Strategies for Minimising Failure of Public-Private Partnership Infrastructure Projects in North Central Nigeria

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The global adoption of the public-private partnership (PPP) concept has been driven by the growing demand for public infrastructure. However, many PPP projects have faced challenges and yielded unfavourable outcomes such as failures, delays, and concession revocations. This research paper aims to investigate the key factors influencing private investments in PPP markets in developing countries like Nigeria. The study employed an empirical questionnaire survey, collecting data from PPP experts involved in six PPP construction projects in northern Nigeria. Based on previous research, a set of 19 success factors and 21 failure factors were identified and used as the basis for quantitative data obtained. The data were analysed using the Failure Mode and Effects Analysis (FMEA) methodology. The findings of the study revealed that three critical failure factors (CFFs) played a role in the varying degrees of failure in the studied PPP projects. These factors include public sector corruption, lack of competition and transparency in procurement processes, and political interference during project implementation. On the other hand, six critical success factors (CSFs) contributed to the success of the PPP projects to different extents. These factors encompassed the availability of suitable financial markets, a favourable investment environment, appropriate risk allocation, competition in the procurement process, a comprehensive and realistic assessment of costs and benefits, and trust among stakeholders. The results of this study can serve as a valuable reference for PPP stakeholders seeking to minimize failure in the implementation of PPP infrastructure projects.

Keywords: Infrastructure projects, Procurement, Public Private Partnership, Critical Success Factors, and Critical Failure Factors

INTRODUCTION

In recent years, there has been a significant increase in the private sector's involvement in financing and constructing public infrastructure in Nigeria, particularly in the North Central region, as a means to address the infrastructure gap (Leigland, 2018). Public-Private Partnerships (PPPs) have been utilized in Nigeria, specifically in the North Central area, for the development of public infrastructure projects. Examples of such projects include the concession of the Nnamdi Azikiwe International Airport in Abuja, the infrastructure provision concession in the Katempe district of Abuja, the housing project concession for Minna Airport City in Makunkele, and the construction of the Minna Five Star Hotel. Despite the increasing popularity of PPPs in Nigeria, particularly in the North Central region, there have been instances of disputes, failures, delays, and concession revocations (Itu & Kenigua, 2021).

Numerous studies have been conducted in both developed and emerging countries to identify the CSFs of PPP projects (Osei-Kyei & Chan, 2017; Kavishe & Chileshe, 2019; Debela, 2019; Muhammad & Johar, 2019; Nguyen *et al*., 2020; Chileshe *et al*., 2020; Mulyani, 2021). Similarly, several studies have identified CFFs that are believed to contribute to the failure of PPP projects. As noted by Zhang and Tariq (2020), the lack of success and failure assessment in PPPs can result in substantial economic losses. Despite the significant failures encountered in the implementation of PPP projects, there is limited stakeholder-based strategy to minimize project failure in Nigeria. Therefore, it is crucial to investigate the critical failure factors that contribute to the failure of PPP.

LITERATURE REVIEW

CFFs in PPP Infrastructure Projects

Trangkanont and Charoenngam (2014) identified Critical Failure Factors (CFFs) as risks in PPP projects. Cheung *et al.* (2010) stated that assigning risks beyond the capacity of the involved parties resulted in the failure of PPP infrastructure projects. Insufficient legal frameworks and high processing costs led to the abandonment or discontinuation of many PPP projects before contracts were signed (Trangkanont & Charoenngam, 2014). Research by Li *et al.* (2005), Sanghi *et al.* (2007), and Trangkanont and Charoenngam (2014) found that both the public and private sectors contributed to the failure of PPP projects. Flaws in government PPP policies and strategies led to poor procurement incentives and a lack of cooperation among government departments. Corruption and the

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lack of experience, organization, and commitment in government agencies hindered effective implementation of PPP projects. On the other hand, the private sector lacked the necessary expertise and knowledge to handle legal, technical, financial, and managerial challenges that arose during project execution, leading to project suspensions and terminations. Public opposition, driven by concerns about the profit-making motives of the private sector, and a lack of transparency in contract awarding also caused delays or terminations of PPP infrastructure projects (Li *et al.,* 2005; El-Gohary *et al*., 2006). Other studies by Xenidis and Agelides (2005), and Iyer and Sagheer (2010) highlighted uncontrollable factors like changes in laws, unexpected requirements, fluctuations in PPP policies due to political instability, and inflation rates impacting project costs as reasons for PPP project failures.

Critical Success Factors of PPP Infrastructure Projects

Critical success factors (CSFs) are essential criteria that, when fulfilled, contribute to the success of a project (Frefer *et al*., 2018). Failure to properly manage these factors can result in project failure. CSFs represent a limited number of crucial actions within an organization that have the potential to enhance performance and ensure success (Kwak *et al.*, 2009). They can be described as "a small number of critical areas of activity in which favourable results are absolutely necessary for a specific manager to achieve his goals" (Bullen and Rockart). CSFs have been widely utilized in research to identify the variables that impact the performance of PPP infrastructure projects. Continuous monitoring of CSFs is necessary throughout the lifecycle of a PPP project (Robinson *et al.,* 2010). The findings of Ram and Corkindale (2014) support the notion that organizational success requires ongoing and diligent attention to CSFs by management. The concept of "important success criteria" was popularized by John F. Rockart of the MIT Sloan School of Management in the 1970s through an article published in the Harvard Business Review (Chen *et al.,* 2014). CSFs have been extensively employed in research to identify the variables that influence the performance of PPP infrastructure projects. Ongoing monitoring of CSFs is crucial throughout the course of PPP projects (Rowlinson, 1999). Ram and Corkindale (2014) further highlighted the significance of continuous attention to CSFs by managers in achieving organizational performance.

RESEARCH METHODOLOGY

The objective of this research was to analyse the Critical Success Factors (CSFs) and Critical Failure Factors (CFFs) in selected Public-Private Partnership (PPP) projects in the North Central region of Nigeria, and how they contributed to project success and failure. CFFs can be seen as risks associated with an activity or decision-making process, where the outcome or consequences are unclear and require human action to mitigate the problem. On the other hand, success factors are drivers or activities that enhance decision-making and lead to successful partnerships. The research utilized a mixed methods approach, but this paper focuses on the results obtained through a quantitative survey using a questionnaire.

The questionnaire used in this study was adapted from previous works by Ameyaw (2014) and Trangkanont and Charoenngam (2014). It was expanded and modified to include factors relevant to the socio-political and economic context of developing countries like Nigeria. The original questionnaire mainly focused on Ghana and Thailand, so additional factors were incorporated to account for country-specific considerations. To ensure the clarity, appropriateness, and applicability of the factors identified, the modified questionnaire was tested in a pilot study involving six international PPP experts with extensive research or industry experience in PPP project implementation. The feedback and suggestions provided by these experts were incorporated, resulting in a final list of 19 success factors and 21 failure factors.

Six (6) PPP case studies in North Central Nigeria were the subject of quantitative data collection using structured questionnaire. A total of 24 important stakeholders directly involved in those projects were chosen, including representatives from the public and private sectors (i.e., Ministries, Departments, and Agencies) as well as consultants, concessionaires, local lenders/banks, and contractors who had a direct hand in the chosen six case studies. Chief Executive Officers and senior staff members of the respondents' respective organizations who were directly involved in the PPP infrastructure project case study came from both the public and private sectors. Failure Mode and Effect Analysis (FMEA) Technique was used in the design of the questionnaire; the respondents were required to provide information on each of the twenty-one identified failure factors and the nineteen identified success factors. The respondents then completed the questionnaire by scoring each of the factors to determine the criticality of the identified failure and success factors in each case study. To analyse the quantitative data from the six PPP case studies, the Failure Mode and Effect Analysis (FMEA) technique was used.

The manufacturing sector has made extensive use of the FMEA technique. In the construction sector, particularly in construction management and PPP studies, the implementation of the FMEA technique has not drawn much attention. The method has only been used a few times by older scholars while researching product innovations in the procurement process for construction industry, Murphy (2008), for instance, adopted the FMEA technique. Murphy *et al.* (2011) used the FMEA

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technique to investigate a framework for assessing building innovation limits through project stakeholder management. Murphy (2008) goes on to claim that the FMEA method is a suitable instrument for subjective case study evaluation that generates empirical values for statistical analysis. Also, Babatunde (2015) adopted FMEA in identifying the criticality of success factor for developing a conceptual framework for stakeholder organisations capability enhancement in PPP infrastructure projects in Nigeria.

In order to evaluate the criticality of the twenty-one failure variables and nineteen success factors found in the six PPP case studies, the FMEA technique was used in ranking the data into three groups, Occurrence (O), Severity (S), and Detection (D) which leads to the calculation of FMEA (see Tables 2 and 3). The following are the FMEA scoring criteria in this context: (i) Occurrence (O): On a scale from 1 to 10, how likely or frequently each failure or success criteria will occur. (ii) Severity (S): Rates the severity of each factor's impact on the project's failure or success on a scale of 1 to 10. FMEA is calculated by multiplying each of the twenty-one failure factors and nineteen success variables found in each case study by their incidence (O), severity (S), and detection (D). The resulting value, known as the "risk priority number" (RPN), makes it possible to order the actions. The failure and success criteria that have greater RPN values are viewed as crucial in the context of this study. For instance, the decisional rule states that a failure or success component is considered essential if its RPN value is more than 750. The CFFs and CSFs that determined whether the six PPP project case studies examined in this study were successful or unsuccessful were determined using the RPN value. Since occurrence (O) is multiplied by severity (S) is multiplied by detection (D), the RPN values vary from 1 to 1,000.

RESULTS AND DISCUSSION

Table 1 shows the qualifications of respondents from the public and private sectors in terms of the organizations they work for, their titles, and the number of years they have been in the workforce. The table shows that 24 respondents (representing four (4) in each case study) were top management from the public and private sectors. Their professional years of experience ranging from seven (7) to twenty-eight (28) years, and they had participated in one (1) to thirty-five (35) PPP projects. Additionally, the respondents had a direct hand in the PPP project case studies from start to finish or up until this stage. The results from the six FMEA-based PPP infrastructure project case studies were divided into two sets as follows:

1. Physical infrastructure/civil and engineering PPP case studies
2. Social infrastructure/Building work PPP case studies.

The concession of engineering infrastructure for Katempe District Phase II FCT Abuja's road project; the concession of Shiroro Hydroelectric Power Plant, Niger State's (Energy); the concession of Doma Dam, Nasarawa State; and the concession of Omi-Kampe Dam, Kogi State were among the physical infrastructure PPP project case studies examined (case study 1-4). While the concession of the Garki hospital in the Federal Capital Territory of Abuja (case study 5) and the concession of the Debt Management Office in Abuja were among the social infrastructure case studies examined (case study 6).

Table 1: Respondents' background

No	Respondents' **organisation**	Respondents' **designation**	Respondents' **years of professional experience**	**Number of PPP projects involved in**
	Case Study 1: Concession of Katempe District Phase II, Abuja			
1	Private sector: Consultant	Project Manager	21	7
2	Private sector: Concessionaire	Manager	25	8
3	Private sector: Financial Institution	Manager	12	6
4	Public Sector: FCDA	Chief Engr Mass Housing/PPP	21	7
	Case Study 2: Concession of Shiroro hydroelectric power plant, Niger State			
5	Public Sector: Federal Min. of Power, works & Housing	Director, Power & Energy	21	8
6	Private Sector: Concessionaire	E.D Engineering Services	28	8
7	Private sector: Concessionaire	Director, Dams	14	4
8	Private sector: Financial Institution	Manager	12	6
	Case Study 3: Concession of Doma Dam, Nasarawa State			
9	Public Sector: Federal Min. of Power, works & Housing	Head of Dept. Dams	25	12
10	Public Sector: ICRC	Deputy Director	21	8
11	Private sector: Consultant	Partner	19	2

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12	Private sector: Contractor	Project Manager	15	2
	Case Study 4: Concession of Omi-Kampe Dam, kogi state			
13	Public Sector: Federal Min. of Power, works & Housing	Chief Engr.	25	5
14	Public Sector: Concessionaire	Director	14	4
15	Private sector: Consultant	Principal Partner	21	8
16	Private sector: Contractor	Managing Director	15	2
	Case Study 5: Concession of Garki Hospital, Abuja			
17	Public Sector: FCTA	Director	27	35
18	Private sector: Concessionaire	General Manager	25	5
19	Private sector: Consultant	Consultant	13	3
20	Private sector: Financial Institution	Manager	20	3
	Case Study 6: Concession of Debt Management Office, Abuja			
21	Public Sector: DMO office	Director Projects	19	1
22	Private Sector: Concessionaire	General Manager	14	4
23	Private sector: Financial Institution	Manager	7	5
24	Private sector: Consultant	Chief Architect	14	4

Table 2 reveals that the delays and failure of Katempe District Phase II, Abuja were caused by the public sector's corruption, a lack of openness, and a lack of competition in the procurement process (i.e. case study1). High transaction costs, drawn-out contractual agreements and bidding processes, political interference during implementation, mistrust among stakeholders, and a lack of a PPPs-enabling environment were all listed as "rather major" failure causes. Additionally, corruption in the public sector, a lack of openness, and a lack of competition in the procurement process are crucial reasons why the Shiroro hydroelectric power plant concession in Niger State failed (i.e. case study 2). Similarly, in case study 2, lack of public sector appreciation for partnerships in a PPP environment, political involvement at the project implementation level, mistrust among stakeholders, a lack of an environment that facilitates PPPs, and difficulties obtaining credit from banks were all deemed to be "somewhat critical" failure factors.

The results of Case Study 3, which is the Concession of Doma Dam in Nasarawa State show that public sector corruption was a major obstacle to the PPP project's realization. Poor regulatory agencies, inexperienced and uncommitted public agencies, an absence of transparency and competition in the procurement process, inconsistent risk assessment and management, political involvement at the project implementation level, and a lack of an environment that facilitates PPPs were identified as "somewhat critical" failure factors. Table 2 also shows that the institutional structure for PPP is complicated and burdensome. High transaction costs, a weak legal system, and a public sector that does not value partnerships in the PPP context governmental agencies with less experience and dedication Public sector corruption, a lack of competitiveness and openness in the procurement process, inconsistent risk management and evaluation, Cost and time overruns, varying inflation rates, Government policy changes and political instability, participation of politics in project implementation, public resistance/opposition, The implementation of the Omi-Kampe Dam in Kogi State was hampered by the lack of PPPs-enabling environment and distrust among stakeholders, which were both deemed to be "rather major" failure reasons (case study4). In the concession of Garki Hospital (case study 5), political interference at the project implementation level was found to be the major cause of failure, and ignorance of PPP laws and regulations was also a major issue. Public sector underappreciation of partnerships in a PPP setting Failure factors that were identified as "quite crucial" were public sector corruption, a lack of an atmosphere that encouraged PPPs, and difficulties obtaining bank finance. The results of Case Study 6, the Concession of Debt Management Office, Abuja show that corruption in the public sector was the primary cause of the PPP project's failure. Additional factors include the PPP institutional framework's complexity and burden, high transaction costs, an ineffective legal system, weak regulatory bodies, inexperienced and uncommitted public agencies.

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Table 2: Summary of the assessment of criticality of failure factors using FMEA technique in physical and social infrastructure PPP project case Studies

S/N	FAILURE FACTORS	CASE STUDY 1				CASE STUDY 2				CASE STUDY 3			
		Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS
FFP1	Complex and cumbersome of PPP	448	482	465	Less critical	120	643	382	Less critical	424	482	453	Less critical
FFP2	High transaction costs	810	347	579	Somehow critical	504	463	484	Less critical	415	347	225	Not critical
FFP3	Ineffective legal framework	336	302	319	Less critical	378	375	277	Less critical	405	302	354	Less critical
FFP4	Poor regulatory authorities	150	801	476	Less critical	392	623	508	Less critical	350	801	576	Somehow critical
FFP5	Lack of awareness on PPP laws and regulations	84	472	278	Less critical	240	294	267	Less critical	238	472	355	Less critical
FFP6	Lack of public sector to appreciate partnerships in PPP environment	160	501	331	Less critical	720	546	633	Somehow critical	380	501	441	Less critical
FFP7	Communication constraint between the public and private sector	504	377	441	Less critical	560	326	443	Less critical	365	377	371	Less critical
FFP8	Inexperience and less committed public agencies	448	476	462	Less critical	392	460	426	Less critical	530	476	503	Somehow critical
FFP9	Corruption in public sector	630	933	782	Critical	720	833	777	Critical	600	933	767	Critical
FFP10	Lack of transparency and competition in procurement processes	800	768	784	Critical	900	777	839	Critical	490	768	629	Somehow critical
FFP11	Lengthy bidding process and contractual arrangements	1000	289	645	Somehow critical	336	272	304	Less critical	555	289	422	Less critical
FFP12	Inconsistent risk assessment and management	384	540	462	Less critical	120	373	267	Less critical	600	540	570	Somehow critical
FFP13	Cost overruns	120	579	350	Less critical	120	687	404	Less critical	240	579	410	Less critical
FFP14	Inflation rate fluctuation	30	462	246	Not critical	30	312	171	Less critical	71	462	267	Less critical
FFP15	Political instability and change in Government policy	60	523	292	Less critical	120	464	292	Less critical	290	523	407	Less critical
FFP16	Political involvement at the project implementation level	700	767	734	Somehow critical	720	733	727	Somehow critical	548	767	658	Somehow critical
FFP17	Public opposition	384	324	354	Less critical	336	296	316	Less critical	291	324	338	Less critical
FFP18	Distrust among stakeholders	810	360	585	Somehow critical	567	576	572	Somehow critical	545	360	453	Less critical
FFP19	Lack of PPPs enabling environment	648	678	663	Somehow critical	560	652	606	Somehow critical	372	678	525	Somehow critical
FFP20	Land acquisition problems	252	225	239	Not critical	175	249	212	Not critical	326	225	291	Less critical
FFP21	Difficulties in securing credit facility from banks	432	357	395	Less critical	648	491	570	Somehow critical	266	357	312	Less critical

Note: FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-1000-Critical

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S/N	FAILURE FACTORS	CASE STUDY 4				CASE STUDY 5				CASE STUDY 6			
		Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS
FFP1	Complex and cumbersome of PPP	800	430	615	Somehow critical	3	547	275	Less critical	448	554	501	Somehow critical
FFP2	High transaction costs	720	306	513	Somehow critical	392	422	407	Less critical	810	621	716	Somehow critical
FFP3	Ineffective legal framework	800	292	546	Somehow critical	5	395	200	Less critical	648	580	614	Somehow critical
FFP4	Poor regulatory authorities	576	261	419	Less critical	1	502	252	Not critical	576	557	567	Somehow critical
FFP5	Lack of awareness on PPP laws and regulations	810	184	497	Less critical	900	368	634	Somehow critical	720	187	454	Less critical
FFP6	Lack of public sector to appreciate partnerships in PPP environment	900	295	598	Somehow critical	504	792	648	Somehow critical	336	530	433	Less critical
FFP7	Communication constraint between the public and private sector	720	265	493	Less critical	336	511	424	Less critical	392	343	368	Less critical
FFP8	Inexperience and less committed public agencies	810	343	577	Somehow critical	80	590	335	Less critical	576	464	520	Somehow critical
FFP9	Corruption in public sector	1000	341	671	Somehow critical	294	933	614	Somehow critical	720	833	777	Critical
FFP10	Lack of transparency and competition in procurement processes	900	353	627	Somehow critical	64	642	353	Less critical	252	967	610	Somehow critical
FFP11	Lengthy bidding process and contractual arrangements	576	325	451	Less critical	100	590	345	Less critical	336	550	443	Less critical
FFP12	Inconsistent risk assessment and management	810	214	512	Somehow critical	72	365	219	Not critical	392	506	449	Less critical
FFP13	Cost overruns	1000	182	591	Somehow critical	18	541	280	Less critical	720	442	581	Somehow critical
FFP14	Inflation rate fluctuation	1000	52	526	Somehow critical	45	346	196	Not critical	336	364	35	Less critical
FFP15	Political instability and change in Government policy	900	258	579	Somehow critical	2	341	172	Not critical	250	582	416	Less critical
FFP16	Political involvement at the project implementation level	900	309	605	Somehow critical	810	697	753	Critical	140	703	422	Less critical
FFP17	Public opposition	800	357	579	Somehow critical	60	387	224	Not critical	288	241	265	Less critical
FFP18	Distrust among stakeholders	720	348	534	Somehow critical	60	666	363	Less critical	448	641	545	Somehow critical
FFP19	Lack of PPPs enabling environment	810	378	594	Somehow critical	448	738	593	Somehow critical	640	678	659	Somehow critical
FFP20	Land acquisition problems	640	219	430	Less critical	378	424	401	Less critical	343	296	320	Less critical
FFP21	Difficulties in securing credit facility from banks	810	167	489	Less critical	378	651	515	Somehow critical	384	563	474	Less critical

Note: FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-100-critical

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Table 3 identifies four critical success factors: access to suitable financial markets, a favourable investment environment, stakeholder trust, and appropriate risk allocation and sharing. These factors contributed to the level of success achieved in the concession of engineering infrastructure for the Katempe district in Abuja phase 2 (case study 1). The FMEA results for case study 2, the Shiroro hydroelectric power plant concession, highlight that a favourable investment climate and stakeholder trust were the two critical success factors enabling the project's success in Niger State.

Table 3 also reveals that case studies 3 and 4, the Doma Dam concession in Nasarawa State and the Omi-Kampe Dam concession in Kogi State, lacked essential success factors and consequently were abandoned. Several factors were categorized as "somewhat critical" success factors, including transparency in the procurement process, project technical viability, favourable investment environment, stakeholder trust, competition in the procurement process, availability of suitable financial markets, favourable legal and regulatory frameworks, good stakeholder relations, appropriate risk allocation and sharing, and stable macroeconomic conditions.

Furthermore, Table 3 demonstrates that a thorough and realistic assessment of costs and benefits was a crucial success factor contributing to the success of case study 5, the Garki Hospital concession in the Federal Capital Territory of Abuja. The presence of competition in the procurement process was highlighted as a critical success factor in the concession of the Debt Management Office in Abuja (case study 6).

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Table 3: Summary of the assessment of criticality of success factors using FMEA technique in physical infrastructure PPP project case Studies

S/N	SUCCESS FACTORS	CASE STUDY 1				CASE STUDY 2				CASE STUDY 3			
		Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS
SFP1	Transparency in procurement process	810	656	733	Somehow critical	648	559	606	Somehow critical	650	518	584	Somehow critical
SFP2	Thorough and realistic assessment of the cost and benefits	504	547	526	Somehow critical	448	571	510	Somehow critical	360	416	388	Less critical
SFP3	Project Technical feasibility	900	384	642	Somehow critical	420	657	539	Somehow critical	485	531	508	Somehow critical
SFP4	Public participation /Consultation with end-user's	160	637	399	Less critical	576	394	485	Less critical	143	235	189	Not critical
SFP5	Clear project brief and client requirements	810	372	591	Somehow critical	168	488	328	Less critical	293	364	329	Less critical
SFP6	Availability of suitable financial markets	900	715	808	Critical	648	683	666	Somehow critical	440	552	496	Less critical
SFP7	Favourable legal and commercially oriented laws and regulations	720	427	574	Somehow critical	720	673	697	Somehow critical	526	430	478	Less critical
SFP8	Good stakeholders relationship	392	377	385	Less critical	560	528	544	Somehow critical	326	428	377	Less critical
SFP9	Favourable investment environment	900	760	830	Critical	800	713	757	Critical	610	500	555	Somehow critical
SFP10	Trust between stakeholders	900	765	833	Critical	810	870	840	Critical	534	576	555	Somehow critical
SFP11	Appropriate risk allocation and sharing	800	780	790	Critical	336	666	501	Somehow critical	444	480	462	Less critical
SFP12	Competition in procurement process	640	720	680	Somehow critical	810	786	798	Critical	472	855	664	Somehow critical
SFP13	Technical innovation and technology transfer	150	224	187	Not critical	100	213	157	Not critical	180	224	202	Not critical
SFP14	Contract specifications and measurement	252	376	314	Less critical	540	282	411	Less critical	192	504	348	Less critical
SFP15	Well-organized and committed public agency	175	376	291	Less critical	245	322	284	Less critical	247	252	250	Less critical
SFP16	Strong and good private consortium	441	624	533	Somehow critical	576	514	545	Somehow critical	387	168	428	Less critical
SFP17	Stable macroeconomic condition	640	633	637	Somehow critical	360	624	492	Less critical	330	688	509	Somehow critical
SFP18	Political support	504	451	478	Less critical	504	428	466	Less critical	348	532	440	Less critical
SFP19	Contract flexibility	630	367	499	Less critical	64	323	196	Not critical	522	161	342	Less critical

Note: FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-100-critical

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S/N	SUCCESS FACTORS	CASE STUDY 4				CASE STUDY 5				CASE STUDY 6			
		Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS	Public RPN	Private RPN	Total AVG RPN	REMARKS
SFP1	Transparency in procurement process	810	388	599	Somehow critical	720	702	711	Somehow critical	210	440	325	Less critical
SFP2	Thorough and realistic assessment of the cost and benefits	392	230	311	Less critical	900	665	783	Critical	336	528	432	Less critical
SFP3	Project Technical feasibility	1000	253	627	Somehow critical	648	797	723	Somehow critical	294	620	457	Less critical
SFP4	Public participation /Consultation with end-user's	720	267	494	Less critical	336	431	384	Less critical	240	416	328	Less critical
SFP5	Clear project brief and client requirements	640	150	395	Less critical	720	492	606	Somehow critical	504	215	360	Less critical
SFP6	Availability of suitable financial markets	720	281	501	Somehow critical	150	414	282	Less critical	336	441	389	Less critical
SFP7	Favourable legal and commercially oriented laws and regulations	810	418	614	Somehow critical	504	450	477	Less critical	60	765	413	Less critical
SFP8	Good stakeholders relationship	1000	208	604	Somehow critical	810	466	638	Somehow critical	120	652	386	Less critical
SFP9	Favourable investment environment	720	327	524	Somehow critical	294	533	414	Less critical	80	607	344	Less critical
SFP10	Trust between stakeholders	576	381	479	Less critical	392	741	567	Somehow critical	224	723	474	Less critical
SFP11	Appropriate risk allocation and sharing	729	277	503	Somehow critical	567	645	606	Somehow critical	640	727	684	Somehow critical
SFP12	Competition in procurement process	720	427	574	Somehow critical	480	757	619	Somehow critical	900	870	885	Critical
SFP13	Technical innovation and technology transfer	576	331	454	Not critical	320	378	349	Less critical	140	277	209	Not critical
SFP14	Contract specifications and measurement	630	187	409	Less critical	392	557	475	Less critical	504	306	405	Less critical
SFP15	Well-organized and committed public agency	720	135	428	Less critical	192	363	278	Less critical	192	515	354	Less critical
SFP16	Strong and good private consortium	720	260	490	Less critical	648	618	633	Somehow critical	288	394	341	Less critical
SFP17	Stable macroeconomic condition	1000	217	609	Somehow critical	405	531	468	Less critical	512	284	398	Less critical
SFP18	Political support	392	285	339	Less critical	630	568	599	Somehow critical	441	659	550	Somehow critical
SFP19	Contract flexibility	512	154	333	Less critical	378	373	376	Less critical	72	285	179	Not critical

Note: FMEA- Failure Mode & Effect Analysis; RPN- Risk Priority Number; Criticality Scale: 1-250-Not Critical; 250-500-Less Critical; 500-750-Somehow Critical; 750-100-critical

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CFFs and CSFs emanating from the case studies

Based on the evaluation of the criticality of the identified failure and success factors using FMEA in the six PPP case studies as previously discussed in (Tables 2 and 3), the results identified a total of three CFFs that caused the case studies to experience varying degrees of failures. they are as follows: i. Corruption in the public sector ii. Lack of transparency and competitiveness in procurement processes iii. Political interference at the project execution level

Similar to this, the FMEA results for the case studies of the PPP projects described above (i.e., studies 1-6) found a total of 6 CSFs that were accountable for varying degrees of success of these case studies of the PPP projects. These CSFs are as follows:

i. Availability of suitable financial markets
ii. Favourable investment environment
iii. Appropriate risk allocation
iv. Competition in procurement process
v. Thorough and realistic assessment of cost and benefits
vi. Trust between stakeholders

CONCLUSION

This study examined the Critical Failure Factures (CFFs) and Critical Success Factors (CSFs) of PPP infrastructure projects in North Central Nigeria with a view to minimizing the failure of PPP infrastructure projects in North Central Nigeria. Similar to the previous study, this research utilizes the Failure Mode and Effects Analysis (FMEA) method to identify, classify, and understand the reasons behind the failures of PPP infrastructure projects in Nigeria's North Central region. It identifies Critical Failure Factors (CFFs) and Critical Success Factors (CSFs) that can enhance project success. The identified CFFs include political interference during project implementation, lack of transparency and competition in procurement processes, and corruption in the public sector. These factors contribute to the failure of PPP infrastructure projects. Similarly, six CSFs were identified as factors that contribute to the success of the PPP project case study to varying degrees. These factors include the presence of well-functioning financial markets, a favorable investment environment, appropriate risk allocation, competitive procurement processes, comprehensive and realistic cost and benefit assessments, and stakeholder trust. The identification of CFFs assists stakeholders in making informed decisions, planning ahead, and effectively managing the execution of PPP infrastructure projects. The identified CSFs have a positive impact on the formulation of PPP policies and the collaboration between stakeholders from the public and private sectors in the construction of PPP infrastructure projects. The study suggests that the major stakeholders involved in PPPs should give utmost consideration to the identified CFFs and CSFs in order to promote the more successful execution of PPP infrastructure projects.

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