Original article

THE MEDIATING ROLE OF TEAM RESILIENCE IN ROAD CONSTRUCTION PROJECT SUCCESS

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Abstract: This study explores how project team resilience influences agile practices, socio-cognitive spaces, and project success in road construction projects in Uganda. Data were gathered via questionnaires from 44 completed projects and analyzed using Partial Least Squares regression with SmartPLS. Findings indicate a strong positive relationship between agile practices, team resilience, and project success. Project team resilience emerges as a critical factor in achieving successful outcomes. Although socio-cognitive space does not directly affect project success, it significantly shapes team resilience, especially in the dynamic context of road construction. Interestingly, project team resilience does not mediate the link between agile practices and project success; instead, agile practices and socio-cognitive space independently influence project success, jointly explaining 58.3% of its variance. The study emphasizes the need to strengthen project team resilience during both the design and implementation stages of road construction projects. Elements like social capital, mastery approaches, and collective efficacy are highlighted as key to building project resilient teams capable of adapting to uncertainty and complexity. A major limitation of the research is its cross-sectional nature, which prevents analysis of changes over time. Future research is advised to adopt a longitudinal approach to better understand how these relationships evolve across a project's lifecycle.

Keywords: Agile Practices; Socio-Cognitive Space; Project Team Resilience; Project Success.

1. INTRODUCTION

In an increasingly complex world of dynamic projects and rapidly evolving environments, management scientists have intensified their search for robust solutions and support systems to enhance project success (Vrchota et al., 2021; Toor & Ogunlana, 2009). A key challenge remains the lack of a universally accepted definition of project success, which continues to frustrate consensus among stakeholders with divergent priorities and interests.

While the literature on project success has evolved over the past three decades (Ika & Pinto, 2022), fundamental gaps persist. Much of the existing research continues to privilege linear, static measures of success, such as time, cost, and scope at the expense of complex, emergent, and behavioral dimensions like designs, stakeholder's satisfaction and sustainability that better reflect modern project realities (Chapman et al., 2021). This creates a critical research gap about how can coordination in balanced

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leadership such as the socio-cognitive space (SCS), consisting of the shared understanding between the project manager and team members create dynamic team-level capabilities, like resilience to help project teams to achieve success under volatile and uncertain conditions.

This study responds to ongoing calls for more integrative, systems-based models of project success (Grant & Pollock, 2011), particularly those that explore how project managers, contractors, public sector stakeholders, and policymakers can enhance project outcomes (Pinto & Slevin, 1988). While Agile practices and adaptive processes are widely recognized for improving efficiency and flexibility, less is understood about how socio-cognitive space and resilience function as dynamic enablers of success in real-world project environments. Gaining a deeper understanding of these mechanisms provides a pathway toward more resilient, learning-oriented project delivery systems. Specifically, this study seeks to uncover how adaptive capacity and team cognition mediate the relationship between Agile practices and project success, particularly in high-stake contexts such as road construction projects.

Beyond meeting technical and performance specifications (Hughes & Kabiri, 2013), successful projects must also adhere to standards of cost, schedule, quality, performance, safety, and environmental compliance (Cheng et al., 2012; Cooke-Davies, 2002). Scholars emphasize the critical roles of contractors, owners, designers, and oversight mechanisms in determining outcomes (Chua et al., 1997). To address success discrepancies, standardized oversight methods are used to compare estimated and actual performance (Abdul Rani et al., 2013; Russell et al., 1997). Success requires persistence, coordination, commitment, and control the elements ineffective without strong administrative support from top management (Kerzner, 2003). Scott-Young and Samson (2008) reported that 15% of projects failed despite receiving half of their budgets due to delays, technology fit issues, and poor oversight. Shenhar and Dvir (1996) found 70% of projects exceeded budgets, highlighting the need for better staff training and collaboration with managers (Saadé et al., 2015). Efficiency is typically defined as meeting time and cost targets as it also crucial, with 60% of project owners citing it as essential (Malach-Pines et al., 2009; Serrador & Turner, 2015). As Atkinson (1999) noted, time, cost, and quality are the "iron triangle" are the most cited success indicators. However, success metrics should be tailored to project type. Complex projects, such as those with fixed-price contracts or high-performing teams, require more nuanced evaluation due to their unique scale and scope (Müller & Turner, 2007).

Globally, construction projects are often plagued by underperformance, cost overruns, delays, and poor workmanship. Road construction is particularly affected (Kakitahi et al., 2013; Love et al., 2016). Key contributing factors include cost variability, delays, and substandard work, often stemming from stakeholder mistrust (Moza & Paul, 2024; Ntayi et al., 2010a). Construction fraud is also a major issue, costing the global industry an estimated $340 billion annually (Sohail & Cavill, 2008). In developing countries, controlling cost overruns is essential to improving public sector construction performance (Odeck, 2004). Failure to do so can undermine national objectives, as seen in Australian projects like the Sydney Cross City Tunnel, Brisbane River City Motorway, and the Clem Jones Tunnel, all marked by cost and time overruns. Similar issues have been reported in Nigeria, the Gaza Strip (Tayeh et al., 2018), the UK (Gledson et al., 2018), Ghana (Ameyaw et al., 2017), and Kenya (Ngacho & Das, 2014).

Uganda, like many developing countries, relies heavily on its road transport sector, which handles over 90% of cargo and passenger movement (Ministry of Works and Transport, 2014). Despite this dependence, the sector faces ongoing performance challenges. Infrastructure projects meet government and client objectives only when completed on time, within budget, and to required quality standards (Atkinson, 1999; Furneaux et al., 2006). In Uganda, however, widespread non-compliance, vague construction standards, and weak governance continue to hinder effective implementation (White & Fortune, 2002). Procurement irregularities further compromise the sector, with an estimated US$258.6 million lost annually to corruption and mismanagement (Agaba & Shipman, 2007). High-profile cases, such as the Kanoni–Ssembabule–Villa Maria (120 km) and Hima–Katunguru (58 km) highways, were investigated for serious implementation issues (New Vision, 2016). In 2020, a court ordered the contractor of the Katosi road project to refund Shs 20 billion (about US$5.56 million) due to procurement fraud. These failures waste public funds, erode trust, and delay national development.

Prior research in developed economies has explored relationships between variables but has largely overlooked the mediating role of project team resilience in project success. Yet, resilient teams are essential for successful project outcomes (Schwaber & Sutherland, 2011). In recent years, interest in project team resilience has grown (Stoverink et al., 2020), focusing on how teams overcome adversity (Alliger et al., 2015; Hartmann et al., 2020). In stable environments, resilience has been linked to improved team performance (Meneghel et al., 2016), cohesion (West et al., 2009), service recovery (Yang et al., 2015), and performance maintenance (Vogus & Sutcliffe, 2012). However, how resilience develops in project-based environments remains unclear. Unlike other teams, project teams must perform under uncertainty, pressure, and adversity (Chiocchio et al., 2015). Understanding resilience in these contexts can shed light on how projects form, evolve, and succeed.

This study draws on Complex Adaptive Systems (CAS) Theory (Holland, 1995), which explains how project success emerges from dynamic, non-linear interactions among team members, stakeholders, and environmental factors. It emphasizes team resilience, adaptive work approaches, and collaborative environments that support continuous learning and coordination under uncertainty. Flexible structures and feedback loops enhance a system's capacity to self-organize and respond effectively, improving outcomes.

This study hypothesizes that project team resilience mediates the relationship between agile practices, socio-cognitive space, and project success in the public road construction sector. The remainder of this article presents the theoretical framework, hypotheses, methods, results, discussion, conclusions, and implications.

2. THEORETICAL FOUNDATION, LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 Theoretical foundation

This study is grounded in Complex Adaptive Systems (CAS) theory by Holland (1995), which describes systems that evolve through learning and adaptation. These systems often face sudden, unpredictable changes, requiring organizations to perform their roles while responding effectively to client needs. Agents within such systems form relationships with other organizations, influencing outcomes (Stacey, 2007). To navigate this dynamic environment, organizations must enable agents to learn from experience, interpret their surroundings, and adapt accordingly (Day, 2014). In road construction, success relies on project team resilience and Agile practices. Adaptive systems are marked by responsiveness, flexibility, reactivity, and proactivity, shaped by input from other agents (Nilsson & Gammelgaard, 2012; Tukamuhabwa et al., 2015). CAS characteristics of adaptability, Agile practices, and project team resilience, significantly impact project success (Cachia & Holgado Ramos, 2020; Mutebi et al., 2020a; Safarpour et al., 2020). Socio-cognitive space supports adaptability by fostering empowerment, shared mental models, and self-management as key features of self-organizing teams (Aga et al., 2016).

In complex environments, project success is multifaceted. Traditional metrics like time, cost, and quality, known as the "iron triangle" (Atkinson, 1999) are no longer sufficient. While useful for basic assessment, both research and practice now emphasize broader direct and indirect success indicators. CAS theory thus offers a relevant framework for understanding road construction success in complex, dynamic contexts.

2.2 Literature review

2.2.1 Agile practices and project success

Agile practices encompass a set of values, tools, and techniques designed to support project execution in fast-changing and complex environments. These approaches encourage collaboration, adaptive planning, and iterative feedback to promote flexibility and responsiveness (Lee & Xia, 2010; Recker et al., 2017). Although initially developed for software development, Agile principles such as continuous stakeholder involvement and empowered teams are increasingly used in sectors like construction, where shifting conditions and stakeholder demands are common (Gemünden et al., 2018).

Project success has conventionally been assessed through the "iron triangle" framework, which focuses on the interrelated dimensions of time, cost, and quality as the primary indicators of performance (Atkinson, 1999). Studies indicate that a considerable proportion of construction projects experience budget overruns, often exceeding initial cost estimates. The main causes include changes in the regulatory environment, inaccurate estimation of material and labour costs, and unpredictable external economic conditions. However, evidence from economic modelling shows that organizations adopting sustainable development and adaptive management principles are better able to mitigate these risks, reducing the likelihood of budget deviations compared to those using traditional project management approaches (Malykhin et al., 2025). Yet more recent studies highlight that success also includes strategic fit, stakeholder satisfaction, innovation, and lasting organizational value (Shenhar et al., 2001; Turner & Zolin, 2012). In the construction sector, success further hinges on the ability to manage dynamic site conditions, coordinate diverse teams, and ensure long-term sustainability (Martinsuo & Hoverfält, 2018). Agile practices resonate with the principles of Complex Adaptive Systems (CAS) theory, which sees projects as evolving systems influenced by feedback loops, decentralization, and emergent behavior (Cicmil et al., 2006; Holland, 1995). Research confirms that Agile fosters stakeholder engagement, enhances cross-functional collaboration, and improves responsiveness to change (McHugh et al., 2011; Serrador & Pinto, 2015). Nonetheless, a mere checklist-style implementation "doing Agile" often fails to deliver benefits if the underlying mindset is embraced (Sandstø & Reme-Ness, 2021). As Hunt (2018) explains, cultural readiness, team maturity, and depth of adoption are key to realizing the full potential of Agile (Conforto et al., 2016).

H_1: Agile practices are positively related to project success.

2.2.2 Agile practices and project team resilience

Resilience within project teams refers to their ability to absorb shocks, adapt to challenges, and maintain performance during disruptions (Naderpajouh et al., 2020; Stoverink et al., 2020). In high-stakes sectors such as road construction, this capacity becomes vital when facing unpredictable delays, shifting requirements, and stakeholder tensions. Despite extensive project management knowledge, persistent delays afflict 33% of projects, averaging a 47-month setback as of August 2021 in India. Agile fosters resilience by promoting decentralized decision-making, adaptive routines, and real-time feedback (Savelsbergh et al., 2012). Tools like sprint planning, stand-up meetings, and retrospectives build teams' awareness and cohesion, helping them navigate stressors with agility (Schwaber & Sutherland, 2011). This adaptability proves especially beneficial in construction, where Agile routines help manage evolving specifications and site- level complexities (Morcov et al., 2020).

Frick et al. (2018) underscore that psychological safety, shared goals, and distributed leadership are critical components of resilience many of which are baked into Agile practice. The leadership style of project managers, particularly those who demonstrate flexibility and responsiveness, has been found to significantly correlate with project success. Furthermore, the experiences, observations, and interactions among project staff play a vital role in shaping the performance outcomes of public road construction projects in Uganda. In addition, employees who adopt Agile routines exhibit greater team adaptability and resilience, which buffer against work-related stress and, consequently, enhance overall project outcomes (Ssenyange & Chodokufa, 2024). However, the relationship between leadership style, agile practices, and project success may not be linear, as contextual and structural elements such as institutional frameworks, organizational culture, and resource availability often exert a greater influence on project performance. Additionally, staff interactions can sometimes create ambiguity or conflict if not effectively managed, while bureaucratic systems in public projects may constrain the flexibility needed for Agile practices to thrive (Sandstø & Reme-Ness, 2021; Turner & Müller, 2005). From the CAS perspective, resilience is not a static trait but an emergent outcome of ongoing team interactions in dynamic environments (Holland, 1995).

H_2: Agile practices are positively related to project team resilience.

2.2.3 Project team resilience and project success

Resilience in teams has been conceptualized both as a set of adaptive processes and as a latent capability (Hartmann et al., 2020; Mathieu et al., 2008). For this study, we adopt the capacity view, treating resilience as a foundational team trait that supports anticipation, adjustment, and recovery in the face of disruption (Hartmann & Jüpner, 2020). This approach aligns with CAS theory, which emphasizes emergent behaviors as key drivers of systemic outcomes. Research shows that resilient teams contribute meaningfully to project success by staying focused, managing uncertainty, and maintaining group cohesion under pressure (Chapman et al., 2021; Kossek & Perrigino, 2016). In construction, where coordination breakdowns and shifting regulations are frequent, resilience is often linked to reduced risk exposure and improved budget adherence (Kutsch & Hall, 2016; Radhakrishnan et al., 2022).

H_3: Project team resilience is positively associated with project success.

2.2.4 Socio-cognitive space and project team resilience

Socio-cognitive space captures the psychological, relational, and shared mental conditions that support mutual understanding and collaboration among project team members (Aga et al., 2016). It flourishes in environments shaped by transformational leadership and participatory governance, which promote autonomy, trust, and open dialogue (Braun et al., 2013). In project-based contexts, especially in construction where team composition is often fluid, a robust socio-cognitive space enhances trust, encourages knowledge sharing, and enables teams to adapt effectively under pressure (Lengnick-Hall et al., 2011; West et al., 2009). Bennett et al. (2010) stress that shared mental models and team cohesion play a central role in building resilience, especially when team members must jointly address time-sensitive challenges.

H_4: Socio-cognitive space is positively related to project team resilience.

2.2.5 Socio-cognitive space and project success

Socio-cognitive space has gained attention as a catalyst for project success, especially in environments marked by uncertainty, interdependence, and stakeholder complexity (Anantatmula, 2010; Zwikael & Unger-Aviram, 2010). Transformational leaders shape these environments by encouraging self-leadership, promoting empathy, and reinforcing a shared vision (Burke et al., 2006). Scott-Young and Samson (2008) demonstrate that alignment in team values and cognition leads to faster decision-making and greater innovation both essential in large infrastructure projects. Meanwhile, Keegan and Den Hartog (2004) argue that the emotional tone of a project team directly influences its ability to absorb leader influence and sustain high performance.

H_5: Socio-cognitive space is positively related to project success.

2.2.6 Agile practices, project team resilience, and project success

Agile frameworks foster resilience by embedding flexibility, transparency, and a learning- oriented mindset in daily operations (Karlsen & Berg, 2020; McHugh et al., 2011). These qualities, in turn, help teams maintain quality and continuity amid disruptions

(Pfutzenreuter et al., 2021) Grounded in CAS theory, this study proposes that resilience acts as a key mechanism through which Agile practices influence project outcomes. Empirical findings show that when Agile is implemented with commitment and coherence, both the team's responsiveness and its long-term effectiveness improve (Amaral et al., 2015; Nahmias et al., 2010).

H_6: Project team resilience mediates the relationship between Agile practices and project success.

2.2.7 Socio-cognitive space, project team resilience, and project success

Socio-cognitive space lays the foundation for resilience by fostering shared goals, strong interpersonal relationships, and psychological readiness. As teams become more resilient, they are better equipped to respond proactively to complexity and unpredictability key ingredients for achieving project success (Gundersen et al., 2012; Kozlowski & Ilgen, 2006). Supporting this view, Zhu et al. (2005) and Sohmen (2013) find that teams with aligned mental models and a collaborative culture are more likely to perform well under pressure and deliver consistent results.This study is based on conceptual frame work in Figure 1.

H_7: Project team resilience mediates the relationship between socio-cognitive space and project success.

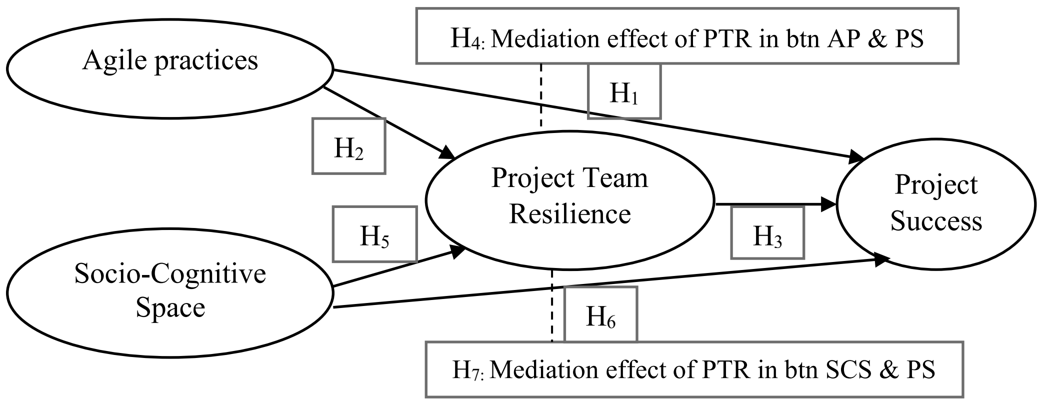

Figure 1: Theoretical framework

3. METHODS

3.1 Research design

This study adopted a cross-sectional, descriptive quantitative survey design, ideal for capturing perceptions at a single point in time (Creswell & Plano Clark, 2023). The design is aligned with a positivist paradigm and a reductionist view that emphasizes objective measurement of relationships among variables (Saunders & Darabi, 2024). The research targeted 49 completed road construction projects implemented under Uganda's National Development Plan II (NDP II) from 2015 to 2022. This timeframe was selected because project success can only be accurately evaluated after completion.

Based on Krejcie and Morgan's (1970) sample size table, 44 projects were selected. The unit of analysis was the road construction project, while the unit of inquiry included engineers, project managers, site supervisors, contract managers, and district technical officers directly involved in implementation. These professionals were considered knowledgeable about team dynamics and project performance (Bryman et al., 2014).

A simple random sampling technique without replacement was applied. Each project was assigned to a paper slip; five were randomly excluded using a rotary method, and the remaining 44 comprised the final sample.

3.2 Nonresponse bias tests

We tested for non-response bias and common method variance to ensure the sample represented the population. By comparing early and late respondents, as well as organizational and respondent characteristics such as number of employees, years of operation, road project category, tenure, sex, age, and educational background. We used a multivariate Chi-square test to assess non-response bias. Consistent with Esser and Vliegenthart (2017), no significant differences were found between early and late respondents across dependent, independent, intermediate, or control variables at the 95% confidence level ($p > 0.05$).

3.3 Common method bias

To eliminate potential common method bias, we applied both procedural and statistical remedies (Podsakoff et al., 2003). Procedurally, we carefully designed the study protocol before data collection, selecting clear, unambiguous measurements to ensure content validity. The instrument was in English and pretested with academicians and project management experts fluent in the language for content validity. Statistically, we first conducted Harman's single-factor test by loading all variables into a principal component analysis using the un-rotated solution. The analysis revealed eleven factors with eigenvalues greater than one, indicating no common method bias. Next, we assessed vertical and lateral inner Variance Inflation Factor (VIF) values in the PLS-SEM model, following Kock and Hadaya (2018). As shown in Table 1, all inner VIF values were below the 3.3 threshold recommended by Kock (2015), suggesting common method bias is unlikely to affect our results.

3.4 Measurement of study variables

In this study, all the measurement for the study variables were adapted from previous scholars. Project success was measured with 12 items capturing the six measures of cost, client, use, satisfaction, performance, specifications and covering time as used by Imam and Zaheer (2021). Agile practices measured with 50 items taping the constructs of Iteration Planning (07), Iterative Development (06), Continuous Integration and Testing (05), Stand-Up Meetings (05), Customer Access (05), Customer Acceptance Tests (05), Retrospectives (05) Co-Location (05) and Self-Organization (08) (So and Scholl (2009). Each of the items for Project success and Agile practices were anchored using a five – point Likert scale (1) = Never; (2) = Rarely;(3) = Sometimes; (4) = Often;(5) = Always. Socio-Cognitive Space is measured in terms of empowerment, self-management and shared mental models according to Müller and Antoni, 2020). The three constructs of socio cognitive space are measured using 56 items; empowerment (28) items adapted from Arnold, et al., (2000); self-management (13) items (Al-Smadi & Bani-Abduh, 2017) and shared mental models (15) items (Drouin et al., 2021; Sinval et al., 2020). Each item was scored on a five–point Likert scale (1) = completely Disagree; (2) = Slightly Disagree; (3) = Slightly Agree;(4) = Agree and (5) = Completely Agree. Project Team Resilience is measured according to Sharma and Sharma, (2016) using group structure, mastery approaches, social capital and collective efficacy. The practice of project team resilience was tapped with (51) items in the questionnaire. Each item was scored on a five-point Likert scale (1) = Strongly Disagree; (2) = Disagree; (3) = neither agree nor disagree; (4) = Agree and (5) = Strongly Agree

3.5 Instrument validation

We used Kaiser-Meyer-Olkin (KMO) and Bartlett's test to determine if the data were suitable for Confirmatory Factor Analysis (CFA) in PLS analysis. As general, KMO values should be higher than 0.7 and Bartlett's test should be significant ($p > 05$). Project success, agile practices, socio-cognitive space, and project team resilience all had KMO values above 0.7 (.712, .722, .744 and .714 respectively, with approximate Chi-Squares of 173.021; 173.021; 618.135; and 642.719). Bartlett's test of sphericity indicies are also significant (Project Success (df = 45; Sig = .000); Agile Practices (df = 55; Sig = .000); Socio-Cognitive Space (df = 120 Sig = .000) and Project Team Resilience (df = 153 Sig = .000) indicating adequate samples and data for confirmatory factor analysis. To evaluate both reliability and validity, we also run a reflective-formative higher-order construct (HOC) PLS-SEM measurement model (Sarstedt et al., 2019). In Sarstedt, et al. (2019), items with factor loadings above 0.708 are considered reliable. Therefore, only items meeting these criteria were considered.

The Cronbach's Alpha and Composite reliability values were above 0.7 for both the HOC and LOC, indicating internal consistency of study variables (Hair & Sarstedt, 2021; Shamim et al. 2017). Furthermore, an AVE value above 0.5 confirms convergent validity (Hair & Sarstedt, 2021). (see Table 1 and 2)

Table 1: Reliability and validity Lower Order Construct

Variables	Constructs	Item Codes	Item Loadings	Cronbach's Alpha	rho_A	CR	(AVE)
Agile Practices	Customer Acceptance	APCA3	0.871	0.722	0.728	0.878	0.782
		APCA4	0.898				
	Customer Acceptance Test	APCAT04	0.851	0.744	0.749	0.814	0.686
		APCAT05	0.805				
	Interactive Development	APID05	0.889	0.754	0.756	0.89	0.802
		APID06	0.902				
	Interactive Planning	APIP01	0.938	0.8	0.849	0.907	0.83
		APIP02	0.884				
	Retrospectives	APR01	0.807	0.821	0.835	0.882	0.652
		APR02	0.893				
		APR05	0.796				
		APR06	0.726				
	Standup Meetings	APSM02	0.916	0.831	0.845	0.899	0.749
		APSM03	0.889				
		APSM05	0.787				
	Self-organization	APSO04	0.876	0.646	0.684	0.778	0.638
		APSO05	0.714				
Project Success	Performance	PS04	0.837	0.635	0.636	0.811	0.683
		PS05	0.815				
	Client Use	PS06	0.735	0.66	0.662	0.815	0.596
		PS10	0.817				
		PS12	0.763				
	Effectiveness	PS07	0.879	0.724	0.725	0.878	0.783
		PS11	0.891				
Project Team Resilience	Social Capital	PTRNT02	0.822	0.885	0.89	0.915	0.684
		PTRNT03	0.824				
		PTRNT04	0.801				
		PTRNT05	0.869				
		PTRNT06	0.818				
	Mastery Approaches	PTRTF03	0.851	0.837	0.85	0.901	0.753
		PTRTF04	0.895				
		PTRTLO03	0.856				
	Collective Efficacy	PRPE01	0.859	0.807	0.808	0.886	0.721
		PRPE02	0.823				
		PRPE03	0.865				
Socio-Cognitive Space	Empowerment	SCE19	0.771	0.886	0.893	0.916	0.687
		SCE23	0.899				
		SCE24	0.832				
		SCE25	0.822				
		SCE26	0.816				
	Self-management	SCSM09	0.929	0.833	0.834	0.923	0.857

	SCSM11	**0.923**				
Mental Models	**SCSMM08**	**0.874**	**0.874**	**0.886**	**0.908**	**0.665**
	SCSMM09	**0.836**				
	SCSMM10	**0.763**				
	SCSMM12	**0.758**				
	SCSMM13	**0.840**				

Composite Reliability (CR); Average Variance Extracted (AVE)

Table 2: Reliability and validity Higher Order Construct (HOC)

HOC	Cronbach's Alpha	rho_A	CR	AVE
Agile Practices	0.867	0.879	0.890	0.734
Project Success	0.753	0.758	0.825	0.687
Project Team Resilience	0.890	0.895	0.910	0.719
Socio-Cognitive Space	0.874	0.885	0.897	0.736

Composite Reliability (CR); Average Variance Extracted (AVE)

As recommended by Hair and Sarstedt (2021), hetero-monotrait (HTMT) ratios of 0.85 or lower confirm discriminant validity. The HOC and LOC variables met this criterion as well, as shown in Tables 3 and 4.

Table 3: Discriminant validity: Heterotrait-Monotrait Ratio (HTMT) for HOC

	1	2	3	4
Agile Practices (1)				
Project Success (2)	0.642			
Project Team Resilience (3)	0.494	0.672		
Socio-Cognitive Space (4)	0.626	0.685	0.651	

Table 4: Discriminant validity: Heterotrait-Monotrait Ratio (HTMT) for LOC

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Client Use (1)																
Collective Efficacy (2)	**0.63**															
CustomerAcceotanceTest (3)	**0.67**	**0.59**														
CustomerAcceptance (4)	**0.45**	**0.45**	**0.82**													
Effectiveness (5)	**0.62**	**0.68**	**0.45**	**0.46**												
Empowerment (6)	**0.50**	**0.51**	**0.25**	**0.50**	**0.70**											
Interactive Development (7)	**0.69**	**0.51**	**0.81**	**0.53**	**0.23**	**0.32**										
Interactive Planning (8)	**0.44**	**0.33**	**0.78**	**0.21**	**0.39**	**0.11**	**0.67**									
Mastery Approaches (9)	**0.54**	**0.85**	**0.35**	**0.54**	**0.61**	**0.48**	**0.49**	**0.26**								
Mental Models (10)	**0.60**	**0.62**	**0.46**	**0.41**	**0.59**	**0.48**	**0.49**	**0.18**	**0.62**							
Performance (11)	**0.81**	**0.44**	**0.53**	**0.52**	**0.37**	**0.71**	**0.77**	**0.37**	**0.43**	**0.36**						
Restrospectives (12)	**0.66**	**0.47**	**0.71**	**0.55**	**0.29**	**0.67**	**0.62**	**0.42**	**0.41**	**0.48**	**0.58**					
Self management (13)	**0.52**	**0.63**	**0.39**	**0.30**	**0.51**	**0.30**	**0.16**	**0.10**	**0.49**	**0.36**	**0.10**	**0.29**				
Self organisation (14)	**0.74**	**0.39**	**0.37**	**0.66**	**0.51**	**0.75**	**0.63**	**0.21**	**0.56**	**0.57**	**0.80**	**0.67**	**0.40**			
Social Capital (15)	**0.59**	**0.42**	**0.15**	**0.38**	**0.62**	**0.57**	**0.29**	**0.18**	**0.58**	**0.28**	**0.56**	**0.27**	**0.31**	**0.70**		

Standup Meetings (16)	**0.44**	**0.44**	**0.50**	**0.35**	**0.37**	**0.28**	**0.37**	**0.25**	**0.35**	**0.47**	**0.11**	**0.37**	**0.73**	**0.21**	**0.16**

Finally, we assessed the significance of formative LOC outer weights using Sarstedt et al. (2019). P-values and BCa range show that all outer weights of LOCs on their respective variables are significant at $p < 0.001$, confirming reflective-formative modeling (see results in Table 5).

Table 5: Significance of outer weights

	weight	**T Stat**	**P Values**	**Bca**
ClientUse -> ProjectSuccess	0.558	8.535	0.000	0.468 - 0.745
Effectiveness -> ProjectSuccess	0.394	3.881	0.000	0.254 - 0.647
Performance -> ProjectSuccess	0.331	4.253	0.000	0.186-0.480
CustomerAcceotanceTest -> AgilePractices	0.160	4.866	0.000	0.109-0.230
CustomerAcceptance -> AgilePractices	0.201	6.528	0.000	0.146-0.262
InteractiveDevelopment -> AgilePractices	0.216	6.101	0.000	0.156-0.301
InteractivePlanning -> AgilePractices	0.172	3.285	0.001	0.055-0.263
Restrospectives -> AgilePractices	0.358	7.046	0.000	0.071-0.212
Selforganisation -> AgilePractices	0.144	3.917	0.000	0.108-0.353
StandupMeetings -> AgilePractices	0.218	3.507	0.000	0.268-0.466
MentalModels -> SocioCognitiveSpace	0.502	7.522	0.000	0.382-0.645
Empowerment -> SocioCognitiveSpace	0.581	8.766	0.000	0.458-0.717
Selfmanagement -> SocioCognitiveSpace	0.185	3.934	0.000	0.082-0.269
MasteryApproaches -> ProjectTeamResilience	0.343	8.581	0.000	0.235-0.410
CollectiveEfficacy -> ProjectTeamResilience	0.319	6.945	0.000	0.272-0.427
SocialCapital -> ProjectTeamResilience	0.544	7.925	0.000	0.404-0.661

3.6 Data analysis

Data analysis was conducted using SmartPLS version 4.0.8.3, following the two-step approach by Hair and Sarstedt (2021). First, the measurement model was evaluated for reliability and validity. Next, the structural model was assessed to test hypothesized relationships. Variance-based Structural Equation Modeling (PLS-SEM) was chosen for its robustness in handling complex models with formative and reflective constructs, as well as its suitability for prediction-oriented research with smaller sample sizes (Hair & Sarstedt, 2021; Ramli et al., 2018).

Bootstrapping with 5,000 subsamples was used to test the significance of path coefficients, and mediation analysis was carried out using indirect effects in line with Preacher and Hayes (2008).

4. RESULTS

4.1 Respondent characteristics

According to the results, 75.8 percent of respondents were males and 24.2 percent were females. Among the respondents, 30.3% were in the 31-35 age group, followed by 41–45-year-olds and then 36–40-year-olds. In addition, 68.2 percent of respondents had a Bachelor's degree, while 27.3 percent had a Master's degree. A total of 57.6% of the respondents have been involved in road construction projects for two to six years. In addition, 24.2% had worked in road construction for seven to 11 years. Further, 80.3 percent of respondents worked on asphalt-paved roads. 27.3% of respondents were contract managers, while 24.2% were road maintenance engineers.

4.2 Correlations among study variables

Correlations between variables were determined using Pearson correlations (r). In regression analysis, linearity assumes relationships between variables. The correlation results in Table 6 allow us to test hypotheses using partial least structural equation modeling (PL-SEM)

Table 6: Correlations among study variables

Study Variables	Mean	STD	1	2	3	4
Agile Practices			1			
Socio-Cognitive Space			.652**	1		
Project Team Resilience			.432**	.653**	1	
Project Success			.575**	.678**	.578**	1

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

Source: Primary data

4.2 Structural model

The structural model assessment aimed to evaluate the strength and significance of hypothesized relationships and to gauge the model's overall explanatory power. Consistent with recommendations by Hair and Sarstedt (2021) and Sarstedt et al. (2019), the evaluation process included checks for multicollinearity, significance and magnitude of path coefficients, the coefficient of determination (R^2), and predictive relevance (Q^2). Inner VIF values were inspected to assess multicollinearity, and all values fell below the critical threshold of 3.3 (Kock & Hadaya, 2018), indicating that collinearity among predictor constructs was not a concern.

To test the significance of the structural paths, a nonparametric bootstrapping procedure with 5,000 resamples was conducted. This method is suitable for PLS-SEM, which does not assume data normality, and it generates robust standard errors and confidence intervals for path estimates (Dash & Paul, 2021; Hair & Sarstedt, 2021).

Importantly, in response to reviewer feedback regarding higher-order constructs, the study employed the two-stage approach for estimating reflective-formative higher-order constructs. In the first stage, latent variable scores for all lower-order reflective constructs were extracted. These scores were then used as indicators in the second stage to model the higher-order formative constructs (Becker et al., 2012; Sarstedt et al., 2019). This technique enhances model parsimony and minimizes multicollinearity risks associated with modeling complex hierarchical structures (Ringle et al., 2012).

The model's explanatory power was assessed using R^2 values, which reflect the proportion of variance in the endogenous constructs explained by the exogenous variables. To evaluate predictive relevance, Stone-Geisser's Q^2 values were obtained through the blindfolding procedure. All Q^2 values exceeded zero, indicating that the model has acceptable predictive capability (Hair & Sarstedt, 2021). Together, these indicators confirm the model's robustness and appropriateness for hypothesis testing in this study.

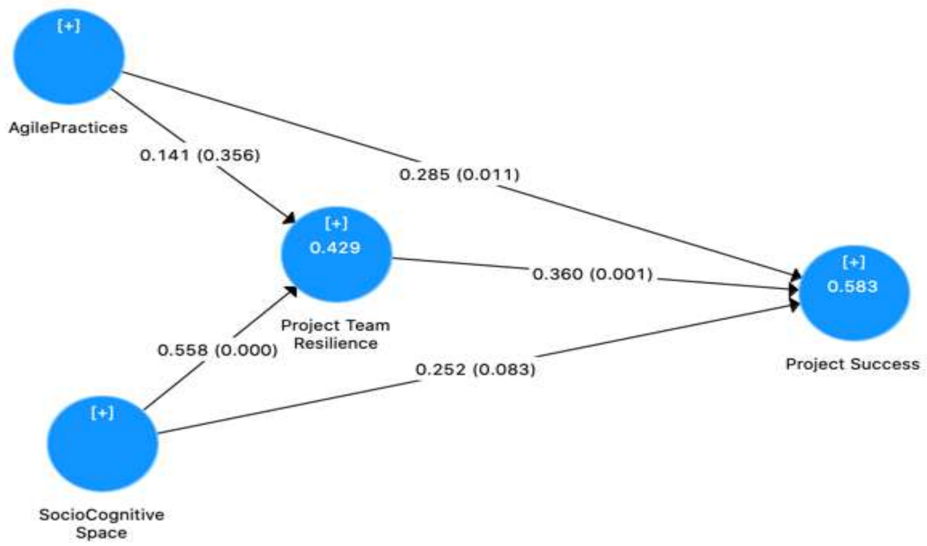

Figure 2: PLS-SEM for Project success model

4.2.1 Hypotheses testing results

Based on Table 7, all hypotheses except H_2 and H_5 were supported. This study examined two mediation hypotheses along with direct effects. Here are the results of the first mediation (H_4). Based on the p-value of 0.05, H_1 corresponds to a significant association between AP and PS. Based on Baron and Kenny's (1986) approach to mediation analysis, the direct path offers strong evidence of partial mediation or no mediation. Therefore, this study examined the potential mediation effect of PTR on the association between AP and PS. We examined first the direct effects of AP and PTR and PTR and PS. According to the p-values, AP and PTR had no direct impact (H_2), but PTR and PS had a significant direct impact (H_3).

Here (H_2) has a t-value of 0.923 and (H_3) has a t-value of 3.197. However, the indirect (mediation) path (H_4) (H2: 0.923; H_3: 3.197) has a lower interaction value than the direct path (H_1). Project team resilience (PTR) does not mediate between agile practices and project success. Second mediation hypothesis (H_7) results were as follows. Similarly, to the first mediation hypothesis (H_4), we proposed a direct link between SCS and PS (H_5). As discussed above, a p-value > 0.05 met Baron and Kenny's (1986) criterion. Hence, the study tested for a potential mediation effect of PTR on the association between SCS and PS. The direct association between PS and PTR (H_3) as well as the association between PS and SCS (H_6) were examined whose p-values were < 0.05. Indirect path interaction value (t-value: H_3 = 3.197; H_6 = 4.123) is greater than direct path interaction value (t-value: H_5 = 1.731). Table 7 and figure 2 confirm that PTR partially mediates the association between SCS and PS.

Furthermore, the effect size (f^2) is .331 (SCS & PTR); .177 (PTR & PS); .116 (AP & PS); .069 (SCS & PS) and .021 (AP & PTR). Cohen (1988) considers these sizes large, medium, and small, respectively. Additionally, R^2 values of 0.429 and 0.583 for project team resilience and success confirm the predictive relevance model (Hair, et al., 2017). Similarly, Q^2predict values for project success (0.553; 0.469) and project team resilience (0.379; 0.366) confirm the model's predictive relevance (Peng & Lai, 2012). Finally, we tested the model's out-of-sample predictive power using Shmueli et al.'s (2019) PLS predict procedure (ten folds, ten repetitions). The MAE and RMSE values for Project success (0.603; 0.742) and project team resilience (0.648; 0.810) support the model predictive power for project success as the PLS-SEM analysis produces smaller predictive errors (in terms of MAE and RMSE) compared to the naïve linear benchmark model (Sarstedt et al., 2019).

Table 7. Hypotheses testing results

Direct Hypotheses	**β**	**T Stat**	**P Values**	**Bca**	**F^2**	
AP -> PS	0.285	2.549	**0.011**	0.059 - 0.499	0.116	
AP -> PTR	0.141	0.923	**0.356**	0.166 - 0.432	0.021	
PTR -> PS	0.36	3.197	**0.001**	0.116 - 0.567	0.177	
SCS -> PS	0.252	1.731	**0.083**	0.084 - 0.490	0.069	
SCS -> PTR	0.558	4.123	**0**	0.291 - 0.818	0.331	
Indirect Hypotheses	**β**	**T Stat**	**P Values**	**Bca**		
AP -> PTR -> PS	0.051	0.84	**0.401**	0.054 - 0.199		
SCS -> PTR-> PS	0.201	2.163	**0.031**	0.068 - 0.438		
Total Effects	**β**	**T Stat**	**P Values**	**Bca**		
AP -> PS	0.336	3.257	**0.001**	0.128 - 0.536		
AP -> PTR	0.141	0.923	**0.356**	0.166 - 0.432		
PTR -> PS	0.36	3.197	**0.001**	0.116 - 0.567		
SCS -> PS	0.453	4.615	**0**	0.229 - 0.617		
SCS -> PTR	0.558	4.123	**0**	0.291 - 0.818		
Predictive Criteria	R^2	Adj. R^2	Q^2	RMSE	MAE	Q^2 Predict
PS	0.583	0.562	0.553	0.742	0.603	0.469
PTR	0.429	0.411	0.379	0.81	0.648	0.366

Agile Practices (AP); Socio-Cognitive Space (SCS); Project Team Resilience (PTR); and Project Success (PS)

Source: Peimary data

5. DISCUSSION

Agile practices are positively correlated with Project success. Agile practices such as retrospectives are likely to influence a project's success. During road construction projects, the road construction team actively gathers lessons learned, and then individuals refine them. As a result, a road section is completed and lessons learned are shared. Agile practices improve targets' performance and result in sustainable results. Similarly, customer acceptance tests, such as timely responses to contractors and feedback from the contract manager, improve efficiency. Agile approaches respond to changing customer needs quickly and efficiently. Furthermore, these frameworks contribute to project success (Recker et al., 2017; Serrador & Pinto, 2015). In accordance with CAS theory (Holland, 1995), employee interaction promotes learning and innovation.

Agile practices are positively correlated with project team resilience in the road construction sector, but not significantly. Because road construction projects have a blueprint with limited flexibility, agile practices may not support team resilience. Interactive planning and active participation in meetings may not necessarily contribute to project team resilience due to limited adjustments to project design. The project's performance could be negatively affected if the phased road segments aren't completed by the deadline. Additionally, the project team may not be able to self-organize while the road is being built, which may prevent them from keeping each other updated. As a result, the project team does not commit to resolving challenges during stand-ups. In support of this, Kutsch and Hall (2016) argue that agile practices may not necessarily affect team resilience without anticipating and managing risks in complex and uncertain environments, which are critical factors in delivering successful projects. In this study, the findings support the CAS theory (Holland, 1995), which emphasizes the self-organization of project teams to mitigate project risks.

The resilience of project teams is significantly associated with project success of road construction projects. A project team's social capital is based on effective communication, information sharing, and a common language. In road construction, project team members use common terms and communicate in an understandable manner, improving efficiency. Furthermore, mastery approaches facilitate the exploration of alternative ways of accomplishing project tasks. In this process, team members share information about the project's progress and come up with creative ways to complete tasks. The collective efficacy of the project team, which refers to each member working competently and handling their share of the work when asked, also has a significant impact. The most successful project management results usually occur when the members of the project team manage their responsibilities well. Hartmann and Jüpner, 2020), and Kossek and Perrigino (2016) argue that thriving under adversity, resolving conflicts productively, and building beneficial relationships are essential to project success.

There is no positive or significant correlation between socio-cognitive spaces and project success. Social cognitive spaces, such as employee empowerment, may not necessarily influence project success. A project manager may not explain the project objectives or team roles adequately. There may be concerns among the project manager and the project objectives about the team's well-being. A project manager who fails to develop the resilience of his or her team. He or she treats team members unequally, fails to discuss team concerns patiently, and doesn't care about the success of the team. Furthermore, mental models may not help the project manager understand the roles. These models may not interact with others without building resilient project teams. Project managers may not understand the appropriate methods of communication, strategic priorities, and implications of strategic decisions to achieve project success. As well, the project team may not be capable of self-management.

Inexperienced project managers are likely to make this mistake if they don't realize how objectives interact. This usually happens because the project manager lacks the necessary knowledge, skills, and abilities. Leaders cannot influence performance behaviors without socio-cognitive spaces, as Drouin et al. (2021) emphasize. For achieving objectives in a dynamic environment, CAS theory emphasizes leadership lessness and self-organization.

As a result, socio-cognitive space positively and significantly impacts the resilience of project teams in road construction projects. To achieve project objectives, the project manager must communicate patiently with project team members, using clear communication patterns. Patterns are useful for building resilient teams. Sharing project objectives empowers employees, and the project manager shows concern for them. The project manager's understanding of the strategic priorities and implications of strategic decisions contributes to the building of project team resilience. Managing the project team self-sufficiently is achieved by knowing the most effective communication methods to build resilience within the team. According to Kissi et al. (2013), the degree to which team members perceive their work environment as supportive influences their resilience, motivation, energy, and efforts during project implementation. As a result of the propagation of information, resources, and materials, project success can be reflected in the features of a CAS, such as adaptability, Agile practices, self-management, and project team resilience.

Results indicate that the resilience of project teams does not mediate Agile practices and project success in road construction projects. Agile practices and project success may not be affected by the resilience of the project team. Sharing information among project managers is unlikely to contribute to project success since members may not speak the same language. Further, the results suggest that mastery approaches of project team members with room to experiment with alternative approaches to implementing project tasks are unlikely to be beneficial to project success. The reason is that road construction projects follow a blueprint with limited flexibility, unlike IT projects based on user feedback. Consequently, even when project team members think outside the box and share knowledge about the project's progress, it may not necessarily contribute to project success. The results of this study confirm the CAS theory (Holland, 1995), which states that flexibility in a complex and uncertain environment may not necessarily be associated with project success. A coherent form of learning and adaptation is therefore needed.

The relationship between socio-cognitive space and project success is partly explained by project team resilience, which explains 58.3% of the variation. Consequently, resilience in a dynamic environment, project design and implementation require team resilience to handle uncertainty. Specifically, social capital, mastery approaches, and collective efficacy were found to be key factors in building resilient project teams. As Kissi et al. (2013) have proposed, the perception of a supportive work environment determines team members' levels of resilience, motivation, energy, and effort during a project implementation. Communicating between the project manager and the team requires team-building interventions focused on goal-setting, role clarification, and problem-solving.

6. CONCLUSION

This study concludes that agile practices play a crucial role in enhancing both project team resilience and overall project success. Project team resilience, in turn, contributes positively to project success, highlighting its importance as a critical project enabler. While socio-cognitive space does not directly influence project success, it significantly enhances project team resilience, which partially mediates its effect on project success by 58.3%. However, project team resilience does not mediate the relationship between agile practices and project success. These findings align with the Complex Adaptive Systems (CAS) theory by Holland (1995), which emphasizes adaptability and learning within dynamic environments. The relationships observed in this study reflect how project teams evolve and respond to complexity through agile and resilient practices.

7. STUDY IMPLICATIONS AND AREAS FOR FURTHER RESEARCH

7.1 Theoretical

The findings of this study offer theoretical contributions grounded in Complex Adaptive Systems (CAS) theory as articulated by Holland (1995). By examining the relationships between agile practices, socio-cognitive space, and project team resilience, the study highlights how adaptive team behaviors and dynamic interactions support project success. The partial mediation of socio-cognitive space through team resilience illustrates how learning, flexibility, and continuous interaction as key elements of CAS to enable teams to respond effectively to complexity and change. These insights extend CAS theory by reinforcing the value of fostering resilient, collaborative environments that enhance adaptive capacity in project contexts.

7.2 Managerial

Managers should demonstrate leadership that can deal with a range of contingent and contextual parameters to enable scope to be created for the socio-cognitive space. As a result, it is critical to create a resilient project team to ensure project success.

Project leadership should prioritize team-building initiatives that include formal and informal interventions aimed at improving social relations, clarifying roles, and resolving tasks and interpersonal conflicts that affect team performance. In other words, when team-building components are properly used, there is a higher chance of successful projects.

7.3 Areas for further research

Despite its contributions, this study has several limitations. Given the non-linear nature of CAS theory, a qualitative approach is recommended to better understand diverse perceptions of project success. Future research should also consider using longitudinal or experimental designs to explore the influence of agile practices and socio-cognitive spaces on project success. Additionally, while this study focused on management and engineering personnel, future studies should include other stakeholders, such as road users, for a more comprehensive perspective.

REFERENCES

Abdul Rani, H., Abdullah, C. S., & Mohtar, S. (2013). The moderating effect of technology utilization on project management function and project performance. *Malaysian Management Journal (MMJ)*, *17*, 77-133.

Aga, D. A., Noorderhaven, N., & Vallejo, B. (2016). Transformational leadership and project success: The mediating role of team-building. *International Journal of Project Management*, *34*(5), 806-818.

Agaba, E., & Shipman, N. (2007). Public procurement reform in developing countries: The Ugandan experience. *Advancing public procurement: Practices, innovation and knowledge-sharing*, *2*(4), 373-391.

Al-Smadi, M. S., & Bani-Abduh, Y. M. (2017). Standardization of the Self Control and Self-Management Skills Scale (SCMS) on the Student of University of Najran. *Universal Journal of Educational Research*, *5*(3), 453-460.

Alliger, G. M., Cerasoli, C. P., Tannenbaum, S. I., & Vessey, W. B. (2015). Team resilience: How teams flourish under pressure. *Organizational Dynamics*.

Ameyaw, E. E., Pärn, E., Chan, A. P., Owusu-Manu, D. G., Edwards, D. J., & Darko, A. (2017). Corrupt practices in the construction industry: Survey of Ghanaian experience. *Journal of Management in Engineering*, *33*(6), 05017006.

Amaral, A., Fernandes, G., & Varajão, J. (2015). Identifying useful actions to improve team resilience in information systems projects. *Procedia Computer Science*, *64*, 1182-1189.

Anantatmula, V. S. (2010). Project manager leadership role in improving project performance. *Engineering management journal*, *22*(1), 13-22.

Arnold, J. A., Arad, S., Rhoades, J. A., & Drasgow, F. (2000). The empowering leadership questionnaire: The construction and validation of a new scale for measuring leader behaviors.

Journal of organizational behavior, *21*(3), 249-269.

Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International journal of project management*, *17*(6), 337-342.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: guidelines for using reflective-formative type models. *Long range planning*, *45*(5-6), 359-394.

Bennett, J. B., Aden, C. A., Broome, K., Mitchell, K., & Rigdon, W. D. (2010). Team resilience for young restaurant workers: research-to-practice adaptation and assessment. *Journal of Occupational Health Psychology*, *15*(3), 223.

Braun, S., Peus, C., Weisweiler, S., & Frey, D. (2013). Transformational leadership, job satisfaction, and team performance: A multilevel mediation model of trust. *The leadership quarterly*, *24*(1), 270-283.

Bryman, A., Bell, E., Hirschsohn, P., Dos Santos, A., Du Toit, J., Masenge, A. Van Aardt & Wagner, C. (2014). *Research methodology: Business and management contexts*.

Burke, C. S., Stagl, K. C., Salas, E., Pierce, L., & Kendall, D. (2006). Understanding team adaptation: a conceptual analysis and model. *Journal of applied psychology*, *91*(6), 1189.

Cachia, R., & Holgado Ramos, D. (2020). Network analysis as a tool for humanitarian protection: research and practice. *Journal of International Humanitarian Action*, *5*(1), 1-14.

Chapman, M. T., Temby, P., Crane, M., Ntoumanis, N., Quested, E., Thøgersen-Ntoumani, C., & Gucciardi, D. F. (2021). Team resilience emergence: Perspectives and experiences of military personnel selected for elite military training. *European Journal of Social Psychology*, *51*(6), 951-968.

Cheng, M. Y., Tsai, H. C., & Sudjono, E. (2012). Evolutionary fuzzy hybrid neural network for dynamic project success assessment in construction industry. *Automation in Construction*, *21*, 46-51.

Chua, D. K. H., Loh, P. K., Kog, Y. C., & Jaselskis, E. J. (1997). Neural networks for construction project success. *Expert Systems with Applications*, *13*(4), 317-328.

Cicmil, S., Williams, T., Thomas, J., & Hodgson, D. (2006). Rethinking project management: researching the actuality of projects. *International journal of project management*, *24*(8), 675-686.

Cooke-Davies, T. (2002). The “real” success factors on projects. *International Journal of Project Management,* 20, 185-190.

Cohen, J. (1988). Set correlation and contingency tables. *Applied psychological measurement*, *12*(4), 425-434.

Chiocchio, F., Rabbat, F., & Lebel, P. (2015). Multi-level efficacy evidence of a combined interprofessional collaboration and project management training program for healthcare project teams. *Project Management Journal*, *46*(4), 20-34.

Conforto, E. C., & Amaral, D. C. (2016). Agile project management and stage-gate model - A hybrid framework for technology-based companies. *Journal of engineering and technology management*, *40*, 1-14.

Creswell, J. W., & Plano Clark, V. L. (2023). Revisiting mixed methods research designs twenty years later. *Handbook of mixed methods research designs*, *1*(1), 21-36.

Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change*, 173, 121092.

Day, J. M. (2014). Fostering emergent resilience: the complex adaptive supply network of disaster relief. *International journal of production research*, *52*(7), 1970-1988.

Drouin, N., Müller, R., Sankaran, S., & Vaagaasar, A. L. (2021). Balancing leadership in projects: Role of the socio-cognitive space. *Project Leadership and Society*, *2*, 100031.

Esser, F., & Vliegenthart, R. (2017). Comparative research methods. *The international encyclopedia of communication research methods*, 1-22.

Frick, S. E., Fletcher, K. A., Ramsay, P. S., & Bedwell, W. L. (2018). Understanding team maladaptation through the lens of the four R's of adaptation. *Human Resource Management Review*, *28*(4), 411-422.

Furneaux, C. W., Brown, K. A., Allan, D., McConville, S., McFallan, S., London, K., & Burgess, J. (2006). Client capabilities and capital works procurement policies: A comparative analysis of Australian jurisdictions. *Brown, K., K. Hampson and P. Brandon. Clients Driving Construction Innovation: Moving Ideas into Practice. Brisbane: Cooperative Research Centre for Construction Innovation, Icon. Net Pty Ltd*, 62-71.

Gemünden, H. G., Lehner, P., & Kock, A. (2018). The project-oriented organization and its contribution to innovation. *International journal of project management*, *36*(1), 147-160.

Gledson, B., Williams, D., & Littlemore, M. (2018, September). Construction planning efficiency and delivery time performance: analysing failure in task-level 'hit rates'. In *ARCOM 2018: 34th Annual Conference–Belfast, UK: A Productive Relationship: Balancing Fragmentation and Integration*.

Grant, A. M., & Pollock, T. G. (2011). Publishing in AMJ - Part 3: Setting the hook. *Academy of management journal*, *54*(5), 873-879.

Gundersen, G., Hellesøy, B. T., & Raeder, S. (2012). Leading international project teams: The effectiveness of transformational leadership in dynamic work environments. *Journal of Leadership & Organizational Studies*, *19*(1), 46-57.

Hartmann, T., & Jüpner, R. (2020). Implementing resilience in flood risk management. *Wiley Interdisciplinary Reviews: Water*, *7*(6), e1465.

Hartmann, S., Weiss, M., Newman, A., & Hoegl, M. (2020). Resilience in the workplace: A multilevel review and synthesis. *Applied Psychology*, *69*(3), 913-959.

Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. *Industrial management & data systems*.

Hair, Jr., J. F., & Sarstedt, M. (2021). Data, measurement, and causal inferences in machine learning: opportunities and challenges for marketing. *Journal of Marketing Theory and Practice*, *29*(1), 65-77.

Hughes, W., & Kabiri, S. (2013). Performance-based contracting in the construction sector.

Holland, J. H. (1995). *Hidden order: How adaptation builds complexity*. Addison Wesley Longman Publishing Co., Inc.

Hunt, J. A. (2018). *PMI-ACP Project Management Institute Agile Certified Practitioner Exam Study Guide*. John Wiley & Sons.

Ika, L. A., & Pinto, J. K. (2022). The "re-meaning" of project success: Updating and recalibrating for a modern project management. *International Journal of Project Management*, *40*(7), 835-848.

Imam, H., & Zaheer, M. K. (2021). Shared leadership and project success: The roles of knowledge sharing, cohesion and trust in the team. *International journal of project management*, *39*(5), 463-473.

Kakitahi, J. M., Landin, A., & Alinaitwe, H. M. (2013). An exploratory study of rework causality in Uganda. *Construction Innovation*, *13*(3), 266-280.

Kerzner, H. (2003). *Advanced project management: Best practices on implementation*. John Wiley & Sons.

Karlsen, J. T., & Berg, M. E. (2020). A study of the influence of project managers' signature strengths on project team resilience. *Team Performance Management: An International Journal*, *26*(3/4), 247-262.

Keegan, A. E., & Den Hartog, D. N. (2004). Transformational leadership in a project-based environment: a comparative study of the leadership styles of project managers and line managers. *International journal of project management*, *22*(8), 609-617.

Kissi, J., Dainty, A., & Tuuli, M. (2013). Examining the role of transformational leadership of portfolio managers in project performance. *International Journal of project management*, *31*(4), 485-497.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, *30*(3), 607-610.

Kossek, E. E., & Perrigino, M. B. (2016). Resilience: A review using a grounded integrated occupational approach. *Academy of Management Annals*, *10*(1), 00-00.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (ijec)*, *11*(4), 1-10.

Kock, N., & Hadaya, P. (2018). Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods. *Information systems journal*, *28*(1), 227-261.

Kozlowski, S. W., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological science in the public interest*, *7*(3), 77-124.

Kutsch, E., & Hall, M. (2016). *Project resilience: The art of noticing, interpreting, preparing, containing and recovering*. Routledge.

Lengnick-Hall, C. A., Beck, T. E., & Lengnick-Hall, M. L. (2011). Developing a capacity for organizational resilience through strategic human resource management. Human Resource Management Review, Vol.21 issue3, pp.243–255.

Lee, G., & Xia, W. (2010). Toward agile: an integrated analysis of quantitative and qualitative field data on software development agility. *MIS quarterly*, *34*(1), 87-114.

Love, P. E., Ahiaga-Dagbui, D. D., & Irani, Z. (2016). Cost overruns in transportation infrastructure projects: Sowing the seeds for a probabilistic theory of causation. *Transportation research part A: policy and practice*, *92*, 184-194.

Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of management*, *34*(3), 410-476.

Malach-Pines, A., Dvir, D., & Sadeh, A. (2009). Project manager-project (PM-P) fit and project success. International Journal of Operations and Production Management 29(3): 268-291.

Malykhin, M., Molodko, O., Pylypchuk, V., Tugay, A., & Dubynka, O. (2025). Assessment of the Feasibility of Implementing a Construction Project at the Pre-investment Stage. *European Project Management Journal, 15(1),* 55-75. DOI: 10.56889/ssvp1672.

McHugh, O., Conboy, K., & Lang, M. (2011). Agile practices: The impact on trust in software project teams. *IEEE software*, *29*(3), 71-76.

Meneghel, I., Salanova, M., & Martínez, I. M. (2016). Feeling Good Makes Us Stronger: How Team Resilience Mediates the Effect of Positive Emotions on Team Performance. *Journal of Happiness Studies*. (17:1), pp. 239-255.

Martinsuo, M., & Hoverfält, P. (2018). Change program management: Toward a capability for managing value-oriented, integrated multi-project change in its context. *International journal of project management*, *36*(1), 134-146.

Morcov, S., Pintelon, L., & Kusters, R. J. (2020). IT project complexity management based on sources and effects: positive, appropriate and negative. *Proceedings Of The Romanian*

Academy Series A-Mathematics Physics Technical Sciences Information Science, *21*(4), 329-336.

Moza, A., & Paul, V. K. (2024). Critical Delay Factors Affecting Construction Project Performance – A Contemporary Perspective. European Project Management Journal, 14(2): 40-56. DOI: 10.56889/fwfq7392

Ministry of Works and Transport. (2014). Annual works and transport sector performance report 2013/2014. Kampala, Uganda. www.works.go.ug.

Müller, R., & Turner, R. (2007). The influence of project managers on project success criteria and project success by type of project. *European management journal*, *25*(4), 298-309.

Müller, R., & Antoni, C. H. (2020). Individual perceptions of shared mental models of information and communication technology (ICT) and virtual team coordination and performance—The moderating role of flexibility in ICT use. *Group Dynamics: Theory, Research, and Practice*, *24*(3), 186.

Mutebi, H., Muhwezi, M., Ntayi, J. M., & Munene, J. C. K. (2020). Organisation size, innovativeness, self-organisation and inter-organisational coordination. *International Journal of Emergency Services*.

Muller, R., Sankaran, S., Drouin, N., Nikolova, N., & Vaagasaar, A. L. (2015). The socio- cognitive space for linking horizontal and vertical leadership. *Asia-Pacific Researchers in Organization Studies (APROS)*.

Muller, R., Drouin, N., & Sankaran, S. (2022). Balanced leadership: making the best use of personal and team leadership in projects. Oxford university press: Print ISBN-13:9780190076122,DOI:10.1093/oso/9780190076122.001.0001).

Naderpajouh, N., Matinheikki, J., Keeys, L. A., Aldrich, D. P., & Linkov, I. (2020). Resilience and projects: An interdisciplinary crossroad. *Project Leadership and Society*, *1*, 100001.

Ngacho, C., & Das, D. (2014). A performance evaluation framework of development projects: An empirical study of Constituency Development Fund (CDF) construction projects in Kenya. *International Journal of Project Management*, *32*(3), 492-507.

Ntayi, J. M., Rooks, G., Eyaa, S., & Qian, C. (2010). Perceived project value, opportunistic behavior, interorganizational cooperation, and contractor performance. *Journal of African Business*, *11*(1), 124-141.

Nahmias, A. H., Crawford, L., & Combe, M. (2010). Factors that influence and are influenced by change projects. In *PMI® Research Conference: Defining the Future of Project Management. Washington, DC. Newtown Square, PA: Project Management Institute*.

Nilsson, F., & Gammelgaard, B. (2012). Moving beyond the systems approach in SCM and logistics research. *International Journal of Physical Distribution & Logistics Management*.

Odeck, J. (2004). Cost overruns in road construction—what are their sizes and determinants?. *Transport policy*, *11*(1), 43-53.

Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of operations management*, *30*(6), 467-480

Pinto, J. K., & Slevin, D. P. (1988, June). Critical success factors across the project life cycle. Drexel Hill, PA: Project Management Institute.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, *88*(5), 879.

Pfutzenreuter, T. C., Lima, E. P., & Frega, J. R. (2021). High performance teams: an investigation of the effect on self-management towards performance. Production, 31, e20210053. https://doi.org/10.1590/0103-6513.20210053

Preacher, K. J., & Hayes, A. F. (2008).

Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior research methods*, *40*(3), 879-891.

Radhakrishnan, A., Zaveri, J., David, D., & Davis, J. S. (2022). The impact of project team characteristics and client collaboration on project agility and project success: An empirical study. *European Management Journal*, *40*(5), 758-777.

Recker, J., Holten, R., Hummel, M., & Rosenkranz, C. (2017). How agile practices impact customer responsiveness and development success: A field study. *Project management journal*, *48*(2), 99-121.

Ramli, N. A., Latan, H., & Nartea, G. V. (2018). Why should PLS-SEM be used rather than regression? Evidence from the capital structure perspective. In *Partial least squares structural equation modeling* (pp. 171-209). Springer, Cham.

Ringle, C. M., Sarstedt, M., & Straub, D. W. (2012). Editor's comments: a critical look at the use of PLS-SEM in" MIS Quarterly". *MIS quarterly*, iii-xiv.

Russell, J. S., Jaselskis, E. J., & Lawrence, S. P. (1997). Continuous assessment of project performance. *Journal of construction engineering and management*, *123*(1), 64-71.

Saadé, R. G., Dong, H., & Wan, J. (2015). Factors of project manager success. *Interdisciplinary Journal of Information, Knowledge, and Management*, *10*, 63.

Safarpour, H., Fooladlou, S., Safi-Keykaleh, M., Mousavipour, S., Pirani, D., Sahebi, A., ... & Dehghani, A. (2020). Challenges and barriers of humanitarian aid management in 2017 Kermanshah earthquake: a qualitative study. *BMC public health*, *20*(1), 563.

Sarstedt, M., Hair, Jr., J. F., Cheah, J. H., Becker, J. M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian marketing journal*, *27*(3), 197-211.

Saunders, M. N., & Darabi, F. (2024). Using multi-and mixed methods research designs. In *Field guide to researching employment and industrial relations* (pp. 71-87). Edward Elgar Publishing.

Scott-Young, C., & Samson, D. (2008). Project success and project team management: Evidence from capital projects in the process industries. *Journal of Operations Management*, *26*(6), 749-766.

Savelsbergh, C., Gevers, J. M., Van der Heijden, B. I., & Poell, R. F. (2012). Team role stress: Relationships with team learning and performance in project teams. *Group & organization management*, *37*(1), 67-100.

Sandstø, R., & Reme-Ness, C. (2021). Agile practices and impacts on project success. *Journal of Engineering, Project, and Production Management*, *11*(3), 255-262.

Serrador, P., & Turner, R. (2015). The relationship between project success and project efficiency. *Project management journal*, *46*(1), 30-39.

Shamim, S., Cang, S., & Yu, H. (2017). Supervisory orientation, employee goal orientation, and knowledge management among front line hotel employees. *International Journal of Hospitality Management*, *62*, 21-32.

Shenhar, A. J., Dvir, D., Levy, O., & Maltz, A. C. (2001). Project success: a multidimensional strategic concept. *Long range planning*, *34*(6), 699-725.

Serrador, P., & Pinto, J. K. (2015). Does Agile work? - A quantitative analysis of agile project success. *International journal of project management*, *33*(5), 1040-1051.

Ssenyange, K., & Chodokufa, K. (2024). The Mediation Role of Stakeholders' Engagement in Enhancing Public Construction Projects Success – The Case of Uganda. European Project Management Journal, 14(2): 78-91. DOI: 10.56889/gbec3568.

Schwaber, K., & Sutherland, J. (2011). The scrum guide. *Scrum Alliance*, *21*(1), 1-38.

Shenhar, A. J., & Dvir, D. (1996). Toward a typological theory of project management. *Research policy*, *25*(4), 607-632.

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J. H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: guidelines for using PLSpredict. *European journal of marketing*.

So, C., & Scholl, W. (2009, May). Perceptive agile measurement: New instruments for quantitative studies in the pursuit of the social-psychological effect of agile practices. In *International Conference on Agile Processes and Extreme Programming in Software Engineering* (pp. 83-93). Springer, Berlin, Heidelberg.

Sohail, M., & Cavill, S. (2008). Accountability to prevent corruption in construction projects. *Journal of Construction Engineering and management*, *134*(9), 729-738.

Stacey, R. D. (2007). *Strategic management and organisational dynamics: The challenge of complexity to ways of thinking about organisations*. Pearson education.

Stoverink, A. C., Kirkman, B. L., Mistry, S., & Rosen, B. (2020). Bouncing back together: Toward a theoretical model of work team resilience. *Academy of Management Review*, *45*(2), 395-422.

Sharma, S., & Sharma, S. K. (2016). Team Resilience: Scale Development and Validation Vision Vol. 20 Issue 1, pp. 37–53, DOI: 10.1177/0972262916628952

Sinval, J., Aragão e Pina, J., Sinval, J., Marôco, J., Santos, C. M., Uitdewilligen, S., … Passos, A. M. (2020). *Development of the Referee Shared Mental Models Measure (RSMMM). Frontiers in Psychology, 11.* doi:10.3389/fpsyg.2020.550271.

Sohmen, V. S. (2013). Leadership and teamwork: Two sides of the same coin. *Journal of IT and Economic Development*, *4*(2), 1-18

Tayeh, B. A., Al Hallaq, K., Alaloul, W. S., & Kuhail, A. R. (2018). Factors affecting the success of construction projects in Gaza Strip. *The Open Civil Engineering Journal*, *12*(1).

Toor, S. R., & Ogunlana, S. O. (2009). Construction professionals' perception of CSF for large scale construction projects.

Tukamuhabwa, B. R., Stevenson, M., Busby, J., & Zorzini, M. (2015). Supply chain resilience: definition, review and theoretical foundations for further study. *International Journal of Production Research*, *53*(18), 5592-5623.

Turner, R., & Zolin, R. (2012). Forecasting success on large projects: developing reliable scales to predict multiple perspectives by multiple stakeholders over multiple time frames. *Project management journal*, *43*(5), 87-99.

Turner, J. R., & Müller, R. (2005). The project manager's leadership style as a success factor on projects: A literature review. *Project management journal*, *36*(2), 49-61.

Vrchota, J., Řehoř, P., Maříková, M., & Pech, M. (2021). Critical Success Factors of the Project Management in Relation to Industry 4.0 for Sustainability of Projects. Sustainability, 13(1), 281.

Vogus, T. J., & Sutcliffe, K. M. (2012). Organizational mindfulness and mindful organizing: A reconciliation and path forward. *Academy of Management Learning & Education*, *11*(4), 722-735.

White, D., & Fortune, J. (2002). Current practice in project management—An empirical study. *International journal of project management*, *20*(1), 1-11.

West, B. J., Patera, J. L., & Carsten, M. K. (2009). Team level positivity: Investigating positive psychological capacities and team level outcomes. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, *30*(2), 249-267.

Yang, Y., Lee, P. K., & Cheng, T. C. E. (2015). Operational improvement competence and service recovery performance: The moderating effects of role stress and job resources. *International Journal of Production Economics*, *164*, 134-145.

Zwikael, O., & Unger-Aviram, E. (2010). HRM in project groups: The effect of project duration on team development effectiveness. *International Journal of Project Management*, *28*(5), 413-421.

Zhu, W., Chew, I. K., & Spangler, W. D. (2005). CEO transformational leadership and organizational outcomes: The mediating role of human–capital-enhancing human resource management. *The leadership quarterly*, *16*(1), 39-52.