

Public–Private Partnerships and Sustainable Infrastructure Development: Evidence from Climate Adaptation Projects in Ethiopia

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Abstract: *This study examined the factors affecting Public–Private Partnerships (PPPs) in infrastructure development for sustainable urban growth, with a particular focus on climate change adaptation projects in the lowland ecosystem of Zuway Dugda Woreda, Arsi Zone, Ethiopia. A descriptive research design with a mixed-methods approach was employed. Primary data were collected through questionnaires and semi-structured interviews from employees and key informants selected using simple random and purposive sampling techniques. Quantitative data were analyzed using SPSS Version 25, while qualitative data were analyzed through thematic analysis. The findings revealed that political instability, economic fluctuations, social challenges, limited technological capacity, and legal and regulatory constraints significantly affect the effective implementation of PPP-based infrastructure projects. The study concludes that overcoming these challenges is critical to enhancing PPP effectiveness and promoting sustainable urban development. It recommends strengthening institutional and regulatory frameworks, improving technological capacity, enhancing stakeholder and community engagement, and increasing awareness among relevant actors to support the successful implementation of climate-resilient infrastructure projects.*

Keywords: *Public–private partnerships, infrastructure development, sustainable urban growth, climate change adaptation, infrastructure projects, Ethiopia.*

INTRODUCTION

1.1. Background of the study

Over the past two decades, Public–Private Partnerships (PPPs) have emerged as an important governance and financing mechanism for addressing infrastructure deficits and improving public service delivery, particularly in developing countries where governments face limited fiscal capacity and increasing demand for urban infrastructure (World Bank, 2017; OECD, 2012). PPPs are broadly defined as long-term contractual arrangements between public authorities and private sector entities in which resources, risks, responsibilities, and benefits are shared to deliver public infrastructure and services efficiently (Yescombe, 2018; UNDP, 2015). Unlike traditional public procurement approaches, PPPs seek to combine public sector accountability with private sector innovation, technical expertise, and financial resources to achieve improved project outcomes (Grimsey & Lewis, 2004; Hodge & Greve, 2017).

Globally, PPPs have received increasing attention as innovative approaches for mobilizing private investment, improving infrastructure quality, and supporting sustainable development objectives (Asian Development Bank [ADB], 2017; World Bank, 2017). They have been widely applied in sectors such as transportation, energy, water supply, health, and urban development, particularly in contexts where public investment alone is insufficient to meet growing infrastructure needs (Burger & Hawkesworth, 2011; Roumboutsos, 2015). However, evidence suggests that the success of PPP projects is not automatic; rather, it depends on the presence of effective

institutional frameworks, transparent governance systems, appropriate risk allocation mechanisms, and strong collaboration among stakeholders (Koppenjan & Enserink, 2009; Osei-Kyei & Chan, 2015).

The theoretical foundation of PPPs can be explained through Resource Dependency Theory (RDT), which emphasizes that organizations rely on external actors to access resources that they do not possess internally (Pfeffer & Salancik, 1978). From this perspective, public institutions in developing countries often engage with private sector actors to overcome shortages of financial resources, technological capabilities, managerial expertise, and innovation capacity required for infrastructure development (Asuamah Yeboah, 2024). Although such resource interdependence creates opportunities for improved infrastructure delivery, it also requires effective coordination mechanisms to manage competing interests and ensure that public objectives are not compromised by private sector profit motives (Klijn & Teisman, 2003; Bovaird, 2004).

The implementation and management of PPP projects involve complex processes extending across the entire project life cycle, including project identification, feasibility assessment, financing, procurement, construction, operation, and evaluation (Grimsey & Lewis, 2004; Yescombe, 2018). Effective PPP management requires strong legal and regulatory frameworks, institutional capacity, technical expertise, and mechanisms for accountability and stakeholder engagement (World Bank, 2017; Osei-Kyei & Chan, 2015). In many developing countries, however, PPP projects face significant challenges, including political instability, weak governance structures, inadequate regulatory environments, limited technical capacity, financial

constraints, and insufficient private sector participation (Ngowi, 2006; Ameyaw & Chan, 2015).

Climate change and rapid urbanization have further increased the demand for resilient infrastructure systems, particularly in vulnerable lowland ecosystems where communities face environmental risks and limited adaptive capacity (IPCC, 2022). Climate-resilient infrastructure requires substantial investment, technological innovation, and coordinated efforts among government institutions, private sector actors, and local communities (Hallegatte et al., 2019). PPPs are increasingly recognized as a potential mechanism for supporting climate adaptation initiatives by facilitating access to finance, expertise, and innovative solutions; however, their effectiveness depends on the institutional, economic, social, and technological conditions within specific contexts (Bing et al., 2005; Zhang, 2005).

In Ethiopia, infrastructure development remains a critical priority for achieving sustainable urban growth and improving public services. However, limited public financial resources, infrastructure gaps, and institutional challenges continue to constrain effective infrastructure provision, creating a need for alternative partnership models such as PPPs (FDRE, 2018; World Bank, 2020). Despite policy efforts to promote PPP arrangements, empirical evidence regarding the factors influencing PPP effectiveness, particularly in climate change adaptation infrastructure projects at the local government level, remains limited. Therefore, this study aims to examine the factors affecting Public–Private Partnerships in infrastructure development for sustainable urban growth, focusing on selected climate change adaptation projects in the lowland ecosystem of Zuway Dugda Woreda, Arsi Zone, Ethiopia. The study further seeks to identify existing institutional, economic, technological, and governance-related gaps affecting PPP implementation and provide evidence-based recommendations for strengthening climate-resilient infrastructure development.

1.2. Statement of the Problem

Infrastructure development is widely recognized as a fundamental driver of economic growth, social development, and improved quality of life. Governments around the world acknowledge that expanding access to reliable infrastructure services is essential for enhancing productivity, promoting inclusive growth, and achieving sustainable development goals (World Bank, 2017; OECD, 2015). However, the increasing demand for infrastructure, combined with fiscal constraints, growing urbanization, and rising development needs, has created significant challenges for governments, particularly in developing countries. Both public and private sectors often face limitations in mobilizing adequate financial resources, technical expertise, and risk-bearing capacity required for large-scale infrastructure development (Suk Hyun & Donghyun Park, 2018; Yescombe, 2018).

Traditionally, governments have been responsible for the provision of essential infrastructure and public services, including transportation systems, water supply, energy,

education, and health facilities. However, increasing infrastructure demands and limited public financial capacity have challenged the ability of governments to independently finance, develop, and maintain infrastructure projects (Grimsey & Lewis, 2004; World Bank, 2017). Although private sector participation provides opportunities for mobilizing investment, innovation, and managerial expertise, private actors are often reluctant to engage in infrastructure projects due to high initial capital requirements, long investment recovery periods, uncertain revenue streams, complex regulatory environments, and significant operational risks (Suk Hyun & Donghyun Park, 2018; Burger & Hawkesworth, 2011). These challenges have encouraged governments to adopt Public–Private Partnerships (PPPs) as alternative mechanisms for sharing resources, risks, and responsibilities between public and private actors.

The increasing impacts of climate change and rapid urbanization have further intensified the need for sustainable and resilient infrastructure development. Cities are among the largest contributors to global greenhouse gas emissions and are increasingly exposed to climate-related risks, making climate-resilient infrastructure essential for sustainable urban development (IPCC, 2022; Fell & Mattsson, 2021). Developing and maintaining such infrastructure requires substantial financial investment, advanced technology, institutional capacity, and effective collaboration among government institutions, private sector organizations, and local communities. Consequently, PPPs have gained attention as potential mechanisms for supporting climate adaptation initiatives by facilitating access to resources, innovation, and technical expertise (Bing et al., 2005; Zhang, 2005).

Empirical evidence from different countries indicates that PPPs can contribute to improved infrastructure delivery when supported by appropriate institutional arrangements, effective governance systems, and strong stakeholder coordination. For instance, Akinola et al. (2024) found that PPPs have significant potential for improving housing delivery in Oyo State, Nigeria, particularly in addressing infrastructure financing constraints. However, the study also highlighted that excessive dependence on government financing, weak alternative funding mechanisms, and limited private sector involvement continue to constrain infrastructure development. Similarly, Haque et al. (2020) demonstrated that PPP initiatives in Khulna, Bangladesh, contributed to sustainable development outcomes despite challenges related to procurement procedures, governance, and implementation practices. These findings indicate that while PPPs provide important opportunities, their effectiveness depends largely on contextual factors such as institutional capacity, regulatory frameworks, risk management practices, and stakeholder engagement.

In Ethiopia, infrastructure development remains a major priority for achieving sustainable economic transformation and improving urban service delivery. However, limited public investment capacity, institutional constraints, technological limitations, and governance challenges continue to affect the implementation of infrastructure projects, particularly in

vulnerable areas (FDRE, 2018; World Bank, 2020). The lowland ecosystems of Ethiopia, including areas such as Zuway Dugda Woreda in Arsi Zone, face additional challenges related to climate vulnerability, limited infrastructure access, and insufficient adaptive capacity. Despite the growing recognition of PPPs as a mechanism for addressing infrastructure gaps, empirical studies examining the factors affecting PPP implementation and performance at the local government level remain limited.

Furthermore, existing studies have primarily focused on PPP applications in sectors such as transportation, housing, and urban services in developed or large urban contexts, while limited attention has been given to climate change adaptation infrastructure projects in lowland ecosystems of Ethiopia. This creates an important knowledge gap regarding the institutional, economic, technological, social, and regulatory factors that influence PPP effectiveness in local infrastructure development.

Therefore, this study aims to examine the factors affecting Public–Private Partnerships in infrastructure development for sustainable urban growth, focusing on selected climate change adaptation projects in the lowland ecosystem of Zuway Dugda Woreda, Arsi Zone, Ethiopia. The study seeks to identify the major challenges influencing PPP effectiveness and provide evidence-based recommendations for strengthening PPP frameworks and promoting climate-resilient infrastructure development in the study area.

1.3 Objectives of the Study

1.3.1 General Objective of the Study

The general objective of this study is to examine the factors affecting Public–Private Partnerships (PPPs) in infrastructure development for sustainable urban growth, with particular emphasis on selected climate change adaptation projects in the lowland ecosystem of Zuway Dugda Woreda, Arsi Zone, Ethiopia.

1.3.2 Specific Objectives of the Study

The specific objectives of the study are to:

1. Assess the role of Public–Private Partnerships in promoting sustainable urban growth and climate-resilient infrastructure development in Zuway Dugda Woreda, Arsi Zone, Ethiopia.
2. Examine the critical success factors influencing the effective implementation of Public–Private Partnerships in infrastructure development projects.
3. Assess the major challenges and constraints affecting the implementation and effectiveness of Public–Private Partnerships in infrastructure development projects.
4. Examine the institutional, economic, technological, social, and regulatory factors influencing the performance

of PPP projects in climate change adaptation infrastructure initiatives

5. Provide recommendations for strengthening PPP frameworks to enhance sustainable and climate-resilient infrastructure development in the study area.

1.4 Research Questions

Based on the objectives of the study, the research seeks to answer the following questions:

- 1) What role do Public–Private Partnerships play in promoting sustainable urban growth and climate-resilient infrastructure development in Zuway Dugda Woreda?
- 2) What are the critical success factors influencing the effective implementation of Public–Private Partnerships in infrastructure development projects?
- 3) What major challenges and constraints affect the implementation and effectiveness of Public–Private Partnerships in infrastructure development projects?
- 4) How do institutional, economic, technological, social, and regulatory factors influence the performance of PPP projects in climate change adaptation infrastructure initiatives?
- 5) What strategies can be adopted to improve the effectiveness and sustainability of Public–Private Partnership arrangements in infrastructure development?

2. RESEARCH METHODOLOGY

2.1. Research Design

According to (Leedy & Ormrod, 2010), the research design is defined as the plan and structure of investigation and how studies are put together. According to (Leedy & Ormrod, 2010) descriptive survey involves acquiring information about one or more groups of people by asking them questions and tabulating their answers. It also further explained the ultimate goal of survey research design is to learn about the large population by surveying their representative sample and summarizing those using statistical tools. Descriptive design is the most economical method of obtaining information; it is not time taking to collect data; and drawing inferences about a particular population from the responses of the sample would be possible (Leedy & Ormrod, 2010). Therefore, in this study Quantitative and descriptive research designs was used. Quantitative phenomena were described quantitatively and information with non-numeric which is important for making critical business decisions that are necessary for the growth of any organization.

2.2. Research Approach

The quantitative approach was used for numerical data whereas the qualitative was used for non-numeric data. A qualitative approach is concerned with the assessment of the attitudes of people and helps to analyze various factors

which make them like or dislike (Mukoka et al., 2020). Therefore, the study was conducted by using both quantitative and qualitative approaches because it helps to collect diverse types of data that provide reliable information and to generalize the result.

2.3. Sources of Data

To achieve the future objective of the study, the important data required for this study was collected both from primary and secondary sources of data. I was collected the primary data from expert's key informant interviews, and questionnaires for this study. Was collected the secondary data from the internet, books, journals, reports, and different documents available online.

Primary Data

For this study was collected the primary sources of data from distributed through questionnaires and interviews; collection permission was obtained from my supervisor, the head of the department, and the authors of the scales. The questionnaires interview will be created for data collection permission, which I was obtained from all the relevant authorities of the organizations through a physical approach. After explaining the nature and aim of the research, participants were identified by exclusion and inclusion criteria, and informed consent was obtained from them.

Secondary Data

Secondary data include information that are obtain mainly from different reports, bulletins, websites and literatures, journals, books, which are relevant to the theme of the study, the will be gathered from various sources to complement the survey-based analysis was collected from relevant books, internet sources, unpublished materials, and procedures.

2.4. Sampling Techniques

According to (Cooper, D. R., Schindler, P. S., & Sun, 2006), a sampling technique is a statistical technique a researcher adopts to develop an appropriate sample that is representative of a population under study. Besides, (*Research Methodology Kothari, C.R., 2004. Research Methodology*, n.d.) Pointed out that the sampling technique is a definite plan for obtaining a sample from a given population. In this study, the researcher will use probability sampling through a simple random sampling technique to select the target population of the 150 and non-probability sampling through purposive sampling technique to get important persons like share company manager, and human resources, management of the project.

2.5. Methods of Data Collection

Questionnaire

The purpose of the questionnaire survey was generated to develop comprehensive information from as many banks experts as possible. Accordingly, quantitative data was gathered from bank experts using closed-ended and partially open-ended questionnaires. The survey questionnaire was designed on likert scale. According to (Joshi et al., 2015) the

original scale is a set of statements offered for a real or hypothetical situation under study. Participants are asked to show their level of agreement (from strongly disagree to strongly agree) with the given statement on a metric scale.

Key Informant Interview

Interviews with key informants through unstructured questions was deployed to explore respondents' earnest feelings and insights about the problem under a study conducted and to gather information, to explain issues at their proper unstructured place. The unstructured questions offered those interviewed sufficient flexibility and an opportunity to express their opinion broadly as well as allowed the researcher to approach several respondents differently and to use follow-up questions to expand his understanding of the subject. To this end, experts who have had practical experience with the problem under study were purposefully interviewed regarding their views on the factors affecting PPPs in infrastructure.

2.6. Method of Data Analysis and Presentation

Data Analysis

In this study data which was collected from both the primary and the secondary sources by using various data collection tools were analyzed and described through different data analyzing methods, such as descriptive statistics including mean median, frequency and standard deviation and SPSS data analysis tools was used.

Data Presentation

The data in this study were presented by using different tables, charts, and figures that are accompanied by written discussion analysis methods depending on the characteristics of the data collected from both the primary and the secondary data sources.

2.7. Validity and Reliability

Reliability Test

According to (Kubai, 2019) reliability is "the extent to which measurements are repeatable when different people measure on different occasions, under different conditions, supposedly with alternative instruments which measure the construct or skill". It can also be defined as the degree to which the measure of a construct is consistent or dependable. For instance when several people guess your weight, the value of the weight might not be necessarily correct since it will be inconsistency with the accurate value hence the measurement is said to be unreliable. If a weighing scale is used by different people to give the value of your weight then there is the likelihood of getting the same value every time a measurement is done hence this measurement would be said to be reliable. For this study, the reliability of collected data from primary and secondary data was checked by using Statistical Package for Social Science (SPSS) software. According to (Taherdoost, 2018) have proposed four cut-off points for dependability: excellent reliability (0.90 and above), high reliability (0.70-0.90),

moderate reliability (0.50-0.70), and low reliability (0.50 and below). Therefore; the result was above 0.9 it is excellent.

Table 1: Reliability Statistics test

Reliability Statistics	
Cronbach's Alpha	N of Items
.950	14

Validity Test

Validity refers to the extent to which a research instrument measures what it is intended to measure (Kubai, 2019). In this study, validity was assessed using SPSS through criterion-related validity and the Kaiser–Meyer–Olkin (KMO) test. The

KMO measure was used to examine sampling adequacy, where a value above 0.50 is considered acceptable (Field, 2000), while values between 0.80 and 0.90 indicate very good adequacy (Kaiser, 1974). The result of the KMO test was 0.826, confirming that the sample was adequate and the instrument was valid for further analysis.

Table 2: Validity Statistics Test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.826
Bartlett's Test of Sphericity	Approx. Chi-Square	744.034
	df	10
	Sig.	.000

3.1. Ethical Consideration

As a result, putting ethical considerations are necessary. The following governing rules of the research were respected during data collection. The research could not affect the physical and social life of the individual respondent, time

would be respected and activities are governed by schedule, respect social values, and due recognition for respondents during and after the interview was attempted, and be free from personal biases and opinions, affair consideration was given for data obtained from respondents.

DATA ANALYSIS AND PRESENTATION**4.1. Demographic Characteristics of the Respondents**

Knowing the demographics of the Low Land eco-system project sample respondents is crucial for having a thorough grasp of the study's findings

Table 3: Demographic Characteristics of respondents

		Frequency	Percent
Age of Respondents	21-30	22	14.7
	31-40	68	45.3
	41-50	51	34.0
	>50	9	6.0
Sex of Respondents	Male	99	66.0
	Female	51	34.0
Education status Respondents	Diploma	44	29.3
	Degree	64	42.7

	Masters	42	28.0
experience (years)	1-5	46	30.7
	6-10	43	28.7
	>10	61	40.7

According to table 3 above, 22 of the respondents (14.7%) were between the ages of 21 and 30, 68 (45.3%) were between the ages of 31 and 40, 51 (34%) were between the ages of 41 and 50 and 9 (6%) were over the age of 50. The results suggest that the majority of responders were between the ages of 31 and 40 followed by responders in the age range of 41 to 50. As a result, the majority of the company current sample of employees are under 40 and are therefore quite youthful. About, 99 respondents (or (66%) were male and 51 respondents (or 34 %) were female. According to the statistics, male made up the majority of employees in Company, while the proportion of female working there is lower than that of male. According to

4.2. Analysis of Role of PPP in Infrastructure development

The role of Public–Private Partnerships (PPPs) in infrastructure development was assessed using five major dimensions: infrastructure development, service delivery, technology implementation, governance and regulation, and financing. Respondents were requested to indicate their level of agreement

the statistics 44 employees (29.3%) have a Diploma, 64 respondents (42.7%) have a first degree, and 42 respondents (28%) have a Masters. This shows that the majority of respondents in the study held first degree, and the company has educated labor available. And about: 46 (30.7%) of respondents have one years to five years' experience, 43 (28.7%) have six to ten years of experience, and 61(40.7%) have greater than ten years of experience. This revealed that most of the respondents have worked in the company for the majority of them for between greater than years, and they have the necessary work experience to carry out their jobs.

using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The mean score indicates the overall perception of respondents, while the standard deviation shows the level of variation in responses among participants.

Table 4: Analyzing the Role of PPP in Infrastructure development

No	Description	Mean	SD	N
1	Infrastructure development	4.0733	1.08124	150
2	Service delivery	3.3867	1.31989	150
3	Technology implementation	3.6600	1.26295	150
4	Governance and regulation	3.6933	1.28464	150
5	Financing	4.0733	1.08124	150

The results in Table 4 show that respondents perceived PPPs as having an important role in infrastructure

development. Infrastructure development and financing recorded the highest mean score ($M = 4.0733$, $SD = 1.08124$), indicating that respondents agreed that PPPs contribute to infrastructure expansion and resource mobilization. This finding supports the view that PPPs help address public financing limitations by engaging private sector investment and expertise (World Bank, 2017). Governance and regulation ($M = 3.6933$) and technology implementation ($M = 3.6600$) also received positive responses, showing the contribution of PPPs to improving institutional practices and technological capacity.

4.3. Analyzing the success factors of PPPs in Infrastructure development

However, service delivery scored relatively lower ($M = 3.3867$, $SD = 1.31989$), suggesting that improvements are still needed to translate infrastructure investment into better public services. The variation in standard deviation values indicates differences in respondents' experiences and perceptions regarding PPP effectiveness. Overall, the findings confirm that PPPs play a significant role in infrastructure development, but stronger governance and service delivery mechanisms are required to enhance their effectiveness.

Table 5: Analyzing The success factors of PPPs in Infrastructure development

No	Description	Mean	SD	N
1	Profitability	3.3867	1.31989	150
2	Operating risk controlling	3.6600	1.26295	150

3	Institutional and regulatory environment facility	3.6933	1.28464	150
4	Delivery time management	3.4800	1.30934	150

The findings presented in Table 5 indicate that respondents identified institutional and regulatory environment as the most important success factor for PPPs in infrastructure development, with the highest mean score ($M = 3.6933$, $SD = 1.28464$). This suggests that effective legal frameworks, supportive institutions, and clear regulatory arrangements are critical for successful PPP implementation. Operating risk control also received a relatively positive response ($M = 3.6600$, $SD = 1.26295$), indicating the importance of proper risk identification and management in PPP projects. However,

profitability ($M = 3.3867$) and delivery time management ($M = 3.4800$) received comparatively lower scores, implying that financial sustainability and project implementation efficiency require further attention. The standard deviation values ranging from 1.26295 to 1.31989 show some variations in respondents' perceptions regarding the success factors of PPPs. Overall, the results highlight that strong institutional and regulatory frameworks, together with effective risk management, are essential for improving the performance and sustainability of PPP infrastructure projects.

4.4. Analyzing the Challenges on PPPs in Infrastructure Development

Table 6: Analyzing the Challenges on PPPs in Infrastructure Development

No	Description	Mean	SD	N
1	Political instability	4.2267	.97724	150
2	Economic fluctuation	3.5867	1.27541	150
3	Social life	3.5733	1.32780	150
4	Technology	3.8000	1.26915	150
5	Legal problem	3.7067	1.32375	150

The findings in Table 6 show that political instability was the major challenge affecting PPPs in infrastructure development, with the highest mean score ($M = 4.2267$, $SD = 0.97724$). This indicates that respondents strongly agreed that political uncertainty negatively influences PPP implementation. This finding supports Resource Dependency Theory, which emphasizes the importance of a stable institutional environment for successful collaboration between public and private actors (Pfeffer & Salancik, 1978). Previous studies also found that political risk, weak governance, and institutional uncertainty are major barriers to PPP success, particularly in developing countries (Osei-Kyei & Chan, 2015; Ameyaw & Chan, 2015). Technology constraints ($M = 3.8000$), legal problems ($M = 3.7067$), economic fluctuations ($M = 3.5867$), and social challenges ($M = 3.5733$) were also identified as important challenges, showing that PPP effectiveness depends on supportive institutional, economic, and technological conditions (World Bank, 2017). The standard deviation values (0.97724–1.32780) indicate some variations in respondents'

perceptions regarding the challenges affecting PPP implementation.

4.5. Analysis of inferential statistics

The outcomes of inferential statistics are presented in this section. Regression analysis and Pearson's Product Moment Correlation Coefficient were used to evaluate the study's goals. These statistical methods allow for the drawing of conclusions about the sample.

4.5.1. Analyzing correlation

Pearson correlation analysis was conducted to examine the relationship between PPP-related infrastructure development factors and sustainable urban growth. The correlation coefficient was used to determine the strength and direction of the relationship among variables. According to Field (2009), correlation values of 0.10–0.29 indicate weak, 0.30–0.49 moderate, and 0.50–1.00 strong relationships.

Table 7: Correlations analysis

Correlations

		Infrastructure development	Service delivery	Technology implementation	Governance and regulation	Financing
Infrastructure development	Pearson Correlation	1	.380**	.436**	.480**	1.000**
	Sig. (1-tailed)		.000	.000	.000	.000
	N	150	150	150	150	150
Service delivery	Pearson Correlation	.380**	1	.844**	.743**	.380**
	Sig. (1-tailed)	.000		.000	.000	.000
	N	150	150	150	150	150
Technology implementation	Pearson Correlation	.436**	.844**	1	.812**	.436**
	Sig. (1-tailed)	.000	.000		.000	.000
	N	150	150	150	150	150
Governance and regulation	Pearson Correlation	.480**	.743**	.812**	1	.480**
	Sig. (1-tailed)	.000	.000	.000		.000
	N	150	150	150	150	150
Financing	Pearson Correlation	1.000**	.380**	.436**	.480**	1
	Sig. (1-tailed)	.000	.000	.000	.000	
	N	150	150	150	150	150

** . Correlation is significant at the 0.01 level (1-tailed).

The results presented in Table 7 indicate that all variables have a positive and statistically significant relationship at the 1% significance level. Infrastructure development showed a strong positive relationship with service delivery ($r = 0.844$), technology implementation ($r = 0.436$), governance and regulation ($r = 0.480$), and financing ($r = 1.000$). This implies

that improvements in PPP-related infrastructure components contribute to sustainable urban growth. The finding is consistent with previous studies emphasizing that PPPs enhance infrastructure development through improved financing, technological capacity, and service delivery mechanisms (World Bank, 2017; Yescombe, 2018).

4.5.2. Analyzing Regression

4.5.3. Multi-co-linearity Tests

The multicollinearity test was conducted to examine the relationship among independent variables. According to Field (2009), multicollinearity exists when tolerance values are below 0.10 and VIF values exceed 10. As shown in Table 8, all

variables have acceptable tolerance and VIF values, with the highest VIF being 4.783, indicating that there is no multicollinearity problem among the explanatory variables.

Table 8 Analyzing Regression

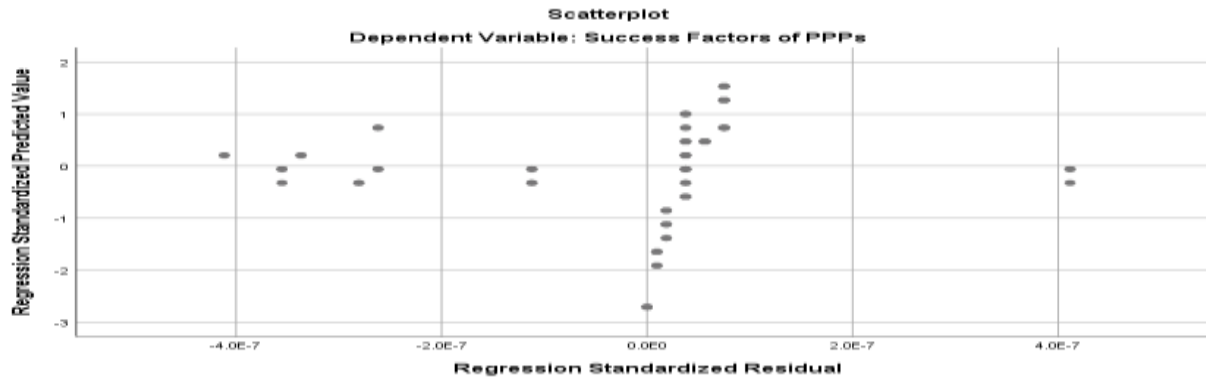
Model		Co linearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Profitability	.271	3.691
	Operating risk controlling	.209	4.783
	Institutional and regulatory environment facility	.329	3.043
	Delivery time management	.976	1.024

Homoscedasticity is the assumption made by the researcher that errors are distributed uniformly among the independent variables, with the same variance of errors occurring at all levels of the independent variables. When the scatter is uneven,

heteroscedasticity is indicated; typical patterns of violations include fan and butterfly shapes. Additionally, we can see the absence of heteroscedasticity if the P-plot is a straight-line graph with a positive slope or if it is not stair-case shaped. The

researcher therefore assumed that the problem of heteroscedasticity was not identified for the data since there is no significant deviation visible in the scatter and P-plots below.

Figure 1: Homoscedasticity test



Normality: The normal P-plot for each of the four independent variables in the following figures illustrates normality, indicating that errors are normally distributed. This ensured the existence of the normal distribution of errors. The points in this plot reflect the observed residuals, and the straight line

represents a normal distribution. Therefore, all points in a set of data with precisely distributed data will lie on the one place. Thus, the data are consistent with the regression model's essential premise.

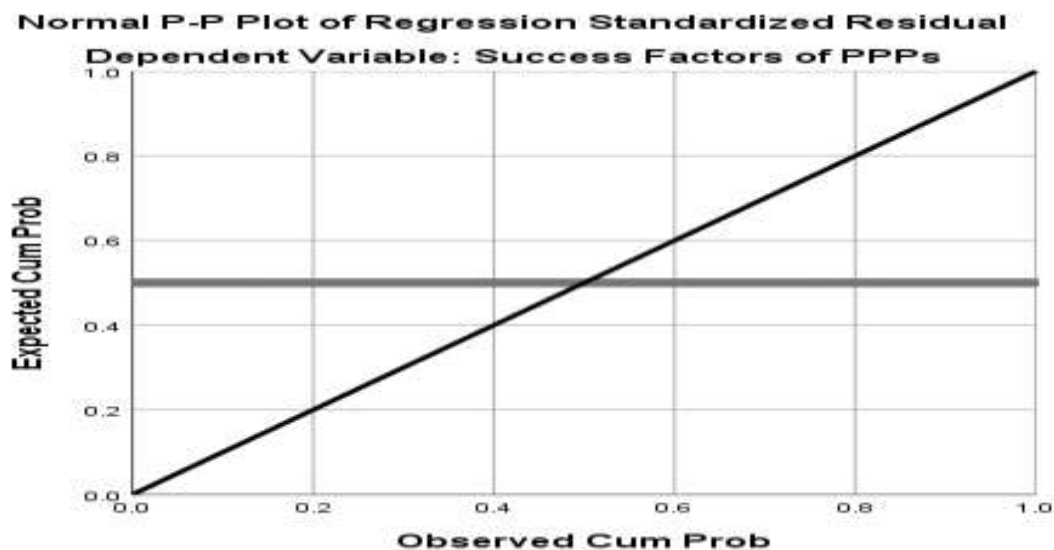


Figure 2: normality regression analysis

4.5.4. Testing Hypothesis

Multiple regression analysis was conducted to examine the effect of PPP-related factors on infrastructure development. The regression results show that the model explains 100% of the variation in infrastructure development ($R^2 = 1.000$, Adjusted $R^2 = 1.000$), indicating an excellent model fit.

According to Sekaran (2000), an adjusted R^2 above 75% represents a strong explanatory power. The ANOVA result further confirms that the overall regression model is statistically significant, indicating that the selected PPP

factors significantly explain variations in infrastructure development and sustainable urban growth.

Table 9: ANOVA Table

Model Summary			
Model	R	R Square	Adjusted R Square
1	1.000	1.000**	1.000 **
a. Predictors: (Constant), Delivery time management, Operating risk controlling, Institutional and regulatory environment facility, Profitability			
b. Dependent Variable: Success Factors of PPPs			

Source: Survey: 2026

The regression results presented in Table 9 indicate that the selected PPP success factors explain 100% of the variation in the success factors of PPPs ($R^2 = 1.000$, Adjusted $R^2 = 1.000$). This indicates that profitability, operating risk control,

institutional and regulatory environment, and delivery time management have a strong explanatory capacity in determining PPP success. According to Sekaran (2000), an adjusted R^2 value above 75% indicates excellent explanatory power.

ANOVA ^a						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	132.359	4	33.090	.	. ^b
	Residual	.000	145	.000		
	Total	132.359	149			
a. Dependent Variable: Success Factors of PPPs						
b. Predictors: (Constant), Delivery time management, Operating risk controlling, Institutional and regulatory environment facility, Profitability						

Source: Survey SPSS (Version 25)

The ANOVA result demonstrates that the regression model significantly explains the relationship between the independent variables and PPP success factors. Therefore, the hypothesis that PPP success factors influence the effectiveness of

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

This study examined the factors affecting Public–Private Partnerships (PPPs) in infrastructure development for sustainable urban growth, focusing on climate change adaptation projects in Zuway Dugda Woreda, Arsi Zone, Ethiopia. Using a mixed-methods approach, data were collected through questionnaires and interviews and analyzed using SPSS Version 25. The findings revealed that PPPs play a significant role in infrastructure development, particularly in financing and infrastructure expansion ($M = 4.0733$). The institutional and regulatory environment was identified as the key success factor of PPPs ($M = 3.6933$), while political instability was found to be the major challenge affecting PPP implementation ($M = 4.2267$). The study also found significant positive relationships between PPP-related factors and sustainable urban growth, with correlation coefficients ranging from 0.380 to 0.844. Regression results further indicated that profitability, operating

infrastructure development is supported. The findings imply that improving institutional arrangements, risk management practices, profitability, and project delivery management is essential for enhancing PPP performance.

risk control, institutional and regulatory environment, and delivery time management strongly explain PPP success ($R^2 = 1.000$). The study concludes that strengthening institutional capacity, improving regulatory frameworks, enhancing risk management, and ensuring political stability are essential for effective PPP implementation and sustainable infrastructure development.

5.2. Recommendation

Based on the findings and conclusions of the study, the researcher recommends strengthening Public–Private Partnership (PPP) practices to enhance sustainable urban growth and infrastructure development. Responsible stakeholders should improve institutional and regulatory frameworks, strengthen transparency and accountability, and establish effective communication and feedback mechanisms through surveys, consultations, and digital platforms to increase stakeholder participation and trust. Project managers and relevant authorities should focus on key PPP success factors, including effective risk management, timely decision-making,

technological improvement, and financial sustainability. In addition, addressing major challenges such as political instability, limited stakeholder awareness, and weak coordination is essential for improving PPP performance. The government and responsible institutions should also expand PPP applications beyond economic infrastructure to include social sectors and enhance capacity building, community participation, and awareness creation to ensure successful and sustainable infrastructure development.

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