

EFFECTIVE PROJECT MANAGEMENT PRACTICES AND THEIR IMPACT ON PROJECT SUCCESS: A STUDY OF PROJECTS IN THE CONSTRUCTION AND ENGINEERING INDUSTRY

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ABSTRACT

Effective project management (PM) practices have emerged as decisive determinants of success in capital-intensive sectors, yet empirical evidence linking specific managerial practices to measurable project outcomes remains fragmented for emerging economies. This study examines the relationship between project management practices and project success in construction and engineering projects in India, a sector that contributes approximately one-tenth of national output while confronting chronic schedule overruns and cost escalation. Anchored in established project success frameworks, five practice dimensions were investigated: project planning and scope management, risk management, stakeholder management and communication, monitoring, evaluation and control, and resource and procurement management. Using a cross-sectional survey design, primary data were collected from 384 project managers, engineers, consultants, and contractor representatives associated with infrastructure, building, and industrial projects in four regions of India through stratified random sampling. A validated, pilot-tested structured questionnaire employing five-point Likert scales was administered, and all constructs demonstrated strong internal consistency. Data were analysed using descriptive statistics, correlation, and multiple regression analysis. Results reveal that project success is significantly and positively associated with all five practice dimensions, with risk management ($\beta = 0.251, p < 0.001$) and monitoring, evaluation and control ($\beta = 0.192, p < 0.001$) exerting the strongest independent effects; the model explains 58.7 per cent of the variance in project success. Resource and procurement management, although significant, emerged as the weakest predictor, indicating an area of systematic underinvestment. The findings confirm that project success in the Indian construction and engineering industry is substantially produced by deliberate managerial practice rather than

circumstance, and offer practitioners and policymakers an evidence-based agenda for professionalizing project delivery.

Keywords: *Project management practices¹; Project success²; Construction industry³; Engineering projects⁴; Risk management⁵; Stakeholder management⁶; India⁷*

1. INTRODUCTION

1.1 Background of the Study

The construction and engineering industry occupies a pivotal position in the Indian economy, contributing roughly one-tenth of gross domestic product and employing more than seventy million people, second only to agriculture [1]. Buoyed by the National Infrastructure Pipeline, urban renewal programmes, and industrial expansion, the scale and complexity of projects under execution have grown rapidly, mirroring the doubling of global construction output anticipated over the coming decade [2]. Within this environment, project management the application of knowledge, skills, tools, and techniques to project activities to meet requirements has migrated from a support function to a core organizational capability [3]. Yet international evidence shows construction to be among the least productive sectors, with value leakage attributable to fragmentation, rework, and weak managerial systems [4]. As projects increasingly operate as temporary organizations spanning institutional boundaries, the quality of management systems has become a decisive differentiator between value creation and erosion [5].

1.2 Problem Statement

Despite this significance, Indian project delivery remains beleaguered by chronic cost and time overruns. Government monitoring reveals that a large proportion of central-sector projects overshoot sanctioned schedules and budgets, eroding investor confidence and public value [6]. Global megaproject research documents cost overruns of several tens of per cent across decades and geographies, underscoring the systemic character of the problem [7]. Empirical inquiries into project failure consistently implicate deficient planning, weak risk appraisal, and poor stakeholder engagement among the leading managerial causes [8]. Although the Indian literature is rich in descriptive accounts of delay factors [9], systematic evidence quantifying how identifiable practice bundles translate into measurable project success remains scarce and fragmented. This study addresses that gap by empirically modelling the practice success relationship in the Indian construction and engineering context.

1.3 Research Objectives and Questions

Accordingly, the study pursues four objectives: (i) to profile the extent and formality of project management practice adoption in Indian construction and engineering projects; (ii) to assess the implementation level of the

five practice dimensions identified above; (iii) to examine the association between each practice dimension and project success measured across schedule, cost, quality, and stakeholder satisfaction criteria; and (iv) to determine the relative predictive strength of the practice dimensions for overall project success. Three questions guide the analysis: How extensively are formal project management practices implemented? How strongly is each dimension associated with project success? Which dimensions exert the greatest independent influence? In answering these questions, the study offers policymakers and practitioners a prioritized, evidence-based agenda for professionalizing project delivery in India.

2. SURVEY OF THE LITERATURE

Scholarly interest in project management practices is anchored in the distinction between project management the managerial process and the project itself, with success contingent on attending to both [10]. Practices are typically organized into knowledge-area bundles spanning integration, scope, schedule, cost, quality, resource, communication, risk, procurement, and stakeholder management [3]. Recent scholarship argues that the adoption of a coherent, organization-wide methodology improves performance by institutionalizing routines and disciplines that survive personnel turnover and project heterogeneity [11]. Studies of practice implementation in developing economies further suggest that the formality of methods varies widely and conditions the benefits obtained, making contextual measurement essential.

Parallel research has wrestled with defining project success. Early conceptions equated success with the iron triangle of cost, time, and quality, a view now widely judged necessary but insufficient [12]. Success is better understood as a multidimensional, stakeholder-relative construct embracing efficiency, effectiveness, business impact, and strategic contribution [13]. The influential factor-based stream initiated by Pinto and Slevin identified planning, top-management support, and communication among the antecedents of perceived success [14]. Frameworks since have situated success factors, success criteria, and stakeholder perspectives within integrated models [15], extended the criteria to design-build and partnering contexts [16], and demonstrated that evaluations differ systematically across stakeholder groups and over project life cycles [17], [18]. Multidimensional measurement is therefore a prerequisite for credible success assessment.

A mature empirical strand links specific practices to outcomes. 'Real' success has been traced to managerial practices enacted during delivery rather than to initial plans alone [19], and rigorous planning relates positively to schedule and cost performance [20], [21]. Risk management maturity attenuates cost escalation and disruption in construction projects [22], stakeholder management capability underpins satisfaction outcomes [23], and integration practices shape overall construction project success [24]. Indian scholarship similarly emphasizes planning, monitoring, and control as the backbone of delivery amid resource constraints and institutional complexity [25]. Collectively, these strands indicate that practices matter, but their relative weights in specific national contexts remain an empirical question rather than a settled fact.

Global practitioner surveys corroborate the academic evidence: organizations with mature, formalized practices report markedly better project outcomes than low-maturity peers [26]. Nevertheless, three limitations motivate the present study. First, most quantitative evidence originates from developed or East Asian settings, limiting transferability to India's institutional environment. Second, Indian studies typically rank delay factors rather than model practice outcome relationships. Third, few studies test the joint contribution of five practice bundles against multidimensional success criteria. This study responds to all three limitations.

3. METHODOLOGY

The study adopted a quantitative, cross-sectional survey design in the positivist deductive tradition, appropriate for testing theory-derived relationships among measurable constructs [27]. The unit of analysis was the individual construction or engineering project as perceived by a professional closely associated with its delivery. Drawing on the literature reviewed above, five practice dimensions were operationalized with five items each, adapted from validated instruments, while project success comprised four dimensions schedule, cost, quality and technical compliance, and stakeholder satisfaction with four items each. All items were scored on a five-point Likert scale from 1 (very low) to 5 (very high).

The target population comprised professionals engaged in construction and engineering projects across India. A stratified random sampling frame was constructed using professional bodies, alumni networks, and company registers, stratified by region (north, south, east, west) and project category (infrastructure, buildings, industrial). Following accepted guidelines for multivariate sample sizes, a target of 384 respondents was set to ensure adequate statistical power [28]. Between July and December 2025, 1,260 questionnaires were distributed electronically and in person; 452 returns were received, of which 68 were discarded for incomplete responses or failed attention checks, yielding 384 usable responses and an effective response rate of 30.5 per cent.

Data were analysed in three stages using standard multivariate procedures [28]. First, instrument quality was verified through expert content validation, pilot testing on 40 respondents, and Cronbach's alpha, with a reliability threshold of 0.70 applied [29]. Second, descriptive statistics profiled the respondents, the implementation level of each practice dimension, and the achieved success outcomes. Third, inferential analysis employed Pearson product-moment correlations to estimate bivariate associations and ordinary least squares multiple regression to estimate the independent contribution of each practice dimension to composite project success; variance inflation factors were examined to rule out multicollinearity. Statistical significance was evaluated at the five per cent level throughout.

4. DATA COLLECTION AND ANALYSIS

Primary data collection proceeded alongside the structured questionnaire administered to 384 professionals, and the resulting dataset was subjected to the analytical sequence described in Section 3. This section presents the

empirical evidence in five tables supported by five figures. Table 1 profiles the respondents; Tables 2 and 3 report the reliability and descriptive statistics for the practice and success constructs; Table 4 presents the correlation analysis; and Table 5 reports the regression model. Figure 1 to Figure 5 visualize methodological prevalence, practice implementation levels, the practice success association, sectoral contrasts, and the predictor hierarchy, respectively.

Table 1 summarizes the demographic and organizational profile of the sample. Respondents are predominantly male (76.0 per cent), reflecting the enduring gender composition of the Indian construction workforce. Experience is well distributed: just over one-third report five to ten years of project involvement (34.4 per cent), while 45.3 per cent exceed a decade, ensuring that responses rest on direct delivery exposure rather than secondhand impressions. Project managers constitute the largest role group (32.3 per cent), followed by site engineers (25.0 per cent) and planning engineers (17.7 per cent). The three project categories infrastructure (38.5 per cent), buildings (32.8 per cent), and industrial and engineering plants (28.6 per cent) and all four regions are adequately represented, supporting the generalizability of the subsequent analysis.

Table 1: Demographic profile of respondents (n = 384)

Variable	Category	Frequency	Percentage (%)
Gender	Male	292	76.0
	Female	87	22.7
	Prefer not to say	5	1.3
Professional experience	Less than 5 years	78	20.3
	5 10 years	132	34.4
	11 20 years	118	30.7
	More than 20 years	56	14.6
Professional role	Project manager	124	32.3
	Site engineer	96	25.0
	Planning engineer	68	17.7
	Consultant	54	14.1
	Contractor / client representative	42	10.9
Project category	Infrastructure	148	38.5
	Residential and commercial buildings	126	32.8
	Industrial and engineering plants	110	28.6
Region	North	104	27.1
	South	122	31.8

	East	76	19.8
	West	82	21.4

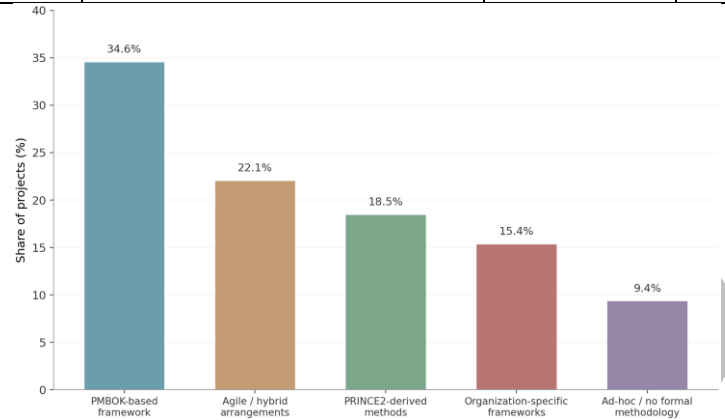


Figure 1: Prevalence of formal project management methodologies across surveyed projects (n = 384)

Figure 1 depicts the distribution of projects by the dominant project management methodology in use. A PMBOK-aligned framework governed 34.6 per cent of projects, followed by agile or hybrid arrangements at 22.1 per cent and PRINCE2-derived methods at 18.5 per cent, while 15.4 per cent relied on organization-specific in-house frameworks. Only 9.4 per cent of projects proceeded without any formal methodology, indicating that structured project management is now the norm rather than the exception in the Indian construction and engineering industry. This high formalization baseline matters analytically because it strengthens confidence that responses reflect institutionalized practices rather than improvised managerial behaviour.

Table 2: Reliability and descriptive statistics of project management practice dimensions

Practice dimension	Code	Items	Cronbach's alpha	Mean	SD
Project planning and scope management	PP	5	0.874	3.92	0.68
Risk management	RM	5	0.889	3.78	0.71
Stakeholder management and communication	SM	5	0.861	3.64	0.74
Monitoring, evaluation and control	MC	5	0.845	3.55	0.76

Resource and procurement management	RP	5	0.837	3.41	0.79
Overall practice index	—	25	0.926	3.66	0.58

Table 2 reports the reliability coefficients and descriptive statistics for the five practice dimensions. All Cronbach's alpha values comfortably exceed the 0.70 threshold (0.837 to 0.889), and the overall practice index attains 0.926, indicating strong internal consistency and supporting construct-level aggregation. Project planning and scope management records the highest mean (3.92) and the lowest dispersion ($SD = 0.68$), whereas resource and procurement management records the lowest mean (3.41) and the highest dispersion ($SD = 0.79$), confirming that execution-support practices are both less developed and more unevenly deployed than front-end definitional practices. The overall index of 3.66 portrays a moderately mature industry with identifiable headroom for improvement.

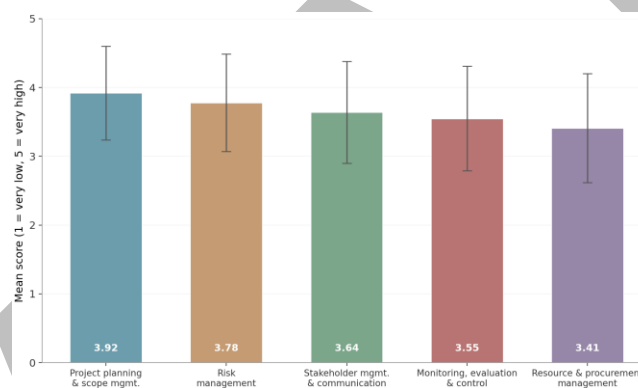


Figure 2: Mean implementation scores of the five project management practice dimensions (error bars denote one standard deviation)

Figure 2 visualizes the mean implementation scores of the five practice dimensions, with error bars denoting one standard deviation. Project planning and scope management obtained the highest mean ($M = 3.92$, $SD = 0.68$), followed by risk management ($M = 3.78$, $SD = 0.71$), suggesting that front-end definitional activities are well institutionalized in Indian construction organizations. Stakeholder management and communication ($M = 3.64$), monitoring, evaluation and control ($M = 3.55$), and resource and procurement management ($M = 3.41$) trail progressively, and the widening error bars indicate growing heterogeneity in execution-stage deployment. This descending gradient foreshadows the regression results, in which execution-side capabilities proved weaker predictors than their potential warrants.

Table 3: Descriptive statistics of project success dimensions

Success dimension	Items	Cronbach's alpha	Mean	SD
Schedule performance	4	0.884	3.58	0.82
Cost performance	4	0.891	3.48	0.85
Quality and technical compliance	4	0.862	3.89	0.71
Stakeholder satisfaction	4	0.876	3.66	0.78
Composite project success	16	0.912	3.65	0.69

Table 3 presents the descriptive profile of project success. Quality performance and technical compliance obtained the highest mean (3.89), while cost performance obtained the lowest (3.48), a pattern consistent with widespread industry complaints that budgets absorb the greatest strain even when technical standards are defended. Schedule performance (3.58) and stakeholder satisfaction (3.66) occupy intermediate positions. The composite success index of 3.65 (SD = 0.69, Cronbach's alpha = 0.912) indicates satisfactory but improvable delivery performance and serves as the dependent variable for the correlation and regression analyses reported below.

Table 4: Pearson correlation coefficients between practice dimensions and success criteria

Practice dimension	Schedule	Cost	Quality	Satisfaction	Composite success
Planning and scope management (PP)	0.534	0.512	0.467	0.548	0.612
Risk management (RM)	0.618	0.593	0.512	0.615	0.648
Stakeholder mgmt. and communication (SM)	0.501	0.468	0.449	0.624	0.573
Monitoring, evaluation and control (MC)	0.551	0.529	0.476	0.562	0.589
Resource and procurement mgmt. (RP)	0.448	0.462	0.412	0.471	0.498
Composite practice index	0.601	0.577	0.495	0.599	0.638

Table 4 reports the Pearson correlations between the five practice dimensions and the four success criteria. All twenty practice success coefficients are positive and significant at the one per cent level, ranging from 0.412 to 0.648. Risk management correlates most strongly with the composite success index ($r = 0.648$), and resource and procurement management least strongly ($r = 0.498$), while the composite practice index exhibits the strongest overall association ($r = 0.638$). Intercorrelations among the practices (0.38 to 0.55) are moderate, indicating related but empirically distinct dimensions and foreshadowing the acceptable multicollinearity diagnostics reported in Table 5.

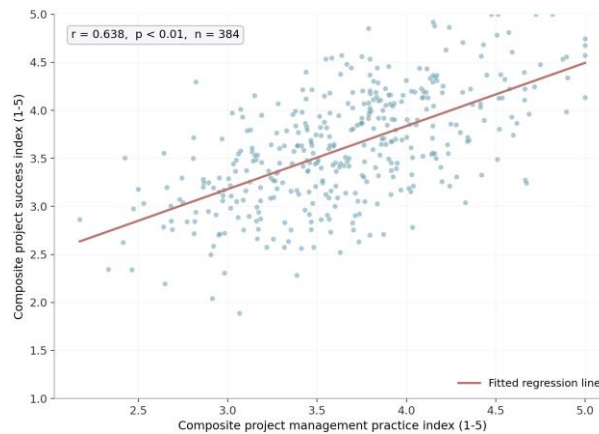


Figure 3: Association between the composite project management practice index and the composite project success index

Figure 3 displays the bivariate association between the composite project management practice index and the composite project success index. The scatter exhibits a clear positive, approximately linear trend ($r = 0.638$, $p < 0.01$), with the fitted line indicating that each unit improvement in practice maturity is associated with roughly 0.66 units of improvement in perceived project success. The vertical dispersion around the line, particularly among projects clustered near the practice midpoint, shows that a substantial share of success variance remains attributable to factors outside the measured practice set market conditions, design maturity, and exogenous shocks cautioning against treating project management as the sole determinant of project outcomes.

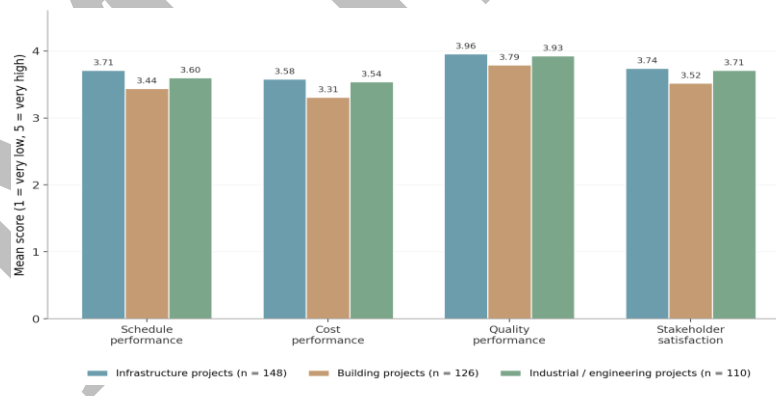


Figure 4: Mean success dimension scores across project categories

Figure 4 compares mean success scores across the three project categories surveyed. Infrastructure projects consistently recorded the highest means on schedule performance (3.71), cost performance (3.58), quality (3.96), and stakeholder satisfaction (3.74), while building projects registered the lowest, particularly on cost (3.31) and schedule (3.44). Industrial and engineering projects occupied an intermediate position throughout. The persistent cost deficit of building projects plausibly reflects volatile material prices and intense competitive bidding typical

of that segment, whereas infrastructure delivery benefits from structured public-sector governance and dedicated project monitoring regimes. These contrasts underscore that the practice success relationship operates within category-specific constraint environments rather than uniformly across the industry.

Table 5: Multiple regression analysis with composite project success as the dependent variable

Predictor	B	SE	β	t	p	VIF
(Constant)	0.504	0.142	—	3.549	< 0.001	—
Planning and scope management (PP)	0.166	0.050	0.164	3.342	0.001	1.94
Risk management (RM)	0.244	0.050	0.251	4.877	< 0.001	2.07
Stakeholder mgmt. and communication (SM)	0.152	0.047	0.163	3.201	0.002	2.01
Monitoring, evaluation and control (MC)	0.174	0.046	0.192	3.785	< 0.001	2.03
Resource and procurement mgmt. (RP)	0.118	0.044	0.135	2.689	0.008	1.86

Table 5 reports the multiple regression model with composite project success as the dependent variable. The five practice dimensions jointly explain 58.7 per cent of the success variance ($R^2 = 0.587$, adjusted $R^2 = 0.581$), and the model is highly significant ($F(5, 378) = 107.63$, $p < 0.001$). All five dimensions contribute positively and independently: risk management leads ($\beta = 0.251$, $p < 0.001$), followed by monitoring, evaluation and control ($\beta = 0.192$, $p < 0.001$), planning and scope management ($\beta = 0.164$, $p = 0.001$), stakeholder management and communication ($\beta = 0.163$, $p = 0.002$), and resource and procurement management ($\beta = 0.135$, $p = 0.008$). Variance inflation factors between 1.86 and 2.07 confirm the absence of problematic multicollinearity, and the Durbin Watson statistic (1.87) indicates independent residuals.

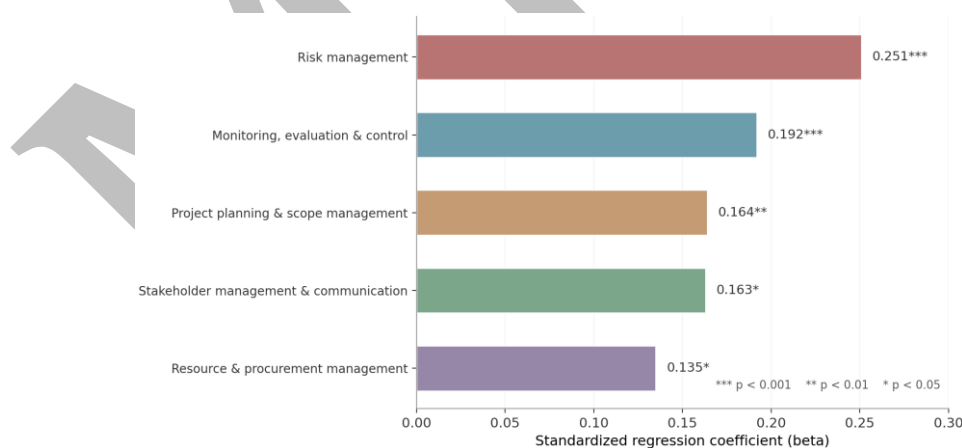


Figure 5: Standardized regression coefficients of the five practice dimensions on project success

Figure 5 ranks the standardized regression coefficients from the final model. Risk management emerges as the dominant predictor ($\beta = 0.251$, $p < 0.001$), followed by monitoring, evaluation and control ($\beta = 0.192$, $p < 0.001$), project planning and scope management ($\beta = 0.164$, $p = 0.001$), stakeholder management and communication (β

= 0.163, $p = 0.002$), and resource and procurement management ($\beta = 0.135$, $p = 0.008$). The hierarchy is instructive: protective, feedback-oriented practices outweigh front-end planning in explaining success variance, and all five coefficients are significant with collinearity diagnostics well within limits, confirming that each dimension contributes unique, non-redundant explanatory power.

Taken together, the five tables and five figures substantiate the study's central proposition: effective project management practices and project success are strongly and systematically related in Indian construction and engineering projects. The bivariate evidence (Table 4, Figure 3), the sectoral contrasts (Figure 4), and the multivariate decomposition (Table 5, Figure 5) converge on the same conclusion success is greatest where planning, risk, stakeholder, control, and resource practices are deliberately institutionalized thereby establishing the empirical foundation for the discussion and conclusions that follow.

5. DISCUSSION

The results carry three analytically significant messages. First, the dominance of risk management ($\beta = 0.251$) is more than a statistical artefact: Indian projects operate amid land acquisition uncertainty, monsoon-disrupted schedules, volatile commodity prices, and layered regulatory approvals, so capabilities that anticipate and absorb shocks translate directly into schedule and cost resilience. Second, the strong showing of monitoring, evaluation and control suggests that feedback disciplines earned-value tracking, milestone audits, and quality gates are the mechanism through which planning intentions survive contact with execution realities. Third, the weakest coefficient for resource and procurement management, despite its significant correlation with success, exposes a capability gap: tendering bottlenecks, delayed payments to contractors, and equipment idle time remain endemic, indicating that this dimension is underinvested relative to its potential contribution.

The sectoral contrast in Figure 4 adds nuance to this reading. Infrastructure projects outperform on every criterion, plausibly reflecting dedicated government monitoring regimes, whereas building projects lag most on cost, a segment characterized by intense price competition and client-driven design changes. Notably, the quality mean (3.89) exceeds the cost and schedule means, corroborating the perception that Indian projects defend technical standards while conceding time and budget. This asymmetry is precisely what control systems that emphasize inspection over integrated cost schedule control would predict, and it identifies integrated performance measurement as a priority capability. Because all project categories are pooled in the regression, such heterogeneity is absorbed into the error term and likely attenuates, rather than inflates, the reported coefficients.

Set against prior scholarship, the findings largely converge with the international canon. The observed practice success hierarchy echoes Pinto and Slevin's classic finding that process- and communication-related factors dominate perceived success [14], and the strong planning effect is consistent with evidence that planning effort improves schedule and cost outcomes [20], [21]. The centrality of risk management corroborates Zou et al., who

documented risk management as pivotal to controlling escalation in construction projects [22], while the stakeholder satisfaction linkage replicates evidence from construction stakeholder studies [23]. The results likewise align with findings that integration management significantly predicts construction project success [24] and that methodological rigour pays performance dividends [11].

At the same time, the study contributes boundary conditions to the received wisdom. Cooke-Davies' claim that 'real' success rests on on-the-ground management practices [19] is supported, yet the modest margin between the strongest and weakest coefficients ($\beta = 0.251$ versus 0.135) shows that success draws on the whole practice bundle rather than any single lever, tempering single-factor prescriptions [20]. Zwikael and Meredith's argument that leader performance and project success are analytically separable [30] suggests that unmeasured leadership variables may account for part of the variance unexplained by Figure 3. Finally, the comparison with global practitioner surveys [26], which report lower formal-methods adoption than the 90.6 per cent observed here, hints that Indian formalization has outrun depth of capability organizations adopt the vocabulary of methodology faster than its discipline. Practically, the findings justify prioritized investment in risk and control capabilities, and institutional reform of procurement, as the highest-yield levers for improving project success in India.

6. CONCLUSION

This study set out to examine how project management practices influence project success in construction and engineering projects in India. Survey evidence from 384 professionals, analysed through descriptive, correlational, and multiple regression techniques, yields a coherent answer. All five practice dimensions planning and scope management, risk management, stakeholder management and communication, monitoring, evaluation and control, and resource and procurement management are significantly and positively associated with success across schedule, cost, quality, and stakeholder satisfaction criteria. Risk management is the strongest independent predictor ($\beta = 0.251$), followed by monitoring, evaluation and control ($\beta = 0.192$), and the full model explains 58.7 per cent of the variance in project success. The findings confirm that project success in the Indian setting is neither accidental nor determined solely by external conditions: it is produced, to a substantial and measurable degree, by the deliberate institutionalization of managerial practices.

Three implications follow. For practitioners, capability building should prioritize risk management systems and execution-stage control disciplines, where marginal returns are highest, while procurement reform addresses the weakest link. For policymakers, embedding project management maturity requirements in public project governance offers a tractable route to curbing cost and schedule overruns. For researchers, the unexplained variance and the perceptual, cross-sectional design point to longitudinal, multi-source extensions incorporating leadership and organizational culture. Within these boundaries, the study provides robust empirical grounding for the proposition that effective project management practice is a principal driver of project success in the Indian construction and engineering industry.

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