The KMO value of 0.929 suggests that the sample size is sufficient for factor analysis. Bartlett's test of sphericity produced a chi-square value of 2749.341 with 325 degrees of freedom and a p-value of 0.000, indicating that the correlation matrix significantly differs from an identity matrix, making it appropriate to use factor analysis to extract meaningful factors from the data.

Table 2. KMO and Bartlett's Test.

KMO and Bartlett's Test for Risks Associated with PPP in South Africa		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.929
Bartlett's Test of Sphericity	Approx. Chi-Square	2749.341
	df	325
	Sig.	.000

The data were subjected to PCA with varimax rotation. The eigenvalue was set at conventional high values of 1.0. As shown in Table 3, four factors with eigenvalues exceeding 1.0 were extracted. The scree plot in Figure 1 also revealed the excluded factors by indicating the cut-off point at which the eigenvalues levelled off. Four components were extracted, as is evident from the Scree plot. The variance of the components was extracted, and it was discovered that the first component (Factor 1) has the highest initial and extraction sums of squared loadings, explaining 60.642% of the variance. The second and third components (Factors 2 and 3) also have relatively high extraction sums of squared loadings, explaining 5.834% and 4.279% of the variance. The total variance explained by the fourth component (Factor 4) is 4.097%, as shown in Table 4. The remaining components explained less than 4% of the variance each. Therefore, the final statistics of the PCA and the extracted factors accounted for approximately per cent of the total cumulative variance. The principal component analysis revealed the presence of four factors with eigenvalues above 1, as presented in Table 4. Based on the examination of the relationship obtained among the variables under each factor, the following interpretation was made: Factor 1 was termed construction risk, Factor 2 was termed regulatory and legal risk, Factor 3 was termed environmental risk and Factor 4 was termed operational risk. The names given to these factors were derived from a close examination of the variables contained in each factor. The indicators that each of the four (4) factors constitute are explained below, and a detailed description of each is provided.

Table 3. Pattern Matrix for the risks associated with Public-Private Partnership procurement systems.

	Component			
Potential Risks	1	2	3	4
Difficulty in land acquisition	.915			
Poor public decision making	.837			
Delays in project approval and permits	.777			
Nationalisation of assets	.691			
Revenues below expectation	.591			
Change in market demand	.567			
Poor quality of workmanship	.536			
Instability risk	.534			
Excessive design changes	.498			
Inadequate distribution of responsibilities	.476			
Lack of commitment from either partner	.470			
Cost overruns	.429			
Less competitive tendering	.372			
Too many legislation changes		.765		
Construction cost overruns		.764		
Too many contracts		.577		

Political risks	.528		
Natural disasters		.823	
Unpredictable geotechnical conditions		.781	
Changes in tax regulation		.646	
Environmental pollution		.624	
Use of unproven engineering techniques		.484	
Interruptions in operation			.799
High finance cost			.713
Inadequate experience of managers			.538
Failure to meet performance criteria			.489

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization. a. Rotation converged in 15 iterations.

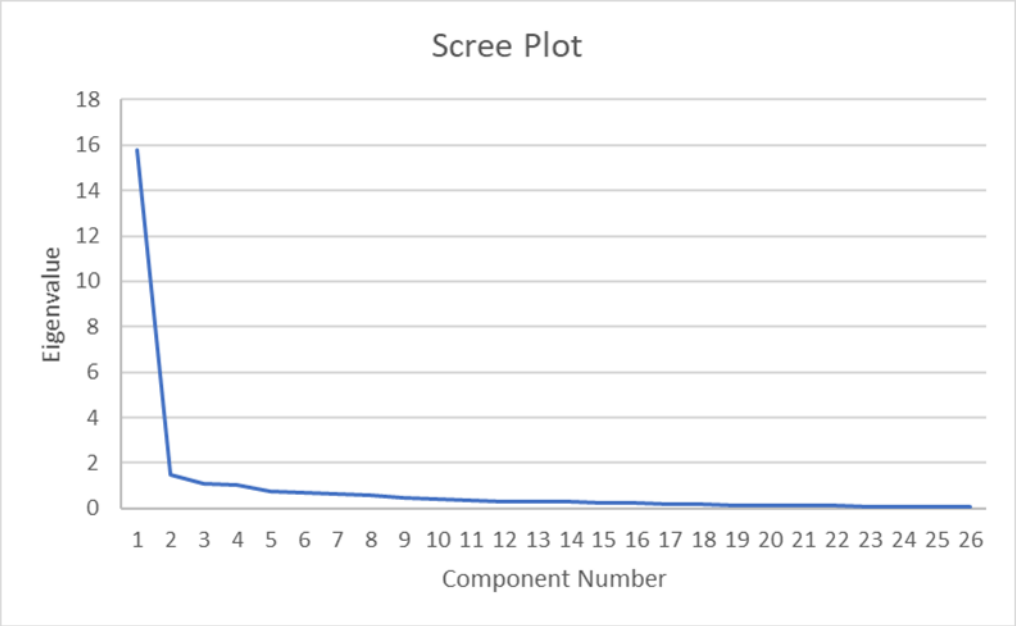

Figure 1. Scree plot for risks associated with Public-Private Partnership procurement systems.

Table 4. Total variance explained for the risks associated with Public-Private Partnership procurement systems.

Component	Initial Eigenvalues			Extractions Sums of Squared Loadings			Rotated Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	**15.767**	**60.642**	**60.642**	**15.767**	**60.642**	**60.642**	**13.020**
2	**1.517**	**5.834**	**66.476**	**1.517**	**5.834**	**66.476**	**7.548**
3	**1.113**	**4.279**	**70.755**	**1.113**	**4.279**	**70.755**	**10.003**
4	**1.065**	**4.097**	**74.852**	**1.065**	**4.097**	**74.852**	**7.905**
5	0.733	2.818	77.670				
6	0.675	2.596	80.266				
7	0.621	2.390	82.657				
8	0.592	2.276	84.933				
9	0.499	1.918	86.851				
10	0.418	1.608	88.459				
11	0.379	1.457	89.915				
12	0.316	1.215	91.130				
13	0.309	1.189	92.318				
14	0.284	1.093	93.412				
15	0.262	1.008	94.420				
16	0.252	0.970	95.389				
17	0.194	0.744	96.134				

18	0.168	0.646	96.780
19	0.156	0.598	97.379
20	0.147	0.567	97.946
21	0.121	0.466	98.412
22	0.113	0.434	98.846
23	0.090	0.344	99.190
24	0.080	0.309	99.499
25	0.068	0.263	99.762
26	0.062	0.238	100.000

Extraction Method: Principal Component Analysis.

Factor 1 (construction risks): As presented in Table 3, the 13 extracted risks of PPPs were difficulty in land acquisition (91.5%), poor public decision making (83.7%), delays in project approval and permits (77.7%), the nationalism of assets (69.1%), revenues below expectation (59.1%), change in market demand (56.7%), poor quality of workmanship (53.6%), instability risk (53.4%), excessive design changes (49.8%), inadequate distribution of responsibilities (47.6%), lack of commitment from either partner (47.0%), cost overruns (42.9%) and less competitive tendering (37.2%). The number in parenthesis indicates the respective factor loading, while this cluster accounted for 60.64% of the variance. Factor 2 (regulatory and legal risks): As presented in Table 3, the four extracted risks of PPPs were too many legislation changes (76.5%), construction cost overruns (76.4%), too many contracts (57.7%), and political risks (52.8%). The number in parenthesis indicates the respective factor loading, while this cluster accounts for 5.83% of the variance. Factor 3 (environmental risks): As presented in Table 3, the five extracted risks of PPPs were natural disasters (82.3%), unpredictable geotechnical conditions (78.1%), changes in tax regulation (64.6%), environmental pollution (62.4%), and unproven engineering techniques (48.4%). The number in parenthesis indicates the respective factor loading, while this cluster accounted for 4.28% of the variance. Factor 4 (operational risks): As presented in Table 3, the four extracted risks of PPPs were interruptions in operation (79.9%), high finance cost (71.3%), inadequate experience (53.8%), and failure to meet performance criteria (48.9%). The number in parenthesis indicates the respective factor loading, while this cluster accounts for 4.10% of the variance.

5. Conclusions and Recommendations

Public-private partnerships (PPPs) have become a prevalent procurement system globally, allowing governments to leverage private sector expertise, efficiency, and capital to deliver essential public services and infrastructure. However, the PPP procurement system is not without its risks. If not properly identified, managed and addressed, these risks can lead to project failures, financial losses, and public discontent. This paper has thoroughly examined the various risks associated with PPP procurement systems, providing insights into their complexities and offering a basis for strategic management. The primary risks identified in PPP procurement systems are construction, regulatory and legal, environmental, and operational. Significant risks presented in the descriptive analysis are political, unstable economy, and construction cost overruns. Political risks are particularly pertinent in PPPs due to their long-term nature. Changes in government, policy shifts, and public opposition can significantly impact project continuity and effectiveness. Financial risks often stem from inaccurate demand forecasts, changes in interest rates, and the financial instability of private partners. These can lead to cost overruns, reduced returns on investment, and even project insolvency. The paper also highlights the interconnectedness of these risks, where a type of risk can trigger another, creating a cascading effect. For example, political instability can lead to legal uncertainties increasing financial and operational risks. This interconnectedness underscores the complexity of managing risks associated with the PPP procurement systems and the need for comprehensive and dynamic risk management strategies.

Conducting a thorough risk assessment at the outset of the project is recommended and crucial. Potential risks should be identified, quantified, and allocated to the party best able to manage them. The contract should clearly outline this allocation to ensure accountability and effective management. Risk management should be an ongoing process. Continuous monitoring of the project environment and adaptive management strategies can help identify emerging risks and allow for timely interventions. Utilising technology and data analytics can also enhance risk monitoring and decision-making. Building capacity within the public and private sectors to understand and manage PPP-specific risks is essential. This can be achieved through relevant training programmes and workshops and by sharing best practices from successful PPP projects with all stakeholders. Engaging stakeholders, including the public, Indigenous and host communities, throughout the project lifecycle is vital. Transparency in decision-making and project progress can mitigate political risks and foster public support. Regular communication and feedback mechanisms should be established to address concerns and build trust among the stakeholders. Finally, developing a strong contractual framework that includes clear terms and conditions, performance metrics, and dispute-resolution

mechanisms is essential. Contracts should be flexible enough to accommodate changes in the project environment while maintaining clear guidelines for risk management of the PPP procurement systems.

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