Mediation Effects of Leadership on Project Success: Evidence from Student-Led Projects

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The importance of leadership as a mediator between project management success factors and project performance remains underexplored in current literature. This study investigates how leadership mediates the relationship between established project management success factors (tools, practices, and organizational support) and performance at individual, team, and project levels in a university setting. Drawing on data from 92 students engaged in real-world projects and using structural equation modeling, our results reveal significant mediation effects of leadership. Specifically, leadership was shown to enhance the effectiveness of project management tools, practices, and support, leading to improved project outcomes. Our findings extend the theoretical understanding of leadership roles in project management by explicitly quantifying mediation effects. Practically, these results underscore the necessity of leadership development programs within educational and organizational training initiatives to optimize project performance.

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I. INTRODUCTION

The success factors of a project have been well studied (Göküz and Akiner, 2025; Rehan et al., 2025). A common understanding is that tools, practices, and support are major factors that will lead to the success of a project. Moreover, leadership is the ability of an individual (i.e., the leader) to influence other individuals (i.e., the followers) toward the achievement of goals in a defined setting such as team or project (Sims et al., 2009). The literature has also suggested that successful projects require leadership to set direction, align, and motivate team members to achieve the goals of a project (Marchewka, 2017;

Piwowar-Sulej and Iqbal, 2025; Twaissi, et al., 2025).

Some case studies show how leadership in various forms, such as an independent, dependent, moderating, or mediating variable, can significantly influence project outcomes. From visionary leadership at SpaceX to transformational leadership at Google, these cases provide concrete evidence supporting the findings from the literature on leadership's role in driving project success. For example, when Steve Jobs passed the leadership to Tim Cook, the transition reflected a change in leadership style from a visionary, innovative leader to a more operational, process-focused leader. The leadership shift had a significant effect on project outcomes at Apple, particularly in the areas of innovation and operational efficiency. Research on leadership as an independent variable, such as Thoha and Avandana (2020) suggest that leadership styles can impact project outcomes, and Apple's ability to maintain its market leadership, even with a change in leadership style, demonstrates this effect.

Although earlier studies have identified many project success factors, little is known about how leadership mediates their impact on performance across different levels. This study addresses that gap by analyzing leadership as the mechanism that links project success factors to project outcomes. It extends prior research by (1) modeling project success factors, rather than team conditions, as the independent variable and (2) evaluating performance at the individual, team, and project levels.

Because projects are often unique and difficult to compare, this study uses student-led, in-class projects as a controlled setting to test these relationships. The results show that leadership significantly shapes how success factors translate into performance by improving communication, motivating teams, and aligning strategies with project goals. For practitioners, the implications are clear: transformational leadership can raise team performance, suggesting its value in recruitment and promotion decisions; strong communication should be emphasized in training and development programs; and leadership overall must be treated as a central driver in achieving consistent project results. These insights not only sharpen theoretical understanding but also provide project managers with concrete, actionable guidance for enhancing outcomes in real-world settings.

The remainder of this paper is organized as follows. The next section reviews the relevant literature and presents the theoretical background for the conceptual model, followed by the development of hypotheses. We then outline the research methodology, including data collection, measurement, and analytical procedures, and report the results. The paper concludes with a discussion of theoretical and practical implications, along with directions for future research

II. LITERATURE REVIEW

This section synthesizes prior research on project success factors, project performance, and leadership, with particular attention to studies that examine leadership as an influencing mechanism. By integrating these streams of literature, we highlight gaps in understanding the mediating role of leadership in linking project success factors to performance at the individual, team, and project levels, thereby framing the motivation for this study.

2.1 Project Success Factors

Tools, practices, and support are important factors that contribute to the success of a project. Project management tools can help improve project planning, scheduling, tracking, and communication. These tools include project management software, task management tools, collaboration tools, and reporting tools. By using these tools, project managers can streamline project workflows, improve team

communication, and track project progress more effectively.

Project management practices refer to the methodologies, frameworks, and best practices used by project managers to plan, execute, and close projects. Examples of project management practices include Agile, Waterfall, PRINCE2, and Six Sigma (Marchewka, 2017; Dursun, GÖKER, and Mutlu, 2022). By using these practices, project managers can improve project outcomes, reduce risk, and enhance team collaboration.

Project management support refers to the resources and assistance that project managers can access to help them manage their projects effectively. These supports include project management training, coaching, and mentoring, as well as access to project management consultants and other experts. By leveraging these supports, project managers can improve their skills and knowledge, stay up to date on industry trends, and gain insights and advice from experienced professionals.

While tools, practices, and support can be important factors in project success, it's important to remember that they are not the only factors that matter. Ultimately, the success of a project will depend on a range of factors, including the quality of project planning, the skills and experience of the project team, the effectiveness of communication and collaboration, the ability to manage risks and challenges, and the ability to adapt to changing circumstances.

2.2 Mediation Mechanism of Leadership in Project Management

Leadership in project management has been examined in research models as an independent, dependent, moderating, or mediating variable. When treated as an independent variable, studies have assessed the effects of different leadership schools, styles, or emerging approaches on outcomes (Thoha & Avandana, 2020; Islama et al., 2024). Some of this work has focused on moderators such as reporting structures or organizational support (Keegan & Den Hartog, 2004; Zaman et al., 2020; Fareed et al., 2023), while others have explored mediators such as employee resistance, job perceptions, or governance mechanisms (Vecchio et al., 2010; Choudhary et al., 2017; Ahmed et al., 2018; Naqshbandi et al., 2019). Still others combine moderating and mediating perspectives (Naqshbandi & Tabche, 2018).

In other roles, leadership has been studied as an outcome of organizational factors, such as empowerment climate in traditional and virtual contexts (Nauman, Khan, & Ehsan, 2010), or as a mediator linking team conditions to performance (Tabassi et al., 2017). More recently, sustainable leadership has been shown to moderate the relationship between sustainable project management and sustainable project success (Liaqat et al., 2024).

Broader leadership theories also inform project research. Turner and Muller (2005) identified six schools of leadership theory—trait, behavioral, contingency, visionary/ charismatic, emotional intelligence, and competency—illustrating how leadership effectiveness can stem from personal qualities, situational fit, emotional intelligence, or learned skills. Within these, Bass (1990) distinguished transactional and transformational leadership, later extended into five categories including empowering leadership (Pearce et al., 2003; Sims et al., 2009). Emotional intelligence theories emphasize styles such as visionary, democratic, and coaching (Goleman et al., 2002), while competency-based approaches classify leadership into emotional, intellectual, and managerial domains (Dulzewicz & Higgs, 2023). Kouzes and Posner's (2017) five practices of exemplary leadership—modeling the way, inspiring a vision, challenging the process, enabling others, and encouraging the heart—remain influential (Marchewka, 2017).

Taken together, the literature shows that leadership affects project outcomes in diverse ways, shaped by style, organizational context,

and moderating or mediating conditions. While findings are mixed, they underscore the centrality of leadership in project performance and point to the need for further research, particularly on its mediating role between project success factors and outcomes at individual, team, and project levels.

While prior research has examined leadership as an independent, moderating, or mediating variable in project management, empirical evidence connecting leadership directly to the mechanisms that link project success factors with performance across multiple levels remains limited. Existing studies often emphasize leadership styles or competencies in isolation, without fully integrating them into the broader framework of project success factors. This study extends the literature by explicitly analyzing leadership as a mediating mechanism, offering a more comprehensive view of how leadership translates tools, practices, and organizational support into tangible performance results. In doing so, it bridges theoretical perspectives with actionable insights, adding both conceptual clarity and practical value to project management for scholarship and practice.

2.3 Project Performance

Meanwhile, the performance of a project can be measured at individual, team, and project levels. Individual level: At the individual level, project performance can be measured by evaluating the performance of each team member. This includes assessing their contribution to the project, their adherence to timelines and deadlines, their ability to work collaboratively with others, and their overall performance in completing project tasks. Individual performance can be measured using metrics such as productivity, quality, timeliness, and customer satisfaction (Zmud, 1980; Settle-Murphy & Thornton, 1999; Yetton et al., 2000).

At the team level, project performance can be measured by evaluating the performance of the team as a whole. This includes assessing the team's ability to work together effectively, their ability to achieve project milestones and deliverables, their communication and collaboration skills, and their overall performance in meeting project objectives. Team performance can be measured using metrics such as team productivity, quality of deliverables, team morale, and team satisfaction (McFarlan, 1981; Anderson et al., 2006; Martin, Pearson, & Furumo, 2007).

At the project level, project performance can be measured by evaluating the overall success of the project. This includes assessing the project's adherence to timelines and budgets, the quality of deliverables, customer satisfaction, and the overall impact of the project on the organization or stakeholders. Project performance can be measured using metrics such as project completion rate, project cost variance, schedule variance, and return on investment (ROI). By measuring project performance at multiple levels, project managers can gain a more comprehensive understanding of the project's strengths and weaknesses, identify areas for improvement, and make data-driven decisions to optimize project outcomes (Henderson & Lee, 1992; Jiang, Klein, & Means, 2000; Leung, 2001).

III. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

The initial phase of interviews provided sufficient justification for proceeding with the survey portion of this research. The primary objective of the survey is to investigate key issues in project management across a range of projects and instructional settings, with the aim of identifying specific success factors that contribute to favorable project outcomes. These success factors have the potential to serve as guiding principles for both project leaders and team members during the various stages of project execution. By applying these factors,

practitioners can adopt best practices, and project managers can effectively leverage project management knowledge in their roles.

Existing literature highlights a multitude of elements that impact project success in organizational settings. According to Besteiro et al. (2015), the traditional project success framework comprises scope, time, and cost. Fortune et al. (2013) emphasized that success factors should align with an organization's strategic orientation and are often shaped by stakeholder expectations. Other researchers argue that all projects must incorporate contingency plans to navigate uncertainties (Lundin & Söderholm, 1995; Söderlund, 2002; Carvalho & Rabechini, 2010). Fortune and White (2006), through a review of 63 studies, identified clear goals, executive sponsorship, and adequate resources as core critical success factors. Hyväri (2006) investigated the relationship between project management failures and success variables. Key factors for success included well-defined objectives, end-user engagement, resource sufficiency, coordination capacity, leadership effectiveness, management support, project structuring, and contextual environmental factors. Additionally, communication, client involvement, schedule clarity, execution efficiency, and monitoring mechanisms were all noted as influential, with communication being especially critical in large organizations.

Besteiro et al. (2015) further asserted the importance of leadership, experience, and knowledge management in enhancing project outcomes. Anderson et al. (2006) explored the correlation between critical success factors and project achievements, introducing three dimensions of success: managerial competence, project impact, and knowledge capture. Their model included nine specific success factors, notably communication, stakeholder engagement, structured planning, project commitment, adaptability, and procedural influence. Communication emerged again as a key enabler for building trust among team members. In a separate empirical study, Besteiro et al. (2015) surveyed project managers across 28 companies and categorized 57 critical success indicators into four thematic clusters: managerial responsibilities, success factors, monitoring/control, and lessons learned. Drawing on this theoretical foundation, the present study proposes three overarching hypotheses, each with subsidiary hypotheses. The independent variables under investigation include project management (1) tools, (2) practices, and (3) support mechanisms. The dependent variables are performance outcomes measured at the (a) individual, (b) team, and (c) project levels. Figure 1 illustrates the conceptual framework linking project success factors with these performance dimensions.

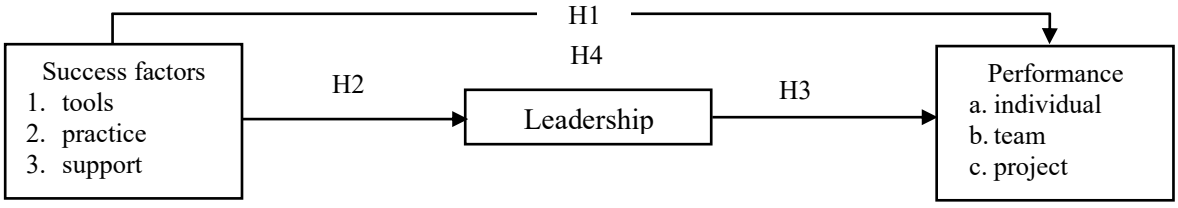

FIGURE 1. STRUCTURE OF THEORETICAL MODEL

3.1 Project Management Tools

According to the PMBOK® Guide, project management involves a more intensive planning process compared to general management disciplines, particularly in its application of structured knowledge areas, methodologies, and tools (PMI, 2021). Foundational tools in project management include various forms of documentation and analytical techniques, such as the project charter, scope definition documents, communication plans, work breakdown structures (WBS), earned value analysis (EVA), critical path methods, decision trees, and risk evaluations. These instruments are essential for guiding project execution and ensuring goal alignment. In a study by Larson and Drexler (2010), students who engaged in a service-learning project as part of a 10-week project management course demonstrated improved proficiency in applying these tools effectively to real-world contexts. Furthermore, Mathur et al. (2014) highlighted that exclusive, tangible project tools positively influence both individual project outcomes and broader organizational performance. Similarly, embedded intangible resources were shown to benefit performance at the organizational level.

3.2 Best Practices in Project Management

Effective project management practices encompass comprehensive planning that addresses scope, time, cost control, deliverables, and risk mitigation. Defining project scope with clarity and precision while actively managing scope creep is critical. Equally essential is maintaining robust communication among all stakeholders to ensure engagement and alignment. Ofori (2013) identified several core contributors to project success, including senior leadership support, open communication, clear project objectives, and active stakeholder participation. These findings are echoed in earlier work by Davidson (2002) and Meredith et al. (2015), which emphasized that implementing proven best practices is vital for achieving favorable project outcomes.

3.3 The Role of Organizational Support

Organizational support refers to employees' beliefs about how much their organization values their contributions and prioritizes their well-being. This form of support has been found to significantly influence employee effectiveness (Eisenberger, 1986). Within the context of project management, support from executive leadership, internal teams, and external partners is a key determinant of success (Verburg et al., 2013; Yazici, 2009). Administrative backing and alignment between human resources systems and project goals are foundational for team success (Thamhain, 1990; Pinto & Slevin, 1987a, b; Thamhain & Wilemon, 1987; Brown & Eisenhardt, 1995). Gray (2001) noted that organizational culture—including shared norms, values, and behavioral expectations—positively influences project results. However, findings also indicate that perceived threats and environmental pressures faced by project personnel can hinder success. Moreover, excessive organizational change and internal conflict are negatively correlated with project outcomes. Scott-Young and Samson (2007) further observed that strong managerial interference or micromanagement may adversely affect project timelines.

Studies incorporating student participants also provide valuable insights into project management success factors. For instance, Kemery and Stickney (2014) explored the development of teamwork skills in undergraduate business students using both evaluative and developmental assessments across individual and team dimensions. These included knowledge of teamwork principles, observed collaborative behavior, and peer

evaluations. Similarly, Larson and Drexler (2010) used service-learning experiences to introduce students to essential project management concepts. Through fund-raising projects, students applied project planning and control techniques—such as creating WBSs, developing schedules, and managing execution—to enhance both technical and interpersonal competencies. One prominent factor in project success was the development of social capital, as students learned to build cohesive teams and leverage peer networks to support project objectives. Lessons learned from these experiences emphasized the critical role of teamwork and collaboration in achieving successful outcomes.

From a resource-based view (Barney, 1991) and systems theory (Katz & Kahn, 1978), success factors such as tools, practices, and organizational support are valuable resources and inputs that enhance performance. The following hypothesis is proposed:

H1: Tools, practices, and organizational support of project management have a positive effect on project performance.

A project involves a group of people. Differing viewpoints or interpretations about the management tools, best practices, and organizational support may lead to team conflict, unproductivity, and mistrust. These diverse viewpoints or interpretations need to be embraced to minimize the potential conflicts and build the mutual trust among group members (Kouzes and Posner, 2017). Without trust, project managers are often less effective in communicating project vision, delegating tasks, motivating and guiding the members toward the project goal. Group members' efforts in using the management tools or engaging in the best practices need to be coordinated as well to clarify the member responsibilities. Establishing teams as a system with interacting components that aid each other throughout the project life cycle is paramount in achieving peak team performance. Without this coordination, team members often lose passion for the team project and relegate responsibilities to the team members most interested or vested in the individual performance (Marchewka, 2017).

A leadership style that can embrace the diverse viewpoints, build trust among the members, coordinate individual members' work, and motivate members toward the project goal will be effective in this setting (Naqshbandi and Tabche, 2018). Contingency theory (Lawrence & Lorsch, 1967) suggests that aligning these factors with situational demands improves outcomes. Based on these considerations, the following hypothesis is proposed:

H2: Tools, practices, and organizational support in project management have a positive effect on the leadership in a project.

A substantial body of research has explored project management success factors within organizational settings. Some scholars have concentrated on identifying and defining comprehensive sets of success factors (e.g., Besteiro, de Souza Pinto, & Novaski, 2015; Fortune et al., 2013; Lundin & Söderholm, 1995; Söderlund, 2002; Carvalho, 2010; Fortune & White, 2006; Hyväri, 2006), while others have investigated how these factors correlate with improved project outcomes and performance metrics (e.g., Zmud, 1980; Yetton et al., 2000; McFarlan, 1981; Anderson et al., 2006; Martin, Pearson, & Furumo, 2007; Henderson & Lee, 1992; Jiang, Klein, & Means, 2000; Leung, 2001; Settle-Murphy & Thornton, 1999).

A clear vision of brought by the project manager can help individuals develop their own work plan based on the available time and budget. In the case of uncertain or vague customer requirements, a clear vision could help individuals make appropriate choice to align with the vision. The customized work plan

and the appropriate choices will help enhance the individuals' work productivity and quality. The vision could help the team divide the work into tasks through work break-down structure (WBS). Work divided in this way streamlines the tasks for each individual and maintains the integrity of the work or work components once the tasks have been completed by individuals. In this case, the quality of individuals' work will be equivalent to that of the team. The clear vision will be a major contributor to the project performance as well. Well-articulated and aligned requirements will guide the team efforts to disassemble the overall project requirement into small tasks, allow individuals to work on each task, and reassemble the individual pieces back to the final product that conforms customers' functional requirements.

A mutual trust work environment will help release individuals' internal energy for a timely and quality work. Recognizing individuals' phased achievement provides the individuals timely feedback and allows them to reflect on the past performance and prepare the work next. The mutual trust environment will promote the open communication within teams, which, in turn, will make the collaboration more effective and achieve project milestones and deliverables in a timely manner with quality by minimizing potential misunderstanding and the ensuing rework. The mutually trusted working environment will help create a seamless collaboration between teams or team members, reduce uncertainties due to the miscommunication or environment changes, and motivate individuals to conduct quality work, leading to an overall work within budget and timeline. Path-goal theory (House, 1971) highlights how success factors shape leaders' ability to guide teams effectively. Based on the discussions above, the following hypotheses is proposed:

H3: Leadership has a positive effect on the performance in a project.

The Stimulus-Organism-Response (SOR) model explains how a stimulus (S) triggers an organism (O), which, in turn, leads to a response (R) (Mehrabian and Russell, 1974). A stimulus is any external factor or event that can trigger a response. In the project management setting, this can be the success factors that project members employ to achieve project objective. An organism represents the individual's internal state. In this case, this can be the leadership style or the manager of the project. A response refers to the observable behavior or action that results from the interaction between the stimulus and the organism's internal state. This can be the performance of the project. The model contends that an active organism intervenes between the external stimulus and the responses.

Leadership itself is widely recognized as a driver of performance through transformational leadership theory (Bass, 1990), leader–member exchange theory (Graen & Uhl-Bien, 1995), and situational leadership theory (Hersey & Blanchard, 1969). Extending this logic, input–process–output models of team effectiveness (McGrath, 1964), the AMO framework (Appelbaum et al., 2000), and socio-technical systems theory (Trist & Bamforth, 1951) suggest that leadership mediates the link between project success factors and performance by translating resources and practices into motivation, alignment, and coordinated action.

This study aims to assess key success factors intended to support project managers and team members during collaborative project work and to explore their relationship with project performance at the individual, team, and project levels. Grounded in the Stimulus-Organism-Response (SOR) framework, the following hypothesis is proposed.

H4: The leadership has a mediating effect on the relationship between project management success factors (tools, practices, and organizational support) and the performance in a project.

IV. METHODOLOGY AND DATA COLLECTION

The development of the instrument to measure success factors and project management performance followed a three-phase process: (1) item generation, (2) online survey administration, and (3) data analysis. A comprehensive review of the project management literature informed the identification of relevant constructs and the creation of measurement items (see Table 1). Each item was rated using a six-point Likert scale, ranging from 1 ("Strongly Disagree") to 6 ("Strongly Agree"). A questionnaire was then designed and distributed to students via the Qualtrics online survey platform. Finally, the collected data were analyzed to validate the measurement instrument and evaluate the proposed model.

Data were gathered through an online survey administered via Qualtrics. The target population included 121 students enrolled across three sections of a project management course at a public university in the United States. A key component of the course involved the completion of a team-based final project. Students, working in teams of 2 to 6 members, collaborated with external community partners to carry out a real-world project from initiation through close-out. Project topics varied and included initiatives such as organizing a fundraising event for a nearby nursing home and hosting a competitive baseball game to raise donations. Of the 121 students invited to participate, 92 completed the survey, resulting in a 76% response rate. Descriptive statistics and demographic information for the sample are presented in Table 2.

Student sample is used in this study for the following reasons. The student respondents were taking the project management course at the college level. The themes of the projects have their roots in the real-world. The experience went through the entire project life cycle. Thus, student group and the referent population of business respondents overlap because their knowledge base and experience are the same. The two groups merge overtime because the students today may become the business professionals in the field tomorrow. Therefore, the findings from this sample are viewed as transferrable to the referent population. Similarly, Turner et. al. (2019) and Tumpa (2025) collected data from 137 students enrolled in a postgraduate course of a project management program to study how project-based group work can enhance learning in project management class.

V. ANALYSIS AND RESULTS

We used PLS-SEM to test the measurement model and hypotheses. PLS-SEM is recommended when researchers want to confirm a theory from the constructs and the sample size is not very large (Chin et al., 2003; Francisco de Oliveira & Rabechini, 2019). PLS-SEM has been widely used in project management literature (Cavazotte et al., 2023; Francisco de Oliveira and Rabechini, 2019; Haq et al., 2019; Khosravi et al., 2020; Tam et al., 2020; Zhu and Cheung, 2023). Regarding the statistical software, we used SmartPLS 4 (Ringle et al., 2022).

TABLE 1. CONSTRUCTS AND ITEMS

Constructs and items	Sources
Tools 1. Communicating among team members 2. Sharing information 3. Making decisions (Decision tree) 4. Evaluating project progress (Critical path) 5. Clear detailed task list (Work Break Structure-WBS)	Frame, 2002; Jitpaiboon et al., 2019
Practices 1. Clear scope definition of project 2. Establishing goals and deliverables 3. Commitment of stakeholders, decision-makers, project managers and team members 4. Clear time requirement 5. Clear contingency plan	Jitpaiboon et al., 2019; Shenhar, 2001
Management support 1. Upper management 2. Project managers 3. Managerial support for project management processes	Jitpaiboon et al., 2019; Verburg et al., 2013; Yazici, 2009
Individual performance 1. Achieve the scope objectives 2. Meet time requirements 3. Sense of accomplishment 4. Quality of work	Igbaria & Tan, 1997; Jitpaiboon et al., 2019
Team performance 1. Meet time requirements 2. Team dynamics 3. Alignment of project activities 4. Balance of obligation	Jitpaiboon et al., 2019; Tabassi et al., 2017
Project performance 1. Achieve the scope objectives 2. Meet time requirements 3. Manage cost effectively 4. Quality of deliverables	Chou & Yang, 2012; Jahanshahi & Brem, 2017; Jitpaiboon et al., 2019
Leadership **1.** Create a clear vision **2.** Initiate an atmosphere of mutual trust **3.** Take responsibility for decisions without shifting blame **4.** Embrace authentic diversity **5.** Celebrate organizational and team success	Tabassi et al., 2017; Kouzes & Posner, 2017

TABLE 2. SAMPLE CHARACTERISTICS

Role in the team		Team size	
Project manager	13 %	1	1%
Member	48 %	2 - 4	57%
Team leader	22 %	5 - 6	41%
Organizer	17 %		

TABLE 3. MEAN, STANDARD DEVIATION, AND FACTOR LOADINGS

Constructs & items	Mean	Standard Deviation	Factor Loadings
Tools (success factor)			
Tools1	4.92	1.26	0.73
Tools2	5.27	0.89	0.74
Tools3	4.91	1.02	0.83
Tools4	4.87	1.07	0.86
Tools5	4.73	1.27	0.72
Practice (success factor)			
Practice1	5.13	1.02	0.81
Practice2	5.21	0.89	0.90
Practice3	5.05	0.85	0.86
Practice4	5.02	1.00	0.80
Practice5	4.80	0.99	0.79
Support (success factor)			
Support1	4.72	1.22	0.77
Support2	4.48	1.27	0.76
Support3	4.69	1.15	0.89
Leadership			
Leadership1	4.89	0.94	0.76
Leadership2	5.09	0.87	0.85
Leadership3	5.10	0.89	0.86
Leadership4	5.01	0.92	0.77
Leadership5	5.04	0.86	0.79
Individual Performance			
Individual Performance1	4.15	0.71	0.83
Individual Performance2	4.36	0.76	0.86
Individual Performance3	4.20	0.73	0.78
Individual Performance4	4.47	0.65	0.84
Project Performance			
Project Performance1	5.23	0.86	0.86
Project Performance2	5.29	0.80	0.77
Project Performance3	4.71	1.27	0.71
Project Performance4	5.27	0.86	0.83
Team Performance			
TeamPerformance1	5.35	0.83	0.77
TeamPerformance2	5.22	0.79	0.88
TeamPerformance3	5.15	0.87	0.91
TeamPerformance4	5.05	0.91	0.81

TABLE 4. RELIABILITY AND VALIDITY OF THE MEASUREMENT MODEL

	Cronbach's alphas	CR	TL	PA	SP	LD	IP	PP	TP
Tools (TL)	0.84	0.88	0.78						
Practice (PA)	0.89	0.92	0.39	0.83					
Support (SP)	0.73	0.85	0.48	0.19	0.81				
Leadership (LD)	0.87	0.90	0.54	0.51	0.52	0.81			
Individual performance (IP)	0.85	0.90	0.51	0.61	0.33	0.60	0.83		
Project performance (PP)	0.83	0.87	0.53	0.45	0.37	0.58	0.62	0.79	
Team performance (TP)	0.86	0.91	0.46	0.51	0.40	0.69	0.76	0.54	0.84

5.1 Measurement Model

Each of the measures were examined for construct reliability, convergent validity, and discriminant validity. Indicator reliability was assessed by the factor loadings (Yao et al., 2023). In this study, the factor loadings were all above 0.7 (see Table 4), indicating that all items loaded strongly on their targeted constructs. The measurement model's reliability and validity of all the constructs were also checked in Table 4. Our measures are robust regarding internal consistency because the values of Cronbach's alphas exceeded the recommended thresholds (0.70) (Fornell & Larcker, 1981; Zhang *et al.*, 2022). Composite Reliability (CR) values are also within the acceptable range defined in prior literature (Bagozzi & Yi, 1988; Haq et al., 2019; Zhang et al., 2022).

To confirm discriminant validity, we calculated the square root of the Average Variance Extracted (AVE) for each construct and compared this with its correlation with other constructs (Chin, 1998). In Table 4, the shaded diagonal elements represent squared root of the AVE, and off-diagonal elements are correlations in our study. The values of the squared root of AVE are all greater than the inter-construct correlations, demonstrating sufficient discriminant validity. Convergent validity and discriminant validity can also be confirmed when measure items load highly (Chin, 1998; Zhang et al., 2022).

To rigorously assess the discriminant validity of our model, we also employed the Heterotrait-Monotrait (HTMT) criterion and found that all computed HTMT values fell within the accepted threshold of below 0.85 (Henseler et al., 2015), thereby reconfirming discriminant validity.

All constructs exhibited satisfactory reliability and validity. Cronbach's alpha and composite reliability (CR) values exceeded the 0.70 benchmark, confirming internal consistency. The square roots of the average variance extracted ranged from 0.78 to 0.84, surpassing inter-construct correlations and meeting the Fornell–Larcker criterion for discriminant validity. Furthermore, all HTMT ratios were below 0.85, reinforcing discriminant validity. These results indicate that the measurement items reliably and distinctly represent their underlying constructs, providing a strong foundation for subsequent structural model analysis.

5.2 Structural Model

Since PLS-SEM is a variance-based approach, model fit was assessed using the SRMR, d_ULS, and d_G indices in SmartPLS (Dijkstra & Henseler, 2015) for all three models. The SRMR values for the three models were 0.080, 0.085, and 0.080, respectively, each below the recommended threshold, indicating satisfactory absolute model fit. Likewise, all d_ULS (1.67, 1.81, and 1.68) and d_G (0.73, 0.92, and 0.76) values were below the upper bounds of their 99% bootstrapped confidence intervals, suggesting that the model-implied and empirical correlation matrices did not differ significantly.

The results of path coefficients are presented in Table 5. The results reveal all success factors have significant positive impacted on the leadership. Therefore, hypotheses H2 is confirmed. Similarly, the direct effects of leadership on all levels of project performance are significant. Therefore, hypotheses H3 is confirmed. However, hypothesis H1 is not fully supported.

TABLE 5. PATH COEFFICIENTS

	Paths	Coefficients	T statistics	P value	Significant?
H1	Tools → Individual performance	0.20	1.69	0.05	Yes
H1	Tools → Project performance	0.27	2.21	0.01	Yes
H1	*Tools → Team performance*	*0.08*	*0.56*	*0.29*	*No*
H1	Practice → Individual performance	0.38	3.82	0.00	Yes
H1	Practice → Project performance	0.17	1.69	0.05	Yes
H1	Practice →Team performance	0.21	2.12	0.02	Yes
H1	*Support → Individual performance*	*0.01*	*0.14*	*0.44*	*No*
H1	*Support → Project performance*	*0.06*	*0.64*	*0.26*	*No*
H1	*Support → Team performance*	*0.07*	*0.79*	*0.21*	*No*
H2	Tools → Leadership	0.25	2.11	0.02	Yes
H2	Practice → Leadership	0.35	3.69	0.00	Yes
H2	Support → Leadership	0.48	3.66	0.00	Yes
H3	Leadership → Individual performance	0.29	2.15	0.02	Yes
H3	Leadership → Project performance	0.31	2.26	0.01	Yes
H3	Leadership → Team performance	0.50	3.99	0.00	Yes

The mediating effect was tested by bootstrapping with 5000 subsamples and bias-corrected bootstrap confidence intervals (BCCI) at 0.95 significance level suggested by previous researchers (MacKinnon et al., 2004; Yao et al., 2023). The 95% BCCI exclude zero indicates that the mediating effect is significant. Table 5 shows the results of mediation test for leadership. Therefore, hypotheses H4 is confirmed.

While the results in Table 5 do not fully support hypothesis H1, it is evident that the insignificant relationships observed in Table 5 exhibit full mediation effects in Table 6. The analysis presented in Table 6 demonstrates that leadership plays a crucial mediating role in linking specific success factors to varying levels of performance across individual, project, and team dimensions. The differential impacts observed suggest that the effectiveness of leadership as a mediating force is contingent on both the type of success factor and the targeted performance outcome.

Individual Performance: The data indicates partial mediation for Tools and Practice, with direct effects of 0.20 and 0.38, respectively, complemented by indirect effects through leadership of 0.07 and 0.10. In contrast, Support shows a negligible direct effect (0.01ns) but a notable indirect effect of 0.10, leading to full mediation. This suggests that while Tools and Practice directly influence individual performance, Support primarily enhances individual performance through its impact on leadership qualities.

Project Performance: Similar patterns are observed at the project level, where Tools and Practice again demonstrate partial mediation with more substantial direct effects (0.27 and 0.18, respectively) and smaller yet significant indirect effects (0.08 and 0.10). Support, however, with a small direct effect

(0.06ns) and a larger indirect effect (0.11), results in full mediation, indicating the pivotal role of leadership in translating support into project performance improvements.

Team Performance: The impact of these factors on team performance also varies, with Tools showing negligible direct influence (0.08ns) but a stronger indirect impact (0.12) through leadership, resulting in full mediation. Practice exhibits both strong direct (0.22) and indirect (0.17) effects, classified as partial mediation. Support, like in other categories, shows minimal direct impact (0.07ns) and significant mediation (0.17) through leadership, emphasizing leadership's critical role in enhancing team dynamics and outcomes.

These varied patterns highlight the importance of contextualizing leadership development within project management. The findings suggest that project managers should not only foster leadership skills but also tailor their leadership development strategies according to the specific dynamics of Tools, Practice, and Support to optimize performance across individual, project, and team levels. This strategic alignment could involve enhancing leadership training programs, focusing on the relational aspects of leadership in team settings, or emphasizing decision-making and problem-solving skills for individual performance gains. The ultimate goal is to align these strategies with the expected levels of performance to maximize efficiency and effectiveness within projects.

This finding reveals that leadership functions as a mechanism linking success factors to project performance, but the effects vary depending on the specific factors and performance levels involved. This insight provides valuable managerial implications, suggesting that project managers should adopt appropriate strategies to align their investments with the expected levels of project performance.

TABLE 6. BOOTSTRAP ANALYSIS - MEDIATING EFFECT OF LEADERSHIP

	Meditation Hypothesis	Direct Effect	Indirect Effect	Total Effect	Partial/Full mediation
H4	Tools→Leadership→Individual Performance	0.20	0.07	0.27	Partial
H4	Practice→Leadership→Individual Performance	0.38	0.10	0.48	Partial
H4	Support→Leadership→Individual Performance	0.01^{ns}	0.10	0.11	Full
H4	Tools→Leadership→Project Performance	0.27	0.08	0.35	Partial
H4	Practice→Leadership→ Project Performance	0.18	0.10	0.28	Partial
H4	Support→Leadership→Project Performance	0.06^{ns}	0.11	0.17	Full
H4	Tools→Leadership→Team Performance	0.08^{ns}	0.12	0.20	Full
H4	Practice→Leadership→ Team Performance	0.22	0.17	0.39	Partial
H4	Support→Leadership→Team Performance	0.07^{ns}	0.17	0.24	Full

The mediation model (our proposed model) explains 51.5% of the variance in individual performance, 42.8% in project performance, and 51.6% in team performance. In contrast, the direct-effect model explains 47.3% of the variance in individual performance, 39.2% in project performance, and 39.0% in team performance. These results indicate that incorporating the mediating mechanism substantially improves the

explanatory power of the model across all outcome variables.

VI. CONCLUSION AND IMPLICATIONS

This study contributes to the project success literature by 1) demonstrating that leadership functions as a cross-level mediator linking project structural factors (i.e., tools, practices, and organizational support) to project performance at the individual, team, and project levels and 2) providing empirical evidence that leadership not only has a direct and positive influence on performance outcomes but also enhances the effectiveness of structural factors by transforming them into coordinated actions and improved results.

Theoretically, this research deepens the understanding of leadership as an active mechanism that integrates technical, procedural, and social dimensions of project management. By showing how leadership bridges the gap between structural enablers and behavioral outcomes, this study contributes to advancing multilevel perspectives within the field of project success research.

The results underscore that effective leadership strengthens the positive relationship between project management practices and performance outcomes. Leaders who articulate a clear vision, promote transparent communication, and motivate their teams create a climate of trust and accountability that converts planning, structure, and managerial support into concrete performance gains. Leadership, therefore, acts as a unifying force that aligns individual efforts with team objectives and organizational goals. This reinforces the argument that project management success cannot be achieved through technical competence alone; it also requires strong interpersonal and strategic leadership capabilities.

From a managerial standpoint, the implications are both practical and actionable. Project leaders should prioritize communication, vision, and motivation to transform structural supports into measurable performance improvements. Tools and practices, such as clear scope definition, risk management, and stakeholder alignment, yield the greatest benefits when coupled with leaders who inspire collaboration and ownership among team members. Organizations seeking to improve project outcomes should therefore invest in leadership development programs designed to enhance competencies in vision setting, emotional intelligence, decision-making, and conflict resolution. These leadership skills enable project managers to navigate uncertainty, foster innovation, and maintain momentum throughout the project life cycle.

Moreover, project management frameworks should explicitly integrate leadership as a core component alongside tools, practices, and support systems. By embedding leadership into training, evaluation, and performance processes, organizations can ensure that project managers possess not only technical expertise but also the relational and strategic skills necessary to guide teams effectively. Establishing mentorship and peer learning programs where experienced leaders coach emerging project managers can further strengthen leadership capacity and promote a culture of shared learning and continuous improvement.

To sustain long-term excellence, organizations should implement comprehensive performance metrics that evaluate both leadership effectiveness and project outcomes. Key indicators such as team satisfaction, communication quality, schedule adherence, completion rates, and return on investment (ROI) provide valuable feedback for leadership development and process refinement. Recruiting and promoting individuals with demonstrated leadership potential will also enhance organizational resilience and ensure

continuity in high-performance project management practices.

In conclusion, the integration of effective leadership with project management tools, practices, and support systems is crucial for achieving superior project performance across multiple levels. By conceptualizing leadership as a cross-level mediator, this study contributes to the theoretical expansion of project success research and provides a framework that bridges technical systems and human behavior. Practically, the findings highlight that leadership is the driving force that converts structural resources into collaborative energy, innovation, and measurable success. Organizations that strategically develop and embed leadership capabilities within their project management processes will not only improve performance outcomes but also foster adaptive, learning-oriented cultures capable of sustaining success in complex and dynamic project environments.

VII. Research Limitations and Future Research Directions

Despite these contributions, several limitations of this study should be acknowledged. First, the data were collected from a student sample enrolled in project management courses. Although the findings provide meaningful insights and are transferable to comparable team-based environments, they may not fully capture the dynamics of professional project settings. Future research should validate the model across industries and organizational contexts, incorporating diverse samples from business professionals to enhance generalizability and external validity.

Second, while the student projects analyzed in this study varied in scope and type, they were inherently limited in duration, scale, and resource complexity. The findings may therefore apply primarily to small-scale or educational projects. Future research should conduct cross-industry and cross-cultural validation of the proposed model by testing it in large-scale, high-stakes, or technologically intensive projects, where leadership dynamics and success factors may manifest differently. Such comparative analyses could identify whether leadership's mediating effects hold consistent across different project environments.

Third, the study relied on cross-sectional survey data to examine the relationships among project success factors, leadership, and performance. This design captures perceptions at a single point in time and restricts the ability to infer causality or understand temporal change. Future studies should employ longitudinal designs to track leadership influence and mediation effects throughout various project phases, enabling researchers to assess how leadership behaviors evolve and shape performance over time. Mixed-method approaches that combine quantitative modeling with qualitative insights (e.g., interviews or case studies) could also deepen understanding of leadership's contextual dynamics.

Finally, hypotheses H1 and H4 are partially supported, evidenced by insignificant relationships in Table 5 and the partial mediation effects in Table 6, respectively. Further analysis suggested that leadership 1) partially mediates the impacts of Practice on the performances at the individual, project, and team levels and 2) fully mediates the impacts of Practice on the performances at all three levels. However, the mediation effects of the leadership on the relationship between Tools and performances are mixed. Leadership partially mediates the impacts of Tools on the performances at the individual and the project levels while it fully mediates the impact of Tools on the performance at the team level. While results confirm the role of leadership as an important mediator to project success, other potential mediating mechanisms warrant exploration. Future research could examine the

roles of organizational culture, communication climate, psychological safety, or trust as alternative or complementary mediators between project success factors and performance outcomes. Testing these variables in parallel or integrated models could yield a more comprehensive understanding of how structural, behavioral, and contextual factors jointly drive project success.

By addressing these limitations, future research can enhance the theoretical rigor and practical relevance of project management scholarship, providing richer, evidence-based insights into how leadership and other mediating factors shape success across industries, cultures, and time horizons.

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