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IMPACT OF INNOVATION AND PROJECT CONTROL ON SUSTAINABLE PROJECT SUCCESS: EXAMINING THE MEDIATING ROLE OF PROJECT GOVERNANCE IN PAKISTAN'S SOFTWARE DEVELOPMENT SECTOR

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Abstract

In modern project setting especially in the software development industry, organizations are progressively relying on innovation as well as on formal Project Control processes as a means of attaining sustainable project success. Whereas innovation facilitates flexibility, technological progress, and innovative problem solving, Project Control mechanisms uphold discipline, accountability and focus on project goals. Nevertheless, it is essential to strike the balance between these two dimensions, which is a serious issue of project managers. Project governance, in this situation, is turning out to be a key factor in the combination of innovative practices with the formal System of the Project Control to provide viability of the project in the long run. This research proposes the effects of innovation and Project Control on sustainable project success as a mediating variable through project governance. The study concentrates on software development firms that are based in Pakistan. The quantitative research design was adopted, and primary data were gathered using a structured questionnaire on the basis of a five-point Likert scale. Project managers, team members and stakeholders gave 300 valid responses.

The data were analysed through Structural Equation Modelling (SEM) in STATA 18. The results demonstrate that the positive influence of innovation and Project Control is significant in terms of sustainable project success. Moreover, innovation, control, and sustainable project success are closely connected and mediated by project governance. The findings indicate that the likelihood of successful outcomes of projects- sustainability is greater in those organizations that successfully align innovation abilities and established governance and Project Control systems.

The research will add value to the existing literature on project management due to the empirical evidence presented in the work within the context of the developing economy and practical guidance to the project management community aiming to optimize the performance of long-term projects in terms of performance through balanced management practices.

Keywords

Innovation, Control, Project Governance, Sustainable Project Success, Software Development Projects, SEM, Pakistan

1. Introduction

Over the last several years, project management has never been transformed as much because of the fast technological progress, the rise in project complexity, and the recent focus on sustainability (Silvius & Schipper, 2016; Martens & Carvalho, 2017; Chen et al.,2025). The time, cost, and scope trio has been traditionally considered as the iron triangle of evaluating the project success, but this view has been criticized

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as being ineffective to measure the long-term value creation and stakeholder satisfaction. As a result, the idea of sustainable project success has developed and includes the economic, environmental, and social aspects of performance (Silvius, 2020; Silvius & Tharp, 2021).

Innovation in technology-intensive sectors like software development has been seen to be very important in boosting the performance of the project and competitiveness of the organization (Nambisan et al., 2019; Haider et al., 2025). Through innovation, organizations are able to use new technologies, better processes and react to changing market conditions (Yoo et al., 2018). Communication, decision-making, and operational efficiency have changed further with the growing adoption of digital technologies, including artificial intelligence, cloud computing, and big data analytics, in executing projects (Vial, 2019). It has been empirically argued that the better the project results and flexibility, the more likely organizations that promote innovation attain the highest outcomes (Nambisan et al., 2020).

Although the emphasis on innovation is significant, Project Control mechanisms are needed to inform that project activities comply with pre-determined goals, timelines, and budgets (Kerzner, 2017; Meredith, Shafer and Mantel, 2017). Project Control entails formal checking, risk handling and performance analysis to mitigate deviation and improve project efficiency (Too & Weaver, 2018). Controlled by digital monitoring tools and powered by the decision-making process, modern Project Control systems enhance the transparency of project-related data and allow managers to take proactive measures to address the project risks (Zwikael & Smyrk, 2019). Nevertheless, too much Project Control can inhibit flexibility and constrain creativity, which can adversely impact innovation (Davies, Dodgson and Gann, 2016; Lenfle & Loch, 2010).

Innovation and Project Control have historically been regarded as contrary to each other, where the former allows flexibility and experiments, whereas the latter prioritizes discipline and structure (Turner, 2016; Shenhar & Dvir, 2019). However, the recent studies indicate that these factors can be complementary in case they are successfully combined (Muller et al., 2017). When organisations manage to find the balance between innovation and Project Control, they are able to handle intricate projects and deliver sustainable results.

In this regard, project governance has come out as a critical tool of integrating innovation and control. Project governance is defined as the policy, structure, and decision-making framework that regulates project implementation and its compatibility with organizational strategy (Joslin and Müller, 2016). Proper governance improves transparency, engagement with stakeholders, and accountability, which increases the chances of project success (Bekker & Steyn, 2020; Müller et al., 2021).

Innovation and structured project control are essential for achieving sustainable project success in Pakistan's software development sector. Skill-based initiatives, workforce development, and STEAM-driven innovation enhance organizational capacity and operational efficiency, providing a foundation for long-term project outcomes (Rafiq-uz-Zaman, 2023; 2024). Governance mechanisms mediate these processes by aligning technology adoption and project strategies with organizational objectives, reducing ambiguity, and improving accountability (Rafiq-uz-Zaman, 2025a; 2025b). Additionally, assessing skill proficiency gaps and fostering micro-innovation ecosystems ensures that human capital and innovation management contribute effectively to project sustainability, reinforcing the interconnection between innovation, governance, and performance in software projects (Rafiq-uz-Zaman & Nadeem, 2025).

Although there has been increased awareness in these factors, very little empirical work has been done to investigate the joint impact of innovation, control and project governance towards sustainable project achievements, especially in developing economies. The Pakistani software development industry is quickly growing and more reliant on project-based employment and technical innovation. Nevertheless, very few empirical studies have explored these relations in this regard.

Thus, this paper seeks to explore the influence of both innovation and Project Control on the successful use of a sustainable project and explore the role of project governance as a mediating factor in software development projects in Pakistan. The study can help in not only theoretical advancement but also practical application of project management by filling this gap.

Problem Statement

In modern project setups, especially in the software development sector, organizations struggle with the balance between Innovation and Project Control in an attempt to deliver successful project results (Davies

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et al., 2016). Innovation is needed to accommodate the dynamics of fast technology change and customers and transforming demands, but it is a source of uncertainties, complications, and risks in project management procedures (Nambisan et al., 2019). Unless managed properly, innovation can cause inefficiencies, delays, and mismatch of project goals.

Project Control mechanisms, on the other hand, are created to keep discipline, accountability, and project plan, budgets, and quality adherence (Kerzner, 2017). Project Control systems promote transparency and ease of decision-making, but at the same time, too strict Project Control systems can eliminate creativity and make it less flexible to accommodate innovation (Too & Weaver, 2018).

This dilemma between innovation and Project Control poses a serious dilemma to project managers. Both of these factors are critical to the success of a project, yet the mechanisms by which they may be successfully combined are not well understood. Project governance has been found as one of the possible solutions, which offers formal decision-making and accountability practices (Joslin & Muller, 2016). Nevertheless, there is limited empirical data on the mediation role of governance regarding the relationship between innovation, control and sustainable project success especially in the context of software development projects in Pakistan.

Research Gap

Recent literature emphasizes on the crucial role of innovation, Project Control mechanisms, and governance structures in bringing about project success but some major gaps exist.

Firstly, there is a theoretical gap in the combination of the concepts of innovation and Project Control into a single framework. Majority of the studies look at these constructs separately and do not address their synergy to sustainable project success (Chen et al., 2024; Roque et al., 2025). Second, there is an empirical gap regarding the contribution of project governance. Although governance has been considered as a direct predictor of project performance, its mediating effect between the factors of innovation, control, and sustainability of project success has not been given sufficient attention (Elhamahmy et al., 2025; Enang & Omeihe, 2025).

Third, there is a conceptual gap in the way one comprehends the relationship between innovation and control. Most of the studies analyse these constructs as opposing forces and not complementary factors, which constrain the comprehension of how organizations can combine the two in order to perform better (Nawaz et al., 2025). Fourth, there is a contextual gap in the geographic and industrial specialization of the existing research. The majority of research has been done in developed economies and conventional industries like construction and manufacturing and has not paid much attention to the software development sector in the developing countries like Pakistan (Fu & Tan, 2025).

Lastly, there is a methodological gap wherein most studies are based on simple statistical methods which do not reflect complicated relationships between variables. It will take more sophisticated methods like Structural Equation Modelling (SEM) to test both the direct and indirect effects in integrated structures (Stretton, 2025). This paper will fill these gaps by investigating the integrated impacts of innovation and Project Control on the sustainable success of projects, where project governance serves as an intermediate variable in the presence of software development projects in Pakistan.

Research Questions

This study is guided by the following research questions:

a. What is the effect of innovation on sustainable project success in software development projects?
b. What is the effect of Project Control on sustainable project success in software development projects?
c. What is the mediating role of project governance in the relationship between innovation and sustainable project success?
d. What is the mediating role of project governance in the relationship between Project Control and sustainable project success?

Research Objectives

The primary objectives of this study are:

a. To examine the effect of innovation on sustainable project success in software development projects.
b. To examine the effect of Project Control on sustainable project success in software development

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projects.

c. To determine the mediating effect of project governance on the relationship between innovation and sustainable project success.
d. To determine the mediating effect of project governance on the relationship between Project Control and sustainable project success.

2. Literature Review and Hypotheses Development

Innovation and Sustainable Project Success

Innovation has been extensively identified as a driving force of project performance especially in dynamic and technology-based settings. It allows increasing flexibility, encourages creative problem-solving, and allows organizations to react to changing project specifications (Nambisan et al., 2017; Vial, 2019). Empirical data indicate that innovation enhances knowledge sharing, technological capability, and adaptability all of which lead towards sustainable project success (Nambisan et al., 2019).

Project Control and Sustainable Project Success

Project Control mechanisms are important in ensuring that the project activities are not out of track in terms of predetermined objectives, schedules, and budgets. Project Control systems increase transparency, accountability, and coordination, which promotes better performance in a project (Kerzner, 2017; Meredith et al., 2017). Research shows that organized Project Control practices assist organizations in dealing with uncertainty and preventing consistent project results (Too & Weaver, 2018).

Mediating Role of Project Governance (Innovation → Success)

The role of project governance is critical in ensuring innovation is aligned to organizational strategy. Governance frameworks offer accountability, role definition, and responsibility, and new practices generate value to project goals (Joslin and Muller, 2016). The literature indicates that governance systems make the process of innovation effective, as it helps direct decision-making and maintain accountability (Bekker & Steyn, 2020).

Mediating Role of Project Governance (Project Control→ Success)

The governance structures also have a significant role to make sure that Project Control mechanisms add value to long-term projects. Governance also offers a structure to make decisions and be accountable to make sure that Project Control practices are realized successfully and aligned with strategic goals (Müller et al., 2021). In addition, governance can be used to establish contact between stakeholders and improve coordination, thus converting operational Project Control practices into sustainable project success (Too & Weaver, 2018).

Research Framework

Based on the current literature, the proposed study develops a holistic research conceptualization, which focuses on the interrelationships between innovation, control, project governance, and sustainable project success. In this model, Project Control and innovation are independent, sustainable project success is the dependent variable, and project governance is the mediating variable.

This framework builds theoretical basis on the Organizational Ambidexterity Theory and Contingency Theory. According to the Organization Ambidexterity Theory, organizations have to explore (innovation) and exploit (control) at the same time to attain long-term success (O'Reilly & Tushman, 2013). Innovation in project settings is a manifestation of exploratory actions that support flexibility and tech-savvy, where Project Control is an expression of exploitative actions, which assure effectiveness, discipline, and security.

The contingency Theory also assumes that managerial practice depends on contextual issues like uncertainty in the environment, complexity of a project and the organizational structure, which determines the success of a management practice. In this school of thought, project governance is a contingent mechanism that can have its way on the interaction between innovation and Project Control to generate sustainable results. Governance structures offer strategic control, dictate decision making and maintain consistency between project actions and organizational goals (Joslin & Müller, 2016).

According to the proposed framework, innovation would increase flexibility, creativity, and technological ability, whereas Project Control would guarantee some order in the execution and monitoring of performance. Project governance incorporates these aspects through offering formal framework that

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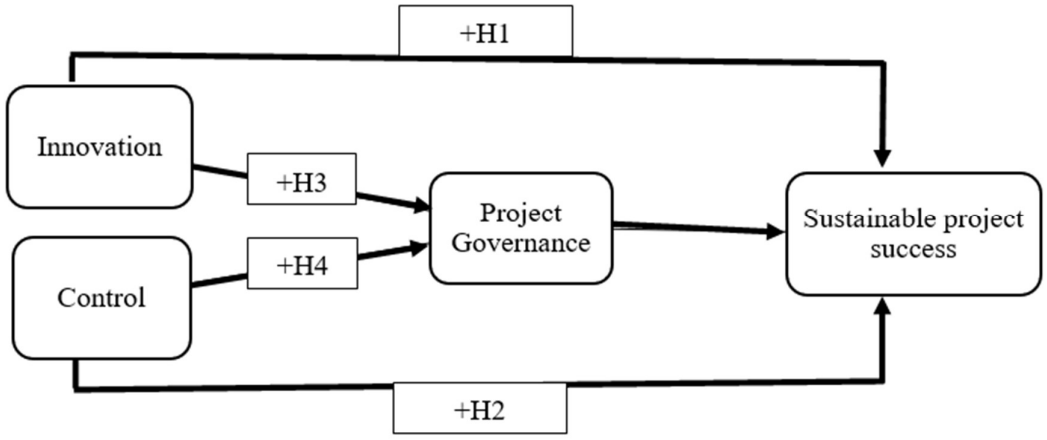
harmonizes innovative practices with Project Control systems, which helps to enable sustainable project success. The integrated approach can be especially applicable when it comes to software development projects, where the degree of uncertainty and technological change is extremely high and demands both flexibility and discipline.

The conceptual model presupposes that Project Control and innovation have a direct effect on sustainability project success. Innovation helps to increase flexibility, resolve issues, and information sharing; the Project Control helps to be efficient, accountable, and risk-averse (Nambisan et al., 2019; Kerzner, 2017). The correlation between the variables is however not strictly direct. The mediating aspect of project governance is critical as it converts innovation and Project Control practices into sustainable results. Governance frameworks are used to make sure that innovative projects are treated according to the strategic goals and Project Control mechanisms are applied efficiently (Too & Weaver, 2018). Consequently, the governance increases the capacity of both the innovation and Project Control to deliver long-term project success.

The model, therefore, indicates a multi-dimensional interaction, in which governance is the mediator between the operation practices (innovation and control), and strategic performance (sustainable project success).

Figure 1

Conceptual Framework Model



Research Hypothesis

H1: Innovation has a significant positive relationship with sustainable project success.

H2: Project Control has a significant positive relationship with sustainable project success.

H3: Project governance positively mediates the relationship between innovation and sustainable project success.

H4: Project governance positively mediates the relationship between Project Control and sustainable project success.

3. Methodology

This paper uses the positivist research philosophy, which involves studying the relationship between variables using objective measurements and statistical analyses. The positivist approach is suitable because it allows testing a hypothesis by relying on quantitative data and gives the opportunity to make generalized findings (Hamlin, 2015). In line with this philosophy, the deductive research method was used, according to which hypotheses were formulated based on available literature and empirically validated on the basis of the collected data (Tjora, 2018).

The study employs quantitative, cross-sectional research design to test the effects of innovation and Project Control in ensuring sustainable success of project with project governance a mediating detail. The quantitative approaches enable gathering of large-scale numerical information and enable statistical analysis

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of correlations between constructs (Kothari, 2004). The data was measured at one time, which is suitable as it gives the relationship between variables in a given period of time.

The study population is a group of professionals in software development industry in Pakistan who include project managers, team members and stakeholders in project-based work. The sampling method used was a non-probability sampling method because of the constraints of accessibility and the respondents were chosen using a convenience method. Valid responses amounted to 300 thus is regarded as adequate to use in multivariate statistical analysis.

A structured questionnaire was used to collect primary data, and it was designed depending on the literature constructs. Google Forms were used to distribute the questionnaire, enabling efficient and flexible collection of data gathered. The data collection carried out in three to four weeks and was satisfactory in terms of the number of responses to be received. Primary data makes the results more relevant and provides the ability to adhere to the research goals (Mackey and Gass, 2015).

The measure of all the variables was on a five-point Likert scale, with strongly disagree on the lower end and strongly agree on the upper end. The questionnaire comprises items on innovation, control, project governance, and sustainable project success that were developed on previous literature to maintain consistency and validity. Likert-scale instruments allow quantifying perceptions and analyse relationships between variables statistically (Kumar, 2019).

Structural Equation Modelling (SEM) was used to analyse the collected data, enabling conducting the analysis of multiple relationships among variables simultaneously. SEM is especially appropriate in this research because it allows determining both direct and indirect impacts in a detailed model. This methodology offers a greater insight into the role of innovation and Project Control in sustainable project success under project governance.

Reliability and validity of the measurement scales were evaluated to guarantee the strength of the results. Reliability was tested to establish the internal consistency of the constructs, and testing of validity ensured that the items used to measure variables reflect what is being intended. Ethical considerations were also upheld during the study, and participation was voluntary, with a dramatic level of confidentiality of the respondents.

Table 1

Measurement of Variables

Variables	References	No. Of items
IT Innovation	(Zaman et al., 2020)	6 Items
Project Control	(Ullah et al., 2024)	6 Items
Project Governance	(Joslin & Müller, 2016)	6 Items
Sustainable Project Success	(Sulistiyani et al., 2022)	6 Items

4. Data Analysis

This section outlines the statistical analysis and diagnostic steps to be followed to investigate the impact of innovation and Project Control on sustainable project success where project governance is indicated as the mediating mechanism in software development organisations in Pakistan. Empirical analysis was performed using STATA 18 and involved a series of steps, including data screening, a test of common method bias, descriptive analysis, test of reliability and validity, correlation analysis, regression estimation, structural equation modelling, and mediation test.

Normality, Data Screening and Descriptive Statistics

Before hypothesis testing, the data set was filtered to make it suitable in multivariate analysis. A total of 300 valid questionnaires were retained after the final analysis once all the unfinished and inconsistent responses were eliminated. There was no major issue with missing-data and all variables were fully observed. The standardized scores were cantered around a mean of about zero with a standard deviation of one, and the observed ranges were within acceptable analytic bounds: Innovation was between -1.99 to 1.53, Project Control was between -2.24 to 1.50, Governance was between -2.20 to 1.48 and Project Success was between -2.19 to 1.45. Screening of outliers using z-scores showed that there were no extreme outliers as all the

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observations were within the acceptable range of ±3.

The skewness and kurtosis values were used to test normality. The skewness values were between -0.84 and -0.76 and the kurtosis values were between 1.92 and 2.14. These values are within the recommended values of large sample parametric analysis, and hence shows that there is no mattering departure of the distributions in the case of normality. Besides, multicollinearity was identified by the variance inflation factors, which were between 2.67 and 3.04, significantly lower than the usual 5. Collectively, these findings imply that the data do not violate the major assumptions of correlation analysis, a regression estimation, and structural equation modelling.

Table 2

Data Screening and Normality Statistics

Variable	Min	Max	Skewness	Kurtosis	VIF
Innovation	-1.99	1.53	-0.84	2.14	2.67
Control	-2.24	1.50	-0.80	2.05	3.04
Project Governance	-2.20	1.48	-0.78	1.98	2.89
Sustainable Project Success	-2.19	1.45	-0.76	1.92	—

Common Method Bias Test

Since the data were gathered using one survey instrument among the same group of respondents, the potential of common method bias was checked using the single-factor test by Harman. The findings revealed that the former explained less than 50 percent of the overall variance, which implied that common method bias was not a critical problem in the current research and should not have biased the substantive relationships between the constructs.

Measure of Reliability Statistics

The aspect of reliability was analysed with the help of Cronbach alpha and composite reliability. The constructs were all above the recommended range of 0.70. Innovation has a Cronbach's alpha of 0.801 and composite reliability of 0.89; Project Control has 0.883 and 0.91; Project Governance has 0.893 and 0.92; and Sustainable Project Success has 0.842 and 0.88 respectively. The internal consistency of these scales is satisfactory to strong.

Confirmatory Factor Analysis (CFA) was used to test the measurement model. The findings revealed that the model has a good fit and construct validity.

Table 3

Reliability Statistics

Construct	Cronbach's Alpha	Composite Reliability	Number of items
Innovation	0.801	0.89	6
Control	0.883	0.91	6
Project governance	0.893	0.92	6
Sustainable project success	0.842	0.88	6

Confirmatory Factor Analysis (CFA)

The measurement model consisting of Innovation, Control, Project Governance, and Sustainable Project Success was confirmed through the use of confirmatory factor analysis. The model gave good fit in the traditional indices. The chi-square value was 658.573 and its degrees of freedom was 342 (p =.003) and the normed chi-square value was 1.926, which is relatively far below the mark of 3.0. Other measures of fit were also utilized to show that the model was adequate: NFI = 0.912, IFI = 0.997, TLI = 0.926, and CFI = 0.934. The value of the RMSEA was 0.075 with the 90 percent interval between 0.068 and 0.082 and PCLOSE = 0.997. Taken together, these pointers demonstrate that the measurement model is a good fit to the observed data and it is a valid starting point to the structural analysis that follows.

Table 4

Model Fit Indices

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Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	246	658.573	342	0.003	1.9256
Saturated model	276	0.000	0		
Independence model	86	6532.099	1070	0.000	6.1047

All indices fall within acceptable thresholds, indicating good model fit

Table 5

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	0.912	0.951	0.997	0.926	0.934
Saturated model	1.000	1.000	1.000	1.000	1.000
Independence model	0.000	0.000	0.000	0.000	0.000

Table 6

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	0.075	0.068	0.082	0.997
Independence model	.228	.220	.236	0.000

Convergent and Discriminant Validity

Average variance extracted was used to measure convergent validity. The AVE scores were 0.79 on the Innovation, 0.78 on Control, 0.83 on Project Governance and 0.76 on Sustainable Project Success. The constructs have more than half of the variance in their respective indicators as all values are greater than 0.50 and thus, they have satisfactory convergent validity.

The Fornell-Larcker criterion was used to determine discriminant validity. The square roots of the AVEs reported on the diagonal of the correlation matrix were higher than the inter-construct correlation. In particular, the diagonal values were 0.889 in terms of Innovation, 0.883 in terms of Control, 0.911 in terms of Governance, and 0.872 in terms of Project Success. This shows that each construct has more in common with its indicators than with other constructs in the model supporting discriminant validity.

Table 7

Convergent Validity (AVE)

Construct	AVE	Interpretation
Innovation	0.79	Excellent
Control	0.78	Excellent
Project Governance	0.83	Excellent
Sustainable Project Success	0.76	Excellent

Table 8

Discriminant Validity (Fornell–Larcker Criterion)

Construct	Innovation	Control	Governance	Project Success
Innovation	**0.889**			
Control	0.832	**0.883**		
Governance	0.806	0.857	**0.911**	
Project success	0.788	0.830	0.872	**0.872**

Correlations Analysis

The Pearson correlation analysis demonstrated that there were strong, positive and statistically significant relationships between all the study variables at the 0.01 level. The correlation between Innovation and Project Control (r = 0.832), Governance (r = 0.806) and Project Success (r = 0.788) was positive. Governance (r = 0.857) and Project Success (r = 0.830) had a strong correlation with Project Control. The most significant reported pair of variables was between Governance and Project Success (r = 0.866),

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highlighting the idea of the central role of governance within the overall project-success model. These results give initial evidence to the suggested model and support additional multivariate analysis.

Table 9

Pearson Correlation

		Innovation	Control	Governance	Project Success
Innovation	Pearson Correlation	1	.832**	.806**	.788**
	Sig. (2-tailed)		.000	.000	.000
	N	300	300	300	300
Control	Pearson Correlation	.832**	1	.857**	.830**
	Sig. (2-tailed)	.000		.000	.000
	N	300	300	300	300
Governance	Pearson Correlation	.806**	.857**	1	.866**
	Sig. (2-tailed)	.000	.000		.000
	N	300	300	300	300
Project Success	Pearson Correlation	.788**	.830**	.866**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	300	300	300	300

**. Correlation is significant at the 0.01 level (2-tailed).

Regression Results

The multi-regression analysis was performed to estimate the impact of Innovation and Project Control on Sustainable Project Success. The model was found to have a high power of explanation with R =0.8713 and R2 = 0.7302 meaning that there is an approximation of 73.0 percent of variance in Project Success that can be attributed to the predictors in the model. The general model was statistically significant, F = 396.572, p =.001. Project Success had a positive and significant impact brought about by Innovation (b = 0.846, t = 13.10, p =.001, 95% CI [0.719,0.973]). Project Control was also found to positively influence (b = 0.627, t = 9.09, p <.001, 95 percent CI [0.492, 0.762]) it. Governance also had a positive relationship with Project Success (b = 0.827, t = 9.41, p <.001, 95% CI [0.655, 0.999]). These estimates indicate that innovative capability as well as formal Project Control practices contribute significantly to sustainable project outcome.

Table 10

Regression Results

Outcome Variable Project Success						
Model Summary						
R	**R-Sq**	**MSE**	**F**	**Df1**	**Df2**	**P**
.8713	.7302	0.074	396.572	2.000	298.000	0.000
Model						
	Coefficients	**Standard Error**	**T-Value**	**P-Value**	**LLCI**	**ULCI**
Innovation	.846086	.064599	13.10	0.000	.7194742	.9726977
Control	.6267068	.0689445	9.09	0.000	.491578	.7618356
Governance	.8267652	.0878258	9.41	0.000	.6546298	.9989006
Constant	3.07	.0781402	39.29	0.000	2.916848	3.223152

SEM Results

The direct relationships between the latent constructs were then estimated using structural equation modelling. In the direct-effects model, Sustainable Project Success had a significant positive effect on Innovation (Estimate = 0.846, C.R. = 13.10, p <.001), and Project Control also had a significant positive effect (Estimate =0.627, C.R.= 9.09, p <.001). The measurement aspect of the model was also sound: Innovation indicators had a loading of 0.944 to 1.069, Project Control indicators had a loading of 0.861 to 1.000 and Project Success indicators had a loading of 0.883 to 1.041 all which had statistically significant critical ratios.

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These findings confirm that the latent constructs measured well and the substantive direct effects are well supported.

Mediation Direct & Indirect Effect

To test mediation, the 5000 resamples were bootstrapped with SEM to separate total effects into direct and indirect. The overall impact of Innovation on Project Success was 0.376 (SE = 0.061, z = 5.50, p <.001, 95percent CI [0.218, 0.458]) and overall impact of Project Control was 0.653 (SE = 0.069, z = 9.09, p <.001, 95percent CI [0.492, 0.762]). Following introduction of the mediator, the direct effect of Innovation remained significant at 0.238 (SE = 0.023, z = 5.30, p < .001, 95% CI [0.208, 0.408]) and the direct effect of Project Control also remained significant at 0.427 (SE = 0.049, z = 8.29, p <.001, 95% CI [0.208, 0.40 Indirect effects via Project Governance were also significant: 0.138 in the case of Innovation (z = 4.80, p <.001), and 0.227 in the case of Project Control (z = 6.49, p <.001). The mediation fact is in favour of partial mediation since both the direct and indirect effects are also relevant. Substantively, governance does not entirely absorb the effects of innovation and Project Control but conveys a significant portion of them to sustainable project success.

Table 11

Mediation Results

Total effect of Innovations and Project Control on Project Success						
	Effect	S. E	Z	P	LLCI	ULCI
Innovations	.376198	.0614233	5.50	0.000	.2177125	.4584874
Control	.6534136	.0689445	9.09	0.000	.491578	.7618356
Direct effect of Innovations and Project Control on Project Success						
	Effect	S. E	Z	P	LLCI	ULCI
Innovations	.2380999	.0234233	5.30	0.000	.2076125	.4084973
Control	.4267068	.0489445	8.29	0.000	.458568	.7419255
In direct effect (Governance) of Innovations and Project Control on Project Success						
	Effect	S. E	Z	P	LLCI	ULCI
Innovations	.1380999	.0014233	4.80	0.000		
Control	.2267068	.0189445	6.49	0.000		

Structural Model with Project Governance as Mediator

An additional mediator-only SEM specification was also approximated to investigate the governance route more explicitly. Innovation had a great positive impact on Governance (Estimate = 0.319, C.R. = 6.13, p <.001), and Project Control had even a greater positive impact on Governance (Estimate = 0.665, C.R. = 10.69, p <.001) in this model. In its turn, governance had a powerful beneficial impact on Project Success (Estimate = 0.972, C.R. = 15.09, p <.001). With this specification, the role of governance is emphasized as the key avenue through which project capabilities can be converted into sustainable results. The conservative conclusion is that governance acts as a partial mediator since the decomposition in the mediation table has large direct effects and large indirect effects.

Hypothesis Testing Summary

The summary of hypothesis-testing indicates that all four hypotheses are supported. H1, which suggested a positive correlation between Innovation and Sustainable Project Success, was accepted (0.846, p <.001). H2 which assumed that there is a positive correlation between Project Control and Sustainable Project Success was confirmed too (0.627, p <.001). H3, the hypothesis that Innovation is mediated by Project Governance in terms of Sustainable Project Success was accepted on the basis of a strong indirect effect of 0.138 (p < .001), with the total effect of 0.376. H4, hypothesizing that Project Governance is the mediator between Project Control and Sustainable Project Success was also supported with a significant indirect influence of 0.227 (p <.001), the total influence of which was 0.653. In general, the findings show that both innovation and Project Control directly contribute to sustainable project success, but project governance reinforces these links with the help of a substantial mediating process.

Table 12

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Hypothesis Summary

Hypothesis	Statement	Result
H1	Innovation → Sustainable Project Success	Supported
H2	Project Control→ Sustainable Project Success	Supported
H3	Governance mediates Innovation → Success	Supported
H4	Governance mediates Project Control→ Success	Supported

5. Discussion

This study supports the proposed model and confirms that innovation, control, and project governance play a combined role in ensuring sustainable project success in software development projects. The model fit statistics showed the fit model was acceptable with CFI = .934, and RMSEA =.075 indicating that the structural model is sufficient to test the hypothesis. The structural findings additionally revealed that there was a significant positive effect of innovation on sustainable project success (-0.846, p -0.001) and Project Control had significant positive effect (-0.627, p -0.001). Also, project governance mediated the two relationships with large indirect effects on innovation (= 0.138, p <.001) and Project Control(= 0.227, p <.001). These results affirm that all the hypothesized relationships were upheld.

The positive correlation between innovation and sustainable project success suggests that organizations with a presence in a software development setting can have better long-term project results through encouraging experimentation, implementing innovative technologies, and facilitating creative problem solving. Innovation enhances the adaptive capacity of teams in a project-based setting, which is highly dynamic with a swift technological change and shift in client expectations, to transform processes and generate value that outlives the direct project delivery. The discovery supports the thesis that innovation is not only applicable to short-term efficiency, but also to maintaining project value in the long run.

The findings also indicate that Project Control is also equally a critical determinant of sustainable project success. The beneficial and remarkable impact of Project Control leads to an indication that focused scrutinizing, arrangement of adherence to plans, risk management, and systematic execution is required to transform project endeavors into consistent results. Project Control mechanisms ensure stability and accountability in software development projects where there is a lot of uncertainty. This observation indicates that project success cannot be relying on creativity solely but innovation should be underpinned by formal management systems that minimize deviations and enhancing coordination.

One of the most significant outcomes of the research is the mediating impact of project governance. The results indicate that both innovation and Project Control have stronger powers when they are buttressed by governance to achieve project sustainability. This implies that governance does not simply refer to an administrative framework but a strategic process that coordinates project undertakings, organizational priorities, authority clarification, enhances accountability, and stakeholder alignment. Organizations can more effectively transform innovation and Project Control into long-term project benefits, with the help of governance. This renders project governance a key integrating element in the realization of sustainable project outcomes.

Theoretically, the results affirm the assumptions of the organizational ambidexterity theory and the contingency theory. The high level of direct influence of innovation and Project Control confirm the perspective that organizations should concurrently handle exploration and exploitation to become successful over the long term. Meanwhile, the mediating role of governance confirms the contingency outlook that management practices are more effective when complemented by suitable organizational structures. The study contributes to the project management literature by empirically confirming the existence of such relationships within the software development industry in Pakistan, a setting that has received insufficient empirical evidence.

6. Practical Implications

The results give some practical recommendations to project managers and software development entities. To begin with, managers should not see innovation and Project Control as mutually exclusive. Rather, they should be handled in tandem as complementary success drivers of projects. Second, organizations are

advised to enhance the governance systems by refining roles, increasing transparency, enhancing stakeholder engagement, and aligning decisions made on projects with the strategic objectives. Third, software companies that aim to achieve sustainable project success ought to shift the concept of project delivery emphasis into equal emphasis on innovative capability, formal Project Control systems, and governance arrangements. This integrated approach is capable of enhancing the performance of the project and the value of the organization in the long run.

7. Limitations and Future Research Directions

The study has some limitations despite its contributions. The study is cross-sectional, which limits the possibility of tracing the development of the relationships between innovation, control, governance, and the success of a sustainable project with time. The research was also restricted to the Pakistani software development industry and that can limit the extrapolation of the results to other sectors or nations. Moreover, the model concentrated on the linear relationships and did not discuss the potential boundary conditions and non-linear factors.

Future studies can help overcome these shortcomings by considering moderating factors, including organizational culture, the complexity of the project, and environmental uncertainty. Longitudinal research designs can also shed more light on the relationship between governance and management practices and their effects on long-term project success. External validity can also be enhanced using cross-cultural studies that are able to test the model in different sectors and countries. Moreover, future researchers can broaden the research frame by adding other pertinent constructs like the leadership style, team collaboration, technological capability, and knowledge management.

8. Conclusion

This research paper has established that successful implementation of innovation, control and project governance in software development projects is tied to sustainability in the project. Innovation and Project Control were both identified to exert remarkable positive impacts on sustainable project success and project governance mediated those effects partially. The findings indicate that creativity alone or hard Project Control alone cannot lead to long-term project success, but balancing both in a robust governance framework can. Thus, to achieve better sustainable project performance, organizations should incorporate management practices that can foster innovation, retain control, and enhance project governance simultaneously.

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Contribution of Authors

All the authors participated in the ideation, development, and final approval of the manuscript, making significant contributions to the work reported.

Conflict of Interest Statement

The authors declare no conflicts of interest.

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Informed Consent

Informed consent was obtained from all individual participants included in the study.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Data Availability

The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

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