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Developing a Performance Evaluation Framework for Public Private Partnership Projects

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Abstract: The public–private partnership (PPP) is a potential procurement strategy for delivering complex construction projects. However, implementing PPPs has not been explored extensively in developing countries like Pakistan. A performance framework is developed in this study to evaluate the application of PPP projects based on 10 key performance indicators (KPIs) and 41 performance measures (PMs). This framework was reviewed by experts for coverage and relevance, then validated through two case studies involving road construction. A triangulation approach was adopted to collect the relevant data through multiparty focus group sessions, archives, and site observations, which enhances the reliability of the data. Results showed there is a difference in performance for six KPIs, but similar practices were reported for four KPIs. The developed performance evaluation framework (PEF) for PPP projects is suitable for developing countries transitioning toward adopting this procurement strategy.

Keywords: procurement; public–private partnership; performance evaluation framework; road construction projects; Pakistan

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1. Introduction and Background

Poor procurement practices are among the most critical risks for construction projects in developing countries like Pakistan [1,2]. Such ineffective procurement may lead to disputes among project stakeholders [3]. Relational partnering helps in achieving value-based procurement [4] by integrating client values with the performance expectations of project stakeholders [5] and with relational risk management [6] as a proactive stance [7], which has a direct impact on project success [8]. The public–private partnership (PPP) is a nontraditional procurement route that refers to a long-term contractual arrangement between a public agency (with limited financial and managerial control) and a private organization performing, mostly, a build-own-operate-transfer strategy [9]. PPPs demonstrate private investment in public infrastructure based on models such as an alternative contract, leasing, joint ventures, concessions, and privatization [10]. However, the risk management capabilities of private organizations are the capstone for gaining efficiency for a PPP [11]. Furthermore, pre-contract problems are identified and addressed before project execution [12]. Therefore, PPPs potentially establish a collaborative environment based on relational contracting [13] where the parties have dynamic positions and responsibilities [14], opting for appropriate consensual sharing mechanisms [15], for resources, risks, and rewards [16].

The chronicles of global development show that the PPP is a centuries-old concept [17]. In the modern era, 'new public management' and 'neoliberalism' are considered prominent promoters on the global scale to improve public administration. This is achieved through interaction and managerial cooperation between public agencies and private organizations [18]. Furthermore, the focus of global development finance institutions on PPPs has amplified their importance [19]. However, disruptive events, like COVID-19 or capital market collapses, have impacted the PPP projects globally because private investments in public road construction projects need more time to recover [16,20]. Therefore, the performance of PPP projects depends on the institutionalization that shapes the landscape and the capacity to address the critical challenges.

Measuring the performance of a PPP project is essential to achieving the viability of relational contracting. This has been successfully implemented for public projects in other sectors such as social infrastructure (hospital construction) [21], tourism development [22], and electric vehicle charging structures [23]. The development of a performance framework counters several constraints, such as industry or sector, nature and stage of project, and country context. However, a performance framework for a sector is reliant on PPP evolution, reform mechanisms, and the extent of implementation. Pakistan is comparatively lagging behind other developing countries [24].

It is noteworthy that adopting PPP relies on the political, cultural, and fiscal imperatives of a specific country. Therefore, the challenges for developing countries vary notably compared to developed countries [25]. At the global scale, competition issues are inherent because of the complexity of PPP as a procurement system for staged or phased road construction projects toward delivering the best value for money (VFM) [26]. Over the last two decades, notable research has been conducted to understand the dynamics of a PPP under construction [27]. Tang, Shen, and Cheng [28] reported that empirical PPP research focuses on risks, relationships, and financing, and non-empirical research emphasizes financing, project success, risks, and concession periods. Later, Cui, Liu [29] reported six research gaps related to social impact assessment, risk management efficiency, performance appraisal, flexible contracting, government supervision, and knowledge management in PPP projects.

Interestingly, another review conducted after eight years reported similar topics such as social networks, conceptualization, risk sharing, adoption, and performance for PPPs [30]. A review study reported the top five critical success factors for PPP projects: appropriate risk allocation and sharing, a strong private consortium, political support, public/community support, and transparent procurement [31]. Similarly, another review study reported challenges in PPP related to financial management, concession period and price determination, operational phase, risk management, project procurement, and stakeholder management [32].

In the last decade, various notable research studies have been conducted to explore the implementation and performance of PPP projects in Pakistan. Chowdhury [33] applied network theory to understand the PPP structure from the stakeholder and intermediary participants' perspective and their influence on project performance. Noor [34] justified the need for nontraditional procurement methods, i.e., PPP, for road construction projects. Naveed [35] reported variance in perceptions and perspectives among stakeholders of PPP projects. Another study explored the failure drivers of PPPs and found that inappropriate decisions and actions of private-sector partners lead to PPP failure in transportation projects [36]. Noor [37] investigated the issues and barriers to procuring PPP in transport sector projects.

The PPP concession was investigated by Ullah and Thaheem [38] to analyze the industry–academia gap for critical success factors, which turned out to be a huge difference. Later, another study developed a relationship among the critical success factors using system dynamics [39]. The risk allocation capability in PPP was modeled for stakeholders, which is influenced by market, sector, and project contexts [40]. Soomro [41] evaluated socioeconomic and political issues in transportation PPP failure. Khahro [42]

developed a risk-severity matrix for sustainable PPP projects, which helped incorporate the United Nations Sustainable Development Goals. Similarly, Ahmad [43] categorized a PPP project's success in four dimensions: time, cost, objects, quality, or stakeholder satisfaction—reporting that the last is most significant.

Available research advocates for a comprehensive, dynamic, and lifelong performance assessment framework for PPP projects in Pakistan. Currently, such a performance evaluation framework (PEF) for road construction projects demonstrating successful PPP transactions is unavailable. The public organizations in Pakistan at the national, provincial, and local levels opt for PPPs as a viable solution for executing capital projects, with financing from external funding covering the infrastructure, energy, and port sectors [8]. However, it has been reported that there is a significant risk of failure in implementing PPPs in developing countries, and Pakistan is not an exception [39,42]. This study is an attempt to develop a robust performance evaluation framework applicable to PPP projects for road construction in the context of Pakistan.

The rest of the study is organized as follows. Section 2 presents the holistic method adopted in this study and explains the multi-staged approach. Section 3 presents the results and discusses on development and evaluation of the PEF for PPP road construction projects using 10 key performance indicators (KPIs) and 41 performance measures (PMs). Section 4 concludes the study and presents the key takeaways, the study's limitations, and future research directions.

2. Methodology

This qualitative research follows three main stages for developing the PEF for PPP projects in the road construction sector within the construction industry. The qualitative approach is suitable for this research to gain understanding and collect information and data through exploration to establish the grounded theory, which can potentially be tested through a quantitative approach with a larger dataset [44]. This study followed ref. [45] to identify the factors and qualitative performance measures, ref. [46] to validate the from experts, and ref. [47] for testing the exploratory case-study design. The data collected for the case studies was from focus group interviews [48], project archrivals [49], and site observations [50], as adopted by previous studies on performance evaluation frameworks for PPP projects.

In *Stage 1*, the PEF for road construction projects was developed. A literature review was conducted to identify the KPI_S and respective PM_S as given in Table 1. Various relevant academic (journals, conferences, and books) and non-academic (institutional reports and archives) sources were reviewed. Initially, KPIs were extracted from relevant studies conducted in the Pakistan context [37,39,41,51], and then a rigorous review of 72 relevant articles was conducted to enhance the theoretical relevance. A total of 10 KPI_S and 41 PM_S were extracted from relevant studies and demonstrate the overall performance of PPPs in developing countries.

In *Stage 2*, the contents of the theoretical PEF were reviewed by the two PPP experts for appropriateness and suitability and affiliated with the case projects as a pilot study to conform to the project nature and the developing country context (specifically for public projects in Pakistan). The experts were selected based on previous experience with PPP projects and engagement in the whole life cycle. The first expert was a deputy director of contracts (works) in LRRA, and the second expert was a coordination manager in LAFCO. Both have relevant construction qualifications and more than five years of experience related to PPP projects in road construction.

In *Stage 3*, the PEF is validated by case studies, which is a well-adopted research strategy in PPP research [52]. Two operational PPP highway projects were selected as case studies based on their unique and prominent characteristics: (a) the Lahore-Sheikhupura-Faisalabad Dual Carriageway (LSF) and (b) the Lahore Ring Road, Southern Loop, SL-I and II (LRR). The LSF is the first-ever PPP road construction project claimed to be successful in Pakistan with a concession period of 25 years and a cost of around PKR 6 billion. The

LRR is the first project executed after PPP legislation in Punjab province with a similar concession period and cost of around PKR 22 billion. The private partner is a joint venture of four companies in the LSF, but it consists of only one contractor in the case of the LRR. The 25-year concession periods range from 2003 to 2028 for the LSF and from 2017 to 2041 for the LRR.

Table 1. Performance Evaluation Framework for Public Private Partnership Projects.

KPIs and PMs	References	Key Research Question	Measurement Scale
KPI_1—General Aspects of Contract			
PM_1—Nature/Framework of contract	[53,54]	What is the legal strength of the concession agreement of this project in terms of clarity and unambiguity of its contents?	Very strong to very weak
PM_2—Flexibility in PPP contract	[55,56]	Does the concession agreement of this project have enough flexibility to cover unknown risks over the concession period?	Yes or no
PM_3—Maintenance regime (MR)/Defect and design liability periods (DLPs)	[28,57]	How long are the MR and DLPs of this project?	Number of years
PM_4—Allocation and utilization of viability gap fund (VGF)	[58,59]	How much VGF was allocated and utilized on this project?	Percentage of construction cost
KPI_2—Time Performance			
PM_5—Construction time variance (CTV)	[52,60]	What is the duration of allocated and actual construction time of this project?	Number of days
PM_6—Construction time growth (CTG)	[61,62]	What is the construction time growth of this project?	Ratio of actual and allocated construction times
KPI_3—Concession Period			
PM_7—Optimum duration	[63,64]	Is the concession period of this project optimum?	Yes or no
PM_8—Flexibility	[63,65]	Is the concession period of this project flexible?	Yes or no
KPI_4—Cost Performance			
PM_9—Construction cost variance (CCV)	[66,67]	How much are the allocated and actual construction costs of this project?	Amount in Pakistani rupees (PKR)
PM_{10}—Construction cost growth (CCG)	[62,68]	What is the construction cost growth of this project?	Ratio of actual and allocated construction costs
PM_{11}—Unit construction cost (UCC)	[69,70]	What is the unit construction cost of this project?	Ratio of actual construction cost to the length of road
PM_{12}—Value for money (VFM) test	[71,72]	Was VFM test performed for this project?	Yes or no
PM_{13}—Tax rate/Toll rate	[73,74]	Are the toll rates of this project optimum?	Yes or no
PM_{14}—Toll adjustment mechanism	[68,75]	Does the concession agreement of this project include a toll adjustment mechanism?	Yes or no
PM_{15}—Viability of financial model	[76,77]	Is the financial model of this project viable?	Yes or no
KPI_5—Quality Performance			
PM_{16}—Specified quality vs. actual quality	[78,79]	Does the actual quality of this project meet its specified quality?	Yes or no
PM_{17}—Defects and problems	[80,81]	Are M&R duties of this project performed efficiently?	Yes or no
PM_{18}—Health and safety	[82,83]	Mention the number of accidents and their consequences during this project's construction phase.	Number of accidents while consequences as number of minor injuries, major injuries, deaths, and financial losses
KPI_6—Service Delivery			
PM_{19}—Specified services vs. actual services	[84,85]	Do actual services match those specified in the concession agreement of the project?	Yes or no
PM_{20}—Quality of services	[86,87]	What is the quality of available services on this project?	Excellent to very poor
KPI_7—Coherence			
PM_{21}—Internal coherence	[88,89]	Does this project have internal coherence?	Yes or no
PM_{22}—External coherence	[89,90]	Does this project have external coherence?	Yes or no

Table 1. *Cont.*

KPIs and PMs	References	Key Research Question	Measurement Scale
KPI_8—Inter-organizational Cooperation and Partnership			
PM_{23}—Community involvement	[91,92]	How much has the local community been involved in important decisions regarding this project?	Percentage of the local community
PM_{24}—Operational difficulties	[93,94]	Are any operational difficulties associated with this project?	Yes or no
PM_{25}—Number of disputes	[95,96]	How many disputes have occurred on this project?	Number of disputes
PM_{26}—Imposition of penalties/damages	[85,97]	How many times were penalties/damages imposed on this project?	Number of instances
PM_{27}—Trust building between public and private partners	[98,99]	What is the level of trust built between public and private partners due to this project?	Excellent to very poor
PM_{28}—Relations with other departments/organizations	[62,100]	What is the impact of this project on the relations of your entity with other departments/organizations?	Excellent to very poor
PM_{29}—Risk sharing mechanism	[101,102]	Does the concession agreement of this project involve a proper risk-sharing mechanism?	Yes or no
PM_{30}—Satisfaction of key stakeholders	[103,104]	Are you satisfied with this project?	Yes or no
KPI_9—Socio-Economic Impact			
PM_{31}—Community labor/Local labor/Local Employment	[105,106]	How much local labor has been engaged in this project?	Percentage of total labor
PM_{32}—Local procurement	[107,108]	How much local procurement has been done on this project?	Percentage of total procurement
PM_{33}—Impact on the local economy	[51,109]	What is the impact of this project on the local economy?	Percentage increase/decrease in the local economy
PM_{34}—Capacity building/Training	[110,111]	Did this project help in the capacity building of your entity in PPP transactions, including through training?	Yes or no
PM_{35}—Impact on vehicle operating costs (VOCs)	[110,112]	What is the impact of this project on VOCs?	Percentage increase/decrease in VOCs
PM_{36}—Impact on travel time	[113,114]	What is the impact of this project on travel time?	Percentage increase/decrease in travel time
PM_{37}—Impact on the environment	[115,116]	What is the impact of this project on the local environment?	Positive to negative
PM_{38}—Impact on the commercialization of the vicinity	[117,118]	What is the impact of this project on the commercialization of the vicinity?	Percentage increase/decrease
KPI_{10}—Sustainability			
PM_{39}—Nature of benefits	[119,120]	What is the nature of the benefits of this project?	Long-term or short term
PM_{40}—Self-sustainability	[121,122]	Is this project self-sustainable?	Yes or no
PM_{41}—Scalability and replicability	[123,124]	Is this project scalable and replicable?	Yes or no

A triangulation approach [125] was adopted to collect the information for each PM from both case studies. Information was mainly collected through focus group sessions with stakeholders as conducted by [50] and the information is available on institutional websites and in reports. Stakeholders who play a critical role on PPP projects, as identified by [103], include a public partner, a private partner, an SPV (special purpose vehicle or project company), financer(s), an escrow agent, commuters/users, and the local community. The same information from various stakeholders determines authenticity and reliability. In addition, site observations on various occasions [126] help to understand relevant aspects of KPI_S through the ongoing progress of projects. The mapping of various potential information sources against each PM is shown in Appendix A.

3. Results and Discussion

3.1. Performance Evaluation Framework for PPP Projects

As shown in Table 1, various KPIs and PMs are utilized in this study to develop the PEF for Pakistan's PPP projects. KPI_1 deals with general features of a PPP project's contract/concession agreement. It is assessed through four PMs. PM_1 investigates the legal strength of the concession agreement in terms of clarity and unambiguity in its definitions and contents, as well as the allocation of responsibilities to the parties involved. PM_2

investigates flexibility in concession agreements to deal with the unknown risks associated with the long-term nature of the agreement. PM_3 investigates the extent of responsibility of the private partner regarding the maintenance and rehabilitation (M&R) of the project. PM_4 investigates the project's allocation and utilization of the viability gap fund (VGF).

KPI_2 deals with the construction-time performance of a PPP project and has two PMs. PM_5 investigates variation between allocated and actual construction duration of the project. A positive sign indicates that actual construction time is less than the allocated construction time and vice versa. PM_6 investigates the deviation of the actual construction duration from the allocated construction duration in the form of a ratio. If its value is less than one, it indicates that the actual construction time is less than the allocated one and vice versa.

KPI_3 was included in the evaluation framework during the pilot study phase, and later it was supported by the literature. It is assessed through two PMs and deals with the duration of the concession period of a PPP project. PM_7 investigates the optimity of the concession period duration of the project. PM_8 investigates the availability of the option to revise the duration of the concession period to account for unknown risks emerging during the project.

KPI_4 deals with the cost performance of a PPP project and is assessed through seven PMs. PM_9 investigates variation between the allocated and actual construction costs of the project. A positive sign indicates that the actual construction cost is less than the allocated construction cost and vice versa. PM_{10} investigates the deviation of the actual construction cost from the allocated construction cost in the form of a ratio. If its value is less than one, it indicates that the actual construction cost is less than the allocated one and vice versa. PM_{11} investigates the unit construction cost of the project, and it helps compare the project with other projects executed in the same sector, preferably under similar conditions. PM_{12} investigates the application of the VFM test on the project while determining its feasibility. PM_{13} investigates the optimity of toll/tax rates levied on the project. PM_{14} investigates the availability of a toll adjustment mechanism in the concession agreement to account for the viability of the financial model. PM_{15} investigates the viability of the financial model of the project in terms of key economic indicators.

KPI_5 deals with the quality performance of a PPP project that is assessed through three PMs. PM_{16} investigates the conformity of the actual quality of the project with that specified in the concession agreement. PM_{17} investigates efforts made by the private partner to maintain the project in agreed condition during its construction and operation and maintenance (O&M) phases. PM_{18} investigates the health and safety arrangement made by the private partner during the construction and O&M phases of the project.

KPI_6 deals with providing basic and necessary services on a PPP project based on its geographical location. It is assessed through two PMs. PM_{19} investigates the conformity of the actual services provided on the project to those specified in the concession agreement. PM_{20} investigates the quality of the actual services provided on the project in terms of their human resources' behavior, machinery, delivery time, etc.

KPI_7 deals with the conformance of a PPP project with local developmental policies that are assessed through two PMs. PM_{21} investigates the conformance of the project with the developmental policies of the client (government entity). PM_{22} investigates the conformance of the project with the developmental policies of the state/country.

KPI_8 deals with the interaction between various stakeholders of a PPP project and is assessed through eight PMs. PM_{23} investigates the involvement of the local community in making important decisions about the project over its life cycle. PM_{24} investigates operational difficulties associated with the project during its concession period. PM_{25} investigates several disputes that arise during the life cycle of the project. PM_{26} investigates several incidents of imposition of penalties or damages on either of the partners during the project's life cycle. PM_{27} investigates the level of trust built between the partners during the project's life cycle. PM_{28} investigates the impact of the project on the relations of the partners with other departments and organizations involved in the project during its life cycle. PM_{29} investigates the provision of a proper risk-sharing mechanism in the concession

agreement to account for critical risks that may arise during the project's life cycle. PM_{30} investigates the satisfaction level of key stakeholders with the project during its life cycle.

KPI_9 deals with the socioeconomic impact of a PPP project on its key stakeholders and is assessed through eight PMs. PM_{31} investigates the extent of the local labor involved in the construction and O&M phases of the project. PM_{32} investigates the extent of local procurement involvement in the construction and O&M phases of the project. PM_{33} investigates the impact of the project on the local economy during its life cycle. PM_{34} investigates the impact of the project on the capacity of the partners/parties during its life cycle, including that caused by different training programs arranged on the project. PM_{35} investigates the impact of the project on the vehicle operating costs (VOCs) borne by the commuters/users during its life cycle. PM_{36} investigates the impact of the project on travel time taken by the commuters/users during its life cycle. PM_{37} investigates the impact of the project on the local environment during its life cycle. PM_{38} investigates the impact of the project on the commercial values of properties and land located in its vicinity over its life cycle.

KPI_{10} deals with the extent to which a PPP project continues to serve its intended purpose(s) over its life cycle. It is assessed through three PMs. PM_{39} investigates the time-scaled nature of the benefits of the project over its life cycle. PM_{40} investigates the self-sustainability of the project in economic, financial, social, and environmental terms. Finally, PM_{41} investigates the replicability and scalability of the project over its life cycle. Scalability refers to the extension of the project in the future. Replicability refers to developing a replica of the project in similar conditions.

3.2. Expert Review

The experts further review the developed PEF for clarity and relevancy to the current project setting for PPP.

3.3. Case Study Validation and Triangulation

The proposed PEF was tested to evaluate the performance of selected case studies, i.e., the LSF and the LRR. The LSF project has been operational for the last 19 years, while the LRR project has been operational for the last 5 years. The data about both case studies were collected from various information sources in conformance by applying the triangulation approach with Annexure-I. The collected data were then analyzed, and the summarized results are given in Table 2.

The LRR performed comparatively better than the LSF against KPI_1. PM_1 shows that the concession agreement of the LSF is "weak" while the LRR's is "strong". Information from various sources indicates that ambiguity in the assignment of responsibilities and definition of some tasks renders the concession agreement of the LSF weak. It is a potential source of conflicts and disputes between the partners [127]. PM_2 shows that concession agreements of both case studies are flexible to accommodate unknown risks. PM_3 shows that the maintenance period of both case studies is 25 years, while the LRR has a one-year defect liability period (DLP) and the LSF has no DLP. The DLP of the LRR project will start after its maintenance period lapses. The DLP played a vital role in evaluating the PPP project performance as parties are still engaged in remedial work while in operation [57]. PM_4 shows that the LSF had no VGF while the LRR had a VGF equal to 19% of its construction cost. The VGF in the LRR project was necessitated by its financial nonviability because of the very high costs of land acquisition and embankment construction. Despite the involvement of provincial government engagement in both projects, multi-contractor engagement impacts the VGF. The VGF for PPP projects enhance the stake of the government investment and the result of financial viability [59].

Table 2. Evaluation Results for LSF and LRR.

KPIs and PMs	Case Studies	
	LSF	**LRR**
KPI_1—General Aspects of Contract		
PM_1—Nature/Framework of contract	Weak	Strong
PM_2—Flexibility in PPP contract	Yes	Yes
PM_3—Maintenance regime (MR)/Defect and design liability periods (DLPs)	MR: 25 years No DLPs	MR: 25 years Defect LP: 1 year
PM_4—Allocation and utilization of viability gap fund (VGF)	No VGF	19% VGF
KPI_2—Time Performance		
PM_5—Construction time variance (CTV)	- 325 days (early)	0 days (substantial completion)
PM_6—Construction time growth (CTG)	0.75	1
KPI_3—Concession Period		
PM_7—Optimum duration	Yes	Yes
PM_8—Flexibility	Yes	Yes
KPI_4—Cost Performance		
PM_9—Construction cost variance (CCV)	- PKR 1325 million	0
PM_{10}—Construction cost growth (CCG)	1.27	1
PM_{11}—Unit construction cost (UCC)	PKR 55.42 million/KM	PKR 1104.10 million/KM
PM_{12}—Value for money (VFM) test	No	Yes
PM_{13}—Tax rate/Toll rate	Yes	Yes
PM_{14}—Toll adjustment mechanism	Yes	Yes
PM_{15}—Viability of financial model	No	No
KPI_5—Quality Performance		
PM_{16}—Specified quality vs. actual quality	Yes	Yes
PM_{17}—Defects and problems	Yes	Yes
PM_{18}—Health and safety		
Accidents	>50	5–15
Minor injuries	36	Nil
Major injuries	8	2
Deaths	12	7
Financial losses	PKR 5 million	Nil
KPI_6—Service Delivery		
PM_{19}—Specified services vs. actual services	Yes	No
PM_{20}—Quality of services	Good	Good
KPI_7—Coherence		
PM_{21}—Internal coherence	Yes	Yes
PM_{22}—External coherence	Yes	Yes
KPI_8—Inter-organizational Cooperation and Partnership		
PM_{23}—Community involvement	>50%	>50%
PM_{24}—Operational difficulties	Yes	Yes
PM_{25}—Number of disputes	Nil	Nil
PM_{26}—Imposition of penalties/damages	Nil	Nil
PM_{27}—Trust building between public and private partners	Very poor	Very poor
PM_{28}—Relations with other departments/organizations	Excellent	Excellent
PM_{29}—Risk sharing mechanism	No	Yes
PM_{30}—Satisfaction of key stakeholders	Yes	Yes
KPI_9—Socio-Economic Impact		
PM_{31}—Community labor/Local labor/Local Employment	80–90%	>90%
PM_{32}—Local procurement	80–90%	>90%
PM_{33}—Impact on the local economy	>25% Increase	∼20% Increase
PM_{34}—Capacity building/Training	Yes	Yes
PM_{35}—Impact on vehicle operating costs (VOCs)	>20% decrease	>20% decrease
PM_{36}—Impact on travel time	>20% decrease	>20% decrease
PM_{37}—Impact on the environment	Positive	Positive
PM_{38}—Impact on the commercialization of vicinity	>100% increase	∼100% increase

Table 2. *Cont.*

KPIs and PMs	Case Studies	
	LSF	**LRR**
KPI_{10}—Sustainability		
PM_{39}—Nature of benefits	Long term	Long term
PM_{40}—Self-sustainability	Yes	Yes
PM_{41}—Scalability and replicability	Yes	Yes

The LSF performed comparatively better than the LRR against KPI_2. PM_5 and PM_6 show that the LSF project has a positive construction time variance (CTV) value and a construction time growth (CTG) value of less than one (01). It is a good aspect of the project as it provides the private partner more time for revenue collection from the project. The LRR project achieved substantial (95%) completion of its construction stage on time and subsequently was made operational. However, it had not achieved 100% completion of its construction even by the time this research work was being conducted because of various political and administrative bottlenecks. This is contextual as the completion time for PPP projects should be on time or before time compared to traditional contractual arrangements [60]. Therefore, the provision for time variance must be considered in the context of developing countries.

The TLSF and LRR performed equally against KPI_3. PM_7 shows that the concession period of both case studies is "optimum". It is strengthened by the fact that the concession period for most of the PPP projects in Pakistan generally varies from 20 to 30 years [128]. PM_8 shows that the concession period of both case studies can be adjusted to account for unknown risks. It is a good indication of the financial viability of the projects [129].

The LRR performed comparatively better than the LSF against KPI_4. PM_9 and PM_{10} show that the LSF project has a negative construction cost variance value (CCV) and a construction cost growth (CCG) value of more than one (1). This is not a good sign as it puts a constraint on the financial viability of the project. Substantial completion of the LRR project was achieved through budgeted costs. As its 100% completion is still pending, its total cost is unknown. It is important how the profit allocation has been set when there is a potential cost increase [67]. This will help to manage the cost variance. PM_{11} shows the unit construction cost (UCC) of both case studies. These values are justifiable compared to those of similar projects carried out in Pakistan. PM_{12} shows that no VFM test was performed for the LSF project, while a VFM study was carried out for the LRR project. One of the potential reasons for the absence of a VFM study in the LSF project was the lack of legislation and guidelines on PPP transactions in the country when the LSF project was initiated. VFM is a tool to check the viability of a PPP project and the overall decision-making [72]. PM_{13} shows that both case studies have "optimum" toll rates, while PM_{14} shows that the concession agreements of both case studies have "toll adjustment mechanisms". PM_{15} shows that the financial models of both case studies are "nonviable", corresponding to incorrect financial projections developed for these projects. The main factors responsible for the nonviability of financial models are the volatile economy of Pakistan, incorrect assumptions, troubled local industry, and force majeure events such as COVID-19. Revenue instability and embedded risk make the financial model nonviable, with no support or incentive for PPP projects [77]. Information from various sources indicates that it is one of the most critical PMs because of its direct impact on the overall sustainability of the PPP projects.

The LRR performed comparatively better than the LSF against KPI_5. PM_{16} shows that the actual quality of both case studies meets the specified quality. PM_{17} shows that the M&R duties of both case studies are being performed efficiently, and no alarming problems and defects exist in these projects. PM_{18} shows that more accidents occurred during the construction of the LSF project than that of the LRR project and thus had more serious consequences. This can be attributed to the LSF being an open-access road while the LRR is a restricted-access one. Reference [82] reported that the health and safety of native residents

is normally at stake in infrastructure projects in urban areas, especially when there are more congested spaces and less provision for alternate routes for pedestrians and traffic. It is essential to include more leading safety indicators to avoid severe accidents on construction sites [130].

The LSF performed comparatively better than the LRR against KPI_6. PM_{19} shows the LSF provides all the specified services, which is not the case for the LRR. The main reasons for the pending services on the LRR are political and administrative bottlenecks and the differences among public and private partners in interpreting some contract clauses related to its services. However, legislation intervention plays a significant role in implementing the PPP for public projects and making partners accountable by contract [85]. PM_{20} shows that relevant stakeholders are "satisfied" with the quality of available services in both case studies. The prime motive of a PPP is to satisfy all the partners based on mutual interest and the core of nontraditional contractual arrangements [86].

LSF and LRR performed equally against KPI_7. PM_{21} shows that both case studies have "internal coherence", while PM_{22} shows that both case studies have "external coherence". The overall coherence demonstrates the common interpretation of the PPP's number of partners and the nature of the transaction [89].

The LRR performed comparatively better than the LSF against KPI_8. PM_{23} shows that more than 50% of local community has been involved in major decisions regarding both case studies. Local community involvement plays a vital part in successful PPP projects [91]. PM_{24} shows that both case studies face operational difficulties such as the local community throwing garbage/trash within the right-of-way (ROW), challenges in toll collection, and illegal road access by unauthorized vehicles. PM_{25} shows that both case studies have faced no documented disputes between partners so far. Similarly, PM_{26} shows that both case studies have no recorded incidents of penalties on any of the partners so far. PM_{27} shows that both case studies resulted in a "very poor" trust level between public and private partners, which is not good. Relational governance is essential to develop a collaborative environment among public and private partners to gain trust based on a fair deal [99]. PM_{28} shows that both case studies had an "excellent" impact on the relations of the public and private partners with other departments and organizations. PM_{29} shows that the LSF has no proper risk-sharing mechanism in its concession agreement while the LRR has a proper risk-sharing mechanism in its concession agreement. The private partner is to bear all financial risks related to the project in the case of the LSF, while both partners will bear financial risks according to the agreed "windfall sharing mechanism" in the case of the LRR. Having no proper risk-sharing mechanism in PPP projects leads to a disastrous situation where partners end disputes with litigation [101]. PM_{30} shows that all stakeholders expressed their overall satisfaction with the PPP arrangement, which is a good sign.

The LSF and the LRR performed almost equally against KPI_9. PM_{31} shows that almost all the labor involved in the project belongs to the local community. PM_{32} shows that almost all the procurement related to the project has been carried out through local markets. PM_{33} shows that both case studies resulted in an increased local economy caused by increased commercial road activities. PM_{34} shows that both case studies helped build the capacity of most of the personnel involved, which is a good indication. Furthermore, no PPP-related training program has been included in their scope, which is good for developing the future capacities of the teams. However, institutional and technical constraints should be addressed toward PPP implementation with a focus on cognitive and social undertakings [101]. PM_{35} and PM_{36} show that both case studies helped reduce VOCs and the travel time of commuters/users, which is a good indication. PM_{37} shows that both case studies had a "positive" impact on the local environment. PM_{38} shows that both projects caused nearly 100% growth in the commercialization of the vicinity, which is a positive indication for local business development.

The LSF and the LRR performed equally against KPI_{10}. PM_{39} shows that both projects have long-term benefits for stakeholders. PM_{40} shows that both projects are self-sustainable. Finally, PM_{41} shows that both projects are scalable and replicable.

To summarize, the LRR is performing better than the LSF overall. The performance of both projects has been evaluated at different instances during their life cycles, while their detailed evaluation covers almost all their important aspects.

4. Conclusions and Recommendations

PPPs have become a crucial developmental tool for developing countries like Pakistan, given their difficult economic conditions. The concerned governments must create awareness about PPP transactions among their policymakers and decision-makers and the masses to make these transactions successful in a true sense. The monitoring and evaluation (M&E) of PPP projects is essential to keep track of their key objective, i.e., to deliver VFM, but the global research on the M&E of PPPs is limited [29], and there is no standard framework available for the purpose. Furthermore, the developed frameworks are contextualized in terms of project type and country.

This study presents a comprehensive, dynamic, and life-long PEF for PPP road construction projects. The PEF consists of 10 KPIs and 41 related PMs extracted from the literature and validated through expert opinion. The utilization of various sources of information increases the confidence in the evaluation results. This framework can be easily used to assess the performance of a PPP road project at any instant of its life cycle in other developing countries. Furthermore, there is a provision to modify the current framework according to the need of the PPP project. The proposed PEF has been further tested through its application on two functional projects in Pakistan. Overall, the LRR project is performing better than the LSF project. However, some evaluation results are alarming, such as those against PM_{15} and PM_{27}. This is consistent with the review study [32], which mentioned that financial and stakeholder management are critical challenges in implementing the PPP. However, PPPs are still in the transition phase to becoming fully adopted by the construction industry of Pakistan. The performance of the case studies in these aspects needs improvement, and this study will be very helpful in any such endeavor.

Current PEF comprises all the relevant KPIs and PMs essential to portray the performance of the PPP project in road construction. This will help all the PPP stakeholders determine the performance at any stage of the project life cycle—most importantly in designing the PPP contractual arrangement of new projects. Furthermore, the PEF is a benchmark study for effective PPP implementation to explore the inherent mutual benefits to stakeholders. Finally, the PEF also complements the 2017PPP Law to provide a guideline for stakeholders for successful PPP.

The PEF is useful for policymakers involved in decision-making for development projects, allowing them to include the critical aspects for successful projects while considering PPPs as a procurement strategy. Nevertheless, the PPP is a potential source for acquiring capital for government agencies, but the successful completion of the projects is essential. A snapshot of the performance at a specific time during project execution is significant to determine the progress alignment with expectations. Hence, this PEF has the potential to provide all the necessary information to develop strategies to counter the hidden risks that evolved during the projects. Furthermore, applying PEF helps funding agencies acquire project insight and gain confidence in the funding utilization. On the other hand, contractors are accountable for timely project completion.

It is noteworthy that this framework has limitations. This framework is applicable to running projects to gain insight into the performance of PPPs. However, this helps to take the timebound performance snapshot for the running project to compare with the expected outcomes from the PPPs on projects at various stages. In this account, there is a possibility that not all KPIs and PMs are relevant at a specific time on the project. Furthermore, this study relied on only two large-scale running road construction projects within the infrastructure sector. There is an opportunity to increase the case studies to achieve a wider

application for this framework. Furthermore, there is potential to identify the country context aspects in this PEF and compare them with other developing or developed countries. PPP implementations vary by government departments (national, provincial, and local) and other agencies, so selecting this framework is more beneficial. Different stakeholders' possible amendments should be made before application. The current PEF only applies to road construction projects, but its relevance to other types of construction is a potential area for further investigation.

The successful execution of PPP transactions for projects is essential for improving VFM. However, critical challenges are inevitable when a PPP is used on projects because of the inherent uncertainty driven by the contextual nature. The PEF developed in this study has the potential to measure the variations related to PPP implementation and to provide a practical instrument to check project performance.

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Appendix A

Table A1. Potential information sources for each performance measure.

Sr. No.	Key Performance Indicators	Sr. No.	Performance Measures	Project Documents	Key Stakeholders							Site
					Public Partner	Private Partner	SPV	Financier(s)	Escrow Agent	Commuters/Users	Local Community	
1	General Aspects of Contract	1	Nature/Framework of PPP Contract									
		2	Flexibility in PPP Contract									
		3	Maintenance Regime (MR) / Defect & Design Liability Periods (DLPs)									
		4	Allocation and Utilization of Viability Gap Fund									
2	Time Performance	5	Construction Time Variance (CTV)									
		6	Construction Time Growth (CTG)									
3	Cocession Period	7	Optimum Duration									
		8	Flexibility									
4	Cost Performance	9	Construction Cost Variance (CCV)									
		10	Construction Cost Growthn(CTG)									
		11	Unit Construction Cost (UCC)									
		12	Value for Money (VFM) Test									
		13	Tax Rate/Toll Rate									
		14	Toll Adjustment Mechanism									
		15	Viability of Financial Model									
5	Quality Performance	16	Specified Quality vs Actual Quality									
		17	Defects and Problems									
		18	Health & Safety									
6	Service Delivery	19	Specified Services vs Actual Services									
		20	Quality of Services									
7	Coherence	21	Internal Coherence									
		22	External Coherence									
8	Inter-Organizational Cooperation & Partnership	23	Community Involvement									
		24	Operational Difficulties									
		25	Number of Disputes									
		26	Imposition of Penalties/Damages									
		27	Trust Building between Public and Private Partners									
		28	Relations with other Departments/Organizations									
		29	Risk Sharing Mechanism									
		30	Satisfaction of Key Stakeholders									
9	Socio-Economic Impact	31	Community Labour/Local Labour/Local Employment									
		32	Local Procurement									
		33	Impact on the Local Economy									
		34	Capacity Building/Training									
		35	Impact on Vehicle Operating Costsn (VOCs)									
		36	Impact on Travel Time									
		37	Impact on the Environment									
		38	Impact on the Commercialization of the Vicinity									
10	Sustainability	39	Nature of Benefits									
		40	Self Sustainability									
		41	Scalability and Replicability									

References

1. Masood, R.; Choudhry, R.M. Identification of risk factors for construction contracting firms-Encompassing mitigation stance. In Proceedings of the 2nd International Conference on Construction in Developing Countries, Cairo, Egypt, 3–5 August 2010.
2. Abas, M.; Khattak, S.B.; Habib, T.; Nadir, U. Assessment of critical risk and success factors in construction supply chain: A case of Pakistan. *Int. J. Constr. Manag.* **2022**, *12*, 2258–2266. [CrossRef]
3. Tookey, J.E.; Murray, M.; Hardcastle, C.; Langford, D. Construction procurement routes: Re-defining the contours of construction procurement. *Eng. Constr. Archit. Manag.* **2001**, *8*, 20–30.
4. Doloi, H. Empirical Analysis of Traditional Contracting and Relationship Agreements for Procuring Partners in Construction Projects. *J. Manag. Eng.* **2013**, *29*, 224–235. [CrossRef]
5. Aliakbarlou, S.; Wilkinson, S.; Costello, S.B. Rethinking client value within construction contracting services. *Int. J. Manag. Proj. Bus.* **2018**, *11*, 1007–1025. [CrossRef]
6. Lehtiranta, L. Relational Risk Management in Construction Projects: Modeling the Complexity. *Leadersh. Manag. Eng.* **2011**, *11*, 141–154. [CrossRef]
7. Iqbal, S.; Choudhry, R.M.; Holschemacher, K.; Ali, A.; Tamošaitienė, J. Risk management in construction projects. *Technol. Econ. Dev. Econ.* **2015**, *21*, 65–78. [CrossRef]
8. Noor, M.A.; Khalfan, M.M.; Maqsood, T. The role of procurement practices in effective implementation of infrastructure projects in Pakistan. *Int. J. Manag. Proj. Bus.* **2013**, *6*, 802–826. [CrossRef]
9. Oyegoke, A.S.; Dickinson, M.; Khalfan, M.M.; McDermott, P.; Rowlinson, S. Construction project procurement routes: An in-depth critique. *Int. J. Manag. Proj. Bus.* **2009**, *2*, 338–354. [CrossRef]
10. Akintoye, A.; Beck, M.; Hardcastle, C. *Public-Private Partnerships: Managing Risks and Opportunities*; Wiley: Hoboken, NJ, USA, 2008.
11. Stegemann, U.; Beckers, F. A Smarter Way to Think About Public-Private Partnerships. In *Risk and Resilience*; McKinsey & Company: Atlanta, GA, USA, 2021.
12. Ling, F.Y.Y.; Kumaraswamy, M.; Dulaimi, M.F.; Khalfan, M. Public Private Partnerships: Overcoming Pre-Contract Problems Faced by Public Clients and Private Providers in Infrastructure Projects in Singapore. *Int. J. Constr. Manag.* **2011**, *11*, 63–77. [CrossRef]
13. Memon, S.; Rowlinson, S.; Sunindijo, R.; Zahoor, H. Collaborative Behavior in Relational Contracting Projects in Hong Kong—A Contractor's Perspective. *Sustainability* **2021**, *13*, 5375. [CrossRef]
14. De Schepper, S.; Dooms, M.; Haezendonck, E. Stakeholder dynamics and responsibilities in Public–Private Partnerships: A mixed experience. *Int. J. Proj. Manag.* **2014**, *32*, 1210–1222. [CrossRef]
15. Zhao, N.; Ying, F. Method selection: A conceptual framework for public sector PPP selection. *Built Environ. Proj. Asset Manag.* **2019**, *9*, 214–232. [CrossRef]
16. Love, P.E.D.; Davis, P.R.; Chevis, R.; Edwards, D.J. Risk/Reward Compensation Model for Civil Engineering Infrastructure Alliance Projects. *J. Constr. Eng. Manag.* **2011**, *137*, 127–136. [CrossRef]
17. Mubin, S.; Ghaffar, A. BOT Contracts: Applicability in Pakistan for infrastructure development. *Pak. J. Eng. Appl. Sci.* **2008**, *3*, 33–46.
18. Miraftab, F. Public-private partnerships: The Trojan horse of neoliberal development? *J. Plan. Educ. Res.* **2004**, *24*, 89–101. [CrossRef]
19. ADB. *Public–Private Partnership Monitor: Pakistan*; Asian Development Bank: Manila, Philippines, 2021.
20. Bank, W. *Private Particiaption in Infrastructure (PPI)*; World Bank: Washington, DC, USA, 2021.
21. Javed, A.A.; Lam, P.T.; Chan, A.P. A model framework of output specifications for hospital PPP/PFI projects. *Facilities* **2013**, *31*, 610–633. [CrossRef]
22. Cheng, Z.; Yang, Z.; Gao, H.; Tao, H.; Xu, M. Does PPP Matter to Sustainable Tourism Development? An Analysis of the Spatial Effect of the Tourism PPP Policy in China. *Sustainability* **2018**, *10*, 4058. [CrossRef]
23. Zhang, L.; Zhao, Z.; Kan, Z. Private-sector partner selection for public-private partnership projects of electric vehicle charging infrastructure. *Energy Sci. Eng.* **2019**, *7*, 1469–1484. [CrossRef]
24. Bakhtawar, B.; Thaheem, M.J.; Arshad, H. Sustainable Public–Private Partnership Delivery in Pakistan; Evolution, Barriers, and Way Forward. In *Public Sector Reforms in Pakistan: Hierarchies, Markets and Networks*; Zahra, A., Bouckaert, G., Zafar Iqbal Jadoon, M., Jabeen, N., Eds.; Springer International Publishing: Cham, Switzerland, 2022; pp. 275–300.
25. Akintoye, A.; Beck, M.; Kumaraswamy, M. *Public Private Partnerships: A Global Review*; CRC Press: Boca Raton, FL, USA, 2015.
26. OECD. *Competition Issues in Public-Private Partnerships*; Organization for Economic Co-Operation and Development: Paris, France, 2014.
27. Ke, Y.; Wang, S.; Chan, A.P.C.; Cheung, E. Research Trend of Public-Private Partnership in Construction Journals. *J. Constr. Eng. Manag.* **2009**, *135*, 1076–1086. [CrossRef]
28. Tang, L.; Shen, Q.; Cheng, E.W. A review of studies on Public–Private Partnership projects in the construction industry. *Int. J. Proj. Manag.* **2010**, *28*, 683–694. [CrossRef]
29. Cui, C.; Liu, Y.; Hope, A.; Wang, J. Review of studies on the public–private partnerships (PPP) for infrastructure projects. *Int. J. Proj. Manag.* **2018**, *36*, 773–794. [CrossRef]

30. Wang, H.; Xiong, W.; Wu, G.; Zhu, D. Public–private partnership in *Public Administration* discipline: A literature review. *Public Manag. Rev.* **2018**, *20*, 293–316. [CrossRef]
31. Osei-Kyei, R.; Chan, A.P.C. Review of studies on the Critical Success Factors for Public–Private Partnership (PPP) projects from 1990 to 2013. *Int. J. Proj. Manag.* **2015**, *33*, 1335–1346. [CrossRef]
32. Jayasuriya, S.; Zhang, G.; Yang, R.J. Challenges in public private partnerships in construction industry. *Built Environ. Proj. Asset Manag.* **2019**, *9*, 172–185. [CrossRef]
33. Chowdhury, A.N.; Chen, P.; Tiong, R.L. Analysing the structure of public–private partnership projects using network theory. *Constr. Manag. Econ.* **2011**, *29*, 247–260. [CrossRef]
34. Noor, M.A.; Khalfan, M.; Maqsood, T. Methods used to procure infrastructure projects in Pakistan: An overview. *Int. J. Procure. Manag.* **2012**, *5*, 733. [CrossRef]
35. Naveed, F. *Public-Private Partnerships (PPPs) for Infrastructure Development in Developing Countries: A Case Study of Pakistan*; Institute for Development Policy and Management (IDPM), The School of Environment, Education and Development (SEED), The University of Manchester: Manchester, UK, 2015.
36. Soomro, M.A.; Zhang, X. Roles of Private-Sector Partners in Transportation Public-Private Partnership Failures. *J. Manag. Eng.* **2015**, *31*, 04014056. [CrossRef]
37. Noor, M.A.; Khalfan, M. Public private partnership in transport sector projects in Pakistan. *Int. J. Crit. Infrastruct.* **2017**, *13*, 70–92. [CrossRef]
38. Ullah, F.; Thaheem, M.J. Concession period of public private partnership projects: Industry–academia gap analysis. *Int. J. Constr. Manag.* **2018**, *18*, 418–429. [CrossRef]
39. Ullah, F.; Thaheem, M.J.; Sepasgozar, S.M.E.; Forcada, N. System Dynamics Model to Determine Concession Period of PPP Infrastructure Projects: Overarching Effects of Critical Success Factors. *J. Leg. Aff. Disput. Resolut. Eng. Constr.* **2018**, *10*, 04518022-1. [CrossRef]
40. Mazher, K.M.; Chan, A.P.; Zahoor, H.; Ameyaw, E.E.; Edwards, D.J.; Osei-Kyei, R. Modelling capability-based risk allocation in PPPs using fuzzy integral approach. *Can. J. Civ. Eng.* **2019**, *46*, 777–788. [CrossRef]
41. Soomro, M.A.; Li, Y.; Han, Y. Socioeconomic and Political Issues in Transportation Public–Private Partnership Failures. *IEEE Trans. Eng. Manag.* **2020**, *69*, 2073–2087. [CrossRef]
42. Khahro, S.; Ali, T.; Hassan, S.; Zainun, N.; Javed, Y.; Memon, S. Risk Severity Matrix for Sustainable Public-Private Partnership Projects in Developing Countries. *Sustainability* **2021**, *13*, 3292. [CrossRef]
43. Ahmad, U.; Waqas, H.; Akram, K. Relationship between project success and the success factors in public–private partnership projects: A structural equation model. *Cogent Bus. Manag.* **2021**, *8*, 1927468. [CrossRef]
44. Fellows, R.F.; Liu, A.M. *Research Methods for Construction*; John Wiley & Sons: Hoboken, NJ, USA, 2021.
45. Jin, X.-H.; Zhang, G. Modelling optimal risk allocation in PPP projects using artificial neural networks. *Int. J. Proj. Manag.* **2011**, *29*, 591–603. [CrossRef]
46. Almarri, K.; Abuhijleh, B. A qualitative study for developing a framework for implementing public–private partnerships in developing countries. *J. Facil. Manag.* **2017**, *15*, 170–189. [CrossRef]
47. Yin, R.K. *Case Study Research: Design and Methods*; Sage: Newbury Park, CA, USA, 2009; Volume 5.
48. Zhang, J.; Zou, W.; Kumaraswamy, M. Developing public private people partnership (4P) for post disaster infrastructure procurement. *Int. J. Disaster Resil. Built Environ.* **2015**, *6*, 468–484. [CrossRef]
49. Saeed, A.M.; Duffield, C.; Hui, F.K.P. An enhanced framework for assessing the operational performance of public-private partnership school projects. *Built Environ. Proj. Asset Manag.* **2018**, *8*, 194–214. [CrossRef]
50. Trangkanont, S.; Charoenngam, C. Critical failure factors of public-private partnership low-cost housing program in Thailand. *Eng. Constr. Arch. Manag.* **2014**, *21*, 421–443. [CrossRef]
51. Mazher, K.M.; Chan, A.P.C.; Zahoor, H.; Khan, M.I.; Ameyaw, E.E. Fuzzy Integral–Based Risk-Assessment Approach for Public–Private Partnership Infrastructure Projects. *J. Constr. Eng. Manag.* **2018**, *144*, 04018111. [CrossRef]
52. Ahmadabadi, A.A.; Heravi, G. The effect of critical success factors on project success in Public-Private Partnership projects: A case study of highway projects in Iran. *Transp. Policy* **2018**, *73*, 152–161. [CrossRef]
53. Yuan, J.; Wang, C.; Skibniewski, M.; Li, Q. Developing Key Performance Indicators for Public-Private Partnership Projects: Questionnaire Survey and Analysis. *J. Manag. Eng.* **2012**, *28*, 252–264. [CrossRef]
54. Patil, N.A.; Laishram, B. Public-private partnerships from sustainability perspective—A critical analysis of the Indian case. *Int. J. Constr. Manag.* **2016**, *16*, 161–174. [CrossRef]
55. Cruz, C.O.; Marques, R.C. Flexible contracts to cope with uncertainty in public–private partnerships. *Int. J. Proj. Manag.* **2013**, *31*, 473–483. [CrossRef]
56. Feng, K.; Wang, S.; Li, N.; Wu, C.; Xiong, W. Balancing Public and Private Interests through Optimization of Concession Agreement Design for User-Pay PPP Projects. *J. Civ. Eng. Manag.* **2018**, *24*, 116–129. [CrossRef]
57. Huynh, T.T.-M.; Dang, C.; Le-Hoai, L.; Pham, A.-D.; Nguyen, T.D. Proposing a strategy map for coastal urban project success using the balanced scorecard method. *Eng. Constr. Arch. Manag.* **2020**, *27*, 2993–3030. [CrossRef]
58. Ullah, F.; Thaheem, M.J.; Umar, M. *Public-Private Partnerships in Pakistan: A Nascent Evolution*; Cambridge Scholars: Newcastle upon Tyne, UK, 2017.

59. Osei-Kyei, R.; Chan, A. Factors attracting private sector investments in public–private partnerships in developing countries: A survey of international experts. *J. Financ. Manag. Prop. Constr.* **2017**, *1*, 92–111. [CrossRef]
60. Osei-Kyei, R.; Chan, A. Risk assessment in public-private partnership infrastructure projects: Empirical comparison between Ghana and Hong Kong. *Constr. Innov.* **2017**, *17*, 204–223. [CrossRef]
61. Babatunde, S.O.; Perera, S. Analysis of financial close delay in PPP infrastructure projects in developing countries. *Benchmarking: Int. J.* **2017**, *24*, 1690–1708. [CrossRef]
62. Sohail, M.; Cotton, A. *Performance Monitoring of Micro-Contracts for the Procurement of Urban Infrastructure*; Water, Engineering and Development Centre (WEDC), Loughborough University: Loughborough, UK, 2000.
63. Guo, K.; Zhang, L.; Wang, T. Concession period optimisation in complex projects under uncertainty: A public–private partnership perspective. *Constr. Manag. Econ.* **2021**, *39*, 156–172. [CrossRef]
64. Bao, F.; Chan, A.P.C.; Chen, C.; Darko, A. Review of Public–Private Partnership Literature from a Project Lifecycle Perspective. *J. Infrastruct. Syst.* **2018**, *24*, 04018008. [CrossRef]
65. Ullah, F.; Ayub, B.; Siddiqui, S.Q.; Thaheem, M.J. A review of public-private partnership: Critical factors of concession period. *J. Financial Manag. Prop. Constr.* **2016**, *21*, 269–300. [CrossRef]
66. Ke, Y. Is public–private partnership a panacea for infrastructure development? The case of Beijing National Stadium. *Int. J. Constr. Manag.* **2014**, *14*, 90–100. [CrossRef]
67. Jin, L.; Zhang, Z.; Song, J. Profit Allocation and Subsidy Mechanism for Public–Private Partnership Toll Road Projects. *J. Manag. Eng.* **2020**, *36*, 04020011. [CrossRef]
68. Bulsara, H.P.; Kumar, A.; Kumar, R.; Chauhan, K.A. Experience of public private partnership in highway infrastructure development: An exploratory study of PPP mature countries and scenario in India. *Int. J. Procure. Manag.* **2015**, *8*, 608. [CrossRef]
69. Wu, J.; Liu, J.; Jin, X.; Sing, M.C. Government accountability within infrastructure public–private partnerships. *Int. J. Proj. Manag.* **2016**, *34*, 1471–1478. [CrossRef]
70. Mangu, S.; Annamalai, T.R.; Deep, A. Comparison of toll and annuity PPPs: A case study of highway projects in India. *Built Environ. Proj. Asset Manag.* **2021**, *11*, 103–120. [CrossRef]
71. Kim, S.Y.; Thuc, L.D. Life Cycle Performance Measurement in Public–Private Partnership Infrastructure Projects. *J. Infrastruct. Syst.* **2021**, *27*, 06021001. [CrossRef]
72. Malek, M.; Gundaliya, P. Value for money factors in Indian public-private partnership road projects: An exploratory approach. *J. Proj. Manag.* **2021**, *6*, 23–32. [CrossRef]
73. Nguyen, A.; Mollik, A.; Chih, Y.-Y. Managing Critical Risks Affecting the Financial Viability of Public–Private Partnership Projects: Case Study of Toll Road Projects in Vietnam. *J. Constr. Eng. Manag.* **2018**, *144*, 05018014. [CrossRef]
74. Buyukyoran, F.; Gundes, S. Optimized real options-based approach for government guarantees in PPP toll road projects. *Constr. Manag. Econ.* **2018**, *36*, 203–216. [CrossRef]
75. Chen, Q.; Shen, G.; Xue, F.; Xia, B. Real Options Model of Toll-Adjustment Mechanism in Concession Contracts of Toll Road Projects. *J. Manag. Eng.* **2018**, *34*, 04017040. [CrossRef]
76. Matraeva, L.V.; Konov, A.A.; Belyak, A.V.; Erokhin, S.G.; Vasyutina, E.S. Public private partnership in social sphere: Models review. *Int. J. Econ. Financ. Issues* **2016**, *6*, 127–136.
77. Attarzadeh, M.; Chua, D.K.; Beer, M.; Abbott, E.L. Options-based negotiation management of PPP–BOT infrastructure projects. *Constr. Manag. Econ.* **2017**, *35*, 676–692. [CrossRef]
78. Buertey, J.; Asare, S. Public private partnership in Ghana: A panacea to the infrastructural deficit. *Int. J. Constr. Eng. Manag.* **2014**, *3*, 135–143.
79. Wang, N.; Ma, M.; Liu, Y. The Whole Lifecycle Management Efficiency of the Public Sector in PPP Infrastructure Projects. *Sustainability* **2020**, *12*, 3049. [CrossRef]
80. McDermot, E.; Agdas, D.; Díaz, C.R.R.; Rose, T.; Forcael, E. Improving performance of infrastructure projects in developing countries: An Ecuadorian case study. *Int. J. Constr. Manag.* **2020**, 1–15. [CrossRef]
81. Tamošaitienė, J.; Sarvari, H.; Chan, D.; Cristofaro, M. Assessing the Barriers and Risks to Private Sector Participation in Infrastructure Construction Projects in Developing Countries of Middle East. *Sustainability* **2020**, *13*, 153. [CrossRef]
82. Osei-Kyei, R.; Chan, A.P.; Ameyaw, E.E. A fuzzy synthetic evaluation analysis of operational management critical success factors for public-private partnership infrastructure projects. *Benchmarking: Int. J.* **2017**, *24*, 2092–2112. [CrossRef]
83. Nawaz, A.; Su, X.; Din, Q.M.U.; Khalid, M.I.; Bilal, M.; Shah, S.A.R. Identification of the H&S (Health and Safety Factors) Involved in Infrastructure Projects in Developing Countries—A Sequential Mixed Method Approach of OLMT-Project. *Int. J. Environ. Res. Public Health* **2020**, *17*, 635. [CrossRef]
84. Gomez, C.; Gambo, M. Evaluation of Special Purpose Vehicle Organisation Skill Sets Taxonomy for Effective Public-Private Partnership Infrastructure Project Delivery. *J. Constr. Dev. Ctries.* **2016**, *21*, 147–165. [CrossRef]
85. Sinha, A.K.; Jha, K.N. Dispute Resolution and Litigation in PPP Road Projects: Evidence from Select Cases. *J. Leg. Aff. Disput. Resolut. Eng. Constr.* **2020**, *12*, 05019007. [CrossRef]
86. Cherkos, F.D.; Jha, K.N. Drivers of Road Sector Public-Private Partnership Adoption in New and Inexperienced Markets. *J. Constr. Eng. Manag.* **2021**, *147*, 04020186. [CrossRef]
87. Shi, S.; Chong, H.-Y.; Liu, L.; Ye, X. Examining the Interrelationship among Critical Success Factors of Public Private Partnership Infrastructure Projects. *Sustainability* **2016**, *8*, 1313. [CrossRef]

88. Navarro-Ligero, M.L.; Valenzuela-Montes, L.M. A Tool for the Assessment of Urban Mobility Scenarios in Climate Change Mitigation: An Application to the Granada's LRT Project. *Transp. Res. Procedia* **2016**, *19*, 364–379. [CrossRef]
89. Liu, T.; Wang, Y.; Wilkinson, S. Identifying critical factors affecting the effectiveness and efficiency of tendering processes in Public–Private Partnerships (PPPs): A comparative analysis of Australia and China. *Int. J. Proj. Manag.* **2016**, *34*, 701–716. [CrossRef]
90. Cherkos, F.D.; Jha, K.N.; Singh, A. Framework to select public–private partnership modalities. *J. Leg. Aff. Disput. Resolut. Eng. Constr.* **2020**, *12*, 04520034. [CrossRef]
91. Anwar, B.; Xiao, Z.; Akter, S.; Rehman, R.-U. Sustainable Urbanization and Development Goals Strategy through Public–Private Partnerships in a South-Asian Metropolis. *Sustainability* **2017**, *9*, 1940. [CrossRef]
92. Patil, N.A.; Laishram, B.S. Sustainability of Indian PPP procurement process: Development of strategies for enhancement. *Built Environ. Proj. Asset Manag.* **2016**, *6*, 491–507. [CrossRef]
93. Gurgun, A.; Touran, A. Public-private partnership experience in the international arena: Case of Turkey. *J. Manag. Eng.* **2014**, *30*, 04014029. [CrossRef]
94. Wang, L.; Müller, R.; Zhu, F.; Yang, X. Collective Mindfulness: The Key to Organizational Resilience in Megaprojects. *Proj. Manag. J.* **2021**, *52*, 592–606. [CrossRef]
95. Hossain, M.; Guest, R.; Smith, C. Performance indicators of public private partnership in Bangladesh: An implication for developing countries. *Int. J. Product. Perform. Manag.* **2018**, *68*, 46–68. [CrossRef]
96. Zheng, X.; Liu, Y.; Sun, R.; Tian, J.; Yu, Q. Understanding the Decisive Causes of PPP Project Disputes in China. *Buildings* **2021**, *11*, 646. [CrossRef]
97. Rebeiz, K.S. Public–Private Partnership Risk Factors in Emerging Countries: BOOT Illustrative Case Study. *J. Manag. Eng.* **2012**, *28*, 421–428. [CrossRef]
98. Kavishe, N.; Jefferson, I.; Chileshe, N. An analysis of the delivery challenges influencing public-private partnership in housing projects: The case of Tanzania. *Eng. Constr. Archit. Manag.* **2018**, *25*, 202–240. [CrossRef]
99. Benítez-Ávila, C.; Hartmann, A.; Dewulf, G.; Henseler, J. Interplay of relational and contractual governance in public-private partnerships: The mediating role of relational norms, trust and partners' contribution. *Int. J. Proj. Manag.* **2018**, *36*, 429–443. [CrossRef]
100. Wang, H.; Liu, Y.; Xiong, W.; Song, J. The moderating role of governance environment on the relationship between risk allocation and private investment in PPP markets: Evidence from developing countries. *Int. J. Proj. Manag.* **2019**, *37*, 117–130. [CrossRef]
101. Ibrahim, A.D.; Price, A.D.F.; Dainty, A.R.J. The analysis and allocation of risks in public private partnerships in infrastructure projects in Nigeria. *J. Financial Manag. Prop. Constr.* **2006**, *11*, 149–164. [CrossRef]
102. Wang, Y.; Cui, P.; Liu, J. Analysis of the risk-sharing ratio in PPP projects based on government minimum revenue guarantees. *Int. J. Proj. Manag.* **2018**, *36*, 899–909. [CrossRef]
103. Wojewnik-Filipkowska, A.; Węgrzyn, J. Understanding of Public–Private Partnership Stakeholders as a Condition of Sustainable Development. *Sustainability* **2019**, *11*, 1194. [CrossRef]
104. Van Du, N.; Thuc, L.D.; Tran, H.-B. Assessing stakeholder satisfaction in PPP transport projects in developing countries: Evidence from Vietnam. *Built Environ. Proj. Asset Manag.* **2021**, *12*, 309–324. [CrossRef]
105. Xue, B.; Liu, B.; Sun, T. What Matters in Achieving Infrastructure Sustainability through Project Management Practices: A Preliminary Study of Critical Factors. *Sustainability* **2018**, *10*, 4421. [CrossRef]
106. Patil, N.A.; Tharun, D.; Laishram, B. Infrastructure development through PPPs in India: Criteria for sustainability assessment. *J. Environ. Plan. Manag.* **2016**, *59*, 708–729. [CrossRef]
107. Weerasekara, D.T.; Disaratna, V.; Withanage, K.T.; Perera, B.A.K.S. Procurement management in the foreign-funded construction projects implemented in Sri Lanka. *Int. J. Constr. Manag.* **2021**, 1–13. [CrossRef]
108. Jobidon, G.; Lemieux, P.; Beauregard, R. Implementation of Integrated Project Delivery in Quebec's Procurement for Public Infrastructure: A Comparative and Relational Perspective. *Sustainability* **2018**, *10*, 2648. [CrossRef]
109. Babatunde, S.O.; Ekundayo, D.; Udeaja, C.; Abubakar, U.O. An investigation into the sustainability practices in PPP infrastructure projects: A case of Nigeria. *Smart Sustain. Built Environ.* **2020**, *11*, 110–125. [CrossRef]
110. Hussain, I.; Farooq, Z.; Akhtar, W. SMEs development and failure avoidance in developing countries through public private partnershi. *Afr. J. Bus. Manag.* **2012**, *6*, 1581–1589.
111. Biygautane, M.; Neesham, C.; Al-Yahya, K.O. Institutional entrepreneurship and infrastructure public-private partnership (PPP): Unpacking the role of social actors in implementing PPP projects. *Int. J. Proj. Manag.* **2019**, *37*, 192–219. [CrossRef]
112. Zhang, J.; Yuan, X.-X. Stochastic modelling of maintenance flexibility in Value for Money assessment of PPP road projects. *Constr. Manag. Econ.* **2021**, *39*, 173–191. [CrossRef]
113. Nieto-Garcia, J.I.; Guzman, A.F. Impact of Fourth Public Private Partnership Road Program in Colombia: Analysis of Accessibility, Goods Transportation Costs, and Territorial Cohesion Changes. *Transp. Res. Rec. J. Transp. Res. Board* **2019**, *2673*, 398–406. [CrossRef]
114. Rohman, M.A.; Doloi, H.; Heywood, C.A. Success criteria of toll road projects from a community societal perspective. *Built Environ. Proj. Asset Manag.* **2017**, *7*, 32–44. [CrossRef]
115. Dhaduk, T.K.; Pitroda, J.R. Developing Project Success Index for Public Private Partnership Project in Developing Countries: A Critical Review. *J. Adv. Civ. Eng. Manag.* **2018**, *1*, 16–24.

116. Ma, H.; Zeng, S.; Lin, H.; Zeng, R. Impact of Public Sector on Sustainability of Public–Private Partnership Projects. *J. Constr. Eng. Manag.* **2020**, *146*, 04019104. [CrossRef]
117. Li, H.; Xia, Q.; Wen, S.; Wang, L.; Lv, L. Identifying Factors Affecting the Sustainability of Water Environment Treatment Public-Private Partnership Projects. *Adv. Civ. Eng.* **2019**, *2019*, 1–15. [CrossRef]
118. Al-Saadi, R.; Abdou, A. Factors critical for the success of public?private partnerships in UAE infrastructure projects: Experts' perception. *Int. J. Constr. Manag.* **2016**, *16*, 1–15. [CrossRef]
119. Shen, L.; Tam, V.W.; Gan, L.; Ye, K.; Zhao, Z. Improving Sustainability Performance for Public-Private-Partnership (PPP) Projects. *Sustainability* **2016**, *8*, 289. [CrossRef]
120. Yang, T.; Long, R.; Li, W. Suggestion on tax policy for promoting the PPP projects of charging infrastructure in China. *J. Clean. Prod.* **2018**, *174*, 133–138. [CrossRef]
121. Chen, C.; Yu, Y.; Osei-Kyei, R.; Chan, A.P.C.; Xu, J. Developing a project sustainability index for sustainable development in transnational public–private partnership projects. *Sustain. Dev.* **2019**, *27*, 1034–1048. [CrossRef]
122. Mansilla, P.; Vassallo, J. Innovative Infrastructure Fund to Ensure the Financial Sustainability of PPP Projects: The Case of Chile. *Sustainability* **2020**, *12*, 9965. [CrossRef]
123. Berrone, P.; Ricart, J.E.; Duch, A.I.; Bernardo, V.; Salvador, J.; Peña, J.P.; Planas, M.R. EASIER: An Evaluation Model for Public–Private Partnerships Contributing to the Sustainable Development Goals. *Sustainability* **2019**, *11*, 2339. [CrossRef]
124. Hunter, G.W.; Vettorato, D.; Sagoe, G. Creating Smart Energy Cities for Sustainability through Project Implementation: A Case Study of Bolzano, Italy. *Sustainability* **2018**, *10*, 2167. [CrossRef]
125. Heale, R.; Forbes, D. Understanding triangulation in research. *Evid. Based Nurs.* **2013**, *16*, 98. [CrossRef] [PubMed]
126. Wang, N.; Ma, M.; Wu, G.; Liu, Y.; Gong, Z.; Chen, X. Conflicts concerning construction projects under the challenge of cleaner production—Case study on government funded projects. *J. Clean. Prod.* **2019**, *225*, 664–674. [CrossRef]
127. Bray, D.; Mulley, C. Workshop 4: Designing contracts/concessions: What has worked and what has not and why?: 12th International Conference Series on Competition and Ownership in Land Passenger Transport. *Res. Transp. Econ.* **2013**, *39*, 226–231. [CrossRef]
128. PPPA. Projects. 2020. Available online: http://www.pppa.gov.pk/ (accessed on 20 September 2020).
129. Albalate, D.; Bel, G. Regulating concessions of toll motorways: An empirical study on fixed vs. variable term contracts. *Transp. Res. Part A: Policy Pract.* **2009**, *43*, 219–229. [CrossRef]
130. Masood, R.; Mujtaba, B.; Khan, M.A.; Mubin, S.; Shafique, F.; Zahoor, H. Investigation for Safety Performance Indicators on Construction Projects. *Sci. Int.* **2014**, *26*, 1403–1408.