Critical Success Factors and Readiness Index: Public-Private Partnerships

By

PANDIT, Ravi Shankar

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

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ABSTRACT

Despite the efforts being made globally to achieve sustainable development through public-private partnership projects, the number of canceled projects remains higher than concluded projects. Yet, we know very little about what determines the success of a PPP project. Review of the critical success factors (CSFs) that determine the success of PPP projects are outdated, and even when some information is available, it almost exclusively relies on qualitative case examinations. This paper attempts to fill this gap by first reviewing the existing literature to determine the list of CSFs. Then, via regression modeling, the paper attempts to determine a quantitative readiness index on the success of PPPs via four main groups: macroeconomic situation, favorable market conditions, governance & political climate, and regulatory & institutional environment. Based on the literature review, the study reveals the importance of nine CSFs: project type, project sector, contract period, private ownership, project financials, change in nations' Gross Domestic Product (GDP), the consumer price index (CPI), income level target of the project, and the number of bids for a project. Using these factors as independent variables in a multivariate regression model, the paper finds that the factors identified explain over 71% of the variations in PPP success.

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ABBREVIATIONS

AFR	Sub-Saharan Africa
CPI	Consumer Price Index
EAP	East Asia and Pacific
ECA	Europe and Central Asia
GDP	Gross Domestic Product
LAC	Latin America and Caribbean
MENA	Middle East and North Africa
MSW	Municipal Solid Waste
OLS	Ordinary Least Square
PPI	Private Partnership in Infrastructure
PPP	Public-Private Partnership
SAR	South Asia

INTRODUCTION

Governments in wealthy and developing nations have shown a growing interest in implementing public-private partnership (PPP) policies after the global financial crises of 2007–2008. Expertise and the funding capacity of the private sector are key motivators for governments to involve them through PPPs. Because of this trend and the need of the moment, researchers have been trying to analyze the implementation and operations of this delicate strategy (Chan et al., 2010; Cheung et al., 2012; Grimsey and Lewis, 2002). As a result, both practitioners and scholars better understand the notion of PPP policy thanks to these researchers' writings (Al-Sharif and Kaka, 2004).

Since the late 1990s, studies covered areas of governance (Li et al., 2005), financial modeling (Abdul-Aziz, 2001), risk management (Shen et al., 2006), relationship management (Chan et al., 2003), economic feasibilities (Wibowo, 2004), procurement (Ng et al., 2007), and success factors within PPPs (Ke et al., 2009). The need to study the success factors has become a critical area of research due to the complexity and variety of PPP projects e.g., Build Operate Transfer, Build Own Operate, and Buy Build Operate (Tang et al., 2010).

Despite the growing interest in PPP project success determinants, the requirement for study and analysis of what has already been reported in the literature is not receiving enough attention. Osei-Kyei & Chan (2015) published the most recent study which summarized the success factors within various types of PPP projects for the years 1990–2013. Therefore, it is imperative to perform a review of the literature on the critical success factors (CSFs) for PPP in order to increase practitioners' and researchers' awareness of the best approaches to implementing and executing PPP projects. To fill this missing void, this research conducted a thorough review of PPP success criteria for the years 1990–2021.

Readiness Index

Because limited funding is available from both government and the private sector, the readiness index – first used in the context of PPPs by the United Nations (UNESCAP, 2005) – was developed to understand the ideal procurement conditions for nations. The readiness index considered various components such as PPP experience, current infrastructure level, financial and market conditions, and political and government climate to ensure that the PPP project moves to completion when started by a nation (Sharma, 2012).

There are currently only three indicators that assess a nation's preparation for PPPs, all of which are qualitative measurements: the Partnership index, the Governmental support index, and the Infrascope index (determined via surveys and questionnaires). These indices do not accurately reflect the current situation; they merely offer a broad economic forecast. This knowledge gap is to be filled by the current investigation. The novelty of this study is being the first study to determine a quantitative indicator for PPPs via regression model which takes into account actual data from both successful and unsuccessful PPP projects around the world.

Giving the public and private sectors comparative perspectives is the overarching goal. With this quantitative index, private companies can plan their investments for PPPs, enabling informed judgments regarding the efficacy of ongoing PPP initiatives. In addition to being convenient and reliable, the futuristic element of the index may also help private-sector companies to understand the viability of PPP projects across new markets, allowing them to broaden their areas of operations. For the public sector or the government, this index shall help them understand the completion chances for ongoing PPP projects and help them choose the right private partner for continuing the current PPP project or collaborating on future PPP initiatives. Moreover, this index shall aid the government to understand the success ratio of PPP projects across other nations and thereby allow them to adopt or amend best practices.

The paper is structured as follows. Section 2 provides a background of PPPs. Section 3

provides the data description and methodology. Section 4 provides the result findings followed by policy recommendations and conclusions.

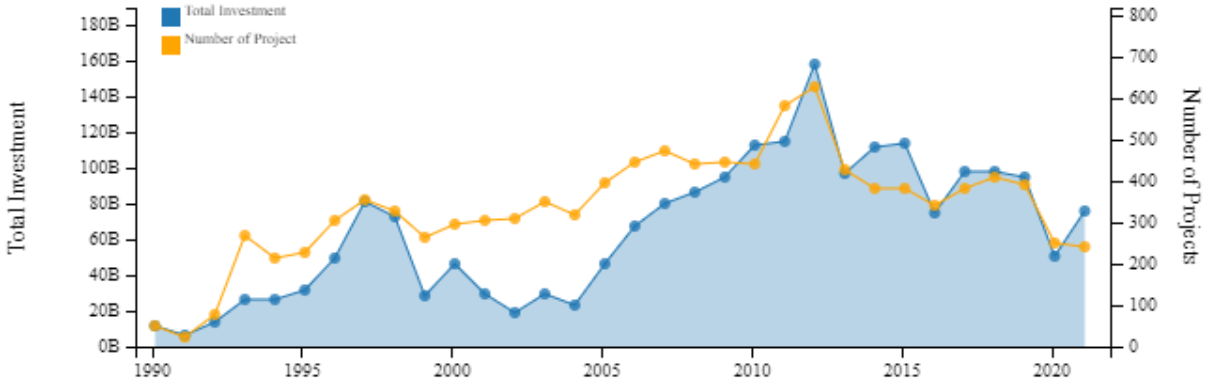
LITERATURE REVIEW

2.1 Background on Public-Private Partnerships

Contractual arrangements between a private party and a government agency (which could also involve multiple parties) - for the provision of a public asset or service - in which the private party carries major risk and management responsibilities are known as PPPs (World Bank, 2017). By leveraging the financial prowess of the private party, the contractual obligations are generally for long-term durations and involve cooperation and sharing of risks for both parties. Given the wide array of development work required for a nation, PPPs may be utilized for several purposes including (and not limited to) water, transport, ICT, and the energy sector (figure 1).

The diversified nature of PPP projects allows them to be tailored differently for each nation. For example, depending on the level of risk, obligations, and capital required for a development project, a PPP contract may be a build–operate–transfer agreement, design-build-operate-transfer agreement, maintenance, and management agreement, and so forth. With this said, PPPs often reduce the fiscal load on a nation and allow the best use of the limited public resources, offering cost and time savings, effective risk distribution, and a greater value for money (Rocca, 2017).

Figure 1: Trend of PPP Projects



Source: The World Bank, 2022

Leibenstein (1966) was one of the first authors to detail the theory of X-efficiency. Under this theory, the provision of goods and services is determined by the market and non-market failure. As PPPs offer public benefits and have negative externalities and information asymmetries, the private sector is bound to be vulnerable to market failures when allocating resources. That is where the government plays its role – to rectify and prevent such market failures. Vice versa, the government, when operating public projects, also becomes ineffective as they are shielded against competition, takeovers, and bankruptcies and require the helping hand of the private sector to usher through these moments (Kaur, 2005). The balancing nature of PPPs allows each party to reduce the chances of market failure and together create maximum efficiency. Hence, it can be said that PPPs origins are representative of the X-inefficiency theory.

2.2 Engagement Characteristics of Public-Private Partnerships

As nations looked to achieve sustainable development goals, it became imperative to enter PPP projects. This trend brought an immediate need for researchers to study the wide scope of PPP projects at all levels i.e., implementation, execution, and completion of PPP projects. These areas included (and not limited to):

(i) Financial Viability of PPP projects (Ismail, 2013)

(ii) Risk Management (Ameyaw & Chan, 2015)

(iii) Critical Success Factors (Liu et al., 2015)

(iv) Macroeconomic conditions (Hyun et., 2019)

The initial question on the minds of the government was to comprehend factors that would increase the private sector participation in PPPs. In this effort, Hammami et al., (2006) examined variables in developing countries that would help decipher the ideal private sector conditions for maximum involvement. The PPP experience of a nation, a transparent and fair political climate, larger fiscal deficits, lower corruption rate, and a larger target market led to a high engagement of the private sector for PPPs. The research conducted by

Banerjee et al., (2006) had similar findings – PPPs tend to be more active in countries with transparent political and governance systems. Similarly, Basilio (2011), also discovered that a larger target market, low rate of inflation, and incentives for the private sector were the key determinants in engaging the private sector.

Going forward, nations that have a history of PPP experience have received more acceptance from the private sector and a higher private sector engagement as this is an indicator of trust for the private sector (Sharma, 2012). The importance of a stable economic and political atmosphere cannot be overstated (see also Moszoro et al., 2015; Osei-Kyei & Chan, 2017). Mota & Moreira's (2015) study across 17 European countries portrayed the key determinants of PPP engagement to rely on macroeconomic conditions (see also Hyun et al., 2019), political stability, and institutional quality. Positive macroeconomic conditions are significant short- and long-term determinants of PPPs, according to Yesigat (2016)'s analysis. It is evident through these studies that involving the private sector – or the readiness of a nation to attract PPP collaborations – requires a stable macroeconomic condition, high levels of transparency in the government's governance and political system, larger fiscal deficits, incentives for the private sector, and low risks. A country is judged to have a developed economy that is PPP ready when these conditions are satisfied (EIU, 2018).

2.3 Previous PPP Readiness Indexes

The partnership index was founded in 2011 and the index was composed based on political economy-40%, investment climate-30%, and Infrastructure deficit-30%. Thus far, more than 72 countries have utilized this index. Moving on to the Infrascope index, developed in 2014, its determinants were divided into five factors: regulations-18.2%, institutions-18.2%, maturity-27.3%, investment and business climate-18.2% and financing-18.2%. These weights were given to a project based on four score categories; mature:80-100, developed:60-80, emerging:30-60, and nascent:0-30. This index has been used in select

European-Union, Latin American, and Asian countries. Lastly, in 2015, the governmental support index was formed. The composition of this index relied on a 33.3% share between 3 variables: policy and political commitment, legal and regulatory framework, and PPP-supporting institutions. Similarly, to the Infrascope index, its percentages were also based on the same score category. None of these indices, however, consider the current successful and unsuccessful PPP projects or offer a quantitative-based analysis for determining the efficacy of PPP projects.

The Concordia Index, which gauges PPP preparedness initially, considers three factors: the political climate, the overall investment climate, and the infrastructural deficiency. The index's coverage, though, was only good for the years 2013 through 2016. Second, a broad framework for evaluating the PPP readiness of European nations' is established by the Government Support Index. Due to the methodology's reliance on equal weighting for all factors taken into account, even factors that may not have a significant impact on the overall PPP preparedness are given equal weight. Third, legal and institutional frameworks are assigned 36.4% weight in the Infrascope PPP Readiness assessment.

2.4 Foundation of Critical Success Factors

Rockart (1982) looked at CSFs as those essential areas which are necessary for the private and public sectors to address if looking at concluding PPP projects. This has been a prominent area of study, since the 1970s, to guide managerial decisions and ensure success of PPP projects (Mohr and Spekman, 1994).

The study on CSFs has resulted in great success for PPP infrastructure projects (Liu et al., 2014). Since then, the study on CSFs has extended to include more sectors of development. For example, Meng et al. (2014) examined the CSFs for water projects in China. Liu & Wilkinson (2013) looked at CSFs in the transportation sector; Abdul-Aziz & Kassim (2011) explored CSFs for the energy sector; Askar & Gab-Allah (2002) touched upon CSFs for the housing sector. These studies have also expanded to include various types

of PPP agreements such as build-transfer-operate, design-build, etc.

The concept of CSFs eventually began to classify itself based on the different stages of the PPP process. For example, the success factors at the pre-PPP project phase were examined by Ng et al. (2012). In contrast, Tang et al. (2012) focused on the CSFs at the briefing stages of PPP. The design of PPP projects was also studied and then the CSFs were clubbed into groups by Raisbeck & Tang (2013). Overall, CSFs have been developed for developed and developing countries; however, scholars now are focusing on CSFs to carry out PPP projects in developing countries (Babatunde et al., 2012; Jefferies et al., 2002).

Given the diverse and complex nature of PPP projects – not to mention the intricacy and uniqueness of each nation, it is a challenging process for both the private-public sectors as well as for researchers to pinpoint the most crucial CSFs for ensuring maximum participation and project completion. Hence, it is vital to comprehensively review, investigate and analyze the significant findings from past studies which incorporates the entire spectrum of the PPP process and dimensions e.g., type of project, country dimensions such as Gross Domestic Product and Consumer Price Index, industry, stage of project, sector of the project, etc.

2.5 Research Hypothesis

2.5.1 Macroeconomic Conditions

It is generally known that fiscal stability in the implementation of economic policies as well as macroeconomic stability with low risk from external shocks promotes private investment. Studies done by Bogado (2015) and Zhang (2005) clearly demonstrate that fostering macroeconomic stability and increased participation by the private sector requires a stable financial climate. With this said, studies by Banerjee et al. (2006) and Hammami et al. (2006) showcase that unstable inflation rates and fluctuating exchange rates lower the engagement rate of the private sector – as the majority of private sector investments are dealt in foreign currencies. This finding leads to the following hypothesis:

Hypothesis 1: The inflation rate (Consumer Price Index) is negatively related to completed projects

The study by Harris (2003) and Mengistu (2013) also allows us to understand the complexity of a nation's Gross Domestic Product (GDP). Those nations with a growing GDP resulted in higher engagement by the private sector and led to higher completion rates of PPP projects due to the rising demands by the public for a better quality of life and the high level of support by the government.

Hypothesis 2: The change in GDP is positively related to completed projects

Hypothesis 3: The Income Level [Upper Middle Income] is related to completed projects

2.5.2 Favorable Market Conditions

As the macroeconomic conditions of a nation stay balanced, it increases the participation of the private sector in PPPs. Having more participants (bidders) also allows the government to select the ideal private partner for a PPP project (Hammami et al. (2006) and Asieudu (2002). As a result, the following hypothesis is made:

Hypothesis 4: The number of bids for a project is positively related to completed projects

2.5.3 Governance and Political Climate

Specific that the average contract period is more than 10 years, available literature has demonstrated that the political and governmental environment in a given country is a significant influence before investors make decisions there (Foster & Briceo-Garmendia, 2010; Singh & Kalidindi, 2014). In order to attract and protect private investment toward

meeting these infrastructure needs, accountable and politically stable governments are necessary. The matter of financials in one of contention. The private sector relies heavily on loans and government support to ensure the project reaches completion (Sharma, 2012). With that said, the data around the world indicates a favoring towards greenfield projects and projects focusing on the energy sector (World Bank, 2021). We make the following hypotheses as a result of these arguments:

Hypothesis 5: The contract period is negatively related to completed projects

Hypothesis 6: The change in Investment [projected investment – real investment] is positively linked to completed projects

Hypothesis 7: The type of project [Greenfield] is related to completed projects

Hypothesis 8: The project sector [Energy] is related to completed projects

2.5.4 Institutional Quality and Regulatory System PPPs

As PPP projects tend to have a heavier burden on the private sector – both financially and physically (in terms of responsibility and completion), Jamali (2004) found that a transparent and fair regulatory framework increases private sector participation and leads to higher success rates of PPP projects (see also Mengistu, 2013). As a result, the following hypothesis is derived:

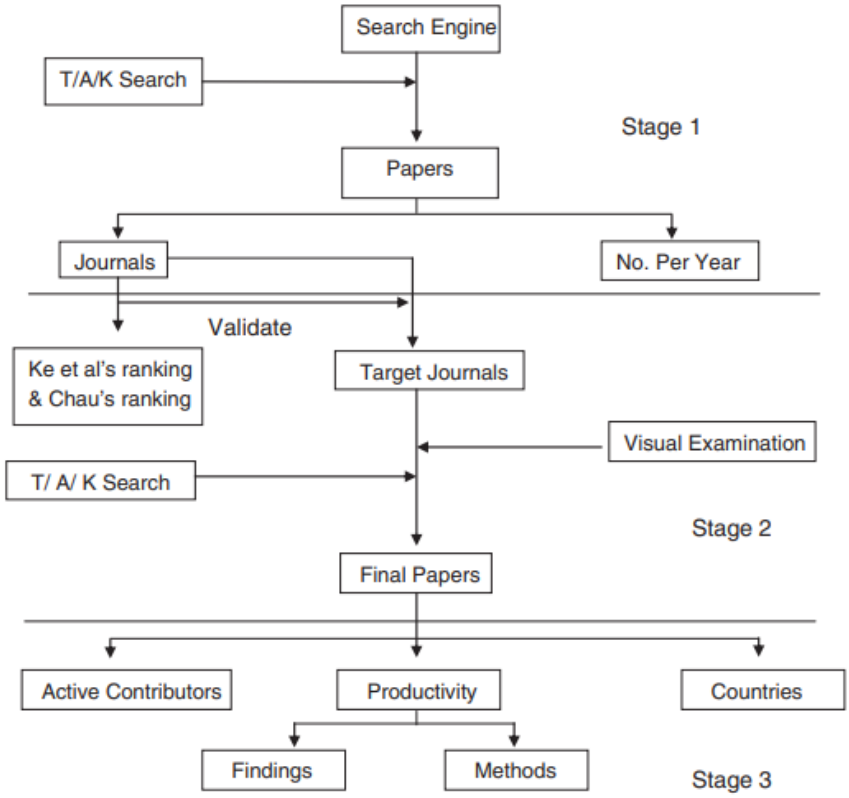
Hypothesis 9: Private Partnership Percentage is negatively related to completed projects

DATA SOURCING, SAMPLING, & METHODOLOGY

3.1 Critical Review of Success Factors

Due to the wide nature of previous PPP studies, it is imperative to conduct a thorough evaluation of the existing literature and identify the CSFs (Tsai & Wen, 2005). For this study, we shall utilize the three-stage search technique (figure 2) to find and select academic journals from the years 1990-2022 (both years inclusive) and analyze the target papers to find out the CSFs.

Figure 2: Three-Stage Search Technique



Source: Hong et al (2012); Yi & Wang (2013)

3.1.1 Classifying Academic Journals

In order to identify the academic-journals related to PPP, this study used the search engine 'Google Scholar.' The following search engine has been consistently used in various systematic reviews due to its broad database (table 2). Haddaway (2015) also noted that Google scholar has been known to be more accurate and surface more research papers than other search engines such as Web-of-Science. For example, a systematic review paper

published in 2014, focusing on the influence of biodiversity and dimensions of poverty located 318,000 relevant pieces of literature whereas Web of Science only generated 4,151 (ibid.). Similarly, another systematic review paper focusing on land management found 126,000 pieces of work on google scholar versus only 290 on Web of Science (ibid.). The same pattern may be observed in all systematic reviews ranging from public health to social sciences to biology (ibid.).

A thorough search was conducted using Google Scholar's "search" feature in order to provide a discernible trend of PPP CSFs- from 1990 to 2022 - and to critically examine it. The search terms included: public private partnership; private finance initiative; private infrastructure; PPP; critical success factors; CSF; critical factors; success factors. Papers were deemed to have complied with the study criteria if they contained these precise terms in the title-abstract-keywords.

3.1.2 Selecting Target Papers

At this point, a more thorough and visual search in all the chosen journals was done to determine which target papers should be subjected to further inspection. The analysis eliminated the pieces of literatures which belonged to the wide gambit of editorial pieces, news or press articles, conference papers and presentation pieces, and student dissertations.

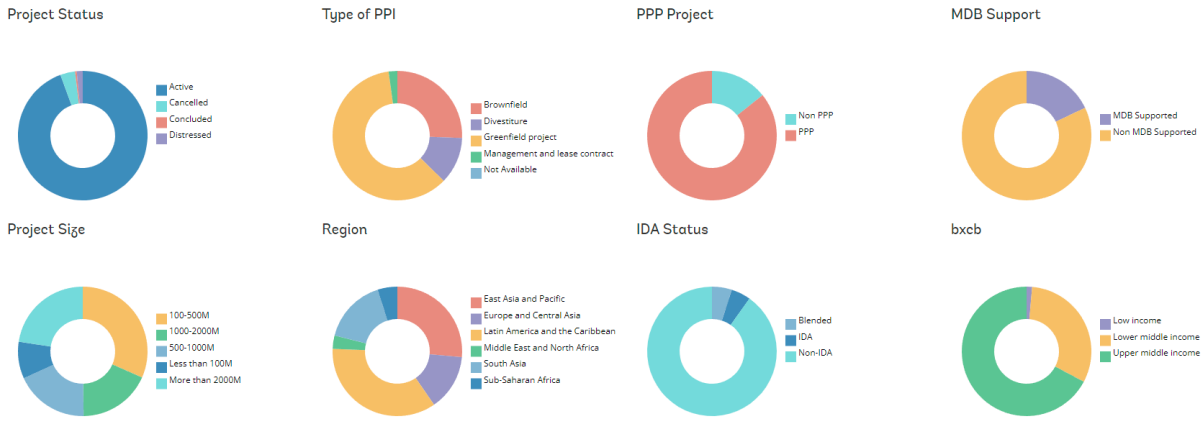
3.1.3 Examining Target Papers

Given Google Scholars' extensive database, it must be noted that the journal articles used in this study is not a representation of all the permutations and combinations available through our search keywords. In addition, it must be emphasized that the purpose of this exercise was not to populate data from all papers but rather to review the trend of research conducted for the CSFs of PPPs. This study aimed to locate those papers most cited and published in established journals from across the globe.

3.2 Description of the Public-Private Partnership Database by World Bank

The PPP-Project Database managed by the World Bank has data on over 10,422 public projects in over 130 low and middle-income countries. The PPP-project database is the effort of many countries in providing the leading source of PPP project level details & trends in the developing world -covering projects in the energy, ICT, and Municipal Solid Waste (MSW)-MSW data includes projects since 2008, transport and water and sewerage sectors. The data details the break-up of the $2,068 billion PPP investments made across the world with the electricity sector receiving the most. The data is representative of six regions: (1) East Asia and the Pacific (EAP), (2) Europe and Central Asia (ECA), (3) Latin America and the Caribbean (LAC), (4) the Middle East and North Africa (MENA), (5) South Asia (SAR), and (6) Sub-Saharan Africa (AFR). The dataset is organized into 24 sub-fields such as project status, type of PPP project, project size, and income level (figure 3).

Figure 3: PPI Database Snapshot by World Bank



Source: The World Bank, 2022

However, given that it primarily includes large infrastructure projects collected from public sources, this dataset does have certain limitations. As a result, there is a significant risk that information on small-sized PPPs, particularly at the local government level, may be omitted. Despite this, this database continues to be the most dependable and popular information source for PPPs in emerging nations.

3.3 Study Sample

In order to develop a quantitative readiness index, we shall develop a regression model. For this purpose, we shall utilize the PPP dataset by the world bank. Firstly, we shall be focusing on only the concluded and canceled projects – which amounts to 353 canceled projects and 227 completed projects, totaling 580 projects (table 1). This accounts for 5.5% of all PPP projects executed to date. The reason why we are focusing on extremities is that these two segments are the end results of any given PPP project i.e., canceled or completed (concluded), and hence needs to be treated as equally, if not more important, than the whole dataset (active, canceled, and concluded). Secondly, once we obtain a regression model that explains the phenomenon of the 'outliers', we may be able to extrapolate vital information that tilts more projects into completion.

Table 1: Region-wise summary of Cancelled and Concluded Projects

Region	**Frequency**	**Percent**
AFR	83	14.3
EAP	123	21.2
ECA	56	9.7
LAC	247	42.6
MENA	18	3.1
SAR	53	9.1
TOTAL	**580**	**100.0**

3.4 Description of Independent and Dependent Variables

Table 2 summarizes the independent variables via the following groups of macroeconomic conditions, favorable market conditions, governance and political climate, and institutional quality and regulatory framework. For each hypothesis, the expected effect

and its coded variable in SPSS is stated. The dependent variable is the final status of a PPP project i.e., canceled = 0 and concluded = 1.

Under Macroeconomic conditions, the change in GDP [in USD millions] has been calculated through the difference in the values of the real GDP [GDP during the final status of a PPP project – either concluded or canceled] and GDP [GDP at the start of the project]. The CPI2021 values have been procured directly from the dataset and is unchanged. The dataset has classified each PPP project into three income levels: low income [47 projects], lower middle income [172 projects], and upper middle income [361].

For the favorable market conditions, the number of bids has been extracted from the dataset and is unchanged.

For the governance and political climate, we extracted four variables. The first was contract period [unchanged]. To determine the change in investment [in USD millions], we utilized the values from the columns of projected investment and real investment. The change in investment was the difference of these extracted values. The type of project mentioned in the dataset was greenfield [190 projects], divestiture [83 projects], brownfield [196 projects], and management and lease contract [111 projects]. The project sector was divided into categories: energy [187 projects], ICT [53 projects], Municipal Solid Waste [1 project], Transport [209 projects], and Water & Sewerage [130 projects].

The Institutional Quality and Regulatory System for PPPs was obtained through the value of the private ownership in the dataset [unchanged].

Table 2: Description of Explanatory Variables

Category	**Hypothesis**	**Expected Effect**	**Data Used from World Bank Dataset (Coded in SPSS)**
Macroeconomic Conditions	Hypothesis 1: The inflation rate (Consumer Price Index) is negatively related to completed projects	Negative	Consumer Price Index: [CPI2021]
	Hypothesis 2: The change in GDP is positively related to completed projects	Positive	Change in GDP [USDm]: [realGDP –GDP]
	Hypothesis 3: The Income level [Upper Middle Income] is related to completed projects	N.A.	Income level: [Upper Middle Income == 1; Low and Lower Middle Income == 0]

Favorable Market Conditions	Hypothesis 4: The number of bids for a project is positively related to completed projects	Positive	Number of Bids: [number_of_bids]
Governance and Political Climate	Hypothesis 5: The contract period is negatively related to completed projects	Negative	Contract Period: [contract_period]
	Hypothesis 6: The change in Investment [projected investment – real investment] is positively linked to completed projects	Positive	Change in Investment (in USDm): [proposed_investment – investment_real]
	Hypothesis 7: The type of project [Greenfield] is related to completed projects	N.A.	Type of Project: [Greenfield project == 1; Divestiture, Brownfield, Lease Contract == 0]
	Hypothesis 8: The project sector [Energy] is related to completed projects	N.A.	Project Sector: [Energy == 1; ICT, MSW, Transport, Water & Sewerage == 0]

Institutional Quality & Regulatory System	Hypothesis 9: Private Partnership Percentage is negatively related to completed projects	Negative	Private Ownership (%)

3.1 Methodology

The method used for determining the regression is the Ordinary Least Squares regression (OLS) method vis SPSS software. OLS is a common technique used by several researchers to estimate the coefficients of linear regression equations which describe the relationship between one or more independent quantitative variables and a dependent variable. The OLS equation for this study is represented by the following equation:

Model:

$$PPP_{success} = \beta 0 + \beta 1*CPI + \beta 2*GDP + \beta 3*income + \beta 4*bids + \beta 5*CP + \beta 6*inv + \beta 7*ptype + \beta 8*sector + \beta 9*private\_per + \varepsilon$$

Where:

$PPP_{success}$: *Success rate of a PPP project (Chance of Concluded Project) [Dependent variable] & all* ***ßs*** *are the regression coefficients [R.H.S]*

β0: *Constant*

β1*CPI: CPI *is the variable for macroeconomic situation (Consumer Price Index)*

β2*GDP: GDP *is the variable for macroeconomic situation (Gross Domestic Product)*

β3*income: Income *is the variable for macroeconomic situation (Income Level)*

β4*bids: Bids *is the variable for favorable market conditions (Number of Bids)*

β5*CP: CP *is the variable for governance and political climate (Contract Period)*

β6*inv: Inv *is the variable for governance and political climate (Change in Investment)*

β7*ptype: Ptype *is the variable for governance and political climate (Type of Project)*

β8*sector: Sector *is the variable for governance and political climate (Sector of Project)*

β9*private_per: Private_per *is the variable for institutional quality and regulatory system (Private Ownership %)*

ε: *Random error component*

RESULTS AND DISCUSSION

4.1 Critical Review of CSFs

After filtering through the initial publications, a total number of 48 publications on the CSFs for PPP projects were identified from 1990 to 2022 (years inclusive). The picked research journals belonged to established journals such as the International Journal of Project Management, Transport Policy, Journal of Management in Engineering, Habitat International, Project Management Journal, Journal of Environmental Management, Journal of Construction Engineering and Management, and Journal of Business Administration. Furthermore, the research journals encompassed project types of infrastructure, transport, waste, water, and energy PPP projects. These research journals also covered several countries including India, China, the United Kingdom, Malaysia, Kenya, Indonesia, and Brazil. Appendix 1 displays a detailed view of all the journal articles selected for this study.

Upon sifting through the research journals, the following nine CSFs were identified under the following groups: macroeconomic conditions (Gross Domestic Product, Consumer Price Index, Income Level), favorable market conditions (number of bids), governance and political climate (contract period, change in investment, type of project, sector of project), and institutional quality and regulatory framework system (private party ownership).

4.2 SPSS-Descriptive Statistics

Table 3 below summarizes the SPSS descriptive statistics for the key independent variables that influences the success rate of a PPP-project. With reference to the variables for the macroeconomic conditions, the consumer price index (CPI) values hold a minimum of 1 and a maximum of 1.98. The mean and standard deviation are 1.18 and 0.21 respectively. This means that, on average, every country undertaking a PPP project is facing an increase in inflation rates.

The minimum and maximum values for the change in GDP are -$1.14X10^5 and $1.14X10^12 whereas the mean value is $2.59X10^11 and the standard deviation is 3.11X10^11. The mean value being positive represents that most countries experienced an increase in their countries' GDP, indicating positive growth. The standard deviation, however, indicates an uneven distribution of the data during the period under review (1990-2021). It must also be mentioned that the CPI recorded maximum observations of 580 [projects] whereas, for change in GDP, it was only 530. This indicates missing values for 50 PPP projects. In the case of income levels, the maximum observations were recorded.

For favorable market conditions, 64 out of the 580 projects under review only indicated the number of companies that bid for that particular PPP project. Nevertheless, the minimum number of bids placed for a PPP project was 1 [company] and the maximum was 122 [companies]. With the standard deviation being 17.18 [companies], it may be said that the data distribution is quite uneven.

Moving forward to governance and political climate, the values for the contract period indicate a low of 1 and a high of 95 years with the mean being 17.29 years and a standard deviation of 11.30 years. As stated in the literature, the values for PPP contracts are generally over 10 years and hence this data is not of any surprise. However, the value of the standard deviation being 11.30 years is quite high and represents an uneven spread of the data points. In addition, the data points observed are 469 out of a total of 580 observations.

The values for the change of investment indicate a minimum of -$3493.39 million and a maximum of $0.00001 million. With the mean being -$50.66 million, it indicates that, on average, the PPP projects under review exceeded their projected budget. Moreover, the number of observations recorded for the change in investment was 487 out of 580 projects – missing data points for 93 projects. The type of project

as well as the sector of projects were recorded in full.

When discussing the Institutional Quality & Regulatory System, the minimum value for private ownership percentage was 10% and the maximum was 100%. The mean takes a high value of 92.88% indicating that the onus or the burden of the PPP project falls mainly on the private sector, in line with the literature. Furthermore, the values recorded for this variable were 553 out of 580.

Table 3: SPSS-Descriptive Statistics

Variable	Obs.	Min	Max	Mean	Std. Dev
Consumer Price Index	580	1	1.98	1.18	0.21
GDP	530	$-1.40X10^{5}$	$1.14X10^{12}$	$2.59X10^{11}$	$3.11X10^{11}$
(Income Level == Upper Middle Income ==1	580	0	1	0.62	0.49
Number of Bids	64	1	122	7.28	17.18
Contract Period	469	1	95	17.29	11.30
Change in Investment	487	-3493.39	.00001	-50.66	224.97
Type of Project == Greenfield==1	580	0	1	0.33	0.47
Sector of Project == Energy==1	580	0	1	0.33	0.47
Private Ownership %	553	10	100	92.97	17.18

4.3 Regression or OLS model results

Through the use of SPSS software, the following relationship and influence between the variables were identified from the 580 completed and canceled PPP projects for the time period 1990-2021. Table 4 below summarizes the results herewith discussed.

Overall, the regression model with the nine independent variables: Consumer Price Index, GDP, Income Level, Number of Bids, Contract Period, Change in Investment, Type of Project, Sector of Project, and Private Ownership, holds an explanatory percentage of 71.3%. It must be said that the model reaffirms the importance of these variables in determining the success of a PPP project.

For the first group of CSFs, macroeconomic conditions, only the income level held a statistically significant value at the 95% confidence interval. The second group of favorable market conditions did not have any statistically significant variables. The third group of governance and political climate had two statistically variables of contract period and type of project. Lastly, for the Institutional Quality & Regulatory System, private ownership percentage did not hold a statistically significant value. With governance and political climate group holding two significant variables at the 99% confidence interval indicates that this group is vital for completing PPP projects. The next group that explains the model highly is macroeconomic conditions. The Institutional Quality & Regulatory System as well as favorable market conditions follow respectively.

For the determinants of macroeconomic conditions, the consumer price index was positively related to completed projects meaning that an increase in inflation increases the chances of a completed project. However, the variable is not statistically significant. In contrast the change in GDP indicated that it was negatively related to completed projects indicating that higher difference in values of GDP leads to lower

chances of a completed PPP project. Once again, this value was also deemed to be statistically insignificant. The income level, more specifically upper middle income, is related to the success of a PPP project. Its value is statistically significant at the 95% confidence interval. This also indicates that projects targeted towards the upper middle-income level will tend to have higher completion PPP rates.

In terms of favorable market conditions, the number of bids variable was negatively related to completed projects. While this value was also not statistically significant, the direction indicates that a lower number of bids corresponds with higher chances of project completion.

The first variable in the governance and political climate group was the contract period. It held a negative relationship with completed projects and was also statistically significant at the 99% confidence interval. This result indicates that lower contract periods [in terms of the number of years] lead to higher project completion rates. The change in investment variable held a negative relationship to completed projects but was not statistically significant. The type of project [where greenfield project type was categorized as 1, while other project types were 0] was found to be related to completed projects and was also statistically significant at the 99% confidence interval. This indicates that greenfield projects tend to lead to higher completion rates of PPP projects than other project types i.e., divestiture, brownfield, and management and lease contracts.

The final variable in this group was the project sector. With energy being treated as 1 while other project sector types are 0, it was found that this value does not hold a statistically significant value. This reflects that indulging in energy PPP projects (versus other project sectors of ICT, Municipal Solid Waste, Transport, and Water & Sewerage) does not result in higher project completion chances.

The Institutional Quality & Regulatory System group was measured by the

private ownership percentage variable. Though this value held a negative relationship to completed projects, its value was not statistically significant. However, the negative relationship reflects a lower private percentage to correspond to higher project completion rates.

Table 4: Determinants of PPP Success Rate

Dep. Variable: PPP success rate {Completed Project}				
Variables	Coefficients	Standard Error	T-Test	Statistical Significance
Consumer Price Index	0.344	0.732	0.470	0.641
GDP	$-5.452X10^{-14}$	0.000	-0.280	0.781
(Income Level == Upper Middle Income ==1	0.267	0.106	2.508	0.018**
Number of Bids	-0.002	0.003	-0.710	0.483
Contract Period	-0.032	0.005	-6.136	0.000***
Change in Investment	$-5.096X10^{-5}$	0.000	-0.361	0.721
Type of Project == Greenfield==1	-0.376	0.133	-2.817	0.008***
Sector of Project == Energy==1	-0.152	0.224	-0.677	0.504
Private Ownership %	-0.004	0.006	-0.745	0.462
Constant	1.104	0.851	1.297	0.204
Max. Observations	580			
R	0.844			
R Square	0.713			
Adjusted R Square	0.630			
Std Error of Estimate	0.3073			

Note: *** p<0.01, ** p<0.05

4.4 Discussion of the Study

The outcome of the study displayed comparison and contrasts across the nine CSF variables i.e., Consumer Price Index, GDP, Income Level, Number of Bids, Contract Period, Change in Investment, Type of Project, Sector of Project, and Private Ownership. The regression model also holds an explanatory percentage of 71.3% which invites interesting viewpoints. Lastly, individually, the result of the hypothesis sparks further discussions.

Looking at the regression model, the value for R-squared was 0.713. As this is the one of the first empirical studies which has investigated the canceled and concluded PPP projects [through actual data], through a regression analysis, it is difficult to pinpoint whether this value is reliable. However, looking at the research article of Osei-Kyei (2018), which tried to predict the success of PPP projects via a regression analysis mentioned that values around 0.40 would be considered reliable. More importantly, it is interesting to note that nine CSF variables [with limited data] could explain more than 70 % of the variance for PPP success. This calls for conducting another round of this investigation with full observation records. Furthermore, we must also look to extend this investigation by including more CSFs.

The governance and political climate (measured via contract period, change in investment, and type and sector of the project) was the largest factor for determining PPP success. However, this is not consistent with the findings of previous literature. In fact, earlier studies by Bogado (2015), Hammami et al (2006) and Lamech & Saeed (2003) have found favorable market conditions to be the largest predictor of PPP success. However, in our empirical investigation, favorable market conditions held the least [of the four groups] explanatory power.

Of course, a reason for this occurrence could be the different number of variables assigned to each group. The first group had 3; the second group had 1; the

third group had 4; the fourth group had 1. Hence, this indifference could be a reason for this occurrence. It must also be mentioned that studies conducted by several authors such as Malik (2022) and Tshehla (2019) have highlighted governance and political climate to be the most influential factor for PPP success. Independently, the variables that explained the regression model best were contract period, type of project [greenfield == 1], and income level [upper middle income == 1]. Though this happens to be the case, it does not mean that the other variables should be disregarded when aiming for PPP success, but rather that these variables should be given significance.

Turning our focus to the hypotheses reveals several insights and queries. Discussing first the macroeconomic condition variables, it is no wonder that rising inflation rates cease investment and private party engagement. However, in this study, it is shown that the inflation rate (CPI) holds a negative relationship with PPP success. This finding is quite odd and contrary to the literature (see Lee, 2018). However, an empirical study conducted by Zhou (1997), which looked at the probability of PPP implementation in thirteen high-inflation countries found that the PPP holds over a range of inflationary experiences. This means that high inflation (or lower levels of inflation) does not necessarily lead to the ceasing of PPPs, although it may lead to PPP project investments being on hold for some time. These contrasting pieces of prior research findings along with the findings of this study invite further investigation into this variable. Similarly, literature has suggested that higher changes in GDP correlate with higher PPP success. However, our findings, once again, are divergent.

Previous literature has suggested that PPP projects focused on the upper middle-income class lead to PPP success. Our findings also indicate that upper-middle-income projects lead to higher PPP success as opposed to their counterparts

i.e., low- and middle-income class. However, the divide of the study sample consisted of a 62.2% share of the upper-middle projects and 37.8% of the low-income and lower-middle-income projects. This may have caused the data to be skewed. Hence, it would be best to conduct further investigation to reaffirm these findings.

The favorable market conditions were measured through the number of bids for a project. According to previous literature, the ideal market conditions call for numerous private sector companies to come forward and bid for a PPP project. By way of this, the public sector may choose the right partner for a particular project leading to its eventual completion. However, the findings of this study indicated a negative relationship to PPP project completion.

Multiple reasons may be the cause for this explanation. First, the observations for this variable carried 516 missing values (out of 580). Second, the countries adopting PPP arrangements may have only a limited number of companies interested in undertaking the PPP project. Third, most public projects require a large funding capital [only possible for successful / large companies] and the number of these companies in developing nations may be limited. Fourth, could be related to political and governance factors [influence] which only caters to ‘specific’ companies. Moreover, this variable should be investigated further with all data points to re-affirm the findings of this study.

The governance and political climate variables had mixed results. The contract period findings aligned with the literature – negative relationship with completed projects whereas the change in investment was different from the literature – positive relationship to completed projects. However, while the value for the contract period was statistically significant, the change in investment value was not. One reason to attribute for this anomaly could be the number of missing values. The contract period and the change in investment had 111 and 93 missing values respectively. Secondly,

the contract period is decided before the commencement of the process and does not generally change within the project execution phase whereas the change in investment is subjected to external and internal factors [during the execution phase] such as fluctuating exchange rates, changes in policy and governance, natural or environment disasters, and several other unforeseen factors. Once again, we should gather the missing values and re-affirm the findings of this study.

Of the 10,422 PPP projects executed from 1990-2021, the type of project most invested in has been greenfield projects. Within our study sample, 32.8% of PPP projects were a greenfield-type project. The remainder belonged to brownfield projects (33.8%), Divestiture (14.3%) and Management and Lease Contract (19.1%). Furthermore, through the findings of this study, we witness that greenfield projects have higher chances of completion success than its contemporaries. While our data sample had a higher share of brownfield projects, a reason for greenfield project to have higher chances of PPP completion may be because a company is able to build its own, brand-new facilities whereas brownfield projects require the purchase or leasing of an existing facility. However, to fully extract the motivations for choosing one project over the other requires further investigation.

Similarly, the most chosen sector for undertaking a PPP project (out of 10,422 projects) was energy (electricity). However, our findings did not demonstrate a significant correlation between PPP success and the energy sector. A reason for this could be the uneven distribution of the chosen study sample: energy (32.6%) versus the combined total of (67.4%): transport, water and sewerage, ICT, and MSW, which could have skewed the findings. It would be best to conduct in-depth interviews with potential PPP managers to gain a deeper understanding of their choice of the PPP sector.

For the Institutional Quality & Regulatory System, the private ownership

variable displayed similar results as the hypothesis – negative relationship to PPP success. Even though our null hypothesis is not rejected, it is surprising that its value was noted as statistically insignificant. A reason could be the missing 27 values; however, it may not lead to a different result. This variable has been given much importance in previous literature (Chan et al., 2010; Meng et al., 2011; Babatunde et al., 2012) and hence further investigation into this result needs to be conducted.

Table 5: Hypotheses Result

Category	**Hypothesis**	**Findings**
Macroeconomic Conditions	Hypothesis 1: The inflation rate (Consumer Price Index) is negatively related to completed projects	Null Hypothesis is rejected
	Hypothesis 2: The change in GDP is positively related to completed projects	Null Hypothesis is rejected
	Hypothesis 3: The Income Level [Upper Middle Income] is related to completed projects	Null Hypothesis not rejected
Favorable Market Conditions	Hypothesis 4: The number of bids for a project is positively related to completed projects	Null Hypothesis is rejected
Governance and Political Climate	Hypothesis 5: The contract period is negatively related to completed projects	Null Hypothesis is not rejected
	Hypothesis 6: The change in investment is positively linked to completed projects	Null Hypothesis is rejected
	Hypothesis 7: The type of project is related to completed projects	Null Hypothesis is not rejected
	Hypothesis 8: The project sector is related to completed projects	Null Hypothesis is rejected
Institutional Quality & Regulatory System	Hypothesis 9: Private Partnership Percentage is negatively related to completed projects	Null Hypothesis is not rejected

POLICY RECOMMENDATIONS AND FINAL CONCLUSIONS

5.1 Policy Recommendations

The study's varied conclusions have consequences for public policy, as well as important information that prospective investors and academics should be aware of if they want to increase the body of knowledge on the topic. In light of this, the following suggestions are offered:

The governance and political climate CSF group is the most significant determining factor for PPP success and should be given priority in the policy arena. Moreover, emphasis should be made towards contract periods of shorter durations and greenfield projects should be encouraged. Even though the change in investment variable was statistically insignificant, the negative relationship of the variable suggests that projects that overrun their projected budget do not predict PPP success. Hence, the public sector should enforce tighter and more transparent protocols regarding the preparation of the projected budget. Lastly, the government should not look entirely focus on energy PPP projects as it is not a significant indicator of PPP success.

The income level focus of the PPP project should also be taken into consideration. As seen in this study, projects that have focused on the upper middle class have shown a clear relationship to PPP success. This does not, however, discredit the other income level groups. Furthermore, the inflation rates and GDP should not be concerning factors when trying to implement PPP projects. Governments should actively promote PPP projects regardless of their economic situation. At the same time, assuming the research finding is reliable for favorable market conditions (number of bids), the government should also not focus on obtaining a high number of bidders for a PPP project. Rather, they should focus on the integrity of the private company at hand.

In spite of the value of private ownership being statistically insignificant, it

must be said that the PPP projects should be shared equally (or with less onus on the private sector than currently). As the variable is negatively related to PPP success, this recommendation may increase chances for PPP success.

5.2 Recommendations for Further Studies & Research

The novelty of this research leaves room for several areas of research. Firstly, the empirical investigation should be conducted again by addressing the missing values present in contract period, private ownership percentage, number of buds, change in investment, and change in GDP. Secondly, the research should be extended to include more CSFs and/or CSF groups. This will help increase the reliability of the regression model. It would also be interesting to include a mixed-method approach to this investigation to gain further insight into the variables e.g., why a PPP manager chooses a specific type of project. Choosing or changing the dummy variables used in this regression model will also allow for better and wider representation of the variance and may lead to interesting findings. Lastly, the empirical investigation could be expanded to involve other quantitative analysis measurements for determining PPP success e.g., prediction modeling, Delphi technique, or Ordered weightage analysis.

5.3 Final Conclusions

The purpose of this study was two-fold. First, to provide an updated study on the existing literature on critical success factors for the years 1990-2022. Second, it aimed to reduce the number of failed PPP projects occurring throughout the world and tilt more projects towards completion by developing a quantitative readiness index.

The research study for the first part of this paper revealed nine CSFs grouped into four main groups: macroeconomic conditions (gross domestic product, consumer price index, and income level group); favorable market conditions (number of bids); governance & political climate (contract period, change in

investment, type of project, and project sector); and institutional quality and regulatory system (private ownership percentage).

By using the nine CSFs as factors (independent variables) in a multivariate regression model, the study found that these factors explained over 71% of the variations in PPP success. Moreover, we found that the contract period, the type of project, and the income level group held statistically significant values. Lastly, 5 out of the 9 hypotheses were rejected. While this research provides many findings, many of which are contrary to the existing literature, it opens several areas of potential future research.

It must also be stated that the data used for the empirical analysis has been extracted from the World Bank PPP database. And hence, caution must be taken regarding the reliability of the data. In fact, if time allows, the researcher (for future research) should try and assemble country-level PPP project details by contacting the host country and/or relevant government departments that can provide this data. This would ensure the utmost reliability and accuracy of the data.

This paper was a novel attempt to create a quantitative readiness index that can aid researchers and practitioners of PPP to ensure that more PPP projects (if not all) tilt toward completion. Hopefully, this study will encourage and motivate fellow researchers to conduct further investigations into PPP success models (via quantitative investigations) and build on this paper.

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APPENDIX

APPENDIX -1: SELECTION LIST OF JOURNAL ARTICLES

No.	Title Of Journal Article	Journal Name
1	Determining Critical Success Factors Of Construction Projects In The Hospitality Industry: A Conceptual Framework	African Journal Of Hospitality, Tourism And Leisure
2	Critical Success Factors Of Public Private Partnership (Ppp) Implementation In Malaysia	Asia-Pacific Journal Of Business Administration
3	A Fuzzy Synthetic Evaluation Analysis Of Operational Management Critical Success Factors For Public-Private Partnership Infrastructure Projects	Benchmarking: An International Journal
4	Recommendations And Guidelines For Implementing Ppp Projects: Case Of The Electricity Sector In Brazil	Built Environment Project And Asset Management
5	A Critical Success Model For Ppp Public Housing Delivery In Ghana	Built Environment Project And Asset Management
6	Use Of Key Performance Indicators For Ppp Transport Projects To Meet Stakeholders' Performance Objectives	Built Environment Project And Asset Management
7	Interdependency Of The Critical Success Factors And Ex-Post Performance Indicators Of Ppp Projects	Built Environment Project And Asset Management
8	Stakeholder Perceptions On Critical Success Factors For Public-Private Partnership Projects In Nigeria	Built Environment Project And Asset Management
9	Critical Success Factors For Ppp/Pfi Projects In The Uk Construction Industry	Construction Management And Economics

10	Empirical Comparison Of Critical Success Factors For Public-Private Partnerships In Developing And Developed Countries: A Case Of Ghana And Hong Kong	Engineering, Construction And Architectural Management
11	Identifying Macro-Environmental Critical Success Factors And Key Areas For Improvement To Promote Public-Private Partnerships In Infrastructure	Engineering, Construction And Architectural Management
12	Critical Success Factors For Public Private Partnership In Water Supply Projects	Facilities
13	Critical Success Factors In Implementation Of Urban Metro System On Ppp: A Case Study Of Hyderabad Metro	Global Journal Of Flexible Systems Management
14	Factors Influencing The Success Of Ppp At Feasibility Stage – A Tripartite Comparison Study In Hong Kong	Habitat International
15	Critical Success Factors For Implementing Ppp Infrastructure Projects In Developing Countries: The Case Of Vietnam	Innovative Infrastructure Solutions
16	Critical Success Factors Of Public–Private Partnership Projects: A Comparative Analysis Of The Housing Sector Between Malaysia And Nigeria	International Journal Of Construction Management
17	Critical Success Factors For Public-Private Partnership (Ppp) Infrastructure And Housing Projects In Kenya	International Journal Of Construction Management
18	Critical Success Factors (Csfs) Of Public–Private Partnership (Ppp) Road Projects In Ethiopia	International Journal Of Construction Management

19	Improving Performance Of Infrastructure Projects In Developing Countries: An Ecuadorian Case Study	International Journal Of Construction Management
20	Critical Coms Of Success In Large-Scale Construction Projects: Evidence From Thailand Construction Industry	International Journal Of Project Management
21	Review Of Studies On The Critical Success Factors For Public–Private Partnership (Ppp) Projects From 1990 To 2013	International Journal Of Project Management
22	Cross-Country Comparisons Of Key Drivers, Critical Success Factors And Risk Allocation For Public-Private Partnership Projects	International Journal Of Project Management
23	Identification Of Critical Success Factors (Csfs) For Public Private Partnership (Ppp) Construction Projects In Syria	Jordan Journal Of Civil Engineering
24	Public Private Partnership In Higher Education In Bangladesh: A Study Of Stakeholders' Conceptualization And Critical Success Factors	Journal Of Business Studies
25	Critical Organizational Success Factors For Public Private Partnership Projects – A Comparison Of Solicited And Unsolicited Proposals	Journal Of Civil Engineering And Management
26	Critical Success Factors For Ppps In Infrastructure Developments: Chinese Perspective	Journal Of Construction Engineering And Management

27	The Critical Success Factors For Public-Private Partnership Highway Construction Project In Malaysia	Journal Of Engineering And Technology
28	Critical Success Factors For Ppp Msw Projects – Perception Of Different Stakeholder Groups In India	Journal Of Environmental Management
29	Factors Contributing To Successful Public Private Partnership Projects: Comparing Hong Kong With Australia And The United Kingdom	Journal Of Facilities Management
30	Critical Success Factors In Public-Private Partnerships (Ppps) On Affordable Housing Schemes Delivery In Tanzania	Journal Of Facilities Management
31	A Survey Of Critical Success Factors For Attracting Private Sector Participation In Water Supply Projects In Developing Countries	Journal Of Facilities Management
32	Critical Success Factors In Public-Private Partnership (Ppp) On Infrastructure Delivery In Nigeria	Journal Of Facilities Management
33	Factor Analysis Of Critical Success Factors For Water Infrastructure Projects Delivered Under Public–Private Partnerships	Journal Of Financial Management Of Property And Construction
34	Life Cycle Critical Success Factors For Public-Private Partnership Infrastructure Projects	Journal Of Management In Engineering

35	Developing A Project Success Index For Public–Private Partnership Projects In Developing Countries	Journal Of Management Systems
36	Determination Of The Critical Success Criteria For Public-Private Partnership (Ppp) Projects In Turkey	Journal Of Polytechnic
37	Identification Of Critical Success Factors For Public–Private Partnership Projects	Journal Of Public Affairs
38	Critical Success Factors For Ppp Infrastructure: Perspective From Taiwan	Journal Of The Chinese Institute Of Engineers
39	Analysis Of Critical Success Factors In Public Private Partnership Projects By Triangulation Method: Turkey Perspective	Journal Of The Faculty Of Engineering And Architecture Of Gazi University
40	Identification And Ranking Of Critical Success Factors For Bot Projects In India	Management Research Review
41	Success Factors For Public-Private Partnership Infrastructure Projects In Vietnam	Munich Personal Repec Archive
42	The Influence Of Critical Success Factors On Value For Money Viability Analysis In Public–Private Partnership Projects	Project Management Journal
43	Critical Performance Factors Of Public Sector Organizations In Concession-Based Public-Private Partnership Projects	Property Management
44	Critical Success Factors Of Public Private Partnership In Hydropower Sector Of Nepal	Pyc Nepal Journal Of Management

45	Stakeholders And Critical Factors In The Brazilian Government´S Public Private Partnerships	Revista Do Serviço Público
46	Examining The Interrelationship Among Critical Success Factors Of Public Private Partnership Infrastructure Projects	Sustainability
47	The Effect Of Critical Success Factors On Project Success In Public-Private Partnership Projects: A Case Study Of Highway Projects In Iran	Transport Policy
48	Interrelationships Among Critical Success Factors For The Planning Of Municipal Solid Waste Management Ppp Projects In India Using Structural Equation Modelling	Waste Management & Research