

**THE ROLE OF CONTRACTUAL GOVERNANCE IN PUBLIC-PRIVATE PARTNERSHIPS SUSTAINABILITY PERFORMANCE: MEDIATING EFFECT OF OPPORTUNISTIC BEHAVIOR AND MODERATING EFFECT OF ENVIRONMENTAL UNCERTAINTY**

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**Abstract**

**Purpose:** This study investigates that how contractual governance (CG) influences the public-private partnership sustainability performance (PPP-SP). Additionally, opportunistic behavior (OB) was used as mediating variable and environmental uncertainty (EU) as moderating variable. The study extends Transaction Cost Economics (TCE) by introducing behavioral and environmental factors that impact public-private partnership (PPP) operations. **Design/Method/Approach:** - This study employed Hayes' PROCESS macro (Models 4, 1 and 7) for mediation, moderation, and moderated-mediation analysis which conducted using data from PPP projects in Khyber Pakhtunkhwa Pakistan through bootstrapping with 5000 resamples. The scholar used regression analysis to investigate both direct and indirect effects while moderation analysis assessed how environmental uncertainty affected the results. **Findings:** The results show that contractual governance has a positive impact on PPP sustainability performance, both directly and indirectly through opportunistic behavior. Environmental uncertainty significantly moderates the relationships between contractual governance and opportunistic behavior, as well as between contractual governance and PPP sustainability performance. **Originality/Value:** This research contributes to TCE theory by introducing opportunistic behavior as a mediator and environmental uncertainty as a moderator in the context of PPP sustainability. It highlights the need for flexible governance structures that can adapt to environmental changes and reduce opportunistic actions to ensure better sustainability outcomes. **Implications:** The study provides practical implications for policymakers and project managers, suggesting that well-designed contractual governance mechanisms and an understanding of environmental uncertainties are important to achieving long-term sustainability in PPP projects. Additionally, the research recommends the adoption of technology integration and competitive intensity as future moderators to enhance governance frameworks.

**Keywords:** Contractual Governance, Public-Private Partnership Sustainability Performance, Opportunistic Behavior, Environmental Uncertainty

**1. Introduction**

Governments worldwide are facing an expanding infrastructure deficit, as fast-growing populations, urbanization, and economic progress continue to

surpass the financial capacity of public budgets. The demand for essential infrastructure such as roads, hospitals, energy systems, and water services has reached unprecedented levels, yet traditional public financing mechanisms remain insufficient to meet these needs (OECD, 2023). Public–Private Partnerships (PPPs) have emerged as a relevant and strategic innovative solution. By bringing together the public oversight and the private sector capital, expertise and efficiency, PPPs are able to deliver on critical infrastructure requirements more effectively (Li et al., 2023). As a result, PPPs have increasingly become preferred procurement model in both developed and developing economies (García & Casady, 2024). Despite their benefits, PPPs are by nature complex and long-term ventures. The contract durations are also long typically lasting for 20 to 30 years (Chen et al., 2022). Over such extended periods, it is particularly challenging to sustain performance across the economic, social and environmental dimensions (Hou et al., 2024). This multidimensional concept is termed PPP sustainability performance referring to whether a partnership guarantees value for money, community expectations, and resiliency throughout the lifetime (Discover Sustainability, 2026). Achieving such performance requires more than sound project design, and requires effective governance. Governance is a critical aspect of decision-making, risk allocation, and regulating partner behavior (Maqbool & Sridhar, 2024). Of all the governance mechanisms, contractual governance is the most basic. It involves the design, completeness, and enforcement of formal agreements that spells out partner rights, obligations, performance standards, and penalty mechanisms (García & Casady, 2024). Contractual governance has three functions: coordinating partner activities based on expectations, safeguarding investments by mitigating opportunistic behavior, and providing dispute settlement mechanisms (Qian & Cao, 2024). These functions are important particularly where PPP arrangements are concerned given that public and private interests are different and information asymmetry is high (Casady et al., 2023). However, empirical findings on the contractual governance-sustainability performance of PPPs nexus remain mixed (Hou et al., 2023; Xiong et al., 2022). This inconsistency implies that the link is not simple and thus may require behavior-based explanations.

Transaction Cost Economics (TCE) provides an interesting framework to understand this complexity. The TCE theory shows that governance systems direct their impact on organizational efficiency by their ability to stop opportunistic activities (Williamson, 1985, as cited in Rujec, 2025). The term opportunism describes a behavior pattern which people use to achieve their personal goals through deceptive and dishonest methods (Maqbool & Sridhar, 2024). The PPP environment experiences opportunistic behavior through three elements: extended contract durations, dedicated resource requirements, and the limited cognitive capacity of decision-makers, which together create both moral hazard and hold-up risks (Ho, 2015). When organizations fail to control opportunism, they will face increased transaction expenses, decreased collaborative efforts, and reduced environmental protection measures (Qian et al., 2024). Contractual governance specifically tackles the problem of opportunism by reducing information asymmetry, clarifying penalties for

malfeasance, and raising the stakes for opportunistic behavior (García & Casady, 2024; Hou et al., 2024).

Contractual governance thereby creates an environment for sustainable performance indirectly by reducing opportunism. This view on contractual governance highlights opportunism as a primary mediating factor between contractual governance and PPP sustainability performance. However, little empirical attention has been directed to this mediating factor in PPP research (Cheng et al., 2021). This research aims to fill this knowledge gap. Furthermore, governance structures are not independent elements in PPPs but are heavily dependent on the environmental context in which they are applied. Environmental uncertainty is defined as changes in regulatory, economic, technological, and socio-political environmental factors surrounding a PPP (Qian & Cao, 2024). High levels of environmental uncertainty can make formal contracts incomplete or easily obsolete (Almeida et al., 2025). The research found that formal contracts lost their ability to prevent opportunistic behavior in specific situations (Wang et al., 2026). The stable environments which exist in this study treat contractual governance as an effective controlling mechanism. The contractual governance system which governs opportunistic behavior needs to be assessed through environmental uncertainty because it functions as a boundary condition which affects both elements and their connection to sustainability performance. The moderating function of this concept needs more research in public-private partnership studies (Cheng et al., 2021) because it remains underexplored.

Based on TCE theory, this study aims to develop and verify an integrated model of moderated mediation. In this study, four research objectives are set: (1) to verify the direct relationship between contractual governance and PPP sustainability performance; (2) to verify opportunistic behavior as a mediator in the relationship between contractual governance and PPP sustainability performance; (3) to verify the moderating effect of environmental uncertainty on the relationship between contractual governance and opportunistic behavior; and (4) to verify the moderating effect of environmental uncertainty on the mediated relationship between contractual governance and PPP sustainability performance through opportunistic behavior. These four research objectives correspond to four hypotheses (H1, H2, H3a, and H3b). This study contributes to the TCE theory in three ways. First, it extends TCE theory into the PPP sustainability field by proposing opportunistic behavior as a behavioral mediator and environmental uncertainty as a contextual moderator in contractual governance (Li et al., 2023). Second, it uses the framework of moderated mediation in testing the hypotheses, which provides a more accurate approach in modeling the conditional relationships between variables (Maqbool & Sridhar, 2024). Third, it provides managerial implications for policymakers and contracting authorities in developing PPP contracts that are both behaviorally robust and responsive to environmental changes (Qian & Cao, 2024).

## 2. Literature Review

### 2.1. Contractual Governance

Contractual governance refers to formal agreements that define roles, responsibilities, risk allocation, and performance expectations between parties.

The contracts in PPP projects function as vital components because these projects require extensive funding and enduring contract terms. Recent research demonstrates that contractual governance consists of three main components which include responsibility allocation and risk-sharing mechanisms together with accountability systems (Liang et al., 2025). The elements establish a structured approach to relationship management which helps decrease uncertainty. The incomplete nature of PPP project contracts results from their inability to foresee all upcoming events. Contractual governance acts as a protection mechanism which provides organizations with protection but not absolute security. Research shows that contractual governance directly enhances project outcomes while it also provides backing to relational governance and risk management functions (Wang et al., 2026). The establishment of strong contracts assists organizations in risk reduction while they use contracts to prevent opportunistic behavior through specific rule establishment and penalty implementation (Lv et al., 2024). Contractual governance supplies organizations with the necessary formal framework to manage their projects efficiently.

### **2.2. Opportunistic Behavior**

Opportunistic behavior describes actions where one party benefits through deceitful practices which include concealing information and violating contracts and showing partiality. The concept originates from Transaction Cost Economics because people tend to pursue their personal interests after they receive incomplete information about their situation. The extended duration of projects together with the existing information gaps makes PPP projects more vulnerable to opportunistic behavior. Research demonstrates that environmental uncertainty together with insufficient transparency creates conditions which increase the likelihood of opportunistic behavior (Li et al., 2025). The behavior establishes obstacles which weaken trust relationships and raise transaction expenses which lead to decreased project success (Cheng et al., 2024). The situation creates multiple problems which result in disputes and work interruptions and monetary damage. The use of strong contracts together with positive relationship management serves as an efficient method to decrease cases of opportunistic conduct (Lv et al., 2025). Project managers need to control opportunistic behavior because it impacts the equity and productivity of PPP operations.

### **2.3. PPP Sustainability Performance**

PPP sustainability performance assesses the ability of a project to accomplish its economic, environmental and social objectives over an extended period. Current evaluation methods for PPP projects measure their financial performance and their environmental sustainability effects (Besaiso et al., 2025). The research findings demonstrate that governance systems have a major impact on sustainability performance improvements. The research study shows that sustainable results can be achieved through the combined effects of both contractual governance and relational governance (Li et al., 2024). The system of contractual governance establishes rules and regulations for organizations to follow while relational governance enables organizations to work together and maintain their partnerships. Some research also suggests that contractual governance may not directly influence sustainability

performance but works indirectly through trust-building and risk reduction (Wang et al., 2026). The research demonstrates that sustainability requires multiple governance systems to work together. The projects achieve their environmental targets and provide social advantages while maintaining their economic sustainability through proper governance practices (Akomea-Frimpong et al., 2025). The system enhances both transparency and accountability, which together serve as vital components of public sector initiatives.

#### **2.4. Environmental Uncertainty**

Environmental uncertainty describes unpredictable shifts in outside conditions which include both economic downturns and policy modifications and technological innovations. The long duration of PPP projects creates essential uncertainties which their operations face throughout their complete operational period. Research shows that environmental uncertainty makes it difficult for project stakeholders to predict future conditions which results in higher risks and more complex decision-making processes (Opoku et al., 2024). The situation creates difficulties for both planning activities and coordination efforts between different parties. Uncertainty creates a direct connection to opportunistic behavior. When future conditions are unclear, parties may act in their own interest. Research demonstrates that increasing uncertainty leads to higher chances for people to engage in opportunistic behavior (Zhang et al., 2024). The project performance declines because environmental uncertainty transforms into project delays and unexpected expenses and organizational disputes (Kukah et al., 2025). The situation requires organizations to establish flexible contracts which should be supported by strong relationship networks.

#### **2.5. Hypotheses Development**

##### **2.5.1. Contractual governance and PPP Sustainability Performance**

Contractual governance serves as the essential governing mechanism for public–private partnerships because it establishes the official relationship framework through binding legal contracts and contractual obligations and monitoring systems. The public–private partnership framework requires projects to establish properly constructed contracts because these agreements help both public and private partners achieve mutual objectives (Almeida et al., 2025; Liang et al., 2025). The contracts establish the distribution of risks and the required performance levels and the methods for resolving conflicts, which results in decreased uncertainty and improved responsibility.

The sustainability framework shows that contractual governance systems enable economic, social, and environmental performance because these systems establish precise project targets which have legal backing. Prior studies suggest that detailed contractual provisions improve coordination efficiency and reduce transaction costs which ultimately enhance project outcomes (Castelblanco & Guevara, 2024; Hou et al., 2024). Formal governance systems establish their strongest operational effectiveness in public-private partnership environments which contain numerous stakeholders and high potential for disputes. The latest research demonstrates that effective contractual governance systems lead to better sustainability results because they enhance transparency and decrease operational waste

while maintaining sustainability standards (Li et al., 2024; Wang et al., 2026). The contractual governance system in public-private partnership environments will serve as direct method to improve sustainability results.

*H1: There is positive relationship between Contractual governance and PPP Sustainability Performance.*

### **2.5.2. Mediating Role Of Opportunistic Behavior**

Organizations maintain formal contracts yet face persistent challenges from opportunistic conduct that damages their inter-organizational relationships. Williamson (1985) describes opportunism as self-interest seeking behavior that uses deceptive methods to achieve its goals through practices that include contract deception and information control and strategic misrepresentation. The contract complexity combined with extended partnership periods in PPP projects creates an environment that increases the chances of opportunistic conduct (Casady et al., 2023). The past studies explain that contractual governance through its three components establishes rules and monitoring systems and enforcement mechanisms which help reduce opportunistic behavior (Liang et al., 2025). The presentation of contracts in their complete structure establishes better diplomatic relations between parties because it creates better understanding between parties who possess different levels of information about the situation.

The research found that opportunistic behavior leads to negative consequences for Public-Private Partnership sustainability performance because it damages trust and raises transaction expenses and hampers teamwork (Li et al., 2024). The reduction of opportunism leads to partners developing cooperative behaviors which advance their shared objectives of achieving long-term sustainability. Previous research shows that opportunistic behavior functions as a mediation factor which connects contractual governance to performance outcomes (Reeves & O'Shea, 2025; Hou et al., 2024). The researchers found that effective contractual governance systems decreased opportunistic behavior between partners which resulted in better sustainability performance outcomes.

*H2: Opportunistic behavior mediates the relationship between contractual governance and PPP sustainability performance.*

### **2.5.3. Moderating role of Environmental Uncertainty**

Environmental uncertainty exists because outside factors show unpredictable behavior which includes regulatory changes and market fluctuations and technological advancements according to Duncan 1972. High uncertainty levels in PPP projects lead to planning difficulties which create additional risks and undermine the effectiveness of governance systems (Ahmad et al., 2023). Contractual governance works effectively under low uncertainty conditions because contracts enable clear definition of duties and responsibilities and expected results. The present circumstances demonstrate that contracts become less effective in highly unpredictable situations because parties involved cannot foresee all future changes at the time of signing their contract according to Milliken 1987.

Environmental uncertainty affects the power of contractual governance to manage opportunistic behavior. When uncertainty is high, monitoring becomes more difficult, and contractual provisions may not fully prevent

opportunistic actions (Almeida et al., 2025). The connection between contractual governance and opportunistic behavior will depend on the degree of environmental uncertainty. The indirect effect of environmental uncertainty on PPP sustainability performance occurs because it changes how governance systems function through opportunistic actions (Zhang et al., 2024). In uncertain environments, even well-designed contracts may fail to achieve desired outcomes if opportunistic behavior is not adequately controlled. Recent studies focus that environmental uncertainty moderates both direct and indirect relationships between governance mechanisms and performance outcomes in PPP contexts (Opoku et al., 2024; Li et al., 2023). The moderating role of this factor needs to be examined because it affects the situation.

H3a: *Environmental Uncertainty moderates the relationship between contractual governance and Opportunistic behavior.*

H3b: *Environmental Uncertainty moderates the relationship between contractual governance and PPP Sustainability Performance via Opportunistic behavior.*

## 2.6. Theoretical Framework

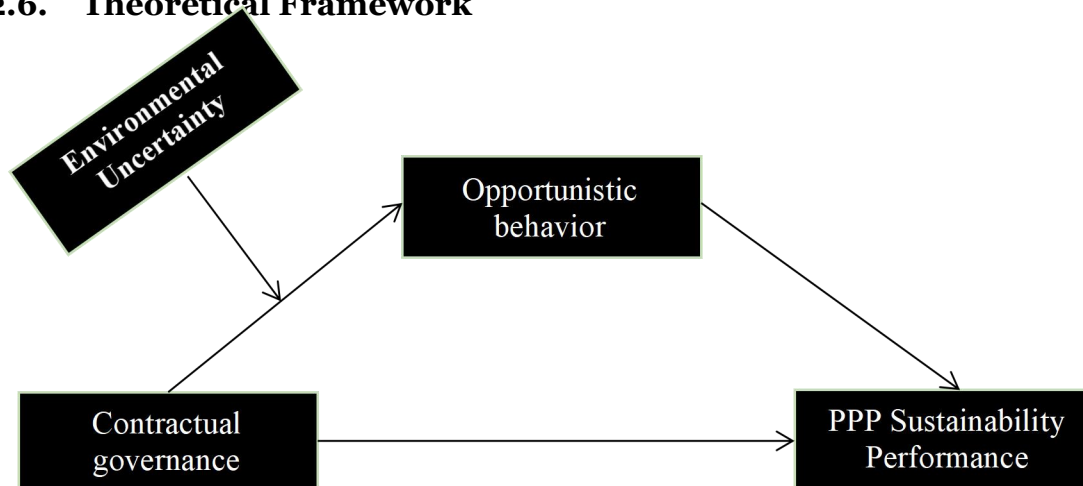


Figure 2.1: Theoretical Model

## 3. Methodology

### 3.1. Population of the Study

The study population of this research consists of workers who are employed in public-private partnership projects which operate throughout Khyber Pakhtunkhwa Pakistan. The study focuses on individuals who are directly involved in project execution, management, and decision-making processes, as they possess relevant knowledge about governance mechanisms and project performance. Primary data collection involved the use of a structured questionnaire which researchers adapted from existing studies. The researchers modified the questionnaire to match the context of PPP projects in order to achieve both relevance and comprehension. The researchers established study objectives for respondents while assuring them that their confidential study responses would be used exclusively for academic research purposes.

The demographic information for 250 study participants appears in Table 3.1. The results show that the majority of respondents were male, with 165

participants representing 66.0% of the sample, while female respondents were 85, accounting for 34.0%. The study results show that male participants worked on more PPP projects than female participants. The age distribution shows that 36.0% of respondents belonged to the 20-30 age group, while 34.0% of respondents belonged to the 31-40 age group. The 41-50 age groups made up 20.0% of the participants, and the 50 plus age group accounted for 10.0% of the participants. The data show that most participants worked between their early career and middle career periods. The educational background of the study participants shows that 44.0% of respondents held a bachelor's degree, 42.0% had a master's degree, and 14.0% possessed MPhil or PhD qualifications, showing that most participants were well educated and capable of understanding the survey items. The work experience distribution shows that 38.0% of respondents had less than 5 years of experience, 34.0% had 5-10 years of experience, and 28.0% had more than 10 years of experience. The job position data shows that 40.0% of respondents worked in operational staff positions, 38.0% worked in middle management positions, and 22.0% worked in top management positions. The table shows that the study gathered responses from multiple employee groups who had different educational backgrounds, work experience, and organizational roles, which improved the data accuracy.

**Table 3.1: Respondents Characteristics Of The Study**

Demographic Construct	Category	Frequency	Percentage
<b>Gender</b>	Male	165	66.0%
	Female	85	34.0%
<b>Age</b>	20–30 years	90	36.0%
	31–40 years	85	34.0%
	41–50 years	50	20.0%
	Above 50	25	10.0%
	<b>Education</b>	Bachelor's Degree	110
	Master's Degree	105	42.0%
	MPhil/PhD	35	14.0%
<b>Experience</b>	Less than 5 years	95	38.0%
	5–10 years	85	34.0%
	More than 10 years	70	28.0%
<b>Job Position</b>	Operational Staff	100	40.0%
	Middle Management	95	38.0%
	Top Management	55	22.0%
	<b>Total n = 250</b>		

### 3.2. Study Sample and Procedure

Data for the study was obtained through a survey method which involved distributing questionnaires to employees working on various PPP projects. The researchers employed random sampling to collect data without any bias. The researchers obtained permission from project supervisors and managers before they approached employees to ask for their participation in the study. The respondents were asked to complete the questionnaire by using their actual experiences together with their organizational knowledge. The

participants filled out the questionnaires in complete anonymity which they submitted through sealed envelopes to maintain their privacy. The researchers distributed 400 questionnaires to participants but only 280 questionnaires were returned. The researchers screened the responses to identify incomplete or inconsistent answers, which resulted in 250 complete questionnaires being selected for analysis, thus achieving a response rate that meets research standards. Table 3.1 shows the demographic information about the respondents.

### **3.3. Data Analysis Techniques**

The researchers used Statistical Package for Social Sciences (SPSS) software to analyze the gathered data. The researchers first used descriptive statistics to present data characteristics before they conducted correlation analysis to investigate the relationships between study variables. The researchers used different analytical methods to test their hypotheses through the Hayes (2013) PROCESS macro which is a common tool for conducting mediation and moderation and conditional process analysis. The researchers used simple regression analysis to test H1 which examines how contractual governance directly affects PPP sustainability performance. The method enables researchers to evaluate how one independent variable influences a particular dependent variable. The researchers used PROCESS Model 4 to investigate the mediating effect of opportunistic behavior in their H2 test. The model calculates direct and indirect impacts while assessing whether opportunistic behavior acts as a significant mediator between contractual governance and PPP sustainability performance. To test H3a the researchers used PROCESS Model 1 to study how environmental uncertainty affects the connection between contractual governance and opportunistic behavior. The model measures how the independent variable interacts with the moderator variable. The researchers used PROCESS Model 7 to examine the moderated mediation effect which tests H3b. The model tests whether the environmental uncertainty level affects how contractual governance indirectly impacts PPP sustainability performance through opportunistic behavior. The PROCESS models used bootstrapping technique which generated 5000 resamples to produce accurate confidence interval estimates of indirect and interaction effects. The approach improves result dependability because it serves as a recommended method for analyzing mediation and moderation relationships.

### **3.4. Scale Measurement**

The study employed the scale which past researchers already tested in earlier studies to achieve confirmation of both validity and reliability. All items were measured using a five-point Likert scale which shows 1 as "strongly disagree" and 5 as "strongly agree".

#### ***Contractual Governance***

The researchers assessed contractual governance through a 10-item scale which they developed from the work of Lu et al. (2015) and Benitez-Avila et al. (2018). The scale measures three aspects of governance which include fundamental contract elements and elements that enable contractual changes.

#### ***PPP Sustainability Performance***

The researchers used a 10-item scale to assess PPP sustainability performance through three different sustainability dimensions which include economic

social and environmental sustainability. The scale development was based on previous research studies which include Li et al. (2023) Cheng et al. (2021) and Tian et al. (2021).

**Opportunistic Behavior**

The researchers used a 7-item scale which the authors Wu et al. (2017) developed to assess opportunistic behavior through three self-interest-based behavioral patterns which include manipulation and exploitation of contractual breaches.

**Environmental Uncertainty**

This study used a 5-item scale which they developed from Milliken's 1987 work and related research to assess environmental uncertainty. The scale measured the unpredictability of external conditions which they used as their study focus.

**Table 3.2: Summary of Study Items and Sources**

Variables	Items	Adopted from the past studies
Contractual Governance	10	Lu et al. (2015); Benitez-Avila et al. (2018)
PPP Sustainability Performance	10	Li et al. (2023); Cheng et al. (2021); Tian et al. (2021)
Opportunistic Behavior	7	Wu et al. (2017)
Environmental Uncertainty	5	Milliken (1987); Dess & Beard (1984)

**4. Results**

**4.1. Reliability Analysis**

**Table 4.1: Summary Of Reliability Statistics**

Study Variables	Scale Items	Alpha Values	Decision
Contractual Governance (Independent variable)	10	.904	Reliable (> .70)
Opportunistic Behavior (Mediating variable)	07	.854	Reliable (> .70)
Environmental Uncertainty (Moderating variable)	05	.833	Reliable (> .70)
PPP Sustainability Performance (Dependent variable)	10	.878	Reliable (> .70)

The reliability analysis shows that all study variables have Cronbach's alpha values greater than 0.70. Contractual governance has an alpha value of 0.904, PPP sustainability performance 0.878, opportunistic behavior 0.854, and environmental uncertainty 0.833. The values demonstrate that the internal consistency of the study scales reaches both satisfactory and reliable. The study scales demonstrate reliability which permits their use in following statistical testing.

**4.2. Validity Analysis**

To determine whether data meets requirements for factor analysis, researchers used both the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's Test of Sphericity (BTS). The KMO values for all variables were above 0.70,

which proved that the sampling method was suitable for research needs. The results of Bartlett's test showed statistical significance which demonstrated that the data set could be used for factor analysis. The researchers used Exploratory Factor Analysis (EFA) to investigate the factor structure while checking for any cross-loading problems. All factor loadings reached 0.60, which demonstrates strong construct validity.

**Table 4.2: Summary of KMO & BTS Statistics**

Variables	Study constructs	KMO	BTS values
<b>Independent Variable</b>	Contractual Governance	.884	Chi-Sq (1125.47) p < 0.05
<b>Mediator</b>	Opportunistic Behavior	.862	Chi-Sq (845.32) p < 0.05
<b>Moderator</b>	Environmental Uncertainty	.801	Chi-Sq (398.21) p < 0.05
<b>Dependent Variable</b>	PPP Sustainability Performance	.776	Chi-Sq (362.58) p < 0.05

The results of KMO and Bartlett's Test show that the data meets the requirements for conducting factor analysis. The KMO values for all variables are above the acceptable threshold of 0.50, ranging from 0.776 to 0.884, which confirms sampling adequacy. The results of Bartlett's Test of Sphericity show significance at (p < 0.05) for all constructs because the test found sufficient correlations among items to conduct factor analysis. The data is appropriate for subsequent analytical procedures.

### 4.3. Hypotheses Testing

#### 4.3.1. Direct Effect

**Table 4.3: Summary Of Regression Analysis**

Variable	(β)	Std.E	t-value	p-value	Supported
Contractual Governance → PPP Sustainability Performance	0.541	0.048	11.27	0.000 (< .05)	YES H1

**R<sup>2</sup> = 0.293**

The results indicate that contractual governance has a positive and significant effect on PPP sustainability performance (β = 0.541, p < 0.001). The R<sup>2</sup> value of 0.293 shows that contractual governance explains around 29.3% variation in PPP sustainability performance. The present identified support for H1.

#### 4.3.2. Mediation effect

This research investigated how opportunistic behavior operated as a mediator through their analysis which used Hayes PROCESS Model 4 together with bootstrapping that generated 5000 samples.

**Table 4.4: Summary of Mediation Analysis**

Path	(β)	Std. E	t	p
Contractual Governance → Opportunistic Behavior	-0.472	0.051	-9.25	0.000
Opportunistic Behavior → PPP Sustainability Performance	-0.389	0.057	-6.82	0.000

Sustainability Performance			
Contractual Governance	→	PPP Sustainability Performance (Direct)	
		0.332	0.049
		6.77	0.000
<b>Effect Type</b>		<b>Effect</b>	<b>LLCI</b>
<b>Indirect Effect</b>		0.183	0.121
<b>Direct Effect</b>		0.332	0.235
<b>Total Effect</b>		0.515	0.365

**Supported (Yes H2)**

The findings show that contractual governance approaches decrease opportunistic behavior through a substantial effect while opportunistic behavior impacts PPP sustainability performance through a negative relationship. The results show that the mediation pathway operates effectively. The direct impact of contractual governance on PPP sustainability performance operates at a significant level with a coefficient of 0.332 and a p-value below 0.001 while the indirect impact through opportunistic behavior shows a significant effect with a coefficient of 0.183 and a p-value below 0.001. The complete impact of contractual governance on PPP sustainability performance amounts to 0.515 which results from both direct and indirect pathways (LLCI = 0.365, ULCI = 0.662). The total effect of contractual governance on PPP sustainability performance results from two components which include direct effects and the mediating role of opportunistic behavior. The confidence intervals for the indirect effect (LLCI = 0.121, ULCI = 0.254), direct effect (LLCI = 0.235, ULCI = 0.427), and total effect (LLCI = 0.365, ULCI = 0.662) do not include zero which allows us to confirm that H2 is supported.

**4.3.3. Moderation Effect**

**Table 4.5: Summary of Moderation Analysis**

Study constructs	Beta	S.e	t	p	Supported
Contractual Governance	-0.401	0.052	-7.69	0.000	
Environmental Uncertainty	0.214	0.047	4.55	0.000	
Interaction Term (CG × EU)	0.158	0.039	4.05	0.000	<b>Yes H3a</b>

**R<sup>2</sup> = 0.318**

Above table 4.5 shows the moderating effect of EU among CG and OB. The interaction term between contractual governance and environmental uncertainty is significant ( $\beta = 0.158, p < 0.001$ ), indicating that environmental uncertainty moderates the relationship between contractual governance and opportunistic behavior. The study found that contractual governance effectiveness to reduce opportunistic behavior depends on the existing levels of environmental uncertainty. Thus, H3a is accepted.

**4.3.4. Moderated-Mediation Effect**

The conditional indirect effect was tested using PROCESS Model 7.

**Table 4.5: Summary Of Moderated-Mediation Analysis**

Environmental Uncertainty Level	Indirect Effect	LLCI	ULCI
Low (-1 SD)	0.245	0.162	0.338
Mean	0.183	0.121	0.254
High (+1 SD)	0.121	0.065	0.198

The results show that environmental uncertainty levels affect the indirect relationship between contractual governance and PPP sustainability performance which operates through opportunistic behavior. The indirect effect is stronger at low levels of uncertainty and weaker at high levels. The moderated mediation effect reaches statistical significance because all confidence intervals test zero. The results prove that environmental uncertainty conditions the moderating role of opportunistic behavior. Thus, this evidence supports H3b.

## 5. Discussion and Conclusions

### 5.1. Discussion

This study investigated how contractual governance and opportunistic behavior affected the sustainability performance of public-private partnerships while environmental uncertainty served as a moderating aspect of their relationship. The research results help to understand how governance systems function in public-private partnerships (PPPs) and how these systems affect the long-term results which include economic and social and environmental aspects of performance.

#### Direct Effect of Contractual Governance on PPP Sustainability Performance

The study results demonstrate that contractual governance creates a positive impact on PPP sustainability performance which has a  $\beta$  value of 0.541 and a p value below 0.001. The research proves that well-structured contracts which establish precise roles and responsibilities together with performance standards succeed in helping PPP projects accomplish their sustainability targets. The findings of this study support the earlier research conducted by Poppo and Zenger, (2009) who demonstrated that formal contracts establish complete clarity about business operations between two parties. Contractual governance functions as the basic system which enables sustainability implementation by requiring all partners to comply with established performance requirements while decreasing the possibility of rule violations (Li et al., 2024; Liang et al., 2025).

#### Mediating Role of Opportunistic Behavior

The research demonstrates that opportunistic behavior functions as a mediator between contractual governance and PPP sustainability performance. The analysis shows that contractual governance significantly reduces opportunistic behavior ( $\beta = -0.472$ ,  $p < 0.001$ ), and this, in turn, negatively affects PPP sustainability performance ( $\beta = -0.389$ ,  $p < 0.001$ ). The mediating effect shows that opportunistic behavior functions as a fundamental element which links contractual governance to improved sustainability results. The results support Transaction Cost Economics (TCE) which claims that organizations must decrease opportunistic behavior to establish trust and promote partner collaboration (Williamson, 1985). Contractual governance

decreases opportunistic behavior, which allows teams to work together better while achieving more successful project results. The research supports previous studies that demonstrate how opportunistic behavior decreases organizational effectiveness (Lv et al., 2024; Xu & Wang, 2024).

#### **Moderating Effect of Environmental Uncertainty**

The study shows that contractual governance regulates opportunistic behavior based on how much environmental uncertainty exists in the situation. When uncertainty levels are high, formal contracts lose their ability to establish predictable outcomes because unexpected events create opportunities for partners to behave opportunistically. Milliken (1987) established that organizations lose their ability to enforce formal governance systems when they encounter high levels of environmental uncertainty. The study shows that contractual governance needs to develop flexible systems which can respond to shifting external factors that affect organizations operating in complex and dynamic environments such as PPPs (Qian & Cao, 2024; Almeida et al., 2025).

#### **Moderated-Mediation Effect of Environmental Uncertainty**

The study investigates how environmental uncertainty affects contractual governance to influence PPP sustainability performance through opportunistic behavior. The results show that indirect effects reach their peak in low-uncertainty environments with a value of 0.245 while high-uncertainty environments show a decrease to 0.121 because confidence intervals remain above zero across all uncertainty levels. The relationship between environmental uncertainty and the mediated relationship shows that contractual governance functions better under stable conditions but fails under unstable conditions. The research shows that flexible governance mechanisms which adapt to external changes create better results (Opoku et al., 2024; Wang et al., 2026).

#### **5.2. Conclusions**

This research study demonstrates how contractual governance functions as an essential mechanism which enables public-private partnerships to achieve sustainable performance. The research results demonstrate that effective governance systems are essential for the successful implementation of public-private partnership projects. The study makes several important contributions to the field:

1. The operational functioning of Contractual Governance establishes essential conditions which enable public-private partnership systems to achieve environmental sustainability performance through its three functions of providing transparent information and maintaining organizational responsibility and implementing successful risk handling procedures.
2. Opportunistic Behavior serves as a key mediator in the relationship between contractual governance and PPP sustainability performance, highlighting the need to control self-interested behaviors for successful project outcomes.
3. The direct and indirect impacts of contractual governance are affected by environmental uncertainty because governance systems need to change their operations when external factors change.

4. The study introduces a moderated mediation model that provides a deeper understanding of the conditional relationships between governance mechanisms, opportunistic behavior, and PPP sustainability performance. The findings show that managers and policymakers need to develop complete contract systems which combine formal contract elements and behavioral aspects which include opportunistic conduct to achieve long-lasting results in public-private partnership projects. Organizations can achieve better governance through contract flexibility which helps them manage unpredictable environmental conditions, particularly during times of extreme uncertainty.

### **5.3. Implications**

#### **5.3.1. Theoretical Implications**

This research study provides three essential theoretical implications which explain how governance systems operate in public-private partnerships (PPPs) through their contractual governance and opportunistic conduct and sustainable practices. The study introduces TCE theory through its integration of Transaction Cost Economics (TCE) and PPP framework which shows that opportunistic actions function as the essential link between contractual governance and sustainability outcomes. The new theoretical development enables researchers to study behavioral patterns which determine PPP performance results because it shows that trust and cooperation between contractual parties have a crucial role in maintaining project sustainability throughout its entire duration. The study demonstrates how environmental uncertainty affects the connection between contractual governance and opportunistic behavior. The research establishes that external environments impact governance effectiveness through its moderated mediation model which shows how uncertainty affects these relationships. The research extends current knowledge about PPP governance by showing how different contextual elements determine the success of governance systems while showcasing the need for governance structures to change according to different environmental circumstances. The study presents new research directions to the existing literature by showing how operational flexibility and absorptive capacity work as additional mediators which affect technology integration as a moderating element. The theoretical extension enables future research to investigate how organizations use innovative technologies together with flexible governance systems to enhance their sustainability performance in complex dynamic environments.

#### **5.3.2. Practical Implications**

The study results present important practical implications for policymakers who create contracts and manage public-private partnership projects. The research findings demonstrate that contractual governance functions as an essential component which helps organizations achieve their sustainability objectives throughout extended project durations. Contract managers and policy decision-makers should focus on designing detailed transparent contracts which define roles and performance expectations and penalties for their contracts to reduce untrustworthy actions while enhancing tracking of responsibilities. The research study demonstrates that effective contract enforcement strategies serve as vital tools which enable project teams to

sustain project quality and environmental protection throughout extended project durations especially when dealing with projects that involve multiple stakeholder groups. The research shows that when people engage in opportunistic behavior it creates problems which interfere with governance systems thus PPP managers must develop personal connections with others instead of depending on official governance structures. Public and private partners who maintain strong communication channels together with shared trust and dedication will experience reduced opportunistic behavior while they establish a cooperative environment which enhances their ability to implement sustainability projects. The research study presents practical recommendations which help improve the resilience of public-private partnership projects through its demonstration of how absorptive capacity and operational flexibility function as critical components. Organizations should establish internal capacities which enable them to handle external disturbances while they gain knowledge about sustainable practices and advanced solutions. The organization will achieve better results through this approach because it enables them to meet changing market requirements while pursuing their sustainability objectives and creating greater benefits for their stakeholders.

#### **5.4. Limitations and Future Direction**

This study demonstrates that the sustainability performance of public-private partnerships (PPPs) is significantly shaped by contractual governance and opportunistic behavior (Li et al., 2024; Hou et al., 2024). However, the reliance on a cross-sectional research design limits the ability to infer causal relationships; as such designs cannot capture how governance mechanisms evolve over time. Scholars therefore recommend that future studies adopt longitudinal approaches to examine how contractual and relational governance develop and influence sustainability outcomes across project lifecycles (Li et al., 2024). Comparative research across countries would also be valuable, as governance structures and sustainability outcomes differ between developed and developing economies, offering deeper insights into how PPPs function in diverse institutional environments (Hou et al., 2024). The research dedicated to studying PPP projects in Khyber Pakhtunkhwa Pakistan fails to produce valid results because the area economic conditions and regulatory frameworks and institutional structures differ from other locations. Researchers should investigate sector-specific governance structures for healthcare and infrastructure and renewable energy sectors to study how governance structures affect sustainability results across various sectors according to Hou et al. 2024. Organizations can create effective governance frameworks by understanding these differences between their sector-based operations. Future studies must examine operational flexibility and absorptive capacity which function as mediators because these two capabilities establish connections between project delivery methods and environmental uncertainty and sustainable innovation solutions adoption. The investigation of competitive intensity and Industry 4.0 technologies which include AI and IoT systems has become necessary because digital transformation together with market dynamics now determines how organizations manage their operations and sustain their results in PPP

projects. The examination of these variables will enhance governance structures which will result in improved sustainability outcomes for public-private partnerships according to Zhao et al., (2022).

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