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THE ROLE OF RELATIONAL GOVERNANCE IN PUBLIC-PRIVATE PARTNERSHIPS SUSTAINABILITY PERFORMANCE: MEDIATING EFFECT OF COOPERATIVE BEHAVIOR AND MODERATING EFFECT OF ENVIRONMENTAL UNCERTAINTY

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Abstract

This study investigates the role of relational governance in enhancing Public-Private Partnership (PPP) sustainability performance, focusing on the mediating effect of cooperative behavior and moderating role of environmental uncertainty. This study employed a quantitative research approach, utilizing survey data collected from 284 participants involved in PPP projects in Khyber Pakhtunkhwa, Pakistan. The finding shows that relational governance significantly influences PPP sustainability performance. Additionally, the results show that cooperative behavior significantly mediates the relationship between relational governance and PPP sustainability performance, while environmental uncertainty negatively moderates the strength of this relationship. The findings suggest that in environments with high uncertainty, the positive influence of relational governance on cooperative behavior and sustainability performance is decreased. The research study adds to existing knowledge about PPP governance through its examination of relational governance and its association to cooperative behavior and environmental uncertainty. The findings demonstrate that organizations need adaptive governance frameworks which should include mechanisms to handle external uncertain situations.

Keywords: Relational governance, public-private partnership sustainability performance, cooperative behavior, environmental uncertainty

Introduction

Public Private Partnerships (PPPs) have changed into a cornerstone of modern infrastructure development, offering a strategic response to the growing pressures on public finances and the increasing demand for high-quality public services (Jian & Rath, 2026; Cui et al., 2018). The Public-Private Partnership (PPP) model provides governments with a flexible method to fund projects during budget constraints because it permits them to obtain financing through private partnerships while their public accounts remain under government control and their regulatory duties and public interest obligations stay intact (Sow & Gathu, 2026; Wang et al., 2020). The collaborative method will achieve two goals because it will create affordable infrastructure projects and it will enhance social inclusion and environmental protection and institutional durability throughout extended periods of time (Ma & Zhou, 2026; Li et al., 2024).

Research continues to investigate the ability of Public-Private Partnerships (PPPs) to deliver sustainable results which have been implemented across various projects (Mokhele, 2026; De metihes et al., 2025). Organizations need to establish sustainable practices that extend beyond financial viability to include social equity and environmental responsibility and institutional durability (García & Casady, 2024; Biygautane et al., 2019). The success of public-private partnerships depends on the governance mechanisms which will be used during the entire project time period. The governance system functions as the fundamental system through which all public-private partnerships operate their entire duration because it establishes their risk sharing methods and conflict resolution paths and operational partnership rules (Liang et al., 2025; Osei-Kyei & Chan, 2015). Organizations implement two types of governance mechanisms which include contractual governance and relational governance as their primary governance structure (Alqershy et al., 2026; Zheng et al., 2021).

All partners in contractual governance must abide by the legally binding agreements which establish their respective rights and responsibilities and obligations. The system provides explicit risk protection and safety measures, yet its fixed nature makes it unsuitable for situations that require quick adjustments to changing conditions (Kumar & Chanda, 2026; Schepker et al., 2014; World Bank, 2023). The relational governance approach focuses on developing trust between partners through reciprocal partnerships, open communication practices, and methods for solving problems together (Benítez-Ávila et al., 2018). The system enables partners to address unexpected obstacles while handling changes in project circumstances, which creates the cooperative behaviors necessary to maintain project success throughout its duration (Zhang et al., 2024; Warsen et al., 2018).

Researchers need to understand that relational governance matters for public-private partnership studies. First, the majority of research in this area adopts cross-sectional designs which provide a snapshot of governance mechanisms at a single point in time but fail to account for the evolution of these mechanisms across the entire lifecycle of a PPP (De Schepper et al., 2014). The research adopts this methodology because it creates limitations for establishing causal relationships while missing important aspects of how organizations change their governance methods between different institutional and economic and technological developments that occur throughout time (Li et al., 2024; Hueskes et al., 2017).

The mechanisms through which relational governance affects sustainability performance need further investigation because researchers already established it as a major factor that determines project success. The study has not yet investigated how partners in a project work together to achieve sustainability goals through information sharing and interest alignment (Opoku et al., 2024; Valotti et al., 2023). Third, the role of environmental uncertainty in shaping the relationship between governance mechanisms and sustainability performance has received limited attention (Kumar & Chanda, 2026). PPPs operate in unpredictable environments because they face sudden changes in regulations and economic conditions and technological developments, but researchers have not yet developed theories about how these uncertainties impact governance systems (Zhang et al., 2024; Cruz & Marques, 2013). The research aims to address existing gaps by developing an integrated framework which combines relational governance with two opposing elements of cooperative behavior and environmental uncertainty. The research project has established four main objectives which it intends to accomplish.

1. The study aims to examine how relational governance influence public-private partnership sustainability performance.
2. To examine the mediating effect of cooperative behavior between relational governance and PPP sustainability performance.
3. To investigate the moderating effect of environmental uncertainty between relational governance and cooperative behavior.
4. To evaluate moderating effect of environmental uncertainty between relational governance and PPP sustainability performance via cooperative behavior.

Review of Literature and Hypotheses

Relational Governance

Partnerships operate through informal, non-contractual mechanisms that define their relationships with each other based on trust and reciprocal obligations and their continuous communication (Carter et al., 2026; Zhu et al., 2026). The system establishes operational methods for unexpected situations, which require organizations to adapt their procedures according to current situations. Relational governance establishes essential elements necessary to support partner collaboration in Public-Private Partnerships (PPPs) because it enables efficiency through reduced transaction expenses and shared partner objectives (Zheng et al., 2021). Contractual governance establishes formal protective measures while relational governance builds trust between parties, which helps them work together to achieve project objectives in environments that are both complex and constantly changing (Carter et al., 2026; Warsen et al., 2019). Research demonstrates that Public-Private Partnerships (PPPs) with strong relational governance mechanisms achieve better outcomes than those that depend only on formal contracts because the former system secures continual project performance throughout its entire duration (Seneerath et al., 2026; Hodge & Greve, 2019).

1.1.1 Cooperative Behavior

Cooperative behavior in PPPs is the willingness of partners to align their interests, share information, and engage in joint decision-making for the common good of the project (Wang et al., 2026; Castañeda et al., 2022). The process of relational governance depends on trust and mutual respect because these elements create operational pathways which help organizations reach their sustainability objectives (Abeere & Sadeh, 2023). Organizations need to implement cooperative behavior because it improves project execution while protecting against operational risks which emerge from different cultural practices and the conflicting priorities of public and private organizations (Biygautane et al., 2019). The research demonstrates that organizations which maintain high cooperation levels can solve problems better while developing partnerships which will sustain them through the extended uncertain periods that occur during PPP projects (Hao et al., 2023). The study shows that cooperative behavior serves as a bridge which connects governance systems to their success because it binds all public and private partners to their commitment for the project's future achievement (Wang, 2026; Chowdhury et al., 2022).

1.1.2 PPP Sustainability Performance

The sustainability performance of a project under PPP framework assesses its ability to achieve economic benefits and social advantages and environmental sustainability throughout its operational duration (Mishra et al., 2026; United Nations, 2023). The concept of sustainability in this situation extends beyond financial results because it focuses on creating value that benefits all stakeholders, which includes current and future generations as well as environmental and societal elements (Cui et al., 2018). The assessment of PPP sustainability evaluates three main criteria which include long-term sustainability and environmental effects and the fair distribution of advantages (Klakegg, 2022). Organizations need to combine their contractual and relational governance systems because official agreements establish operational rules while relational governance enables partners to work together with operational flexibility and dedication to their shared long-term objectives (Chen & Chen, 2026; Villalba & Liyanage, 2016). The recent study demonstrates that successful governance practices must match sustainability targets because the best performing PPP projects require governance systems which support organizations to adapt their operations according to new developments and stakeholder demands (Casady et al., 2020; Wang et al., 2020).

1.1.3 Environmental Uncertainty

Environmental uncertainty refers to the unpredictability of external factors such as regulatory changes, market fluctuations, technological innovations, and socio-economic shifts that affect PPP projects (Hu & Wang, 2026; Ge et al., 2023). These uncertainties introduce risks that can undermine the effectiveness of governance mechanisms and complicate decision-making processes (Korthals, 2021). The two partners need to use relational governance because environmental uncertainty functions as a critical element which decreases formal contract capabilities to handle unexpected issues that emerge during their partnership (Cruz & Marques, 2013). The literature suggests that high levels of uncertainty create governance systems which allow partners to maintain their relationship through trust and mutual cooperation instead of following strict contractual agreements (Valotti et al., 2023; Zhou et al., 2022). Research has shown that PPPs which operate in environments with high uncertainty require strong relational governance systems to help them succeed over the long term (Tallaki & Bracci, 2021; Babatunde & Perera, 2021).

1.2 Hypotheses development

Relational Governance and PPP Sustainability Performance

Relational governance plays a critical role in driving sustainability performance in PPPs by fostering trust, mutual commitment, and long-term cooperation between public and private partners (Li et al., 2026; Abeere- & Sadeh, 2023; Chowdhury et al., 2022). The partners in long-term projects use relational governance as their governing system work together to manage project complexities while achieving sustainable project results (García & Casady, 2024; Valotti et al., 2023). The partners of the project can use relational governance to manage their sustainability objectives through ongoing development while meeting established performance requirements throughout the duration of their project (Li et al., 2024; Liang et al., 2025; Casady et al., 2020). The research shows that PPPs which establish strong relational norms and maintain open communication and trust-based interactions achieve better economic and social and environmental sustainability results than those which rely on strict contractual rules (Maqbool & Sridhar, 2024; Yang et al., 2026; Warsen et al., 2019). The framework of relational governance enables organizations to work together through problem-solving processes while sharing their knowledge, which serves as a foundation for organizations to reach their sustainability objectives in difficult infrastructure projects (Zhang et al., 2024; Opoku et al., 2024; Wang et al., 2020). Based on these theoretical insights and empirical findings, the following hypothesis is proposed:

H1: *There is a positive relationship between relational governance and PPP sustainability performance.*

Mediating effect of Cooperative Behavior

The primary way that relational governance brings about actual sustainability results in PPP projects operates through the mechanism of cooperative behavior (Liang et al., 2025; Zheng et al., 2021). The system of relational governance establishes an environment which develops trust and reciprocity among partners while establishing shared standards, which then leads to cooperative behavior between partners through their implementation of information sharing and joint decision-making processes and resource management (Abeere & Sadeh, 2023; Hao et al., 2023; Zhou et al., 2022). The public and private sector partners need these activities to achieve their sustainability objectives through common pursuit which neither partner can reach through their own efforts (Li et al., 2026; Opoku et al., 2024; Valotti et al., 2023). Partners who demonstrate ongoing cooperative behavior create a stronger foundation for their project work because it helps them handle project risks, settle disputes and meet their environmental and social sustainability objectives (Li et al., 2024; Castañeda et al., 2022; Wang et al., 2021). The existing research demonstrates that organizations which promote cooperative behavior can use this method to improve their project outcomes through better governance practices which lead to, measurable project performance improvements, especially in sustainability areas (Maqbool & Sridhar, 2024; Ge et al., 2023; Tallaki & Bracci, 2021). Relational governance offers benefits to PPP projects, which depend on cooperative behavior to transform latent advantages into real sustainability results across all economic, social and environmental aspects of these projects (Yang et al., 2026; García & Casady, 2024). Given this reasoning, the following hypothesis is proposed:

H2: *Cooperative behavior mediates the relationship between relational governance and PPP sustainability performance.*

Moderating Role of Environmental Uncertainty

The working of relational governance depends on environmental uncertainty which combines unpredictable regulatory changes with market volatility and technological disruptions to limit partner cooperation in PPP projects (Li et al., 2026; Ge et al. 2023; Zho et al. 2022; Korthals Altes 2021). High uncertainty environments force partners to depend on relational governance for their collaborative work because formal contracts no longer provide sufficient means to manage their interactions with each other during unpredicted events (Hayat et al. 2024; Zheng et al. 2021). Partners must depend on trust and open communication together with shared norms to maintain their cooperation during uncertain times because contract terms cannot address all possible project situations that will arise (Valotti et al. 2023; Tipu et al. 2024). Environmental uncertainty will decrease the progressive impact that relational governance has on partner cooperative behavior. Partners who need to adapt their work processes because of changing external conditions will benefit from relational governance which provides them with flexibility to change their collaborative methods (Li et al. 2024; Hao et al. 2023; Chowdhury et al. 2022). The combination of relational governance and high environmental uncertainty forces partners to work together more closely because they need to manage external risks while keeping their project work on schedule (Liang et al. 2025; Tallaki & Bracci 2021). Based on these hypothetical understandings, the following hypothesis is proposed:

H3: *Environmental uncertainty moderates the relationship between relational governance and cooperative behavior; such that the relationship is weaker when environmental uncertainty is high.*

Moderated-Mediation effect of Environmental uncertainty

Beyond its direct moderating effect on cooperative behavior, environmental uncertainty is also expected to moderate the indirect relationship between relational governance and PPP sustainability performance via cooperative behavior (Zhang et al., 2024; Tipu et al., 2024; Ge et al., 2023). The moderated mediation perspective suggests that the strength of the indirect relationship between relational governance and sustainability performance through cooperative behavior is contingent on the level of environmental uncertainty within the project context (Hayat et al., 2024; Zhou et al., 2022; Zheng et al., 2021).

When environmental uncertainty reaches its peak conditions, organizations depend on relational governance methods to create cooperative relationships that lead to sustainable results. The existence of high uncertainty environments drives partners to work together which results in decreased collaborative efforts that have direct effects on sustainability outcomes (Li et al., 2024; Hao et al., 2023). The high environmental uncertainty creates conditions which decrease cooperative behavior to function as a mediating factor because the external environment decreases the need for organizations to engage in more than what their formal contracts require (Abeere & Sadeh, 2023; Chowdhury et al., 2022; Wang et al., 2021). This integrated perspective matches the established research on moderated mediation because it shows how environmental uncertainty negatively moves both mediating process and project consequences through its assessment of contextual elements (Valotti et al., 2023; Yang et al., 2026; Babatunde & Perera, 2021). The following hypothesis can be formulated based on this reasoning:

H4: *Environmental uncertainty moderates the mediated relationship between relational governance and PPP sustainability performance via cooperative behavior; such that the indirect effect is weaken when environmental uncertainty is high.*

1.1. Theoretical framework

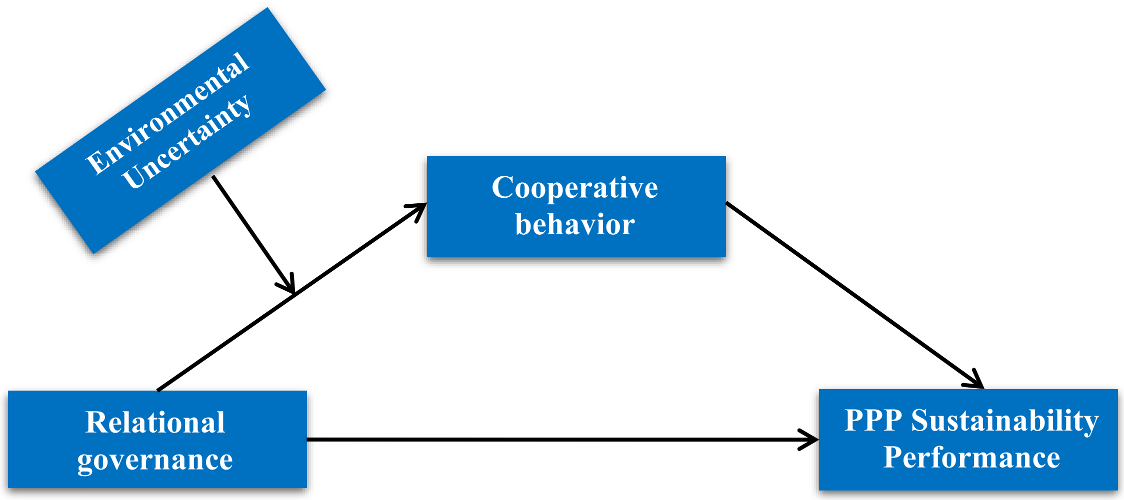

Figure 2.1: *This study framework*

2 Methods

2.1.1 Population of the study

The population for this study comprises individuals employed in Public-Private Partnership (PPP) projects operating in Khyber Pakhtunkhwa, Pakistan. The study specifically targets workers who are directly involved in the execution management and decision-making processes of these projects because they know about governance mechanisms and project performance. The participants will help researchers understand how relational governance and cooperative behavior affect PPP sustainability performance in complex project environments that contain uncertainties. The researchers used a structured questionnaire to collect data which they developed from existing research studies to make it suitable for understanding PPP projects in Khyber Pakhtunkhwa. The researchers created new items from the original items to develop measurement tools which better matched local practices and governance models. The research team guaranteed all study participants that their answers would remain secret and used the collected data exclusively for academic research. The study sample included 284 participants who worked in different positions across PPP projects which enabled researchers to analyze governance practices and project results.

Sample size and technique

The study sample consists of 284 participants who are employed in various roles within PPP projects, ranging from operational staff to middle management and top management. All relevant stakeholders who participate in governing and executing PPP projects were included as respondents through convenience sampling methods. Data was collected through the use of a self-administered questionnaire which the researchers distributed to people who participated in multiple PPP projects throughout Khyber Pakhtunkhwa. The sample consists of a balanced representation of genders educational backgrounds and work experience which ensures that the results reflect the diverse perspectives within the PPP sector.

The study sample consists of 284 participants who work on Public-Private Partnership (PPP) projects throughout Khyber Pakhtunkhwa which is located in Pakistan. The study found that 65.9% of respondents identified as male while 34.1% identified as female which showed that more men participated in PPP projects. The age distribution shows that 35.9% of respondents are between 20-30 years, followed by 34.2% in the 31-40 years age group, suggesting that the sample consists mainly of younger professionals. The study found that 38.0% of participants had work experience less than 5 years while 33.8% possessed 5 to 10 years of experience and 28.2% had more than 10 years of experience which showed that both entry-level workers and experienced professionals participated in the study. The majority of participants possess a Bachelor’s Degree which accounts for 42.9% of the group while Master’s Degree holders make up 39.4% of the group. The sample job positions distribute across various organizational levels because 40.1% of employees work as operational staff members while 38.0% hold middle management roles and 21.9% occupy top management positions. The research demonstrates good employee representation because it includes both junior staff members and senior staff members who provide complete governance and performance evaluation for PPP projects. The study gains data reliability through diverse educational backgrounds of participants and their various work experiences which deliver essential information about the elements that shape relational governance, cooperative behavior, and PPP sustainability performance in unpredictable project settings.

Table 3.1: **Characteristics of study participant**

Demographic variables	Category	Frequency	%
Gender	Male	187	65.9%
	Female	97	34.1%
Age	20-30 years	102	35.9%
	31-40 years	97	34.2%
	41-50 years	57	20.1%
	51+ years	28	9.9%
Experience	Less than 5 years	108	38.0%
	5-10 years	96	33.8%
	More than 10 years	80	28.2%
Qualification	Bachelor’s Degree	122	42.9%
	Master’s Degree	112	39.4%
	MPhil / PhD	50	17.6%
Job Position	Operational Staff	114	40.1%
	Middle Management	108	38.0%
	Top Management	62	21.9%

2.2 Data analysis

The scholar conducted their data analysis using the Statistical Package for Social Sciences (SPSS) software program. The analysis process included several key steps: This study performed their initial analysis through descriptive statistics which provided results about the participant demographics together with the main variable distribution. This step helped in providing a clear picture of the sample’s composition and data characteristics. Present study also conducted a correlation analysis to study the relationships between four study variables which included relational governance, cooperative behavior, environmental uncertainty, and PPP sustainability performance. This method allowed researchers to determine both the strength and direction of relationships among the studied variables. The study used Hayes's (2013) PROCESS macro which roles as a standard tool to perform both mediation testing and moderation testing. The specific models used were: Model 4: To test the mediating effect of cooperative behavior between relational governance and PPP sustainability performance. Model 1: To test the moderating effect of environmental uncertainty on the relationship between relational governance and cooperative behavior. Model 7: To test the moderated mediation effect of environmental uncertainty on the indirect relationship between relational governance and PPP sustainability performance via cooperative behavior. The study employed regression models to examine how relational governance directly impacts PPP sustainability performance through hypothesis H1 while hypothesis H2 tests whether cooperative behavior serves as a mediator between these two variables and hypothesis H3a and H3b assess how environmental uncertainty interacts with their relationship. The researchers conducted the mediation and moderated mediation analysis by applying bootstrapping with 5000 resamples which produced reliable confidence intervals for estimating both indirect and interaction effects in their study results. The bootstrapping technique provides more accurate estimates of the confidence intervals which makes it a highly recommended method in mediation and moderation studies according to Hayes **(**2013**)**.

2.3 Measurement

The current study employed measurement scales from previous studies to validate their research results. The questionnaire used a five-point Likert scale which allowed participants to show their level of agreement with study statements between 1 (Strongly Disagree) and 5 (Strongly Agree).

To measure relational governance, a scale developed by Lu et al. (2015) and Benitez-Avila et al. (2018) was used. The scale includes eight items. 10-item scale developed by Li et al. (2023) was used to measure sustainability performance across three dimensions: economic, social, and environmental sustainability. The 7-item scale to measure cooperative behavior was adapted from the work of Wu et al. (2017). Environmental uncertainty was measured using a 5-item scale based on Milliken's (1987) work and related studies.

Table 3.2: Summary of used survey scale and source

Constructs	Scale Items	Adopted Source	Description
Relational Governance	08	Lu et al. (2015); Benitez-Avila et al. (2018)	Measures trust, communication, and collaboration between partners in PPPs.
PPP Sustainability Performance	10	Li et al. (2023)	Measures sustainability performance across three dimensions: economic, social, and environmental.
Cooperative Behavior	7	Wu et al. (2017)	Measures the extent of cooperation between public and private sector partners in PPP projects.
Environmental Uncertainty	05	Milliken (1987)	Measures the unpredictability of external conditions (regulatory changes, market volatility, etc.).

2.4 Results

Reliability analysis

Table 4.1: Summary of Reliability and convergent validity

Status	Variables	Alpha	CR	AVE
ndent variable	onal Governance	0.91	0.93	0.64
Dependent variable	PPP Sustainability Performance **(PPP-SP)**	0.88	0.91	0.62
Mediating variable	Cooperative Behavior **(CB)**	0.90	0.92	0.66
Moderating variable	Environmental Uncertainty **(EU)**	0.87	0.89	0.60

The Scale Reliability and Convergent Validity results, as shown in Table 4.3, indicate that all constructs in the study exhibit strong internal consistency and validity. The Cronbach's Alpha values for all latent variables exceeded the threshold of 0.70 because they ranged between 0.87 and 0.91 which showed good reliability. The Composite Reliability CR values all exceed 0.70 with 0.93 being the highest value which confirms the reliability of the constructs. The Average Variance Extracted AVE values between 0.60 and 0.66 exceed the minimum threshold of 0.50 which shows that each construct explains more than 50 percent of the variance in the items to confirm strong convergent validity. The measurement scales for relational governance PPP sustainability performance and cooperative behavior and environmental uncertainty measurement scales show both reliability and validity according to these findings.

Correlation analysis

Table 4.2: Summary of correlation matrix of the present study

Latent Variables	Mean	SD	1	2	3	
RG (1)	**3.42**	**0.55**	**1.00**			

PPP-SP (2)	**3.73**	**0.62**	**0.489****	**1.00**		
CB (3)	**3.89**	**0.68**	**0.574****	**0.633****	**1.00**	
EU (4)	**3.26**	**0.70**	**0.318***	**0.525****	**0.562****	**1.00**

Note: *** Correlation is significant at 0.01 level (2-tailed). RG= Relational Governance, PPP-SP= PPP Sustainability Performance, CB= Cooperative Behavior, EU= Environmental Uncertainty*

The correlation matrix in Table 4.2 shows important associations between the main study elements of Relational Governance (RG), PPP Sustainability Performance (PPP-SP), Cooperative Behavior (CB), and Environmental Uncertainty (EU). The research shows that stronger relational governance results in enhanced project sustainability outcomes through a moderate positive relationship ($r = 0.489$, $p < 0.01$) between these two variables. The study shows that relational governance establishes a strong positive connection ($r = 0.574$, $p < 0.01$) with cooperative behavior because effective governance creates a partnership environment for successful collaboration. The study shows that cooperative behavior establishes a strong relationship with PPP sustainability performance ($r = 0.633$, $p < 0.01$), which demonstrates that partnership between organizations leads to sustainable outcomes in PPP projects. The analysis shows that environmental uncertainty creates moderate connections with relational governance ($r = 0.318$, $p < 0.05$) and PPP sustainability performance ($r = 0.525$, $p < 0.01$), which demonstrates that organizations must develop flexible governance methods to handle unpredictable situations while attempting to achieve sustainable results. The study shows that environmental uncertainty creates a strong positive connection with cooperative behavior ($r = 0.562$, $p < 0.01$) because partners increase their teamwork efforts to address external challenges. The study shows that relational governance and cooperative behavior function as key factors for successful public-private partnership projects in environments where environmental uncertainty exists.

KMO and BTS statistics

Table 4.3: Summary of Sample adequacy

Variable status	Variables	KMO values	BTS values
Independent Variable	***Relational Governance (RG)***	0.81	**Chi-Sq (942.18) p < 0.01**
	PPP Sustainability Performance (PPP-SP)	0.79	**Chi-Sq (850.67) p < 0.01**
Dependent Variable	***Cooperative Behavior (CB)***	0.76	**Chi-Sq (795.42) p < 0.01**
Mediating Variables	***Environmental Uncertainty (EU)***	0.72	**Chi-Sq (712.39) p < 0.01**

The KMO values for all variables in the study range from 0.72 to 0.81 which confirms that the data meets minimum requirements for conducting factor analysis because it exceeds 0.6. The KMO value of 0.81 for Relational Governance (RG) shows excellent sampling adequacy while Environmental Uncertainty (EU) has a KMO value of 0.72 which still meets minimum standards for analysis. The test results showed that all tested variables had significant Bartlett's Test of Sphericity results which indicated that their correlation matrices displayed a distinct pattern from an identity matrix. The analysis proves that data meets requirements necessary for performing factor analysis. The variables show adequate association for factor analysis and the data meets requirements for studying the fundamental structure of study constructs. The findings establish that data possesses dependable quality which allows for advanced statistical work in PPP project research.

Hypotheses testing

Table 4.4: Summary of Hypothesis-1

Metrics	Values	Desion	Method
(β)	**0.536**		
(Std. e)	**0.045**		
t-value (t)	**11.91**		
p-value (p)	**0.000**	**Accepted**	Simple Regression
DW Statistic	**1.462**		
R²	**0.469**		
(PPP-SP)			

The regression analysis for Hypothesis H1 shows a positive association between Relational Governance (RG) and PPP Sustainability Performance (PPP-SP) because the unstandardized beta value (β) of 0.536 shows that higher Relational Governance results in higher PPP Sustainability Performance. The t-value of 11.91 and p-value of 0.000 confirm the statistical significance of this relationship. The Durbin-Watson statistic (1.462) shows that the residuals are distributed in a random manner which confirms that there is no major autocorrelation problem. The R^2 value of 0.469 shows that 46.9% of the PPP Sustainability Performance variation is accounted for by Relational Governance. Since the hypothesis is statistically significant and the model explains a substantial portion of the variance, H1 is accepted, confirming that Relational Governance positively impacts PPP Sustainability Performance.

Table 4.5: Summary Hypothesis-2

Path	β	Std. e	t	p
Relational Governance (RG) → Cooperative Behavior (CB)	0.456	0.042	10.86	**0.000**
Cooperative Behavior (CB) → PPP Sustainability Performance (PPP-SP)	0.512	0.050	10.24	**0.000**
Relational Governance (RG) → PPP Sustainability Performance (PPP-SP) (Direct Effect)	0.392	0.047	8.34	**0.000**
Indirect Effect (via CB)	0.234	0.032	7.31	**0.000**

Effect Type	Effect	t-value	p-value	Confidence Interval (CI)
Total Effect	0.626	10.42	**0.000**	[0.558, 0.694]
Direct Effect	0.392	8.34	**0.000**	[0.302, 0.482]
Indirect Effect	0.234	7.31	**0.000**	[0.173, 0.296]

Sobel test: (z = 5.72)

The above table shows that mediating effect of Cooperative Behavior (CB) mediates the relationship between Relational Governance (RG) and PPP Sustainability Performance (PPP-SP). The direct effect of Relational Governance on PPP Sustainability Performance is significant ($\beta = 0.392$, $p < 0.01$), which shows a positive association between the two variables. The indirect effect through Cooperative Behavior shows significant results ($\beta = 0.234$, $p < 0.01$), which demonstrates that Cooperative Behavior functions as a partial mediator between Relational Governance and PPP Sustainability Performance. The total effect ($\beta = 0.626$) shows the combined influence of both direct and indirect effects. The Sobel test ($z = 5.72$) establishes the mediation results, which confirm that Cooperative Behavior functions as a partial mediator. Thus, this study identified support for H2.

Table 4.6: Summary Hypothesis-3

Path	β	SE	t		95% CI
EU × RG → CB (Interaction)	**-0.289**	**0.045**	**-6.44**	**0.000**	[-0.379, -0.199]

The table above shows the moderating effect of environmental uncertainty between relational governance and cooperative behavior relationship via cooperative behavior. The β value of -0.289 and $p < 0.01$ demonstrate a negative moderation effect which shows that increasing environmental uncertainty actually weaken the strength of the positive relationship between relational governance and cooperative behavior. The study found that higher environmental uncertainty conditions make relational governance less successful in promoting cooperative behavior between PPP partners. The 95% confidence interval (CI = [-0.379, -0.199]) does not include zero, confirming that this negative interaction effect is statistically significant. The results indicate that relational governance systems usually boost cooperative behavior except when environmental uncertainties from economic changes and regulatory shifts affect their performance. The research demonstrates that organizations require flexible governance systems which enable them to sustain cooperative relationships during times of environmental unpredictability. The current study is accepted H3.

Table 4.7: Summary Hypothesis-4

PP Level	Indirect Effect	LLCI	ULCI
Low (-1 SD)	0.254	0.150	0.357
Medium (Mean)	0.321	0.230	0.400
High (+1 SD)	0.191	0.091	0.295
Index of Moderated Mediation	-0.043	-0.085	0.003

Note: *PPP-SP = Public-Private Partnerships Sustainability Performance, Bootstrap N = 5000, CI = 95%. Conditional effects tested at ±1 SD from mean.*

The table 4.7 shows that higher environmental uncertainty leads to decreased strength between relational governance and PPP sustainability performance through cooperative behavior. The low environmental uncertainty level shows that relational governance maintains its ability to create cooperative behavior between parties who work together in stable conditions. The indirect effect shows a downward trend when environmental uncertainty rises because high uncertainty conditions create a decrease with the effect showing 0.191(LLCI= 0.091, ULCI= 0.295).

The Index of Moderated Mediation (-0.043, LLCI = -0.085, ULCI = 0.003) shows that environmental uncertainty acts as a negative moderator which weakens the mediated association between relational governance and PPP sustainability performance. Thus, present study identified support for H4.

Discussion

This study aimed to explore the role of relational governance in enhancing PPP sustainability performance, with a particular focus on the mediating effect of cooperative behavior and the moderating role of environmental uncertainty. The research demonstrates that relational governance functions as an essential element which creates sustainable results for Public-Private Partnerships (PPPs) through its governance system based relationships between trust and collaboration and governance system flexibility. Research shows that relational governance enables trust building and creates flexible systems which organizations need to manage their intricate extended-duration projects. The implementation of relational governance in PPPs creates ongoing operational benefits through its ability to maintain project objectives while partners work together to solve problems, which enables projects to maintain sustainability in environments that frequently change (Zheng et al., 2021; Warsen et al., 2018). The study by Maqbool and Sridhar (2024) demonstrates that relational governance enables organizations to achieve sustainable performance because it develops organizational flexibility, which organizations require to handle unexpected problems that emerge during project execution. The research demonstrates that PPP sustainability performance depends on relational governance which previous studies identified as an essential factor for project success through long-term relationships and flexible operational methods (Zheng et al., 2021; Warsen et al., 2018).

The research results demonstrate that cooperative behavior functions as the main factor which connects relational governance to PPP sustainability performance. The research demonstrates that successful project results depend on the cooperation between different parties who work together to achieve their objectives through relational governance mechanisms. The heightening of cooperative behavior enables PPPs to develop better capabilities for handling risks and solving conflicts while maintaining balance between the needs of public and private stakeholders (Wang et al., 2021; Castañeda et al., 2022). The mediation effect demonstrates that relational governance enables stronger partnerships which support joint problem-solving processes necessary for PPP projects to meet their sustainability targets (Maqbool & Sridhar, 2024). The cooperative behavior of organizations functions as the essential link which transforms their relational governance system into actual sustainable results. The organizations which show greater cooperative behavior in their public-private partnerships demonstrate better ability to handle unexpected challenges because their adaptive capacity improves (Castañeda et al. 2022). The literature underscores that cooperative behavior directly leads to better performance by promoting information sharing which strengthens decision-making processes. The project achieves its sustainable results because cooperative behavior enables all stakeholders to stay dedicated toward their common long-term objectives.

The study results demonstrate that environmental uncertainty serves as a moderating factor which decreases the beneficial effects of relational governance on both partnership cooperation and sustainability results. The research shows that organizations facing high uncertainty from both legislative changes and market fluctuations experience challenges in implementing formal contracts which require them to use flexible governance methods (Cruz & Marques, 2013; Tallaki & Bracci, 2021). The relational governance capacity to promote cooperative behavior suffers when environmental uncertainty increases prompting public private partnership partners to implement flexible strategies for sustaining their collaborative relationship and operational results (Li et al., 2024). The long-term success of public private partnership projects requires risk management frameworks which can handle unexpected external events according to research conducted by Zhou et al. in 2022 and Ge et al. in 2023. The analysis shows that environmental uncertainty acts as a barrier which reduces the indirect effect of relational governance on public private partnership sustainability through cooperative behavior. The research indicates that organizations dealing with uncertain situations will experience diminished benefits from relational governance which affects their sustainability outcomes. The research findings demonstrate that organizations need to create governance systems which provide protection against external threats while also allowing them to adjust to new situations without compromising their project objectives (Zhang et al., 2024; Valotti et al., 2023). The study demonstrates the essential function of relational governance for achieving PPP sustainability since it shows how shared environmental disturbance. The enforcement of relational governance systems needs to establish two main objectives which include developing cooperative relationships and building resilience capabilities to withstand external disruptions. The implementation of flexible adaptive frameworks together with improved communication systems for public and private stakeholders will enable PPP projects to effectively manage environmental uncertainties while achieving their sustainability objectives. The findings indicate that successful PPP projects need to focus on establishing trust between parties and developing governance frameworks that allow for adaptability and creating responsive operational plans. The research results provide insights into how PPPs operate through governance systems which serve as essential resources for researchers and practitioners who need to manage extended infrastructure development projects.

Conclusion

The research investigates how relational governance systems improve the sustainability performance of Public-Private Partnerships through mediation of collaborative behavior and impact of environmental uncertainty as moderating factor. The results demonstrate how unpredictable external conditions affect the success of Public-Private Partnership projects while showing the operational mechanisms that lead to positive outcomes. The study demonstrates that relational governance functions as a important factor which determines the sustainability performance of public-private partnerships because it creates a foundation for public and private sector partners to work together. Through the establishment of trust which enables open communication and establishes long-term commitments relational governance helps stakeholders achieve common goals which results in better economic and social sustainability results. The process of cooperative behavior operates as a mediating factor which connects relational governance to improved PPP sustainability results. The mediation effect indicates that relational governance directly affects performance through its role in promoting partner cooperation and joint problem-solving activities. The study demonstrates that environmental uncertainty affects how relational governance and cooperative behavior interact because organizations experience stronger effects during times of low uncertainty while their effects become weaker during high uncertainty periods. The finding shows that relational governance functions as a dynamic element for building cooperative relationships between organizations but its power decreases when external elements like environmental uncertainty, economic instability, and technological disruptions rise in intensity.

Implications

Theoretical Implications

The theoretical framework of PPP governance receives promotes development through this study which combines three essential elements of relational governance and cooperative behavior and environmental uncertainty. The study demonstrates that cooperative behavior roles as a mediator between relational governance and sustainability performance because previous research established relational governance as a fundamental governance mechanism for PPP projects. The study shows how environmental uncertainty affects governance systems by demonstrating that relational governance functions better in certain environmental conditions which have not been studied in previous PPP research. The research creates new research possibilities because it needs to investigate how external events like political instability and global economic crises affect governance systems and performance results in PPP projects.

Practical Implications

The study demonstrates that public and private workers must establish strong partnerships to succeed in their public-private partnership initiatives. The study shows that trust and effective communication serve as essential elements for governance frameworks which lead to successful project results according to policymakers and PPP project managers. The success of PPP projects requires organizations to establish environments which enable team members to work together while sharing their common goals and taking shared responsibility for their duties. The organization can achieve this objective through the implementation of joint problem-solving workshops that establish regular communication channels and develop adaptable agreements which permit modifications during the resolution of new problems. The research emphasizes that environmental uncertainty must be assessed when governance structures undergo development for public-private partnership projects. The existing framework needs adaptive governance systems which should protect against risks while maintaining operational flexibility during unexpected events. The research suggests that scenario planning and dynamic contract models should be used as tools which help PPPs to handle unexpected obstacles. Public and private sector organizations can maintain their partnership effectiveness through the implementation of these strategies which handle unpredictable situations (Ge et al., 2023). These practical recommendations provide actionable insights for enhancing the resilience of PPP projects. The uncertainty factor requires governance frameworks to establish adaptable systems which maintain operational stability. The establishment of flexible contracts which permit project modifications together with ongoing risk evaluations and adaptive management methods establishes a critical framework which enables PPP projects to operate successfully in unpredictable situations. The development of joint training programs and resource sharing between PPP partners should be developed as the primary approach to establishing contingency plans which will help organizations deal with unexpected disturbances in high uncertainty environments.

Study Limitation and Directions

This study presents several important findings which researchers should develop further. The study design does not allow researchers to establish causal relationships that develop through time. Researchers require longitudinal studies which will enable them to observe how Cooperative behavior develops together with relational governance strategies during the entire duration of Public-Private Partnership projects. The study specifically examined Khyber Pakhtunkhwa Public-Private Partnership projects which restrict researchers from applying study results to different regions or countries where economic and political systems and institutional frameworks differ. Future research should seek to expand this study to other regions or industries to validate the findings across diverse PPP environments.

Another limitation exists because participants provided their own data which brings potential for social desirability bias and their own personal understanding of the questions. Researchers should use both quantitative findings and qualitative methods that include interviews and case studies to examine how relational governance and cooperative behavior operate in various PPP sectors. The lived experiences of PPP partners provide valuable understanding about how governance practices affect sustainability through their impact on behavioral patterns which drive these two elements. Future studies should investigate how technology and digital platforms enable organizations to work together and maintain relationships through their public-private partnership projects. The upcoming research will focus on understanding how digital communication tools and decision-making technologies impact collaborative processes and sustainability results within public-private partnerships.

References

Abdi, M., & Aulakh, P. S. (2017). Locus of uncertainty and the relationship between contractual and relational governance in cross-border interventions. *Journal of Management*, *43*(3), 771–803.

Abeere-Inga, E., & Sadeh, A. (2023). Trust, communication, and relational governance in public-private partnership projects. *Journal of Engineering, Project, and Production Management*, *13*(2), 112–125.

Alqershy, M. T., Shi, Q., Anbar, D. R., & Mousa, K. (2026). Governance mechanisms and social responsibility performance in international megaprojects: the contingent role of host country institutional environment. *International Journal of Managing Projects in Business*, 1-24.

Babatunde, S. O., & Perera, S. (2021). Analysis of the barriers to sustainability integration in public-private partnership projects in developing countries. *Journal of Facilities Management*, *19*(2), 241–261.

Benítez-Ávila, C., Koeijn, M., & Dewulf, G. (2018). The interplay of relational and contractual governance in public-private partnerships: The mediating role of trust. *International Journal of Project Management*, *36*(3), 442–456.

Biygautane, M., Hodge, G. A., & Gerber, P. A. (2019). The governance of public-private partnerships: A comparative analysis of institutional designs and properties. *Public Management Review*, *21*(10), 1488–1514.

Cao, Z., & Lumineau, F. (2015). Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic review. *Journal of Operations Management*, *33*, 15–42.

Carter, E., Gibson, M., Heinrich, C. J., & Malatesta, D. (2026). A tyranny of metrics vs. a tool for learning: exploring performance information use on the spectrum of formal to relational in outcomes-based contracts. *Public Management Review*, 1-26.

Casady, C. B., Eriksson, K., Levitt, R. E., & Scott, W. R. (2020). (Re)defining public-private partnerships (PPPs) in the new governance era: An comparative analysis of institutional durability and sustainability. *Public Management Review*, *22*(2), 161–183.

Castañeda, M. G., Cucciniello, M., & Mariani, L. (2022). Cooperative behavior in public-private partnerships: A systematic literature review and future research agenda. *Public Money & Management*, *42*(7), 512–522.

Chen, Y. A., & Chen, C. L. (2026). Exploring operating mechanisms of agricultural e-commerce service ecosystems from a multileveled perspective. *Journal of Services Marketing*, 1-17.

Chowdhury, A. N., Chen, P. H., & Tiong, R. L. (2022). Analyzing the structure of public-private partnership projects: A multi-stakeholder perspective on cooperation. *Construction Management and Economics*, *40*(4), 287–306.

Cruz, C. O., & Marques, R. C. (2013). Flexible contracts to cope with uncertainty in public-private partnerships. *International Journal of Project Management*, *31*(3), 473–483.

Cui, C., Liu, Y., Hope, A., & Wang, J. (2018). Review of studies on the public-private partnerships (PPP) for infrastructure projects. *International Journal of Project Management*, *36*(5), 773–794.

De Matteis, F., Borgonovi, E., Notaristefano, G., & Striani, F. (2025). The contribution of public-private partnership (PPP) to sustainability: governance and managerial implications from a literature review. *Corporate governance: the international journal of business in society*, *25*(1), 144-159.

De Schepper, S., Dooms, M., & Haezendonck, E. (2014). Stakeholder dynamics and responsibilities in Public–Private Partnerships: A theoretical exploration. *International Journal of Project Management*, *32*(7), 1210–1222.

García, M., & Casady, C. B. (2024). Sustainable governance in public-private partnerships: Beyond the financial bottom line. *Journal of Infrastructure Systems*, *30*(1), 04023045.

Ge, R., Huang, Y., & Zhang, J. (2023). Environmental uncertainty and the performance of public-private partnerships: The moderating role of adaptive governance. *Sustainability*, *15*(4), 3122.

Hao, S., Zhang, Z., & Gao, Y. (2023). Relational governance, cooperative behavior, and project performance in PPP projects: The mediating role of knowledge sharing. *Journal of Civil Engineering and Management*, *29*(1), 45–59.

Hayat, N., Al-Mamun, A., & Nasir, N. A. M. (2024). Governance mechanisms and project success in public-private partnerships: The moderating role of environmental uncertainty. *International Journal of Managing Projects in Business*, *17*(2), 201–224.

Hodge, G. A., & Greve, C. (2017). On constant metamorphosis: Analyzing the infrastructure public-private partnership. *The Oxford Handbook of Public Management*. Oxford University Press.

Hodge, G. A., & Greve, C. (2019). Public-private partnerships: A Review. *Public Management Review*, *21*(5), 762–771.

Hu, S., & Wang, S. (2026). How Environmental Uncertainty Drives Asymmetric Mispricing in China: Dual Channels and Heterogeneous Media Effect. *International Journal of Financial Studies*, *14*(1), 23.

Hueskes, M., Verhoest, K., & Block, T. (2017). Governing public–private partnerships for sustainability: An analysis of procurement and strategic objectives. *International Journal of Project Management*, *35*(6), 1184–1195.

Jain, N., & Rath, J. P. (2026). Public–Private Partnerships as Drivers of Sustainable Business Innovation in India's Infrastructure Sector. *Journal of Management Studies and Development*, *5*(01), 92-108.

Klakegg, O. J. (2022). Governance frameworks for public projects: The role of sustainability. *Project Management Journal*, *53*(3), 215–233.

Korthals Altes, W. K. (2021). Uncertainty and the governance of public-private partnerships in land development. *Land Use Policy*, *109*, 105624.

Kumar, N., & Chanda, S. (2026). Rewriting the rules: embedding enforceable human rights in FIFA's host nation agreements. *The International Sports Law Journal*, 1-17.

Li, H., Fan, J., Zhang, W., Cao, Y., & Su, L. (2026). Exploring Interorganizational Trust in Public–Private Partnership Projects under Digital Scenarios: An Evolutionary Game Approach. *Journal of Infrastructure Systems*, *32*(1), 04025044.

Li, X., Zhang, L., & Wang, Y. (2024). Evolution of governance mechanisms in long-term PPP projects: A longitudinal study. *Construction Management and Economics*, *42*(2), 115–134.

Liang, Y., Wang, H., & Zhao, X. (2025). Risk-sharing and conflict resolution in modern PPP frameworks. *Journal of Construction Engineering and Management*, *151*(1).

Ma, L., & Zhuo, S. (2026). Environmental regulation and green innovation: The moderating roles of green finance and executive green perception. *Journal of Innovation & Knowledge*, *14*, 100954.

Maqbool, R., & Sridhar, V. (2024). Sustainable infrastructure and social inclusion: The role of public-private partnerships. *Sustainability*, *16*(3), 1240.

Mishra, D., & Das, R. (2026). Enhancing sustainability and efficiency in PPP-based municipal solid waste management: a comprehensive framework integrating success factors and barriers: D. Mishra and R. Das. *Clean Technologies and Environmental Policy*, *28*(4), 99.

Mokhele, M. O. (2026). Assessment of the effectiveness of public-private partnerships in collaborative projects in South Africa: Building back better in post-disaster recovery. *Progress in Disaster Science*, 100553.

Opoku, A., Chen, C., & Ahmed, V. (2024). Information sharing and interest alignment for sustainability goals in PPPs. *Built Environment Project and Asset Management*, *14*(2), 210–225.

Osei-Kyei, R., & Chan, A. P. (2015). Review of studies on critical success factors for public–private partnership (PPP) projects. *International Journal of Project Management*, *33*(6), 1335–1346.

Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance act as substitutes or complements? *Strategic Management Journal*, *23*(8), 707–725.

Schepker, D. J., Oh, W. Y., Martynov, A., & Poppo, L. (2014). The many futures of contracts: Moving beyond structure and safeguarding to process and adaptation. *Journal of Management*, *40*(1), 193–225.

Senarath, S. A. C. L., Subramaniam, N., & Gong, Z. (2026). Managing operational risks in public private partnerships (PPPs): social capital and management control systems (MCS) perspectives. *Journal of Management Control*, 1-31.

Sow Badji, A., & Gathu, C. (2026). Leveraging public-private partnerships for climate finance: advancing climate-smart agriculture for NDC implementation in Kenya and Senegal. *Climate Policy*, 1-15.

Tallaki, M., & Bracci, E. (2021). Risk management and governance of public-private partnerships: A systematic literature review. *Public Money & Management*, *41*(8), 643–654.

Tipu, S. A., Rahim, A., & Ryan, J. C. (2024). Relational governance and project performance: A meta-analysis of the mediating role of trust and cooperation. *Project Management Journal*, *55*(1), 88–104.

United Nations. (2023). *Sustainable Development Goals and the role of Public-Private Partnerships*. UN Publications.

Valotti, G., Mariani, L., & Cucciniello, M. (2023). Achieving sustainability through collaboration: A study of public-private interactions. *Public Administration Review*, *83*(4), 890–905.

Villalba-Romero, F., & Liyanage, C. (2016). Evaluating success in PPP road projects in Europe: A comparison of performance measurement approaches. *Transportation Research Procedia*, *14*, 372–381.

Wang, A. (2026). Interaction of governance ambidexterity and the institutional environment on handling uncertainty in public-private partnerships. *International Journal of Managing Projects in Business*, 1-21.

Wang, Y., Hu, Y., & Zhang, Z. (2020). Accountability and transparency in public-private partnerships: A systematic review. *Public Performance & Management Review*, *43*(1), 164–192.

Wang, Z., Zhang, J., & Wang, Y. (2021). Exploring the impact of relational governance on the sustainability of public-private partnership projects. *Sustainability*, *13*(18), 10123.

Warsen, R., Klijn, E. H., & Koppenjan, J. (2018). Mix and match: How contractual and relational conditions are combined in successful public-private partnerships. *Journal of Public Administration Research and Theory*, *29*(1), 114–132.

Warsen, R., Klijn, E. H., & Koppenjan, J. (2019). Mix and match: How contractual and relational conditions are combined in successful public-private partnerships. *Journal of Public Administration Research and Theory*, *29*(1), 114–132.

World Bank. (2023). *Infrastructure, PPPs and the Sustainable Development Goals: Annual Report 2023*. World Bank Group.

Yang, Y., Li, Q., & Zhou, Z. (2026). Assessing the impact of governance on PPP sustainability: A multi-criteria evaluation approach. *International Journal of Managing Projects in Business*, *19*(1), 12–34.

Zhang, J., Liu, W., & Li, S. (2024). Navigating environmental uncertainty in PPPs: The role of adaptive governance. *International Journal of Managing Projects in Business*, *17*(1), 45–68.

Zheng, X., Liu, Y., & Gao, Y. (2021). How do contractual and relational governance impact project performance? The mediating role of knowledge sharing. *International Journal of Project Management*, *39*(2), 127–139.

Zhou, X., Zhang, W., & Lynch, J. (2022). The impact of environmental uncertainty on governance choice in public-private partnerships. *Management Decision*, *60*(5), 1312–1334.

Zhu, L., Ding, Y., & Cheung, S. O. (2026). Does the incentive mechanism leverage cognitive trust to enhance information sharing behavior in projects?. *Engineering, Construction and Architectural Management*, 1-19.